Decision-Making among Women at High Risk for Breast Cancer: Complementary Roles of Emotion and Cognition

DISSERTATION

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Abstract

Women with a high risk of breast cancer have options for reducing risk, including surgery (mastectomy and/or oophorectomy), chemoprevention, and lifestyle changes. However, the ways in which women decide whether or not to pursue these options is not well understood. Both cognitive factors (e.g., perceived risk, perceived seriousness, attitudes) and emotional factors (e.g., cancer-related distress, emotion regulation) play a role in the decision-making process, but have not been tested as a single, integrated model. The present study investigates an innovative dual-pathway model of decision-making in a sample of women at high risk for breast cancer (N = 103). A single group, cross-sectional design was used. Participants self-reported cognitions about breast cancer risk (perceived susceptibility, perceived seriousness), attitudes about risk-reducing behaviors, cancer-related distress, emotion regulation, and intentions for risk-reducing behaviors. Mediation analyses examined hypothesized relationships between cognitive variables in predicting behavioral intentions, while moderation analyses examined hypothesized relationships between emotional variables in predicting behavioral intentions. Significant moderating effects of reappraisal were found for emotion-based models predicting mastectomy intentions ($p = 0.04; 95\% \text{ C.I.} = [0.01, 0.03]$) and chemoprevention intentions ($p = 0.02; 95\% \text{ C.I.} = [0.01, 0.03]$). No significant effects were observed for cognitive mediation models (all $ps > 0.05; 95\% \text{ C.I.} \ \text{lower bound} = -$.
Results indicate that: 1) emotion regulation strategy use plays a significant role in risk-management decision-making; and 2) risk-management decisions are made independent of perceived severity. Results contribute to knowledge of decisional processes among women at high risk for breast cancer and highlight the need for modifications to existing health decision-making models. Specific targets for decision-making support interventions are identified.
“The oldest and strongest emotion of mankind is fear, and the oldest and strongest kind of fear is fear of the unknown.”

– H.P. Lovecraft, Supernatural Horror in Literature
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Chapter 1: Introduction

The healthcare field is increasingly moving towards a preventative care model. As a result, individuals are being informed of their disease risks with a view to reducing that risk (Bowen et al., 2003). Recognition of the limitations of current diagnostic and therapeutic approaches to breast cancer has resulted in a new focus on breast cancer risk assessment and prevention. While women in the general population have a 12% lifetime risk of developing invasive breast cancer, a sub-sample of women carries elevated risk. The National Comprehensive Cancer Network (NCCN) defines this “high risk” population as those women with a greater than 20% lifetime risk (National Comprehensive Cancer Network (NCCN), 2016). For these women, the increased focus on breast cancer risk assessment and prevention is especially important. Priorities for women at increased risk for breast cancer include learning about their risk status, obtaining information about the options available to lower their risk, and developing decision-making skills (Stacey, O’Connor, DeGrasse, & Verma, 2003).

High-risk women have options for reducing their risk of breast cancer (see Table 1), including risk-reducing surgery (mastectomy and/or oophorectomy), chemoprevention, and lifestyle changes (National Comprehensive Cancer Network (NCCN), 2016). These strategies are discussed further below, but it is important to note
that none of the available options to reduce the risk of developing breast cancer offer women a 100% breast cancer risk reduction, and each preventive option has risks and benefits, both medical and psychological (Kelly A. Metcalfe et al., 2007; Warrier, Tapia, Goltsman, & Beith, 2016). Thus, cancer risk management decision making among high-risk women is complex, changes with age, and has effects across the lifespan (Bayraktar & Arun, 2017; Hoskins, Roy, & Greene, 2012; Hoskins, Roy, Peters, Loud, & Greene, 2008; Leonarczyk & Mawn, 2015; Stan, Shuster, Wick, & Swanson, 2013; Taylor & Tischkowitz, 2014). Decisions regarding risk-reducing procedures are often difficult for women to make. Patients must balance potential benefit of interventions against risk of adverse side effects and decrease in quality of life (Ozanne, Annis, Adduci, Showstack, & Esserman, 2007). The ways in which women make such complex decisions is not well understood (Hartmann & Lindor, 2016; Klitzman & Chung, 2010), particularly because women’s decision making typically does not mirror a statistical medical model of risk assessment (Hesse-Biber, 2014).

Integrated Decision-Making Model of Risk Reduction

Based on our review of the literature on decision-making among high risk women, we have developed a guiding theoretical model for the present study (see Figure 1). This model incorporates components of three different models of preventive health behaviors: (1) Hochbaum’s Health Beliefs Model, (2) Fishbein and Ajzen’s Theory of Planned Behavior, and (3) Leventhal’s Self-Regulation Model. Notable components drawn from each model are highlighted below.
Hochbaum’s Health Beliefs Model

The Health Belief Model (HBM) is one of the most commonly used theories in health education and health promotion (Glanz, Rimer, & Lewis, 2002; National Cancer Institute (NCI), 2003). The underlying concept of the HBM is that health behavior is determined by personal beliefs or perceptions about a disease and the strategies available to decrease its occurrence (Hochbaum, 1958). Personal perception is influenced by intrapersonal factors, including, most notably, perceived susceptibility (e.g., “How likely am I to get the disease?”) and perceived seriousness (e.g., “Were I to get the disease, how bad would it be?”). Perceived risk has been identified as a key element in risk management decision making among high-risk women, and as a result, prior research has used the HBM to examine outcomes such as mammography adherence and breast self-examination (Gorin & Albert, 2003; Halabi et al., 2000; Janz & Becker, 1984; Lagerlund, Hedin, Sparén, Thurfjell, & Lambe, 2000; Lerman, Rimer, Trock, Balshem, & Engstrom, 1990). Given the extensive use of the HBM, as well as the plethora of research on perceived risk outside of this model, we chose to include perceived susceptibility and perceived seriousness in our theoretical model.

Fishbein and Ajzen’s Theory of Planned Behavior

The Theory of Planned Behavior (TPB) emerged from the field of social psychology as a means of explaining the relationship between attitudes and behaviors
within human action (Ajzen, 1985, 2002). The underlying concept of the TPB is that behavior is best predicted by a person’s intention to perform that particular behavior. Intentions in their turn are predicted by three determinants: the individual’s attitudes towards the behavior, subjective norms about the behavior, and perceived behavioral control (which is in turn sub-divided into self-efficacy and controllability). According to the TPB, the influence of individual difference variables is mediated by the cognitive determinants. Like the HBM, the TPB has been applied successfully to explain various health behaviors. In one meta-analysis, the TPB predicted, on average, 39% of variance in intentions across various behaviors (Armitage & Conner, 2001). Furthermore, it has been applied to several behaviors relevant to the previvor population, including breast cancer screening practices (Drossaert, Boer, & Seydel, 2003; Godin et al., 2001; Rutter, 2000), genetic testing (Braithwaite, Sutton, & Steggles, 2002), uptake of chemoprevention among women at high risk for breast cancer (Ager et al., 2014), and uptake of contralateral prophylactic mastectomy in women diagnosed with unilateral breast cancer (Richards et al., 2016). Also, although the model has not been tested in its entirety, perceived control has been related to intentions to have bilateral prophylactic mastectomy in women at high risk for breast cancer (van Driel et al., 2016). For the purposes of the present research, the three key cognitive determinants of the TPB were included in the theoretical model. However, only attitudes were considered to play a mediating role in the cognitive decision-making pathway. Subjective norms and perceived control were not considered to be directly influenced by cognitions about the health threat; rather, they could exist independent of the effects of perceived severity and perceived susceptibility.
Leventhal’s Common Sense Model of Self-Regulation

Leventhal’s Common Sense Model (CSM) (Brissette, Leventhal, & Leventhal, 2003; Leventhal, Meyer, & Nerenz, 1980) of self-regulation is an influential theory that proposes a role for both emotions and emotion regulation in influencing health behavior change. The CSM proposes that people concurrently develop two action plans to cope with an illness threat: (1) a plan for managing the objective demands of the illness threat, and (2) a plan for managing affect (i.e., emotion regulation) associated with the illness threat (e.g., cancer worry). Thus, the actions that an individual takes in response to an illness threat can have parallel aims: to reduce risk itself and to reduce emotion about the risk. In the CSM, emotional reactions to a threat are considered partially independent processes from cognitive assessments or appraisals, which interact with one another to produce behavioral outcomes (Leventhal, Safer, & Panagis, 1983; Loewenstein, Weber, Hsee, & Welch, 2001; Miller & Schnoll, 2000). These coping efforts can lead an individual to either incorporate emotion regulation into the objective action plan, or to prioritize emotion regulation over objective coping (Hay, McCaul, & Magnan, 2006). Therefore, use of emotion regulation techniques mediates the relationship between affect and behavioral intentions, determining whether affect will impede or encourage risk management. The CSM has previously been used to examine cancer risk perception (Sivell et al., 2008; Walter & Emery, 2006), uptake of breast cancer screening (Bowen et al., 2003; Price et al., 2010), decisions to undergo BRCA1/2 testing (K. Kelly et al., 2005; Shiloh & Ilan, 2005; van Oostrom et al., 2003) or seek other genetic risk
information (Marteau & Weinman, 2006), and uptake of contralateral prophylactic mastectomy in women diagnosed with unilateral breast cancer (Sivell et al., 2008), but has not been used to predict uptake of risk-reducing strategies among women with high-risk. We believe that the CSM is an ideal framework for investigating the parallel nature of cognition and emotion in decision making among women at high risk for breast cancer. The key components of the CSM which were included in our theoretical model are (1) the dual-pathway framework integrating emotion and cognition, and (2) the mediating role of emotion regulation.

**Theoretical Integration**

Taken together, these three models help elucidate the complex decisional process faced by women at high risk for breast cancer. A health threat, such as being at increased risk for breast cancer, generates both cognitive and emotional responses. These both play a role in subsequent decision-making about that health threat (Schwarz, 2000).

Although the relationship between emotion and cognition has been the subject of historical debate (Leventhal & Scherer, 1987), it should be noted that cognitions and emotions are not decoupled (Storbeck & Clore, 2007). Rather, they are inseparably interrelated in a dynamic, multilevel emotion processing system (Gray, 1990). However, there is a distinction to be made in the types of cognition relevant to emotion: knowledge and appraisal (Lazarus & Smith, 1988). Knowledge refers to the facts of an encounter, while appraisal defines the personal significance of said encounter. This distinction is
reflective of the pathways in our integrated theoretical model: specifically, the cognitive pathway incorporates the “facts” of risk, while the emotional pathway mirrors the “feelings” of risk.

The key feature of one’s cognitions is one’s subjective perception of severity, a product of perceived susceptibility and perceived seriousness. While perceived severity has a direct impact on an individual’s intentions to engage in risk-reducing behavior, it also leads to the generation of attitudes. These attitudes are an expression of favor or disfavor toward a given attitude object, and incorporate the sum total of the “pros” and “cons” of a potential behavior. Attitudes thus enable individuals to manage their cognitions about a health threat and, in turn, impact an individual’s intentions to engage in risk-reduction. We characterize these effects at the “cognitive path”.

A complementary emotional path exists, however. While one’s emotional reaction to a health threat may impact one’s behavioral intentions, one may also engage in emotion regulation strategies to maintain a preferred emotional state. Emotion regulation therefore mediates the relationship between affect and behavioral intentions.

The present research examined this integrated model in the context of risk management decision-making among women at high risk for breast cancer. In applying this theoretical model to this unique context, several key components are discussed below: (1) the health threat (e.g., objective risk); (2) risk management behaviors (e.g., risk reducing surgery, chemoprevention, and lifestyle changes); (3) cognitive responses
(e.g., perceived risk); (4) emotional responses (e.g., cancer-specific distress); and (5) the joint effect of cognitive and emotional responses on behavioral intentions.

The Health Threat: Objective Breast Cancer Risk

A health threat is the stimulus that initiates the emotional and cognitive processes outlined above. Specifically, we examined the health threat associated with heightened breast cancer risk. Living with a heightened risk of breast cancer can be likened to an illness experience (Crossley, 1998) in the sense that the risk of developing cancer can be seen as all-pervasive and enduring (Hallowell, 2000; Robertson, 2000). Although women at high risk of breast cancer do not face an immediate health threat, they must cope with the likelihood of severe future illness. High risk women have heightened awareness of their increased cancer risk as a direct consequence of their strong family cancer histories, their intensive screening regimens, and the process of genetic risk assessment, testing and counseling (Andersen et al., 2016; Portnoy, Loud, Han, Mai, & Greene, 2015). Many experience social isolation (Werner-Lin, 2008b), anticipatory loss (Hoskins & Greene, 2012), and distress traversing normative life cycle stages of partnering (Hoskins et al., 2008) and family planning (Werner-Lin, 2008a).

While some patients describe their risk as a “state of uncertainty” (Hallowell, 2000; Robertson, 2000), several models have been developed to objectively estimate a patient’s risk of eventually developing breast cancer. The most famous of these is the Gail model (see Figure 2) (Gail et al., 1989), which incorporates a variety of exogenous
(e.g., estrogen exposure, chemotherapy exposure) and endogenous (e.g., genetics) risk factors that can affect the development of this multifactorial disease (Sakorafas, 2003; Sismondi et al., 2015). Risk factors in the Gail model include age at menarche, age at first live birth, number of previous biopsies, and number of first-degree relatives with breast cancer (Gail et al., 1989). Additional models have been developed to incorporate risk factors such as benign breast disease and genetic mutations (e.g., BRCA1/BRCA2) (H. Anderson, Bladström, Olsson, & Möller, 2000; Lee et al., 2014).

For women who are determined to be at high risk based on objective assessments, risk management options may be recommended. The processes of risk assessment and decision making are often difficult for women who are at high risk for breast cancer. Unlike some conditions (e.g., Huntington’s disease) in which risk status carries a 100% risk of developing the disease in one’s lifetime, being at high risk for breast cancer does not necessarily mean a woman will develop cancer in her lifetime (Hesse-Biber, 2014). Yet, despite the very real possibility of not developing cancer, many women pursue risk-reducing procedures.

Behavioral Intentions: Risk Management Behaviors

High-risk women have several options for reducing their risk of breast cancer (see Table 1). Current cancer risk management recommendations for high-risk women include options for mastectomy, oophorectomy, chemoprevention, and lifestyle changes (National Comprehensive Cancer Network (NCCN), 2016). Two of these options,
sometimes described as “drastic” or “radical”, have profound effects on a woman’s body and are associated with complex and emotionally charged decision making (Glassey, Ives, Saunders, & Musiello, 2016; Hartmann & Lindor, 2016; Nash, Azeez, Vlahov, & Schori, 2006).

**Risk-Reducing Mastectomy (RRM)**

Risk-reducing mastectomy is the removal of both breasts, unaffected by cancer, in an attempt to reduce subsequent breast cancer risk. The indications for RRM include a strong family history,\(^1\) histological risk factors (e.g., LCIS, ADH, and ALH),\(^2\) and/or a BRCA mutation (Burke, Portschy, & Tuttle, 2015; Giuliano et al., 2007; Tuttle, Abbott, Arrington, & Rueth, 2010). Consensus guidelines regarding these indications for RRM have been published (Giuliano et al., 2007), and adherence to those guidelines has been evaluated (Hoover, Paragi, Santoro, Schafer, & Chamberlain, 2010). Hoover and colleagues (2010) found that 97.6% of women undergoing RRM did indeed have at least one documented indication for RRM consistent with consensus guidelines. While RRM has been shown to decrease the incidence of breast cancer in high risk patients, risk stratification is not precise, and it remains difficult to determine which patients would benefit most from RRM (Hoover et al., 2010). Furthermore, there is no clear

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\(^1\) In 2007, the Society of Surgical Oncology issued a statement defining a “familial cancer syndrome” as “a family history of breast cancer in multiple first-degree relatives and/or multiple successive generations of family members with breast cancer... [and/or] a family history of multiple members with bilateral and/or premenopausal and/or male breast cancer” (Giuliano et al., 2007).

\(^2\) Authors have noted that the risk elevation associated with benign breast disease is rarely so significant as to prompt women to opt for RRS in the absence of other factors (Chagpar, 2014).
recommendation regarding the age at which RRM should be considered, although it appears that the largest gains in life expectancy are derived from RRM in the fourth decade of life (Sigal, Munoz, Kurian, & Plevritis, 2012).

There are many benefits of RRM. First, RRM reduces subsequent risk of breast cancer by 90% in observational studies conducted in the high-risk setting (Clark & Domchek, 2011; National Comprehensive Cancer Network (NCCN), 2016; Portnoy et al., 2015). Only one small study has not shown a significant reduction in the risk of subsequent breast cancer after bilateral mastectomy (Skytte et al., 2011). In addition, some argue that RRM is not only more effective for risk management, but is also more cost-effective than surveillance for high-risk women (K. Anderson et al., 2006; Mattos et al., 2015; Norum et al., 2008).

Second, some authors have even gone so far as to assert that RRM may provide psychological benefits in women with a high risk of developing breast cancer (Mal Bebbington Hatcher, Fallowfield, & A’Hern, 2001). For example, Metcalfe and colleagues (2004) found that women’s mean distress levels after RRM were only slightly above normal values. Women’s self-reported quality of life after RRM as comparable or even above levels of age-matched women in the general population (Brandberg et al., 2008; Hallowell et al., 2015; Harmsen, Hermens, Prins, Hoogerbrugge, & de Hullu, 2015; Isern, Tengrup, Loman, Olsson, & Ringberg, 2008; Kelly A. Metcalfe, Esplen, Goel, & Narod, 2005). Furthermore, women who receive RRM often experience reductions in perceived breast cancer risk and cancer-related anxiety, compared with
controls (Borreani et al., 2014; Brandberg et al., 2008; Hallowell et al., 2012, 2015; Mal Bebbington Hatcher et al., 2001; Heiniger, Butow, Coll, et al., 2015; Kelly A. Metcalfe & Narod, 2002). While the main advantage of undergoing RRM is the substantial reduction in disease risk, the psychological benefits associated with this risk reduction are often cited by women as equally important (Hallowell, 2000; Heiniger, Butow, Coll, et al., 2015; Vodermaier, Bauerfeind, & Nestle-Kramling, 2005). However, electing to undergo RRM is avoidance-driven, in that it is conceptualized as a way to eliminate the anxiety associated with screening and possible cancer diagnosis and treatment (Hoskins & Greene, 2012). There is some evidence that, prior to the procedure, women who elect to receive RRM have higher cancer-related anxiety than women who do not elect to receive RRM (Heiniger, Butow, Charles, & Price, 2015; Lodder et al., 2002; Vodermaier et al., 2005). This suggests that while RRM may effectively reduce cancer-related anxiety for some, it only reduces it to a level that is comparable with those at-risk women who do not elect RRM.

However, RRM is not without its drawbacks. First, it should be noted that RRM has not been shown to be associated with reduced overall mortality (Heemskerk-Gerritsen et al., 2013; Ingham et al., 2013; Wuttke & Phillips, 2015). In addition, RRM significantly reduces but does not totally eliminate the risk of subsequent breast cancer. As Sakorafas (2003) states: “the Achilles heel of prophylactic mastectomy… is the difficulty in achieving a total extirpation of the breast tissue. This reduces the prophylactic effect of surgery.” For this reason, it is more appropriate to refer to this procedure as “risk reducing” rather than “prophylactic”. Case reports and longitudinal
studies have described patients who developed breast cancer after receiving RRM, with frequency ranging from 0% to 3.2% (Hagen et al., 2014; Ziegler & Kroll, 1991). Thus, even after RRM, careful and regular long-term follow-up is indicated (Sismondi et al., 2015). Finally, many studies of RRM have the common limitation of length of follow-up time, given that some of these studies are based on 10 years or less of follow-up time; thus, the women in these studies may develop breast cancer later on outside of the study window (Jatoi & Benson, 2016; Tran, Helm, & Litton, 2016).

Second, a sizeable minority of patients undergoing RRM experience ongoing complications or are unhappy with the cosmetic result (Altschuler et al., 2008; Hallowell et al., 2015; Mal Bebbington Hatcher et al., 2001). Unfortunately, RRM is an irreversible procedure (Burke et al., 2015). While many cosmetic complications can be rectified (Hagen et al., 2014), surgical complications from RRM occur in about 20% of patients, with the most common being infection and flap necrosis (Burke et al., 2015; Kauff et al., 2002; Petit & Greco, 2002). Other physical sequelae include unanticipated operations (Stefanek, Hartmann, & Nelson, 2001; Zion et al., 2003) and, in the case of nipple-sparing mastectomy, loss of nipple sensation (Wood, 2004).

Third, RRM often has significant psychosocial sequelae, including changed body image, altered arousal, and decreased sexual function (Brandberg et al., 2008; Gahm, Wickman, & Brandberg, 2010; Gopie et al., 2013; Wood, 2004). A large retrospective study from the United States (Borgen et al., 1998) described satisfaction with surgery in 370 women who had undergone RRM 0.2–51.5 years previously (mean: 14.8 years).
Sixteen percent of the women in the study reported to find the cosmetic result unacceptable, and 5% regretted their decision for surgery. Notably, 75% of the women in the Borgen et al. (1998) study had breast reconstruction surgery, which resolves some of these issues (Petit & Greco, 2002). Insurance coverage for reconstructive breast surgery is unpredictable (Hartmann, Degnim, & Schaid, 2004). Moreover, Gopie et al. (2013) found that even after completion of reconstruction, 37% of the women reported unpleasant sensation(s) in their breasts, 29% were not satisfied with their breast appearance, and 21% felt embarrassed of their naked body. Yet these results are inconsistent, and other research (e.g., Metcalfe et al., 2004) demonstrates that the majority of women do not experience low levels of sexual activity or difficulties with body image following RRM; rather, their level of sexual functioning after RRM was comparable to the general population. Furthermore, recent evidence demonstrates the safety of nipple-sparing mastectomy for high risk women (Manning et al., 2015; Manning & Sacchini, 2016). Conservative procedures such as this may result in improved cosmesis and, possibly, diminish negative psychosocial outcomes associated with RRM.

Finally, some patients express regret with their decision to undergo RRM (Payne, Biggs, Tran, Borgen, & Massie, 2000). Altschuler et al. (2008) found that women had lingering negative psychosocial outcomes following RRM. Specific regrets relate to cosmesis, perceived difficulty of detecting breast cancer in the remaining breast tissue, surgical complications, problems with and anxiety regarding safety of implants, residual pain, concerns about consequent body image, sexual dysfunction, and emotional upset (Altschuler et al., 2008; Heiniger, Butow, Coll, et al., 2015; Payne et al., 2000).
Furthermore, women consistently report that they wished they had had more information prior to RRM, particularly related to the after-effects of the surgery (Glassey et al., 2016). The context of first consideration of surgery may also be important. When a physician initiates the discussion about RRM, rather than the patient, the patient is more likely to report regret post-surgery (Payne et al., 2000; Hartmann & Lindor, 2016). Additionally, age may predict satisfaction with RRM. Metcalfe and colleagues (2004) reported that young women (<50 years) were more likely to report dissatisfaction with RRM compared to older women.

Taken together, studies of psychological sequelae of RRM suggest that the procedure results in a large reduction of cancer specific distress, which may be replaced by other problems, such as a decrease in physical health and a less positive body image. The major limitation of these findings is the use of convenience samples (i.e., intact groups). Thus, women who choose RRM may differ compared with those who do not. The results described above may not be generalizable to all high-risk women (Kelly A. Metcalfe et al., 2004).

Although the overall uptake of RRM is low, it is rising (Eisen, Rebbeck, Wood, & Weber, 2000; Flippo-Morton et al., 2016; Hagen et al., 2014; Rhiem & Schmutzler, 2014). An analysis by Portschy et al. (Portschy, Marmor, Nzara, Virmig, & Tuttle, 2013) using the Surveillance Epidemiology and End Results (SEER) database evaluated the use of prophylactic mastectomy between 2000 and 2009. The overall rate of RRM was 16%, but increased by 50% during the study period (Portschy et al., 2013). Current estimates
of RRM range from 20% to 54% across studies of high-risk women (Beattie, Crawford, Lin, Vittinghoff, & Ziegler, 2009; Borreani et al., 2014; Chai et al., 2014; Flippo-Morton et al., 2016; Friebel et al., 2007; Garcia et al., 2014; Kelly A. Metcalf et al., 2008; M. D. Schwartz et al., 2012), and uptake differs significantly by country (Flippo-Morton et al., 2016; Glassey et al., 2016). Notably, actual receipt of RRM is lower than would be expected based on women’s expressed intentions (Lerman et al., 2000). Some have suggested that this increase may be due to increased awareness of genetic breast cancer, increased genetic testing, improvements in mastectomy and reconstruction techniques, increased knowledge about these procedures, fear of cancer, and social acceptability of plastic surgery (Botkin et al., 2003; Burke et al., 2015; Güth et al., 2012; Julian-Reynier et al., 2001; Kelly A. Metcalfe et al., 2008; Wang et al., 2015). Alternatively, Rheim and Schmutzler (2014) suggest that the upward trend in RRM rates can most readily be explained by a lack of knowledge of the risks on the part of both physicians and patients. No matter what the cause, a consequence of the current surge in the choice of RRM is that it will undoubtedly result in an increased probability that some patients may undergo RRM without a demonstrable benefit (Hoover et al., 2010).

**Risk-Reducing Oophorectomy (RRO)**

Risk-reducing oophorectomy (RRO) is the removal of the ovaries with preventive intent in the absence of signs or symptoms suggesting ovarian cancer. Beyond its use for the prevention of ovarian cancer, RRO has been evaluated in observational studies for its effect on breast cancer risk (Hartmann & Lindor, 2016; Ray, Loescher, & Brewer, 2005),
and is commonly considered between ages 35 and 40, once child-bearing is complete (American College of Obstetricians and Gynecologists Committee on Practice Guidelines, 2008; Portnoy et al., 2015; Stuckey & Onstad, 2015).

There are many benefits of RRO. First, studies of RRO and breast-cancer risk among high-risk women showed a significant reduction in risk of approximately 50% when the operation was performed in women before menopause (Domchek et al., 2006, 2010; Hartmann & Lindor, 2016; Kramer et al., 2005; Mavaddat et al., 2013; Menkiszak et al., 2016; Rebbeck et al., 1999, 2002). Additionally, premenopausal RRO is associated with a 60% reduction in all-cause mortality (Domchek et al., 2010; Finch et al., 2009). Although evidence has been presented suggesting that oophorectomy after menopause offers protection against breast cancer (Kotsopoulos et al., 2012), many studies (Eisen et al., 2005) have confirmed that women receive the greatest risk-reducing benefits when the surgery occurs prior to menopause, at completion of childbearing (preferably by age 40).

Like RRM, RRO also has drawbacks. First, RRO, of course, incurs the risks associated with any abdominal surgery. In addition to surgical risks, RRO results in premature menopause and loss of fertility (Armstrong, Schwartz, Randall, Rubin, & Weber, 2004; Finch et al., 2011; National Cancer Institute (NCI), 2016). Furthermore, early surgical menopause due to RRO is associated with an increased risk of osteoporosis, cardiovascular disease, sexual dysfunction, and reduced quality of life (Marchetti, Iadarola, & Palaia, 2014; Wuttke & Phillips, 2015). Thus, the complications
of premature menopause in the case of RRO may be significant (Eisen et al., 2000). Second, women who undergo RRO often have negative psychological outcomes (Eisen et al., 2000), although these may be time-limited and resolve within a year (Elit, Esplenn, Butler, & Narod, 2001). Third, although women are typically satisfied with their decision to undergo RRO, many report post-surgery that they would have liked to have received more information about the physical and emotional after-effects of surgery (Hallowell, 2000). Finally, several authors have discussed limitations regarding the study designs and statistical analyses of studies on RRO, including selection bias, immortal time bias, small sample size, and short duration of follow-up (Jatoi & Benson, 2016; Tran et al., 2016). Therefore, these studies may have inflated the significance of RRO for breast cancer risk reduction.

Some have suggested that RRO is more acceptable to patients than RRM (Andersen et al., 2016; Chai et al., 2014; Flippo-Morton et al., 2016), although this may be due to more frequent physician recommendation (K. A. Metcalfe, Kim-Sing, Ghadirian, Sun, & Narod, 2014). Nevertheless, reported uptake of RRO ranges widely. Across studies, 45-71% of high risk women elect RRO (Beattie et al., 2009; Chai et al., 2014; Friebel et al., 2007; Garcia et al., 2014; Kauff et al., 2008; Mannis, Fehniger, Creasman, Jacoby, & Beattie, 2013; Rhiem et al., 2011; M. D. Schwartz et al., 2012; Sidon et al., 2012). However, Garcia and colleagues (2014) reported that, despite high overall uptake of RRO in their sample, only 17% of women receiving RRO were under age 40 (the NCCN recommended age). This is problematic, given that the benefit of RRO for reducing breast cancer risk is considerably decreased after onset of menopause.
Chemoprevention

Chemoprevention is the use of medicines, vitamins or other agents to prevent the development of cancer. The most popular and well-supported chemotherapy agents are selective estrogen receptor modulators (SERMs, e.g., tamoxifen, raloxifene) and aromatase inhibitors (AIs, e.g., letrozole, anastrozole, exemestane) (Mahoney, Bevers, Linos, & Willett, 2008; Mocellin, Pilati, Briarava, & Nitti, 2016). Persistently increased blood levels of estrogens are associated with an increased risk of breast cancer, and SERMs block the effects of estrogen in the breast tissue (Danforth, 2016; F. Li, Dou, Wei, Li, & Liu, 2016). Tamoxifen is presently deemed to be the agent of choice (Sismondi et al., 2015; Vogel, 2016). In 2013, the American Society of Clinical Oncology (ASCO) recommended that tamoxifen should be discussed as an option to reduce the risk of ER-positive breast cancer in women over age 35 at increased risk of breast cancer (Visvanathan et al., 2013). Studies have shown that women who face an elevated 5-year risk of developing a first breast cancer can cut their odds of breast cancer in half by taking tamoxifen (Fisher et al., 1998; Ubel et al., 2010), with a median follow-up ranging from 96 to 158 months (Jatoi & Benson, 2016). Multiple, randomized clinical trials have also demonstrated the safety of tamoxifen for chemoprevention, with long-term follow up to 20 years (Vogel, 2015). Raloxifene and exemestane have also shown benefit in reducing breast cancer risk, and raloxifene has been shown to have fewer side effects (H. D. Nelson, Smith, Griffin, & Fu, 2013; Society of Gynecologic Oncologists, 2014; Stuckey & Onstad, 2015). However, raloxifene is only recommended for
postmenopausal women (Banegas et al., 2013; Bevers et al., 2010; Visvanathan et al., 2013).

There are downsides to chemoprevention. The efficacy of SERMs in preventing breast cancer is limited to estrogen receptor–positive tumors (Mocellin et al., 2016; Ropka, Keim, & Philbrick, 2010), and there is some evidence indicating that tamoxifen is effective for prevention among BRCA2 carriers but not BRCA1 carriers (Wieand et al., 2001). Although SERMs can only be used for 5 years (Pruthi, Gostout, & Lindor, 2010), findings in the adjuvant setting suggest that 10 year use is more effective than 5 year use (Davies et al., 2013). While adherence over the first year was adequate, persistence sufficient for the full preventative effect is extremely rare (S. G. Smith et al., 2016). Additionally, there is increased risk from these medications for important medical conditions, including endometrial cancer, thromboembolic events, and hot flashes (Blaha et al., 2009; Ropka et al., 2010; Stan et al., 2013; Ubel et al., 2010; Visvanathan et al., 2013). Finally, side effects of agents such as tamoxifen include mood swings, depression, and low libido (National Cancer Institute (NCI), 2012).

Women with a 5-year risk of 1.67 or greater are considered “high risk” and eligible for chemoprevention (Stuckey & Onstad, 2015). Fifteen to eighteen percent of women in the community setting meet this threshold (Brewster, Christo, Lai, & Helzlsouer, 2005; Hum, Wu, Pruthi, & Heisey, 2016) and it has been estimated that more than 2 million U.S. women could benefit from chemoprevention medication (Freedman et al., 2003).
However, risk-reducing medication remains an underutilized risk management option. Although some sub-groups of women (i.e., those diagnosed with atypia or lobular carcinoma in situ [LCIS]) are more likely to use chemoprevention for risk reduction (Clifford, Hughes, Roberts, Pirzadeh-Miller, & McLaughlin, 2016; S. G. Smith et al., 2016), uptake of chemoprevention in the high-risk setting remains relatively low (Bober, Hoke, Duda, Regan, & Tung, 2004; Collins et al., 2013; Fisher, Vogel, Costantino, Wickerham, & Cronin, 2002; Garcia et al., 2014; Martinez, Fagerlin, Witteman, Holmberg, & Hawley, 2016; Matloff, Moyer, Shannon, Niendorf, & Col, 2006; Melnikow et al., 2005; Wuttke & Phillips, 2015). An estimated 12-17% of high-risk women utilize chemoprevention agents for breast cancer risk reduction (Melnikow et al., 2005; M. D. Schwartz et al., 2012). Awareness of the availability of breast cancer preventive therapy is limited (Cyrus-David & Strom, 2001), even among a group of highly educated women (Karavites, Allu, Khan, & Kaiser, 2015). Moreover, few women at elevated risk report having discussed tamoxifen use with their providers (Kelly A. Metcalfe et al., 2005). Physician recommendation is highly correlated with treatment decision (Hum et al., 2016; Wuttke & Phillips, 2015), and many physicians do not feel comfortable prescribing chemoprevention agents to reduce breast cancer risk (Collins et al., 2014; Hum et al., 2016).

Even with a provider recommendation, decision-making about chemoprevention is complex, and many eligible women decline treatment or remain undecided (Bober et al., 2004). High-risk women are likely to opt against chemoprevention for reasons such
as fear of side effects and difficulty in understanding information about chemoprevention (Bober et al., 2004; Fabian & Kimler, 2005; Hum et al., 2016; Lovegrove, Rumsey, Harcourt, & Cawthorn, 2000; Port, Montgomery, Heerdt, & Borgen, 2001). Factors driving intentions for chemoprevention include time needed to take the medication for it to work and 5-year risk of breast cancer (Martinez et al., 2016). Breast cancer–related anxiety, cancer worry, and heightened cancer risk perception were also associated with the decision to take a chemoprevention agent (Bastian et al., 2001; Hum et al., 2016). Furthermore, medication adherence is related to personal perception of the necessity of the medication, concerns about adverse side effects, and the patient’s perception of the risk/benefit ratio (McKay, Latosinsky, & Martin, 2005; Melnikow et al., 2008; Ropka et al., 2010; Salant, Ganschow, Olopade, & Lauderdale, 2006). It should also be noted that patients’ reluctance to take chemoprevention agents is not simply a reluctance to take medications per se; many patients are more willing to take other medications (e.g., statins, antidepressants, and herbals) for which limited safety and efficacy data are available (Matloff et al., 2006).

**Lifestyle Changes**

Modification of lifestyle (e.g., the avoidance of obesity, physical inactivity, and high alcohol intake) is a principal strategy for the prevention of breast cancer (Sismondi et al., 2015). Although a constellation of breast cancer risk factors has been identified, and physicians feel comfortable discussing these types of changes with their patients (Collins et al., 2014; Hum et al., 2016), the magnitude of their impact has been
questioned (Prentice, 2004), and many lifestyle risk factors are not easily modified (Mahoney et al., 2008). These include overweight and obesity (among postmenopausal women), physical inactivity, and alcohol intake (Spector et al., 2009).

**Diet**

The relationship between diet and breast cancer is not clearly understood. The long latency of breast cancer makes evaluation of diet during early life, a period when environmental exposures may play a strong role, a further methodologic challenge (Mahoney et al., 2008). A high-fat diet typically leads to increased caloric intake, which may result in overweight (Spector et al., 2009). Body fatness increases the risk of breast cancer after menopause (World Cancer Research Fund & American Institute for Cancer Research, 2007), and a weight gain of more than 20 kilograms after the age of 18 doubles the risk for breast cancer (Rosato et al., 2011). Aside from following general dietary recommendations for healthy eating, there is no clear evidence that specific dietary components can effectively reduce breast cancer risk. Although diet and lifestyle factors may have an impact on breast cancer risk, dietary or lifestyle modification alone is not likely to be a sufficient method for breast cancer prevention, especially among high-risk women (Sakorafas, 2003; Willett, 2001).

**Physical Activity**

Others have posited that increased physical activity may reduce one’s risk for breast cancer. It has been demonstrated in several prospective studies that regular physical activity can significantly reduce breast cancer incidence in postmenopausal and
premenopausal women, the risk being reduced on average by 25% (Friedenreich et al., 2010). Although some argue that this is via reduction in overall body weight (see above), analyses controlling for body weight demonstrates that four or more hours per week of exercise results in about a 40% reduction in breast cancer risk (Thune, Brenn, Lund, & Gaard, 1997).

Alcohol Consumption

An international panel of the World Cancer Research Fund and American Institute for Cancer Research concluded that there is convincing evidence that alcohol intake, even at moderate levels, raises the risk of breast cancer at all ages (Mahoney et al., 2008). Specifically, consumption of 15 g/day of alcohol raised breast cancer risk by 2.5-fold, and women who average 1.5 drinks per day have a 30% increase in risk (Collaborative Group on Hormonal Factors in Breast Cancer, 2002).

Uptake

Over time, some high risk women maintain awareness of their cancer risk but adapt and change thoughts and behaviors. Anecdotally, engaging in healthy lifestyle behaviors are transitions that often occur (Hamilton, Williams, Skirton, & Bowers, 2009). Yet many women, even those at high risk, are unaware of associations between lifestyle behaviors and breast cancer risk (Bernat, Anderson, Parrish-Sprowl, & Sparks, 2015; Spector et al., 2009). Only a few studies have explored whether high-risk women are more likely to change their lifestyles, and results are contradictory (Ochoa et al., 2010). In some studies, high-risk women reported improvements in their health-related behavior
(diet, exercise, alcohol consumption and smoking) in the period following a first-degree relative’s cancer diagnosis (Lemon, Zapka, & Clemow, 2004; Ochoa et al., 2010), whereas many authors report that high-risk women did not undertake more preventive behavior (Madlensky, 2005; Ochoa et al., 2010). In an illustrative study by Spector and colleagues (2009), only one-third of the women reported healthy lifestyle changes because of their breast cancer risk status; dietary change was most frequently reported. Researchers have concluded that spontaneous behavioral change to a more preventive lifestyle in relatives of cancer patients is very low (Ochoa et al., 2010).

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Which \ risk\text{-}reducing \ strategy \ is \ best?
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No data exist directly comparing risk-reducing mastectomy, risk reducing oophorectomy, chemoprevention, and lifestyle changes for breast cancer risk reduction. Researchers have typically assumed that patients would not accept random assignment to treatment groups, as patients tend to have strong opinions regarding these procedures. Outside of randomized controlled trials, two groups have used statistical simulations to directly compare risk-reducing strategies. While model-based analyses cannot replace empirical studies, they can address clinically important questions that are not amenable to randomized trials.

Kurian, Sigal, and Plevritis (2010) used decision analysis to simulate RRM and RRO in BRCA1/2 mutation carriers to directly compare survival probability. They found that the most effective single intervention for BRCA1 mutation carriers was RRO at age
40, yielding a 15% absolute survival gain, while the most effective single intervention for BRCA2 mutation carriers was RRM at age 40, yielding a 7% survival gain. The combination of RRM and RRO at age 40 improved survival more than any single intervention, yielding a 24% survival gain for BRCA1 and 11% for BRCA2 mutation carriers.

In a similar study, Abdollahian and Das (2014) used a statistical model to evaluate the risk-reduction strategies that would maximize quality-adjusted life years (QALYs) or minimize cost. For BRCA1 mutation carriers, the cost-optimal strategy was a combination of RRM and RRO at age 30 with no screening afterwards, while the QALYs-optimal strategy suggested RRO at age 30 and RRM at age 50 with screening afterwards. For BRCA2 mutation carriers, the cost-optimal strategy was RRO at age 30, RRM at age 40, and yearly screening only after age 56, while the QALYs-optimal strategy suggested RRM at age 40 with screening afterwards.

Cognitions about the Health Threat: Perceived Risk

One of the most frequently researched cognitive components of the risk-reduction decision making process is perceived risk. In fact, leading theoretical models of health behavior (e.g., the HBM) include perceived risk as a key cognitive element. Individuals’ motivation to act to protect their health is believed to increase as a function of their belief that they are susceptible to a health threat (Shiloh & Ilan, 2005). Thus, perceptions of risk are critical drivers of volitional health behaviors (Waters & Hay, 2016). However,
people’s beliefs about the numeric probability of an event are only part of how people perceive the risk. There is also “a more intuitive and non-analytic component to uncertainty that is not necessarily well represented in a numeric subjective probability response but can be an important mediator of decisions and behavior” (Windschitl, 2002). In other words, people’s objective knowledge about the risk of an event occurring can differ significantly from their “intuitive perceptions” about whether or not the event will occur (Windschitl, 2002). In the case of women at high risk of breast cancer, patients’ perceived risk has a large impact on risk management decisions independent of their objective risk. There is a large body of evidence indicating that perceived risk is more powerful and influential for decision making than objective risk.

However, risk perceptions are complex and influenced by many factors which may impair accurate risk comprehension and risk management decision making (Croyle & Lerman, 1999; Hopwood, 2000). Risk is a difficult concept to grasp for most lay individuals, and there is no consensus on how best to present individualized risk information to patients (Barnes, Hanoch, Miron-Shatz, & Ozanne, 2016; Dorval et al., 2013). Furthermore, one factor that has been consistently reported to affect the accuracy of perceived risk is numeracy, or one’s ability to understand and use numerical information (Ancker & Kaufman, 2007; W. Nelson, Reyna, Fagerlin, Lipkus, & Peters, 2008). National surveys estimate that about half of the population of the United States has no more than a rudimentary ability to deal with quantitative information (Reyna & Brainerd, 2007). Patients such as these have lower risk comprehension (Barnes et al., 2016), and are especially prone to overestimating their own risk of cancer (Davids,
Schapira, McAuliffe, & Nattinger, 2004; L. M. Schwartz, Wolshin, Black, & Welch, 1997). Understanding their own risk for breast cancer often involves complicated processes such as interpreting base-rates, joint-probabilities (Wolfe & Reyna, 2010), or conditional probabilities (Wolfe, Fisher, & Reyna, 2013; Wolfe, Fisher, Reyna, & Hu, 2012) as well as comparing risks and understanding fractions, percentages, decimals, and frequencies (Reyna, Nelson, Han, & Dieckmann, 2009). Research has shown that even individuals with high levels of numeracy can struggle with these types of concepts (Peters, McCaul, Stefanek, & Nelson, 2006; Portnoy, Roter, & Erby, 2010; Reyna & Casillas, 2009; Wolfe, 1995; Wolfe et al., 2013, 2012).

It may also be the case that individuals have simplified their risk information in order to make sense of it, consistent with “Fuzzy Trace” theory (Reyna & Adam, 2003) which looks to identify the specific problems individuals have in understanding and processing risk estimates. According to “Fuzzy Trace” theory, complicated information is encoded into a “gist” where people have a tendency to use the least precise level of representation that still works for their cognitive processing, in order to facilitate decision making (Reyna & Adam, 2003). There is an understandable tendency to assume that patients will always see risk in context (e.g., they will consider 13% as being a lower risk than 15% and a higher risk than, say, 10%) and that their interpretations of risk inherently include intuitive and emotional reactions which translate being “high” or “low” into “something to worry about” or “something to be relieved about”. Many individuals demonstrate a “fuzzy” processing preference in that they prefer to reason using gist representations (Weil et al., 2015; Wolfe & Fisher, 2013). Put another way, most
individuals rely much more heavily on the qualitative information when estimating subjective probabilities while placing less weight on the quantitative information provided.

As a result, patients’ perceived risk may be inaccurate, with a tendency to overestimate (Black, Nease, & Tosteson, 1995; Burke et al., 2015; Caruso et al., 2009; Gurmankin, Domcheck, Stopfer, Fels, & Armstrong, 2005; Lerman et al., 1995; Rhiem & Schmutzler, 2014; Sivell et al., 2008; B. L. Smith et al., 1996). In fact, women even overestimate their risk of breast cancer in relation to other health risks (Alexander, Ross, Sumner, Nease Jr., & Littenberg, 1996; Bluman et al., 2003; Katapodi, Lee, Facione, & Dodd, 2004; I M Lipkus, Biradavolu, Fenn, Keller, & Rimer, 2001). Overestimation of an individual’s risk status has been associated with several negative outcomes, including increased anxiety and distress for one’s self and family members, lower perception of control over cancer, depression, and hyper-vigilance in screening practices (Mellon et al., 2008). Accurate risk perception is particularly important for women making potentially life-altering decisions regarding breast health (Hopwood, Howell, Lalloo, & Evans, 2003; Sivell et al., 2008). Those with inaccurate risk perceptions may have difficulty using empirical risk information to guide risk-management decision-making (Heshka, Palleschi, Howley, Wilson, & Wells, 2008; Katapodi et al., 2004; K. Kelly et al., 2005; Meiser & Halliday, 2002; Sivell et al., 2008). For example, Ozanne and colleagues (2014) found that the majority of a cohort of 75 women who had undergone RRM had a significantly exaggerated perception of their risk at the time they made their surgery decisions. Similarly, Metcalfe and Narod (2002) found that women who had undergone
RRM estimated their lifetime risk of developing BC to be 76% compared to computer generated estimates of 59% for BRCA carriers and 17% for those with a strong family history. In another study, Hatcher and colleagues (2001) followed 143 women who were at high risk for breast cancer. Of these, 79 chose to undergo RRM. The perceived risk of breast cancer was higher among women who chose surgery, and this perception was often inaccurate. Additionally, Morris and colleagues (2001) found that only 46% women seeking genetic counseling were actually believed to carry significant risk as assessed by a genetic counselor. Furthermore, a substantial minority of women in this sample chose to pursue RRS even after being told that they were not at heightened risk (Morris et al., 2001). Research has consistently demonstrated that women at moderate (versus high) risk of breast cancer are equally likely to consider both RRM and RRO (Andersen et al., 2016). Hoskins and Greene (2012) attribute these risk management decisions to women’s belief that breast cancer is not only likely, but inevitable, unless they take active steps to prevent it. Supporting this hypothesis is the fact that some women express strong preferences regarding risk reduction even before receiving information about their risk status (Hesse-Biber, 2014; Tong et al., 2015; van Dijk et al., 2003). These findings raise serious questions about the level of informed consent and the consequent appropriateness of risk-management decisions (Barnes et al., 2016).

Thus, the literature underscores the need for genetic counselling that disentangles risk perception from objective information to promote better decision-making (Bayraktar & Arun, 2017; Miron-Shatz, Hanoch, Katz, Doniger, & Ozanne, 2015). Accurate, tailored interpretation and communication of genetic risk is critical for patient decision-
making. In past research, 90% of the women who regretted surgery had not received preoperative counselling (Borgen et al., 1998). In addition, pre-counseling distress impacts risk-reducing surgery intentions and decisions, even after comprehensive genetic counseling (Graves et al., 2007; M. D. Schwartz et al., 2012; Tong et al., 2015; van Dijk et al., 2003). Moreover, many high risk women report dissatisfaction with the information and counseling they have received regarding these decisions and rate decision making as one of the most stressful aspects of risk management (Claes et al., 2005; Kenen, Shapiro, Hantsoo, Friedman, & Coyne, 2007).

Genetic counseling aims to improve accuracy of risk perceptions (Biesecker, 2001), but may result in risk perceptions that are only slightly more accurate (Hopwood, 2000) and do not last in the long-term (Gamp & Renner, 2016; Sivell et al., 2008). Although patients report subjective benefit following counseling (Catania et al., 2016), a significant proportion of counselees continue to overestimate or underestimate their risk (Braithwaite, Emery, Walter, Prevost, & Sutton, 2006; Butow, Lobb, Meiser, Barratt, & Tucker, 2003; Smerecnik, Mesters, Verweij, De Vries, & De Vries, 2009). For example, Ozanne and colleagues (2010) found that preferences for risk-reducing intervention varied widely across women but were stable across time. Participation in a risk assessment and counseling visit had no effect on women’s preferences for preventive interventions, suggesting that women have clear and informed values that guide these preferences and should therefore guide decision making. These and other results suggest that the objective risk information provided in the counselling is an event in this process of decision making, but not necessarily the most influential (Gamp & Renner, 2016; van
Dijk et al., 2003; van Dijk, van Roosmalen, Otten, & Stalmeier, 2008). In short, personal experiences may carry more weight for these high-risk patients than the information provided by genetic counselors in risk assessment (D’Agincourt-Canning, 2005; Heiniger, Butow, Charles, et al., 2015; K. Kelly et al., 2005; Madlensky, 2005; Matloff et al., 2006; McAllister, 2003; Sanders, Campbell, Donovan, & Sharp, 2007).

Emotions about the Health Threat: Cancer-Specific Distress

Until recently, most research on both medical and non-medical decision making assumed that most biased or flawed decisions were the result of cognitive limitations such as low numeracy (Tversky & Kahneaman, 1974). Affect was commonly excluded from traditional value-expectancy theories of health behavior and decision-making. However, recent research suggests that traditional value-expectancy theories are not sufficient to fully explain health behavior decision-making, and affect is increasingly recognized as an independent player in the decision-making process. Loewenstein and colleagues’ (2001) “risk-as-feelings hypothesis” highlights the role of affect experienced at the moment of decision making, proposing that responses to risky situations (including decision making) result in part from direct (i.e., not cortically mediated) emotional influences, including feelings such as worry, fear, dread, or anxiety. Research by Zajonc and colleagues (1980), Bargh (1984), and LeDoux (1996) likewise shows that affective reactions to stimuli are often more rapid and basic than cognitive evaluations. Slovic et al. (2007) integrated these findings into the theoretical framework of the affect heuristic, which describes the importance of affect in guiding judgments and decisions. This
framework asserts that mental representation of events become “tagged” with an affective meaning constructed of people's positive and/or negative previous experiences with this event. Thereby, relying on affect can be a very quick and efficient way to weigh the pros and cons of a situation, especially in case of a very complex and uncertain situation (Slovic et al., 2007).

Thus, emotional experiences may play a significant role in decision making for women at high risk for breast cancer. Although the research evidence indicates that high risk women do not have heightened levels of general psychological distress relative to healthy controls (Borreani et al., 2014; Butow et al., 2005; Coyne, Kruus, Racioppo, Calzone, & Armstrong, 2003; Rees, Fry, Cull, & Sutton, 2004), some studies have reported elevated levels of cancer-specific anxiety or worry in this population (Butow et al., 2003; Hay, Buckley, & Ostroff, 2005; Hutson, 2003; Mosher, Danoff-Burg, & Brunker, 2005; Raveis & Pretter, 2005; Rees et al., 2004; Schmid-Büchi, Halfens, Dassen, & van den Borne, 2011). Other authors posit that large within-group variability exists, with a subgroup of high risk women vulnerable to high or sustained cancer related distress (Beran et al., 2008; Croyle, Smith, Botkin, Baty, & Nash, 1997; Den Heijer et al., 2011; Halbert et al., 2011; Hamann, Somers, Smith, Inslicht, & Baum, 2005; Kinney et al., 2005; Voorwinden & Jaspers, 2016; Watson et al., 2004). For example, one study of sisters of women diagnosed with breast cancer, found that approximately 50% of study participants had moderate to severe levels of cancer-specific distress (Kelly A. Metcalfe et al., 2013). Higher levels of cancer-specific distress have also been demonstrated in girls from high-risk families as early as age 10 (Bradbury et al., 2015), lasting into late
adolescence and adulthood (Bradbury et al., 2016). Cancer-specific distress can disrupt functioning in a variety of areas (Wellisch, Gritz, Schain, Wang, & Siau, 1992). An early population-based study of unaffected first-degree relatives of breast cancer patients found that 53% reported intrusive thoughts about breast cancer and 33% reported impairments in daily functioning due to breast cancer worries (Lerman & Schwartz, 1993). In a more recent study, approximately two thirds of a high risk breast cancer clinic sample perceived worries about breast cancer as interfering with their functioning in a variety of domains including sleep, work, concentration, relationships, having fun, feeling sexually attractive, meeting family needs, and reproductive decisions (Trask et al., 2001). In one small qualitative study, some women's cancer related worry was so extreme the researcher described they were “unable to plan for the future because they believed they didn't have one” (M. Bebbington Hatcher & Fallowfield, 2003). Additionally, there is some evidence to suggest that the experiences associated with having a family history of breast cancer, such as bereavement, contribute to cancer anxiety above and beyond the more objective risk associated with family history (Rees et al., 2004) and may significantly influence expectations about risk prevention and outcomes (Padamsee, Muraveva, Wills, Yee, & Paskett, 2016).

Taken together, this literature suggests that the manner in which an individual emotionally responds to a threat can have implications for motivating health behaviors (Bernat et al., 2015; Consedine, Magai, & Bonanno, 2002), above and beyond one’s perceived risk (Leventhal et al., 1983; Loewenstein et al., 2001; Redelmeier, Rozin, & Kahneman, 1993). People have strong affective reactions to cancer risk information
(Zikmund-Fisher, Fagerlin, & Ubel, 2010), which may affect utilization of risk reducing strategies. Thus, anticipating and assessing affective reactions is an essential step in understanding risk reduction decision making.

Like other heuristics that provide efficient and generally adaptive responses but occasionally get us into trouble, reliance on affect can also mislead (Slovic, Finucane, Peters, & MacGregor, 2004). Of clinical concern is research indicating that affect, rather than objective risk, is associated with uptake of risk management strategies (Andersen, Smith, Meischke, Bowen, & Urban, 2003; Hoover et al., 2010; Hurley, Miller, Costalas, Gillespie, & Daly, 2001; Meiser et al., 2000; M. D. Schwartz et al., 1999; M. D. Schwartz, Peshkin, Tercyak, Taylor, & Valdimarsdottir, 2005; Stefanek, Helzlsouer, Wilcox, & Houn, 1995). Cancer-related anxiety has been related to reduced comprehension of risk information (Lerman et al., 1995), potentially leading to poorly informed decisions. RRS has been associated with cancer-specific worry (Hesse-Biber, 2014; Lodder et al., 2002; Portnoy et al., 2015; M. D. Schwartz, Kaufman, et al., 2003; Stefanek et al., 2001; van Dijk et al., 2003; van Driel et al., 2016), anxiety (Lodder et al., 2002; M. D. Schwartz et al., 2012), and fear. Litton and colleagues (2009) surveyed a sample of high-risk women (both BRCA positive and BRCA negative), and found that 84% of the sample felt that RRS was the most effective way to reduce their sense of fear about getting cancer. Further information was provided by Haroun et al. (2011); 38% of respondents to their survey cited fear of cancer as the reason they had a RRM. Cameron and Reeve (2006) also found that worry was associated with positive beliefs about benefits of RRS among high-risk women. Finally, Van Driel and colleagues (2016)
found that both high negative affect (characterized by feelings of distress) and high positive affect (characterized by feelings of energy and self-esteem) were associated with patient intentions to have RRM.

However, not all researchers have demonstrated a positive relationship between emotional experience and risk-reducing behaviors. Some have found that there is a negative association or no association between these two variables (Bernay, Porrath, Golding-Mather, & Murray, 1982; Case, Andrews, Johnson, & Allard, 2005; Claes et al., 2005; Murray & McMillan, 1993; O’Malley & Fletcher, 1987; Shiloh & Ilan, 2005). This pattern has been described by some as a “U-shaped” effect of emotions on risk management behavior, such that very low and very high levels of affect are both related to reductions in risk management behavior (Hay et al., 2006). Apart from differences in results due to methodological issues, these conflicting results may be the facilitating or interfering effect that emotion regulation efforts can have on action plans. Yet very few studies examine the potential mediating effects of emotion regulation in this context (Bowen et al., 2003; Taber et al., 2015).

Interactions of Emotion and Cognition

Modern decision-making theories point to a dual-pathway framework in which both cognitive and emotional information are taken into account (Slovic et al., 2004). Cognitive information (e.g., knowledge, perceived risk) is processed via the “analytic system”, which uses algorithms and normative rules, such as probability calculus, formal
logic, and risk assessment. It is relatively slow, effortful, and requires conscious control. Emotional information (e.g., worry, anxiety) is processed via the “experiential system”, which is intuitive, fast, mostly automatic, and not very accessible to conscious awareness. Rather than viewing cognition and emotion as opposing processes, these dual-process theories generally take an integrative approach in which these two systems operate in parallel but each seems to depend on the other for guidance (De Vries, Fagerlin, Witteman, & Scherer, 2013; Peters, 2012; Reyna, 2012a, 2012b; Schmiege, Bryan, & Klein, 2009; Zikmund-Fisher et al., 2010). Sometimes these effects act in concert, and sometimes these effects act in opposition. For example, psychological distress has been linked to decreased ability to understand genetic information and to make informed decisions (Gurmankin et al., 2005; Katapodi, Northouse, Milliron, Liu, & Merajver, 2013; K. Kelly et al., 2004). When the analytic and intuitive systems disagree, in many cases it is the affective centers that rule the day and determine people’s decisions and actions (Loewenstein et al., 2001). In the case of breast cancer risk, research has consistently found a positive relationship between general and cancer-specific distress/anxiety, risk perception, and risk-averse choices (Audrain et al., 1998; Cameron & Diefenbach, 2001; Constans, 2001; Easterling & Leventhal, 1989; Erblich, Bovbjerg, & Valdimarsdottir, 2000; Hay et al., 2006; McCaul, Canevello, Mathwig, & Klein, 2003; McGregor et al., 2004; Meiser et al., 2001; Price et al., 2007), although sometimes this relationship is modest (Sjoberg, 1998).

One such study, conducted by Price et al. (2007), examined the relationship between cancer worry and perceived risk. Although the two were correlated, general
anxiety and the stressful impact of recent cancer related events contributed to cancer worry independent of the effects of perceived risk. These results suggest that women’s anxiety or worry about breast cancer is influenced by a range of factors, including risk perception, and that these experiences have an independent effect on worry, over and above a woman’s sense of her risk. Accordingly, even if a woman is able to quote her risk accurately and understand that developing cancer is not a certainty, if she has had difficult experiences in her family with cancer, or is in general, a “worrier” (i.e., high trait anxiety), then her breast cancer worry might be elevated.

Another notable study conducted by Heiniger and colleagues (2015) highlights the affective versus cognitive understanding of risk among women at high risk of breast cancer. The authors examined whether anecdotal experiences with cancer or objective risk information predicted more of the variance in risk comprehension (“What do you understand about your risk?”) and risk management decisions (“What do you do to manage or minimize your risk?”). In their sample, the individual’s experience of coming from a high-risk family was more important for risk management decisions. Although women’s cognitive understanding of their risk appeared generally accurate, this objective risk information was considered of secondary value. The authors conclude that assessment of risk perceptions both for research and in clinical practice should aim to differentiate between affective and cognitive factors in risk perception (i.e., what women think about their risk, and how they feel about their risk).
All told, the literature supports the notion that cognitive and affective factors reciprocally influence each other, with a subsequent impact on decision-making. However, further research is needed to disentangle the direct effects and/or interactions between emotion and cognition to improve cancer decision making (Reyna, Nelson, Han, & Pignone, 2015).

Focus of the Present Investigation

A dual-pathway framework of decision-making among patients at high risk for breast cancer has not been tested as a comprehensive model. Further information is needed to understand (1) the interaction of cognitive and affective factors in decision making, and (2) the potential role of emotion regulation in this process. Two models, one mediation and one moderation, reflecting portions of the theoretical model (Figure 3a and Figure 4a) were tested in a sample of women at high risk for breast cancer.

In the present study, mediation analysis was conducted to examine the cognitive pathway, comprised of (1) the direct effect of cognitions about risk on behavioral intentions and (2) the indirect effect of attitudes on the relationship between cognitions about risk and behavioral intentions for risk-reducing behavior. Moderation analysis was used to examine the emotional pathway, comprised of (1) the direct effect of emotions about risk on behavioral intentions and (2) the moderating effect of various emotion
regulation strategies on the relationship between emotions about risk and behavioral intentions. Analyses were repeated for six behaviors (RRM, RRO, chemoprevention, and lifestyle changes [dietary changes, physical activity, and alcohol consumption]).

Our hypotheses were fourfold:

1. First, cognitions about risk would have a direct effect on behavioral intentions, such that higher perceived severity would predict increased behavioral intentions.

2. Second, emotions about risk would have a direct effect on behavioral intentions, such that higher levels of negative emotions would predict increased behavioral intentions.

3. Third, attitudes about risk-reducing behaviors would significantly mediate the relationship between cognitions about risk and behavioral intentions, such that more positive attitudes about risk-reducing strategies would predict increased behavioral intentions.

4. Finally, emotion regulation strategy use would significantly moderate the relationship between emotions about risk and behavioral intentions, such that a

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3 A Principal Components Analysis (PCA) was conducted to reduce emotion regulation measures into data-derived emotion regulation strategies. We hypothesized two to three components (reappraisal, emotional expression/suppression, and possibly emotional processing). Planned analyses allowed each component to be analyzed in a separate moderation model. Thus, we anticipated testing two to three separate moderators. Actual models tested are described in the Results section.
greater use of approach strategies would be associated with a stronger relationship between negative emotions and behavioral intentions.\(^4\)

We anticipated that the strongest effects will occur for RRM and RRO, however. Thus, the models involving these behaviors were the primary focus of this investigation. As the emotions associated with lifestyle changes are often less intense (compared to RRS), we anticipated that these models might demonstrate weaker effects. It might be difficult to distinguish between lifestyle changes (i.e., dietary changes, increased physical activity, and reduced alcohol consumption).

\(^4\) Emotion regulation may be conceptualized as either a mediator or a moderator. For the purposes of the present study, the hypothesis was that of a moderating relationship. However, we tested both relationships and compared fit of model to the data. Fit statistics for both models are presented in the Results section.
Chapter 2: Method

Design

A single group, cross-sectional design was used. Data were collected from women at high risk for breast cancer on one occasion.

Procedures

Data was obtained from three sources (see Figure 5). Group 1 (n = 65) included patients from the high-risk breast clinic at The Ohio State University Comprehensive Cancer Center (n = 65). This multidisciplinary, high-risk breast clinic provides services to individuals who have not previously been diagnosed with cancer. Over 200 new patient risk evaluations are conducted per year and over 900 return patients (previously deemed to be high risk) are seen for follow-up (Senter & Hatfield, 2016). For the present study, eligible participants were identified via medical record review prior to their appointment at the high-risk breast clinic; both new and returning patients were approached after meeting with their physician.
Group 2 included participants who self-identified as high-risk based on family history of breast cancer, and contacted the study team via The Ohio State University’s StudySearch website (n = 20). Finally, Group 3 included undergraduate students required to participate in research for course credit (n = 18). Students self-identified as high-risk during a screening survey. Screening items for Groups 2 and 3 are presented in Appendix C. Although family history was not confirmed via medical record review for Groups 2 and 3, prior research has demonstrated that self-reported family cancer history is a reliable and valid means of identifying healthy individuals at risk (Flória-santos et al., 2016).

Across groups, a total of 194 women were approached regarding study participation (Group 1 = 110, Group 2 = 54, Group 3 = 30). A total of 103 women (53%) participated and provided complete data.

Eligibility criteria were the same across group and included: female; high risk for breast cancer (defined below); age ≥18 and ≤90; able to speak/read English. Exclusion criteria were: concurrent diagnosis of organic brain syndrome, dementia, or mental retardation; non-English speaking; significant sensory deficit; and/or major mental illness (e.g., schizophrenia, psychotic disorder); prior diagnosis of cancer (including ductal carcinoma in situ).

Women were defined as “high risk” if they met one of the following four criteria. First, women with a Gail model score (see Figure 2) of 1.67% or higher are typically
classified as "high-risk" (Stuckey & Onstad, 2015) and therefore were eligible for the present research (n = 41). Gail scores range from 1.00% to 8.00% in a standard screening population (\(M = 1.50\%, \text{ S.D.} = 0.7\%) (Eadie, Enfield, Taylor, Michell, & Gibson, 2013) and can be interpreted as the number of women out of 100 with similar scores that would develop breast cancer in the following five-year period (Altschuler & Somkin, 2005). This number is calculated by licensed genetic counselors and recorded in the patient’s electronic medical records. However, the Gail model only provides estimates for women above age 35 without a documented BRCA1 or BRCA2 mutation. Thus, additional eligibility criteria were used to capture these populations. Second, women with a documented BRCA1 or BRCA2 mutation were eligible for the present research (n = 15\textsuperscript{5}). Despite the inapplicability of the Gail model in this population, carriers of this genetic mutation have an elevated lifetime risk of breast cancer (between 50% and 80%). Third, women who have been previously diagnosed with atypical hyperplasia, fibroadenoma, or lobular carcinoma in situ (LCIS) were eligible (n = 6), as these benign breast diseases confer higher lifetime risk of breast cancer (between 18% and 60%). Finally, women below age 35 were eligible if they have been referred for genetic counseling based on strong family history (n = 41). This is defined by the Society of Surgical Oncology as “a family history of breast cancer in multiple first-degree relatives and/or multiple successive generations of family members with breast cancer… [and/or] a family history

\footnote{In clinical practice, it is rare for an individual unaffected by cancer to be tested for a BRCA1 or BRCA2 mutation (Glassey et al., 2016). In addition, the estimated prevalence of BRCA mutations in the general population is approximately 0.1\%. Taken together, this accounts for the relatively low number of BRCA carriers (15\%) in our high-risk sample.
of multiple members with bilateral and/or premenopausal and/or male breast cancer” (Giuliano et al., 2007).

After describing the purpose of the study, interested participants were then scheduled for a 60-minute assessment interview. Participants were offered the choice of completing the interview in-person (n = 68) or via telephone (n = 35). At the time of the study interview, all participants were provided with oral and written informed consent. Following informed consent, women completed questionnaires with the help of a female assessor. Assessments consisted of women’s self-reports of cognitions about breast cancer risk, emotions about breast cancer risk, emotion regulation, and other areas.

Participants

Sociodemographic, disease, and treatment characteristics are presented in Table 2. The sample was primarily Caucasian (85%), in early adulthood ($M = 43, SD = 18$ years), partnered (58%), and had some college education (79%). Most women (79%) had employer-sponsored health insurance, and an average of 1 ($SD = 1$) comorbid conditions (age-adjusted). There were significant differences between groups in age, education level, employment status, health insurance type, partner status, BMI, and number of medical comorbidities (see Table 3). Women from Group 1 (accrued from the high-risk breast clinic) were older, were more likely to be partnered, were more likely to have public health insurance, and had the highest number of comorbidities. Women from Group 3 (accrued from the Research Experience Pool) were younger, had lower levels of
education, were less likely to be employed, were more likely to have self-purchased health insurance, were less likely to be partnered, and had the lowest average BMI. These differences by accrual strategy were anticipated. However, it should be noted that age was significantly correlated with partner status ($r = 0.42, p < 0.01$), education ($r = 0.34, p < 0.01$), insurance type ($r = -0.55, p < 0.01$), BMI ($r = 0.25, p < 0.05$), and number of medical comorbidities ($r = 0.30, p < 0.01$). Women accrued from the high-risk breast clinic were the oldest on average ($M = 53$), followed by women accrued via StudySearch ($M = 31$), with women accrued via the Research Experience Program being youngest on average ($M = 19$). Thus, many of the differences by accrual source may be attributable to the age differences between groups.

Measures

Measures are presented in full in Appendix C. Descriptions of each measure are presented below.

*Cognitions about BC Risk*

Patients’ cognitions about breast cancer risk were operationalized. (1) *Perceived susceptibility* was assessed via a single, numeric, open-ended response item. Patients were asked to estimate their personal risk of experiencing breast cancer in their lifetime on a scale from 0% (it definitely will not happen) to 100% (it will definitely happen). (2) *Perceived seriousness* was assessed via a single item (“If you were to develop breast...
cancer, how serious would it be?”), which patients rated on an 11-point Likert scale (0 = “not serious” to 10 = “extremely serious”). Responses to these two items were multiplied for a perceived severity score.

_Cognitions about Risk-Reducing Behavior_

In the present study, a thought listing task elicited patients’ cognitions about risk-reducing options (Cacioppo & Petty, 1981). In this procedure, subjects are asked to list the thoughts they have when provided with specific stimulus, usually a word. Subjects may also be given a time interval during which the thoughts may have occurred, such as the last week. In the present study, each patient was provided with a booklet and the following instructions:

“We are interested in your thoughts about six options for reducing breast cancer risk.”

The booklet had six lined pages, each headed with a different prompt. Prompts included the following: (1) having breast surgery (mastectomy); (2) having my ovaries removed (oophorectomy); (3) taking oral tamoxifen, raloxifene, or an aromatase inhibitor (AI); (4) changing my diet; (5) increasing my physical activity; (6) reducing my alcohol consumption. Patients were instructed to list any thoughts that came to mind when the read the prompt. Patients listed as many thoughts as they wished on each page, separated by a line. After completing the six pages, they were instructed to go back through each
page and rate each thought on valence (positive [“a good thing about this behavior”] or negative [“a bad thing about this behavior”]), confidence (1 = “no confidence in this thought” to 5 = “an extreme amount of confidence in this thought”), and importance (1 = “not at all important” to 5 = “extremely important”).

Positively rated thoughts and negatively rated thoughts were tallied and weighted by confidence and importance ratings (in a multiplicative manner). A “net positivity” score was created by subtracting the weighted negative thoughts from the weighted positive thoughts. The net score was divided by total number of thoughts listed in order to control for verbosity. Thus, a higher score on the thought listing task represents more positive thoughts about the behavior.

Attitudes about Risk-Reducing Behavior

Attitudes about risk-reducing behaviors were assessed using two items. First, patients were instructed to rate how positively they feel towards each risk reducing behavior, ignoring the potential negative aspects of the behavior. Patients rated positivity on an 11-point Likert scale from 0 (“not at all positive”) to 10 (“extremely positive”). Second, patients were instructed to rate how negatively they feel towards each risk reducing behavior, ignoring the potential positive aspects of the behavior. Patients rated negativity on an 11-point Likert scale from 0 (“not at all negative”) to 10 (“extremely negative”). These ratings were used to generate two scores. First, negative attitude ratings were subtracted from positive attitude ratings to create an “overall attitudes”
score, ranging from -10 to +10. Second, based on reviews by Breckler (1994) and van Harreveld and colleagues (2015), ratings of positivity and negativity were combined to create an “ambivalence index”. For each participant, the lower attitude rating (either positive or negative) was specified as the “ambivalence index,” representing the amount of conflict between the positive and negative attitudes. Thus, potential scores on the “ambivalence index” ranged from 0 to 10.

Emotions about BC Risk

Patients’ emotions about breast cancer risk were assessed using two measures. First, the Impact of Events Scale (IES) (Horowitz, Wilner, & Alvarez, 1979) examines stress-related intrusive thoughts and avoidant thoughts and behaviors related to traumatic events. Seven items represent intrusion and eight represent avoidance. Participants are asked to indicate how frequently in the last week items have been true in describing their feelings regarding a traumatic event. Participants indicate their responses on a four-point scale from 0 (“not at all”) to 3 (“often”). Researchers in psycho-oncology use the IES, making it a measure of “cancer-specific stress” or “cancer-related anxiety” by replacing the vague term “it” with the phrase “cancer diagnosis and treatment” (Butler, Koopman, Classen, & Spiegel, 1999; Cella, Mahon, & Donovan, 1990; Cella & Tross, 1986; Cordova et al., 1995; Kornblith et al., 1992). The IES has also been used to measure distress associated with breast cancer specifically (Sie, Spruijt, & Zelst-stams, 2016). In the present study, items were modified to assess distress associated with heightened breast cancer risk (e.g., “I thought about how my life had been before I found out about
Second, three items assessed patients’ primary emotional experiences related to
their risk of breast cancer. Patients rated on an 11-point Likert scale (0 = “not at all” to
10 = “extremely”) how sad, angry, and anxious their risk of breast cancer makes them feel.

**Emotion Regulation**

Patients’ use of various emotion regulation strategies was assessed using two
measures. (1) The Emotional Approach Coping Scale (EACS) (Stanton, Kirk, Cameron,
& Danoff-Burg, 2000) is an 8-item measure assessing coping through emotional
approach. It comprises two four-item subscales: emotional expression (active verbal
and/or non-verbal efforts to communicate or represent one’s emotional experience) and
emotional processing (active efforts to acknowledge, explore meanings, and come to an
understanding of one’s emotions). The EACS is scored on a five-point Likert scale from 1 (“usually do not do this at all”) to 4 (“usually do this a lot”). The EACS has been frequently used in medical settings and has demonstrated an internal consistency with ranging from 0.69 to 0.92 in chronic illness samples (e.g., α = 0.69-0.71 for patients with cancer (Batenburg & Das, 2014; M. Cohen & Numa, 2011; Manne, Ostroff, & Winkel, 2007; Puig, Lee, Goodwin, & Sherrard, 2006; Stanton et al., 2000); α = 0.92 for patients with myofascial pain (J. A. Smith, Lumley, & Longo, 2002); α = 0.85 for patients with fibromyalgia (Geenen, van Ooijen-van der Linden, Lumley, Bijlsma, & van Middendorp, 2012)). (2) The Emotion Regulation Questionnaire (ERQ) (Gross & John, 2003) is a 10-item measure assessing specific emotion regulation strategies. It comprises two subscales: cognitive reappraisal (6 items) and expressive suppression (4 items). ERQ items are rated on a seven-point Likert scale from 1 (“strongly disagree”) to 7 (“strongly agree”). The ERQ demonstrated a 2-month test-retest reliability of about 0.7 (Gross & John, 2003).

A Principal Components Analysis (PCA) was conducted to reduce the two emotion regulation measures into data-driven categories reflecting emotion regulation strategies. We hypothesized that this would result in two to three components: reappraisal, emotional expression/suppression, and possibly emotional processing. This hypothesis was supported by the results of the PCA (see Table 4). Based on examination of the scree plot and eigenvalues, as well as parsimony, a three-component solution was selected. These three components represent the emotion regulation strategies of expression/suppression, reappraisal, and processing, respectively. Together, these
components explain 60% of the variance in the 18 emotion regulation items. Each individual component was analyzed in a separate moderation model (see analytic strategy below).

**Intentions for Risk Reducing Behavior**

Patients were asked whether they plan to engage in six breast cancer risk-reducing behaviors (risk reducing mastectomy, risk reducing oophorectomy, chemoprevention, dietary changes, increasing physical activity, and reducing alcohol consumption) at some point in the future. Participants had the option of responding “yes” (coded as 1), “no” (coded as -1), or “unsure” (coded as 0). If participants responded “yes” or “unsure”, they were asked to estimate the time frame in which they would engage in this behavior. Intentions for each individual behavior were also combined in an additive manner to generate a single variable representing global intentions for breast cancer risk reduction. Higher scores on this “global intentions index” indicate that an individual generally intends to engage in more risk-reducing behaviors.

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6It should be noted that patients will have the option of responding neutrally to this prompt (“unsure”). The decision science literature has noted that the choice to delay decision-making is a decisional outcome (Korfage et al., 2013). In the case of risk-reducing behaviors, the choice to delay decision-making may be considered an “informed decision” in that it accurately reflects a patient’s ambivalent attitudes towards the procedure (Korfage et al., 2013). Therefore, the inclusion of this option in the ratings of behavioral intentions is theoretically grounded.
Control Variables

Three measures were included as potential control variables. First, women’s estimated lifetime risk of breast cancer (percentage) was used. Second, the Charlson Comorbidity Index score was used (Deyo, Cherkin, & Ciol, 1992). Third, trait anxiety was used. The trait subscale of the State-Trait Anxiety Inventory (Spielberger, Auerbach, Wadsworth, Dunn, & Taulbee, 1973) is a 20-item self-report measure of generalized experiences of anxiety (trait). Participants indicate their responses on a four-point scale from 0 (“almost never”) to 3 (“almost always”). The STAI-T is widely used and has been shown to be a reliable and valid measure of trait anxiety (Spielberger, Gorsuch, & Lushene, 1970).

Analytic Strategy

Moderation and mediation analyses were conducted using the PROCESS macro (Hayes, 2012) for the statistical program SPSS (version 22). This program allows for the estimation of moderation and mediation effects via a bootstrapping procedure. Bootstrapping is the method of choice for sample sizes <200 rather than others (e.g., Sobel test). With bootstrapping, effects are estimated based on a large number of bootstrap samples (e.g., 10,000 samples used here) generated from the original data by random sampling with replacement. If the 95% confidence interval (CI) for the estimates of an effect does not include zero, it suggests the significance of the effect at the 0.05 level. Bootstrapped mediation analyses are regarded as a flexible alternative to the
conservative Baron and Kenny “causal steps” method of testing mediation (Baron & Kenny, 1986).

The specified models were consistent with the hypotheses presented above. For the mediation model, perceived severity was specified as the predictor, net positivity towards risk-reducing behaviors was specified as the mediator, and behavioral intentions was specified as the outcome (see Figure 3b). For the moderation model, breast cancer risk-related distress (IES) was specified as the predictor, emotion regulation was specified as the moderator (with three data-driven categories reflecting PCA results), and behavioral intention was specified as the outcome (see Figure 4b). Models were run for each risk-reducing behavior, resulting in a total of 6 mediation models and 18 moderation models.

Finally, models which involved a significant moderation were further examined using the MODPROBE macro (Hayes & Matthes, 2009), which is specifically designed to estimate and probe two-way interactions in ordinary least squares (OLS) regression models).

Power Analyses

Fritz and MacKinnon (2010) conducted simulations to determine the necessary sample sizes for the most common and most frequently recommended tests of mediation. The results for the bias-corrected bootstrap showed it to be consistently the most
powerful test. In order to detect an indirect effect when the two component pathways (e.g., \( \alpha \) and \( \beta \)) represent medium effect sizes (e.g., \( R^2 = 0.39 \), or 13\% of the variance, per Cohen (1990)), the required \( N \) is 71. Thus, our sample of 103 enabled us to detect a medium-sized indirect effect at 80\% power.
Chapter 3: Results

Descriptive and Preliminary Analyses

Summary statistics and correlations among measures are reported in Table 5 and Tables 6-10. Intentions for risk-reducing behavior are reported in Table 11. Sociodemographic variables (e.g., race, age, partner status, level of education) were considered for control. Only variables that correlated significantly with outcomes of interest were retained. These correlations are reported in Table 12.

As anticipated, the sample reported a range of experiences related to their breast cancer risk (see Table 5). Regarding the cognitive components of the model, perceived susceptibility ranged from 8% to 100%, with a mean of 56% (SD = 20%). When compared to their objective risk (as documented in medical chart), only 12 (12%) of participants accurately estimated their risk (±10%). Seventy-six percent of the sample (n = 78) over-estimated their risk by more than 10%, and 13% (N = 13) under-estimated their risk by more than 10%. Perceived seriousness of breast cancer had an observed range between 1 and 10, with a mean of 7 (SD = 2.3). As described in the methods section above, perceived severity scores were calculated by combining perceived susceptibility scores and perceived seriousness scores in a multiplicative fashion. Thus,
scores for perceived severity ranged from 0-9, averaging 3.9 (SD = 2). There were no differences in perceived severity based on accrual source or assessment type.

The Thought Listing task resulted in “net positivity” scores for each risk-reducing behavior. Possible scores for each ranged from -25 to +25. The risk-reducing behavior with the highest net positivity score was diet (M = 7.55), followed by physical activity (6.45), reduction in alcohol use (6.06), oophorectomy (3.14), and mastectomy (2.07). Chemoprevention had the lowest net positivity score (M = -0.91). Both accrual source and assessment type (in-person versus phone) significantly correlated with net positivity scores. Accrual source correlated with positivity towards mastectomy and positivity towards oophorectomy such that women from the high risk breast clinic reported more positive thoughts about these two behaviors (mastectomy = 4.63, oophorectomy = 6.25) than women accrued via other sources (mastectomy = -2.02, oophorectomy = -2.95). Assessment type correlated with positivity towards mastectomy, positivity towards oophorectomy, and positivity toward reduction in alcohol use, such that women who completed the interview in-person reported less positive thoughts these three behaviors (mastectomy = 0.14, oophorectomy = -0.34, alcohol use = 3.76) than women who completed the interview via phone (mastectomy = 6.00, oophorectomy = 7.33, alcohol use = 10.49).

Relatedly, participants’ attitudes regarding each risk-reducing behavior were used to generate an “overall attitudes” score and an “ambivalence index”. Observed attitudes ranged from -10 to 10, with higher scores indicating more positive attitudes towards the
behavior, accounting for negative attitudes. Overall attitudes were highest for physical activity ($M = 4.28$), followed by alcohol use ($4.25$), diet ($4.20$), oophorectomy (-0.38), and chemoprevention (-0.45). Mastectomy had the lowest overall attitudes rating ($M = -1.43$). Observed ambivalence ranged from 0 to 10, with higher ambivalence scores indicating that participants endorsed strong opposing evaluations (e.g., were high on both positive and negative attitudes towards the behavior). Mastectomy had the highest ambivalence rating ($M = 4.47$), followed by oophorectomy (3.58), physical activity (3.52), chemoprevention (3.47), and diet (3.37). Reduction in alcohol use had the lowest ambivalence rating ($M = 2.03$).

Regarding the emotional components of the model, patients’ breast cancer risk-related distress (IES) scores ranged from 0 to 75, with an average of 10.8 ($SD = 13.2$). In contrast with patterns generally seen in the literature, patients generally scored higher on the avoidance subscale ($M = 6.5$) than the intrusion subscale ($M = 4.3$). A clinical cut-off of 26 has been suggested for the combined intrusion and avoidance subscales (Horowitz et al., 1979). Of the 103 participants, only 12 (12%) demonstrated clinically significant levels of breast cancer risk-related distress. Items assessing primary emotional response to risk (range: 0-10) demonstrated that patients experienced higher anxiety/fear related to their risk ($M = 4.3$, $SD = 2.8$) than they did sadness ($M = 2.9$, $SD = 2.8$) or anger ($M = 1.9$, $SD = 2.6$). Participants also endorsed use of several different emotion regulation strategies. Means for the EACS subscales of Emotional Expression and Emotional Processing were almost identical ($M = 10.2 [SD = 3.3]$ v. $10.0 [SD = 2.9]$). Participants also scored similarly on the ERQ subscales of Cognitive Reappraisal and Expressive
Suppression ($M = 16.3$ [$SD = 6.3$] v. $17.6$ [$SD = 5.6$]). However, it should be noted that possible scores for Cognitive Reappraisal are higher than those for Expressive Suppression are lower (6-35 versus 4-28). There were no differences in IES, primary emotions, or emotion regulation strategy use based on accrual source or assessment type.

Participants’ intentions for risk-reducing behaviors varied widely (see Table 11). Only 25% of women planned to pursue risk-reducing mastectomy in the future; even fewer (11%) reported intentions for risk-reducing oophorectomy. While 23% of women planned to utilize chemoprevention for risk-reduction, this behavior also elicited the highest percentage of “unsure” responses (27%). Women reported generally high intentions to improve diet (90% “yes”) and increase physical activity (88% “yes”). A substantial minority (36%) also planned to reduce alcohol use in the future. There were no differences in behavioral intentions based on accrual source. However, assessment type was correlated with intentions for alcohol use, such that women who completed the interview in-person reported greater intentions to reduce alcohol use in the future (43%) compared to women who completed the interview via phone (23%).

Of the potential control variables (objective lifetime risk of breast cancer, CCI comorbidities, trait anxiety, age, education, employment, income, insurance, race, ethnicity, partner status, BMI), only age, objective lifetime risk of breast cancer, education, and BMI were significantly correlated with specific behavioral intentions outcomes (see Table 12) and are thus included for control in those respective analyses.
Primary Analyses

Cognitive Pathway

Simple mediation analyses did not support the indirect effect of perceived severity on behavioral intentions through its effect on positivity toward risk-reducing behavior: none of the six indirect effects specified in mediation models were significant (see Table 13). However, our results did demonstrate four significant pathways of interest (see Figure 6). First, positive thoughts about risk-reducing behavior were related to intentions to engage in that behavior for (1) risk-reducing mastectomy ($b = 0.02, S.E. = 0.01, p = 0.02, 95\% \text{ C.I.} = [0.01, 0.03]$) and (2) chemoprevention ($b = 0.02, S.E. = 0.01, p = 0.01, 95\% \text{ C.I.} = [0.01, 0.04]$). In both models, this effect was such that greater positivity toward a behavior was related to greater intentions to engage in that behavior. Second, perceived severity of breast cancer was related to positive thoughts about engaging in (1) diet changes ($a = -1.36, S.E. = 0.51, p = 0.01, 95\% \text{ C.I.} = [-2.38, -0.35]$) and (2) increased physical activity ($a = -1.62, S.E. = 0.52, p > 0.01, 95\% \text{ C.I.} = [-2.66, -0.58]$). Both of these effects were negative; higher perceived severity was related to a lower number of positive thoughts about lifestyle changes.

Emotional Pathway

A moderation analysis examined the effects of breast cancer risk-related distress (IES), emotion regulation components from the PCA, and the interaction of the two on...
intentions for risk-reducing behavior. As can be seen in Tables 14 and 16, none of the interaction effects involving ER Component #1 (expression/suppression) or ER Component #3 (emotional processing) were significant. However, as demonstrated in Table 15, the interaction between IES and ER Component #2 (reappraisal) emerged as a significant predictor of intentions for risk-reducing mastectomy ($b_3 = 0.02, \Delta R^2 = 0.04, p = 0.04, 95\% \text{ C.I.} = [0.01, 0.03]$) and intentions for chemoprevention ($b_3 = 0.02, \Delta R^2 = 0.07, p = 0.02, 95\% \text{ C.I.} = [0.01, 0.03]$). This indicates that the relationship between IES and behavioral intentions is not the same for patients reporting different use of cognitive reappraisal as an emotion regulation technique.

These significant moderations were probed further using the Johnson-Neyman technique. For the moderation model predicting intentions for mastectomy, results indicated that the significant positive relationship between IES and behavioral intentions became non-significant among those individuals reporting less use of cognitive reappraisal (ER Component #2 = 0.4693). Approximately 78.43% of the sample fell into the region of non-significance. Therefore, the positive relationship between IES and intentions for mastectomy was only present among the 22% of the population reporting the greatest use of cognitive reappraisal (see Figure 7). A similar effect was found for the moderation model predicting intentions for chemoprevention. Results indicated that the significant positive relationship between IES and behavioral intentions became non-significant among those individuals reporting less use of cognitive reappraisal (ER Component #2 = 0.3844). Approximately 74.23% of the sample fell into the region of non-significance. Therefore, the positive relationship between IES and intentions for
chemoprevention was only present among the 26% of the population reporting the greatest use of cognitive reappraisal (see Figure 7).

Additionally, one significant pathway of interest emerged from a non-significant moderation model. ER Component #2, representing use of cognitive reappraisal, was significantly related to intentions to increase physical activity ($b_2 = -0.16, S.E. = 0.07, p = 0.02, 95\% \text{ C.I.} = [-0.30, -0.03]$). That is, greater use of cognitive reappraisal was significantly associated with lower intentions to increase physical activity.

**Summary of Primary Analyses**

Of the six hypothesized mediation models representing the cognitive pathway, none of the indirect effects were significant.

Of the eighteen hypothesized moderation models representing the emotional pathway, only two of the interactions were significant. Both of these involved the emotion regulation strategy of cognitive reappraisal; none of the models specifying emotional expression or emotional processing demonstrated significant results.
Exploratory Analyses

*Cognitive Pathway*

To better understand the nature of the data on cognitions, nine types of exploratory analyses were conducted: (1) examining risk accuracy as a predictor; (2) testing unweighted Thought Listing Task scores as a mediator; (3) examining the potential mediating role of attitudes; (4) testing mediation models in a sub-group of participants accrued from a high-risk breast clinic; (5) testing mediation models in a sub-group of participants who over-estimated their risk for breast cancer; (6) testing mediation models in a sub-group of participants under age 50; (7) testing mediation models in a sub-group of patients with high self- and response-efficacy; (8) specifying global intentions for risk reduction as the outcome; and (9) reversing the hypothesized predictor and outcome variables.

*Risk Accuracy*

Accuracy of risk perceptions was calculated by subtracting participants’ estimated lifetime risk from objective lifetime risk. This difference was specified as predicting behavioral intentions both directly and indirectly via positivity towards risk-reducing behaviors. Results of these mediation analyses did not support the direct effect of risk accuracy on behavioral intentions, nor the indirect effect of risk accuracy on behavioral intentions via positivity: across six models, there were no significant direct or indirect effects. In fact, the only significant relationship involving risk accuracy was the
significant negative relationship between risk accuracy and positivity towards diet change
($a = -0.10, S.E. = 0.04, p = 0.01, 95\% \text{ C.I.} = [-0.18, -0.02]$).

**Thought Listing Scores: Weighted versus Unweighted**

During the Thought Listing task, participants were asked to rate each thought generated on valence, confidence, and importance. Scores for the Thought Listing task were generated in a multiplicative manner, so that each thought was weighted by confidence and importance. An alternative method for scoring the Thought Listing task is to simply subtract the number negative thoughts from the number of positive thoughts (still dividing by total number of thoughts listed in order to control for verbosity). This alternative score was specified as the mediator of the relationship between perceived severity and behavioral intentions. When thought listing scores were unweighted, all results were the same as those derived from weighted scores.

**Attitudes**

Rather than positivity towards risk-reducing behaviors, attitudes towards risk-reducing behaviors was specified as a mediator of the relationship between perceived severity and behavioral intentions. Results of these mediation analyses did not support the indirect effect of perceived severity on behavioral intentions through its effect on ambivalence towards risk-reducing behavior: none of the six indirect effects specified in mediation models were significant. However, our results did demonstrate two significant pathways of interest. More positive attitudes towards risk-reducing behavior were related to greater intentions to engage in that behavior for (1) risk-reducing mastectomy ($b = \ldots$)
0.05, \(S.E. = 0.02, p = 0.03, 95\% \text{ C.I.} = [0.01, 0.10]\)) and (2) chemoprevention \((b = 0.08, \ S.E. = 0.02, p < 0.01, 95\% \text{ C.I.} = [0.04, 0.12])\).

The mediation models involving mastectomy and chemoprevention were further examined by specifying ambivalence as a moderator of the relationship between attitudes and behavioral intentions (see Figure 8). Although the conditional indirect effect was not significant, there was a significant moderating effect of ambivalence on the relationship between attitudes towards mastectomy and mastectomy intentions \((b_3 = -0.02, S.E. = 0.01, p = 0.04, 95\% \text{ C.I.} = [-0.05, -0.01]); \text{ see Figure 9}\). This significant moderation was probed further using the Johnson-Neyman technique. Results indicated that the negative relationship between attitudes towards mastectomy and mastectomy intentions became non-significant among those individuals reporting higher levels of ambivalence (ambivalence = 2.1955). Approximately 72.88\% of the sample fell into the region of non-significance. Therefore, the negative relationship between attitudes towards mastectomy and mastectomy intentions was only present among the 27\% of the population reporting the least amount of ambivalence towards mastectomy (see Figure 10).

Ambivalence did not play a significant moderating role on the relationship between attitudes towards chemoprevention and chemoprevention intentions. However, ambivalence towards chemoprevention did have a significant direct effect on chemoprevention intentions \((b_2 = 0.08, S.E. = 0.04, p = 0.04, 95\% \text{ C.I.} = [0.01, 0.15])\),
such that higher levels of ambivalence were associated with greater intentions to engage in chemoprevention.

*High-Risk Clinic Sample*

Mediation analyses as originally hypothesized were conducted among those participants who were accrued via the high-risk breast clinic (n = 65). All results were the same as those derived from the full sample of 103.

*Over-Estimators*

Mediation analyses as originally hypothesized were conducted among those participants who over-estimated their breast cancer risk by more than 10% (n = 78). All results were the same as those derived from the full sample of 103.

*Participants under Age 50*

As many of the concerns regarding risk management might be specific to younger women (Glassey et al., 2016), mediation analyses as originally hypothesized were conducted among those participants younger than 50 (n = 61). The significant negative relationship between perceived severity of breast cancer and diet/physical activity changes found in the full sample of 103 was not replicated in women under 50. Otherwise, all results were the same as those derived from the full sample.
**High-Efficacy Participants**

According to the Extended Parallel Process Model (EPPM; Witte, 1992), health threats only have an effect on behavioral intentions when individuals have high self-efficacy (belief that one can succeed in specific situations or accomplish a task) and high response efficacy (belief that a recommended response effectively deters or alleviates a health threat). Thus, mediation analyses as originally hypothesized were conducted among those participants who scored above average on both the BIPQ personal control and treatment control items ($n = 36$). The only finding replicated from the full sample was significant relationship was the significant negative relationship between perceived severity of breast cancer and diet changes. No other component effects, direct effects, or indirect effects were significant.

**Global Behavioral Intentions**

Rather than specifying intentions for one specific behavior as the outcome of interest, intentions for all six behaviors were combined in an additive fashion and specified as the outcome. Thus, higher scores on this index demonstrate greater intentions to take action to reduce one’s risk for breast cancer. Results of these mediation analyses did not support the direct effect of perceived severity on global behavioral intentions, nor the indirect effect of perceived severity on global behavioral intentions via positivity towards risk-reducing behaviors: neither the direct effect nor the indirect effect was significant.
Reversed Models

A limitation of cross-sectional studies is that no conclusions about causality can be drawn. However, comparing hypothesized models to reversed models may allow researchers to rule out competing hypotheses. In the present study, reversed mediation models were tested to rule out the possibility that participants’ intentions for risk-reducing behavior may affect perceived breast cancer severity. In all six models, the relationship between behavioral intentions and perceived severity was non-significant. Furthermore, none of the six indirect effects specified in mediation models were significant. Therefore, there was no evidence to support the competing hypothesis that participants’ intentions for risk-reducing behavior may affect perceived breast cancer severity.

Emotional Pathway

To better understand the nature of the data on emotions, eight types of exploratory analyses were conducted: (1) specifying emotion regulation as a mediator rather than a moderator; (2) examining the potential interactions between emotion regulation and primary emotional experiences related to breast cancer risk; (3) testing moderation models in a sub-group of participants accrued from a high-risk breast clinic; (4) testing moderation models in a sub-group of participants who demonstrated clinically significant levels of breast cancer risk-related distress; (5) testing moderation models in a sub-group of participants under age 50; (6) testing moderation models in a sub-group of patients
with high self- and response-efficacy; (7) specifying global intentions for risk reduction as the outcome; and (8) reversing the hypothesized predictor and outcome variables.

Emotion Regulation as a Mediator

As emotion regulation can be conceptualized as either a moderator or a mediator, an alternative model tested the potential mediating effects of emotion regulation on the relationship between breast cancer risk-related distress and behavioral intentions. No significant indirect effects were observed. However, our results did demonstrate two significant pathways of interest. First, breast cancer risk-related distress was related to use of ER Component #1 (expression/suppression), such that greater distress predicted less use of emotional expression to regulate one’s emotions \( a = -0.02, S.E. = 0.1, p < 0.01, 95\% \text{ C.I. } = [-0.04, -0.01] \). Second, use of reappraisal as an emotion regulation strategy predicted intentions to engage in physical activity \( b = -0.10, S.E. = 0.05, p = 0.04, 95\% \text{ C.I. } = [-0.20, -0.01] \). This effect was negative; greater use of reappraisal was related to lower intentions to increase physical activity.

Primary Emotional Experiences

Participants reported how sad, angry, and anxious their risk of breast cancer makes them feel. These ratings were specified as the predictor variables in moderation models, with ER components specified as the moderator, and behavioral intentions as the outcome. Results are presented for each primary emotion.
Sadness. When sadness was specified as a predictor, five moderation models demonstrated significant interactions with ER components. First, intentions for risk-reducing mastectomy were significantly predicted by the interaction of sadness and ER Component #1 (expression/suppression; \( b_3 = 0.02, \Delta R^2 = 0.09, p < 0.01, 95\% \text{ C.I.} = [-0.15, -0.03] \), as well as the interaction of sadness and ER Component #3 (emotional processing; \( b_3 = 0.02, \Delta R^2 = 0.06, p = 0.02, 95\% \text{ C.I.} = [0.01, 0.13] \)). For the model involving ER Component #1, two Johnson-Neyman significance regions were identified. The relationship between sadness and behavioral intentions was significant at both low levels of emotional expression and very high levels of emotional expression. At low levels of emotional expression, the relationship between sadness and behavioral intentions was positive, such that higher levels of sadness were associated with increased behavioral intentions. At high levels of emotional expression, the relationship between sadness and behavioral intentions was negative, such that higher levels of sadness were associated with decreased behavioral intentions. The relationship between sadness and behavioral intentions was non-significant for moderate levels of emotional expression (-0.6144 < ER Component #1 < 1.5307). Approximately 66.67% of the sample fell into the region of non-significance. Therefore, the relationship between sadness and intentions for mastectomy was present for both the 27% of the population reporting the least use of emotional expression and the 6% reporting the greatest use of emotional expression. Regarding ER Component #3, the positive relationship between sadness and behavioral intentions was significant at high levels of emotional processing (ER Component #3 = 0.8226). Approximately 79.76% of the sample fell into the region of non-significance. Therefore, the significant positive relationship between sadness and
intentions for mastectomy was only present among the 20% of the population reporting the greatest use of emotional processing.

Second, intentions to increase physical activity were significantly predicted by the interaction of sadness and ER Component #2 (reappraisal; \( b_3 = 0.05, \Delta R^2 = 0.05, p = 0.02, 95\% \text{ C.I.} = [0.01, 0.09] \)), as well as the interaction of sadness and ER Component #3 (emotional processing; \( b_3 = 0.04, \Delta R^2 = 0.04, p = 0.04, 95\% \text{ C.I.} = [0.01, 0.07] \)). For the model involving ER Component #2, two Johnson-Neyman significance regions were identified. The relationship between sadness and behavioral intentions was significant at both low levels of cognitive reappraisal and very high levels of cognitive reappraisal. At low levels of reappraisal, the relationship between sadness and behavioral intentions was negative, such that higher levels of sadness were associated with decreased behavioral intentions. At high levels of reappraisal, the relationship between sadness and behavioral intentions was positive, such that higher levels of sadness were associated with increased behavioral intentions. The relationship between sadness and behavioral intentions was non-significant for moderate levels of cognitive reappraisal (-0.7443 < ER Component #2 < 2.5800). Approximately 72.94% of the sample fell into the region of non-significance. Therefore, the relationship between sadness and intentions for physical activity was present among both the 25% of the population reporting the least use of cognitive reappraisal and the 2% reporting the greatest use of cognitive reappraisal. Regarding ER Component #3, the negative relationship between sadness and behavioral intentions was significant at low levels of emotional processing (ER Component #3 = 1.0703). Approximately 84.71% of the sample fell into the region of non-significance. Therefore,
the significant negative relationship between sadness and intentions for physical activity
was only present among the 15% of the population reporting the least use of emotional
processing.

Finally, intentions to reduce alcohol consumption were significantly predicted by
the interaction of sadness and ER Component #2 (reappraisal; $b_3 = 0.08$, $\Delta R^2 = 0.05$, $p = 0.04$, 95% C.I. = [0.01, 0.15]). Using the Johnson-Neyman technique, it was
demonstrated that the negative relationship between sadness and alcohol use intentions was significant at low levels of cognitive reappraisal (ER Component #2 = 0.0736).
Approximately 44.71% of the sample fell into the region of non-significance. Therefore, the negative relationship between sadness and alcohol use intentions was only present among the 55% of the population reporting the least use of cognitive reappraisal.

*Anger.* When anger was specified as a predictor, only one moderation model

demonstrated a significant interaction with ER components. Mastectomy intentions were
significantly predicted by the interaction of anger and ER Component #2 (reappraisal; $b_3 = 0.07$, $\Delta R^2 = 0.05$, $p = 0.04$, 95% C.I. = [0.01, 0.14]). Using the Johnson-Neyman technique, it was demonstrated that the positive relationship between anger and mastectomy intentions was significant at high levels of cognitive reappraisal (ER Component #2 = -0.0703). Approximately 52.38% of the sample fell into the region of non-significance. Therefore, the significant positive relationship between anger and mastectomy intentions was only present among the 48% of the population reporting the greatest use of cognitive reappraisal.
Anxiety. When anxiety was specified as a predictor, two moderation models demonstrated significant interactions with ER components. Intentions for risk-reducing mastectomy were significantly predicted by the interaction of anxiety and ER Component #1 (expression/suppression; $b_3 = -0.07, \Delta R^2 = 0.06, p = 0.02, 95\% \text{ C.I.} = [-0.14, -0.01]$), as well as the interaction of anxiety and ER Component #2 (reappraisal; $b_3 = 0.08, \Delta R^2 = 0.07, p = 0.02, 95\% \text{ C.I.} = [0.01, 0.15]$). For the model involving ER Component #1, the positive relationship between anxiety and behavioral intentions was significant at low levels of emotional processing (ER Component #1 = -1.6427). Approximately 92.86% of the sample fell into the region of non-significance. Therefore, the significant positive relationship between anxiety and intentions for mastectomy was only present among the 7% of the population reporting the least use of emotional processing. Regarding ER Component #2, two Johnson-Neyman significance regions were identified. The relationship between anxiety and behavioral intentions was significant at both very low levels of cognitive reappraisal and very high levels of cognitive reappraisal. At low levels of reappraisal, the relationship between anxiety and behavioral intentions was negative, such that higher levels of anxiety were associated with decreased behavioral intentions. At high levels of reappraisal, the relationship between anxiety and behavioral intentions was positive, such that higher levels of anxiety were associated with increased behavioral intentions. The relationship was non-significant for moderate levels of cognitive reappraisal (-1.6184 < ER Component #2 < 1.5432). Approximately 86.90% of the sample fell into the region of non-significance. Therefore, the relationship between anxiety and intentions for mastectomy was present among both the 2% of the population
reporting the least use of cognitive reappraisal and the 11% reporting the greatest use of cognitive reappraisal.

*High-Risk Clinic Sample*

Moderation analyses as originally hypothesized were conducted among those participants who were accrued via the high-risk breast clinic (n = 65). One significant interaction effect emerged. The interaction between IES and ER Component #3 (emotional processing) emerged as a significant predictor of intentions for mastectomy ($b_3 = 0.02, \Delta R^2 = 0.06, p = 0.03, 95\% \text{ C.I.} = [0.01, 0.03]$). This indicates that the relationship between IES and mastectomy intentions is not the same for patients reporting different use of emotional processing as an emotion regulation technique. This significant moderation was probed further using the Johnson-Neyman technique. The positive relationship between IES and mastectomy intentions became non-significant among those individuals reporting less use of emotional processing (ER Component #3 = 0.8252). Approximately 76.56% of the sample fell into the region of non-significance. Therefore, the significant positive relationship between IES and intentions for mastectomy was only present among the 23% of the population reporting the greatest use of emotional processing.

*Clinically Significant Distress*

Moderation analyses as originally hypothesized were conducted among those participants who demonstrated clinically significant levels of breast cancer risk-related distress (n = 12). No significant main or interaction effects were observed.
Participants under Age 50

As many of the concerns regarding risk management might be specific to younger women (Glassey et al., 2016), moderation analyses as originally hypothesized were conducted among those participants younger than 50 (n = 61). Two significant interaction effects emerged. First, as in the full sample of 103, the interaction between IES and ER Component #2 (reappraisal) emerged as a significant predictor of intentions for chemoprevention ($b_3 = 0.02$, $\Delta R^2 = 0.10$, $p = 0.01$, 95% C.I. = [0.01, 0.04]). This indicates that the relationship between IES and chemoprevention intentions is not the same for patients reporting different use of cognitive reappraisal as an emotion regulation technique. This significant moderation was probed further using the Johnson-Neyman technique. Similar to the results in the full sample, the positive relationship between IES and chemoprevention intentions became non-significant among those individuals reporting less use of cognitive reappraisal (ER Component #2 = 0.1344). Approximately 55.74% of the sample fell into the region of non-significance. Therefore, the significant positive relationship between IES and intentions for chemoprevention was only present among the 44% of the population reporting the greatest use of cognitive reappraisal.

Second, the interaction between IES and ER Component #3 (processing) emerged as a significant predictor of alcohol use intentions ($b_3 = -0.02$, $\Delta R^2 = 0.07$, $p = 0.04$, 95% C.I. = [-0.04, -0.01]). This indicates that the relationship between IES and alcohol use intentions is not the same for patients reporting different use of emotional processing as an emotion regulation technique. However, the Johnson-Neyman technique was not able
to be employed for this moderation model, as there were no statistical significance transition points within the observed range of the moderator.

**High-Efficacy Participants**

Per the EPPM, mediation analyses as originally hypothesized were conducted among those participants who scored above average on both the BIPQ personal control and treatment control items (n = 36). Only one significant interaction effect was observed. As in the full sample of 103, the interaction between IES and ER Component #2 (reappraisal) emerged as a significant predictor of intentions for mastectomy ($b_3 = -0.05$, $\Delta R^2 = 0.18$, $p < 0.01$, 95% C.I. = [0.01, 0.09]). This indicates that the relationship between IES and mastectomy intentions is not the same for patients reporting different use of cognitive reappraisal as an emotion regulation technique. This significant moderation was probed further using the Johnson-Neyman technique. Two Johnson-Neyman significance regions were identified. The relationship between IES and behavioral intentions was significant at both very low levels of cognitive reappraisal and very high levels of cognitive reappraisal. At low levels of reappraisal, the relationship between IES and behavioral intentions was negative, such that higher levels of breast cancer risk-related distress were associated with decreased behavioral intentions. At high levels of reappraisal, the relationship between IES and behavioral intentions was positive, such that higher levels of breast cancer risk-related distress were associated with increased behavioral intentions. The relationship was non-significant for moderate levels of cognitive reappraisal (-1.2268 < ER Component #2 < 0.2885). Approximately 71.43% of the sample fell into the region of non-significance. Therefore, the relationship
between anxiety and intentions for mastectomy was present among both the 6% of the population reporting the least use of cognitive reappraisal and the 23% reporting the greatest use of cognitive reappraisal.

Global Behavioral Intentions

Rather than specifying intentions for one specific behavior as the outcome of interest, intentions for all six behaviors were combined in an additive fashion and specified as the outcome. Thus, higher scores on this index demonstrate greater intentions to take action to reduce one’s risk for breast cancer. Of the three models tested, one significant interaction effect was observed. The interaction between IES and ER Component #2 (reappraisal) emerged as a significant predictor of global behavioral intentions ($b_3 = 0.04$, $\Delta R^2 = 0.04$, $p = 0.04$, 95% C.I. = [0.01, 0.08]). This indicates that the relationship between IES and global behavioral intentions is not the same for patients reporting different use of cognitive reappraisal as an emotion regulation technique. This significant moderation was probed further using the Johnson-Neyman technique. Similar to the results for individual behaviors, the positive relationship between IES and global behavioral intentions became non-significant among those individuals reporting less use of cognitive reappraisal (ER Component #2 = 1.0726). Approximately 84.47% of the sample fell into the region of non-significance. Therefore, the significant positive relationship between IES and global behavioral intentions was only present among the 16% of the population reporting the greatest use of cognitive reappraisal.
Reversed Models

Reversed moderation models were tested to examine the competing hypothesis that participants’ intentions for risk-reducing behavior may affect breast cancer risk-related distress. In all eighteen models, the main effect of behavioral intentions on breast cancer risk-related distress was non-significant. However, one reversed moderation model did demonstrate a significant interaction effect: the interaction between intentions for risk-reducing mastectomy and ER Component #2 (reappraisal) emerged as a significant predictor of breast cancer risk-related distress ($b_3 = 3.23, \Delta R^2 = 0.04, p = 0.03, 95\% \text{ C.I.} = [0.24, 6.23]$). Specifically, this effect was such that the significant positive relationship between intentions for risk-reducing mastectomy and breast cancer risk-related distress was only significant among individuals with the highest levels of cognitive reappraisal. The interaction effects specified in the other five moderation modes were not significant.

Summary of Exploratory Analyses

Results of exploratory analyses for the cognitive pathway were similar to primary analyses, and did not provide any further clarification on the relationships between the variables of interest.

Results of the subgroup analyses for the emotional pathway demonstrated minimal differences from the primary analyses (e.g., participants with clinically significant distress, patients under age 50, high-efficacy participants). However, other
exploratory analyses did provide two interesting results. First, there were many more
significant interaction effects when primary emotional experiences (i.e., sadness, anger,
and anxiety) were specified as the predictor, rather than IES scores. Second, reversed
mediation models demonstrated one significant interaction effect. This may indicate that
the direction of the relationship between emotions about risk and behavioral intentions is
opposite of our hypotheses.
Chapter 4: Discussion

Women at high risk for breast cancer are driven to increase their knowledge about risk reduction and develop decision-making skills (Stacey et al., 2003). However, little is known about the way that these women make decisions about risk management. The literature to date has indicated that the process is not straightforward, and does not mirror statistical models of risk assessment (Hesse-Biber, 2014). However, building on basic behavior change theories (Ajzen, 1985, 2002; Brissette et al., 2003; Glanz et al., 2002; Leventhal et al., 1980), authors have suggested that cognitive and affective factors play an interacting role in this process (Slovic et al., 2004). Until now, no studies have examined such a model. To our knowledge, this is the first study to examine a dual-pathway framework of decision-making among patients at high risk for breast cancer. Using this integrated model, we sought to understand (1) the interaction of cognitive and affective factors in decision making, and (2) the potential role of emotion regulation in this process. The moderation and mediation analyses provide implications about the way that decisions are being made and, perhaps more importantly, how they are not being made. Notably, results allow for the expansion and revision of our theoretical framework of decision-making in the context of breast cancer risk reduction.
Our guiding theoretical model for the present study incorporated components of three different models of preventive health behaviors. First, from Hochbaum’s Health Beliefs Model, we drew the concepts of perceived susceptibility and perceived seriousness. Second, from Fishbein and Ajzen’s Theory of Planned Behavior, we drew the concept of attitudes as a key predictor of behavioral intentions. Finally, from Leventhal’s Self-Regulation Model, we drew two major concepts: (1) the dual-pathway framework integrating emotion and cognition, and (2) the mediating role of emotion regulation. The results of the present study behoove revisions to this theoretical model. A revised model is presented in Figure 11.

In this revised model, cognitive and emotional components of decision-making are sequential rather than parallel. The results of our mediation analyses representing the cognitive component demonstrated that behavioral intentions were formed independent of cognitions about the health threat. However, emotions about the health threat did predict behavioral intentions. Furthermore, emotion regulation played a significant moderating role. Thus, it may be that affective reactions act as a type of “shorthand” for cognitive reactions to the health threat. This revised theoretical model in some ways mirrors Kiviniemi and colleagues’ (2007) Behavioral Affective Association Model (BAAM). For decision-making about health behaviors, BAAM stipulates that cognitive components precede affective components. However, Kiviniemi and colleagues’ model focuses on cognitive and affective reactions to health behaviors, rather than health.
threats. In the context of the present study, this means that our model focuses on reactions to cancer risk, rather than reactions to risk-reducing behavior. For example, the BAAM has been used to examine intentions for physical activity (Kiviniemi et al., 2007) and colonoscopy screening for colorectal cancer (Klasko-Foster, 2017). Thus, our revised model’s focus on individuals’ reactions to health threats provides a unique extension to the BAAM.

Alternatively, it may be that our theoretical model was not fine-grained enough to disentangle the direct effects and/or interactions between emotion and cognition. A review of the literature on decision-making under conditions of risk indicates a need to distinguish further among emotion-based experiences of risk (Dillard, Ferrer, Ubel, & Fagerlin, 2012; Ferrer et al., 2011; Janssen, Waters, van Osch, Lechner, & de Vries, 2014; Isaac M. Lipkus, Klein, Skinner, & Rimer, 2005). Emotional experiences of risk often include both feelings about risk and feelings of risk. This conceptual conflation is understandable, as the differences between the two are nuanced. Feelings about risk, or affective risk perceptions, refer to the valence (positive vs. negative) and associated arousal (high vs. low) of affective responses to the possibility of developing a disease or illness, and often involve worry or fear (e.g., “How worried/fearful/nervous are you about developing [disease] in the future?”). Feelings of risk, or experiential risk perceptions, are rapid judgments made by integrating deliberative and affective information. These may include instinctive assessments of vulnerability (e.g., “How vulnerable to [disease] do you feel?”) or gist-representations of risk (Reyna, 2012b; Weinstein et al., 2007). Affective and experiential risk perceptions have been identified as unique, key
components of decision-making (Loewenstein & Lerner, 2003). They are frequently contrasted with cognitive risk perceptions, which are systematic, logical, and rule-based. Furthermore, affective, experiential, and cognitive risk perceptions all predict unique variance in intentions to engage in preventive behaviors for heart disease, diabetes, and cancer (Ferrer, Klein, Persoskie, Avishai-Yitshak, & Sheeran, 2016; Janssen, van Osch, de Vries, & Lechner, 2011). Because the nature of the association among risk perceptions and health behavior may depend on the profile of different types of risk perceptions and the accuracy of such perceptions (Ferrer & Klein, 2015), a fine-grained and accurate distinction among these types of risk perceptions might improve the predictive value of our hypothesized model.

A second modified version of our model, including experiential pathways, is pictured in Figure 12. Although modifications to the integrated theoretical model might improve its predictive value, the model as hypothesized did result in intriguing suggestions about the influence of emotional and cognitive factors on intentions for breast cancer risk management. These results are discussed further in the sections below.

Emotional Pathway

In the present study, moderation analyses examined (1) the direct effect of emotions about risk on behavioral intentions and (2) the moderating effect of emotion regulation on the relationship between emotions about risk and behavioral intentions. We hypothesized that emotions about risk would have a direct effect on behavioral intentions,
such that higher levels of negative emotions would predict increased behavioral intentions. In fact, our results demonstrated no significant effect of breast cancer risk related distress on behavioral intentions. This may be due to a floor effect: the mean for IES total scores was 10.81 of a possible 75 points, and only 12 participants scored above the clinical cut-off score of 19.

Furthermore, we hypothesized that emotion regulation strategy use would significantly moderate the relationship between emotions about risk and behavioral intentions, such that a greater use of approach strategies would be associated with a stronger relationship between negative emotions and behavioral intentions. Two moderation models did indeed demonstrate significant moderation effects. Both of these involved the emotion regulation strategy of reappraisal. Specifically, the relationship between emotions and mastectomy intentions was only present among individuals with the highest use of cognitive reappraisal. The same was true of chemoprevention. This finding is inconsistent with prior research, which has demonstrated that affective components of risk are less predictive of motivation when reappraisal is high (Ferrer, 2017). Further, the relationship between emotions and mastectomy intentions was such that higher IES was related to greater intentions for mastectomy. As the IES measures avoidant symptoms, one might interpret this as an indication that risk-reducing mastectomy is an analogous avoidant coping strategy for breast cancer risk-related distress.
Exploratory analyses provided further information about the role of emotion and emotion regulation in risk-management decision making. First, primary emotions (including fear, anger, and sadness) additionally emerged as significant predictors of intentions for the same behavior – mastectomy – but the effects of the emotions were dependent on emotion regulation strategy. When use of emotional expression was high, mastectomy intentions were highest when sadness was low and anxiety was low. When use of reappraisal was high, mastectomy intentions were highest when anger was high and anxiety was high. When use of emotional processing was high, mastectomy intentions were highest when sadness was high. Thus, emotion regulation played a significant moderating role in the motivational effects of these three discrete emotions. Second, exploratory analyses in which the predictor and outcome variables were reversed demonstrated some support for the effect of behavioral intentions on breast cancer risk-related distress. Specifically, the interaction between intentions for RRM and use of reappraisal as an emotion regulation strategy was a significant predictor of IES scores. This effect is opposite to our hypothesized model, and contrasts with previous literature demonstrating that affective associations are causally antecedent to behavior and behavioral intentions (Courneya, Friedenreich, Arthur, & Bobick, 1999; McAuley, Jerome, Elavsky, Marquez, & Ramsey, 2003; Quine, Rutter, & Arnold, 2000). These results could indicate that patients’ decisions about risk reduction may have a subsequent effect on their emotions about their risk. For example, individuals deciding to pursue risk-reducing mastectomy may be more distressed because of that decision. There is some evidence to support that perceptions of risk change in response to a behavior
(Magnan, Köblitz, Zielke, & McCaul, 2009). Perhaps this study provides some evidence that these effects can be extended to affective aspects of risk.

Cognitive Pathway

In the present study, mediation analyses examined of (1) the direct effect of cognitions about risk on behavioral intentions and (2) the indirect effect of attitudes on the relationship between cognitions about risk and behavioral intentions for risk-reducing behavior. We hypothesized that cognitions about risk would have a direct effect on behavioral intentions, such that higher perceived severity would predict increased behavioral intentions. However, neither our primary analyses nor our exploratory analyses demonstrated significant effects of perceived severity on behavioral intentions. In other words, the women in this sample have made decisions about risk reduction options independent of how likely a diagnosis of breast cancer is (perceived susceptibility), and how bad breast cancer would be (perceived seriousness). However, perceived severity did demonstrate a significant effect on positivity towards diet and physical activity, such that higher perceived severity was associated with lower positivity towards diet and physical activity. Interestingly, this negative relationship existed despite overall high intentions to make lifestyle changes (88-90%, see Table 11). Although this contrasted with our hypothesized effects, negative associations between risk perceptions and intentions are not uncommon (Ferrer et al., 2016). There are two potential explanations for this pattern. First, it may be that women who perceive their cancer risk as devastating (high seriousness) and inevitable (high susceptibility) may feel that
lifestyle changes will not be effective to lower their considerable risk, and therefore feel less positive about those options. If this is the case, the lack of knowledge about the preventative benefit of lifestyle change indicates a need for interventions that educate about breast cancer risk and motivate health protective behaviors (Bernat et al., 2015; Bernat, Hullmann, & Sparks, 2017). Alternatively, it may be that participants who intend to protect themselves against cancer may (accurately) assess their future cancer risk as lower (Ferrer et al., 2016). In other words, if a woman plans to reduce her risk through lifestyle behaviors, she may factor those behaviors into her estimation of risk. Thus, perceived risk may reflect protective intentions in cross-sectional analyses. These effects can be further clarified via study design and data analysis methods. Specifically, cross-lagged panel analyses of longitudinal data are needed to clarify whether behavioral intentions drive risk perception, whether risk perceptions drive behavioral intentions, or both (Preacher & Hayes, 2008).

Furthermore, we hypothesized that attitudes about risk-reducing behaviors would significantly mediate the relationship between cognitions about risk and behavioral intentions, such that more positive attitudes about risk-reducing strategies would predict increased behavioral intentions. Although the direct relationship between perceived severity and behavioral intentions was not significant, bootstrapped mediation analyses still allowed for the examination of the significance of the indirect effect. However, there was no significant indirect effect of perceived severity on behavioral intentions via positivity about risk-reducing behavior. Exploratory analyses specifying ambivalence as a mediator produced no additional indirect effects of note. However, the literature does
consistently and fervently report evidence that the role of perceived severity on behavior is not limited to direct effects, but likely also involves mediating and moderating pathways of influence (McQueen et al., 2010). Alternative mediators or alternative measurement methods might obviate the direct and indirect effects of perceived severity on behavioral intentions.

Implications for Measurement

Per Cronbach and Meehl’s (1955) nomological network, a lack of statistical relationship between measured variables may indicate one of two things. Either a relationship between those two variables does not exist at the level of the constructs, or the criterion is not an adequate measure of the construct. Beyond the modifications to the theoretical model described above, modifications to the measurement of variables may also be considered. Thus, the measurement of key variables in the integrated theoretical model must be carefully considered. This includes cognitive variables, emotional variables, and outcome variables.

Cognitive variables such as perceived risk have been frequently examined in the decision-making literature. Although perceived risk is central to theories of behavior change and has been demonstrated to influence health decisions and behavior (particularly for RRM and RRO) there is no “gold standard” measure to do so (Waters, McQueen, & Cameron, 2014). Many researchers have made suggestions about best principles for measurement of risk perceptions (Brewer, Chapman, Schwartz, & Bergus,
Our results also provide two implications for our second cognitive variable, positivity towards risk-reducing behaviors. First, positivity was the product of participants’ ratings of thoughts on three variables: valence, confidence, and importance. For valence in particular, ratings by judges may be more consistent and accurate than self-rating (Cacioppo, Glass, & Merluzzi, 1979). Future studies might compare individuals’ own ratings of their thoughts to those of independent raters. Second, participants’ thoughts were weighted by confidence and valence ratings in order to calculate a “net positivity” score. However, results of our exploratory analyses demonstrated no difference between these weighted values and an unweighted score (based on valence ratings alone). Thus, this study suggests that valence ratings alone provide sufficient information on the thoughts listed in this task, and that additional ratings of thoughts do not add value beyond valence ratings.
Likewise, our measure of emotional experience, the Impact of Events Scale (IES) may not be a sufficient measure of breast-cancer risk related distress. Although many studies have used the IES as a measure of cancer-specific distress measure, this instrument might be inadequate to assess distress about cancer risk. First, the IES specifies a one-week recall window. Given the very long timeline of breast cancer risk management decision-making, perhaps this time frame was too narrow to effectively identify breast cancer risk-related distress. Second, the IES was designed to measure a stress reaction after a traumatic incident (Horowitz et al., 1979). Thus, it may not be appropriate for the context of high-risk women, whose primary concerns typically consist of worries about getting cancer in the future (Voorwinden & Jaspers, 2016). Our exploratory analyses demonstrated some additional benefit of using primary emotional experiences as a predictor. Assessing primary emotional experiences may be particularly beneficial in the context of risk-reduction decision-making. Although affect is commonly categorized as positive and negative, it can be further divided into discrete emotions (Lerner & Keltner, 2000, 2001; Raghunathan & Pham, 1999). Discrete emotions have different effects on motivation. Sadness is typically associated with a bias towards high-risk/high-reward options, anger is typically associated with approach tendencies and a bias towards action, and fear is typically associated with risk-averse decisions or a bias towards low-risk/low-reward options (Ellis, 2017; Raghunathan & Pham, 1999). Given the contradictory effects on motivation, it is logical that more specific effects are demonstrated in models examining discrete, primary emotions. Given the future-orientation of risk management decision making, there may be benefit to the examination
of anticipated affective responses, not just current ones (Ferrer et al., 2015; Loewenstein & Lerner, 2003; Nordgren, van der Pligt, & van Haareveld, 2007). That is, instead of asking women how they feel about their risk now, researchers might ask women how they believe they would feel in the future, upon being diagnosed with breast cancer.

In the present study, patients did report future intentions for breast cancer risk reduction. These behavioral intentions were assessed such that a woman’s intention for one behavior was considered to be independent of her intentions for other behaviors. However, this may not be an accurate representation of the way that patients think about breast cancer risk management decisions. Instead, intentions for risk-reduction might be a set of medical trade-offs. For example, taking medication for chemoprevention may be represented as a trade-off between risk for breast cancer and risk for endometrial cancer, while RRO may be represented as a trade-off between risk for breast cancer and early-onset menopause. Thus, patients may not be independently weighing the benefits and drawbacks of each treatment, but instead choosing between the lesser of two evils. In addition, patients may conceptualize each option as mutually exclusive, rather than compatible. For example, a patient planning on RRM may feel that she does not need to make lifestyle changes in order to reduce her risk. In sum, the use of an assessment in which patients are forced to rank treatment options, or pick between them (similar to a delay-discounting task (Reynolds & Schiffbauer, 2004)) might be a more accurate representation of patients’ behavioral intentions.
In addition, our measure of behavioral intentions did not incorporate an assessment of individuals’ current behaviors. This may have affected participants’ responses; for example, an individual who is currently exercising regularly may not intend to increase physical activity in the future. Likewise, an individual who is consuming a large amount of alcohol may see greater need to reduce alcohol consumption than one who drinks rarely. Thus, future studies should incorporate measures of current and past risk-reducing behaviors, in order to provide a context for decision-making regarding future behaviors.

Finally, future studies might include active surveillance as a potential outcome. Although the risks of treatment options must be balanced with the risks inherent in active surveillance (Denberg, Flanigan, Kim, Hoffman, & Steiner, 2007; Ellis, 2017; Singer et al., 1991; Sommers et al., 2007), women’s confidence in screening methods influence their decisions for risk-reduction (Glassey et al., 2016; Mal Bebbington Hatcher et al., 2001; J. Li, Hart, Aronson, Crangle, & Govindarajan, 2016; Lloyd et al., 2000). As we did not assess surveillance as an outcome in the present study, inclusion of this option in the future may allow for further clarification of patients’ intentions for risk management. Furthermore, if it is the case that women are choosing to forgo RRS and chemoprevention in favor of screening, compliance with screening regimens must be stressed as imperative (Flippo-Morton et al., 2016).
Implications for Sample Selection

Just as breast cancer patients are heterogeneous, so too are women at high risk for breast cancer. Although there are many variables by which subgroups could be identified, two of the most common in the literature include objective risk and time since risk determination.

Women at high risk for breast cancer have an estimated lifetime risk greater than the population average of 12%. Thus, women with risk estimates between 13% and 80% are all considered to be “high risk.” However, a disproportionate amount of the research focuses on the highest of the high: BRCA1/2 carriers. Although the American Cancer Society and the National Comprehensive Cancer Network (NCCN) provide screening and treatment guidelines for BRCA1/2 carriers only and are not applicable to “moderately high” risk women, who are often identified through variants of uncertain significance and pathogenic variances in low-penetrance genes (Clifford et al., 2016; Scalia-Wilbur, Colins, Penson, & Dizon, 2016). Thus, the “moderately high risk” women face the most uncertainty in the management of their risk. They are not considered to be high enough risk for certain procedures (e.g., risk-reducing surgery), but are simultaneously considered to be too high risk for standard screening. Although rapidly developing genomics work may provide greater clarity in the coming years, “moderately high risk” women are currently provided with minimal guidance for risk management. As a result, these women’s decision-making processes may be much more complicated. In our sample, women’s average lifetime risk ranged from 9% to 65%, with a mean of 32.5%.
Only 15% were BRCA1/2 carriers. Thus, the present study is a notable first step in investigating the psychological processes at work in women at “moderately high” risk of breast cancer. Future work may further refine the differences in risk management decision making based on objective risk strata (e.g., “high high” risk versus “moderately high” risk versus “low high” risk).

Also, when women learn of their risk status varies. Some may become aware early in life, perhaps following a family member’s cancer diagnosis. For others, it may occur later, perhaps when lesions found on a scan are biopsied and benign breast disease is diagnosed. Regardless of the timing, a woman who is just learning of high risk likely differs from others learning months or years previously. First knowledge of risk status may be felt as an acute stressor, while living with a heightened risk has been likened to living with a chronic one. Thus, time since risk notification may be an important conceptual as well as descriptive variable in this research. The present study sampled the range – women who were presenting to a high-risk breast clinic for the first time and those who were returning for follow-up.

Furthermore, enrolling women who have known about and managed their high risk for many years may have also affected the behavioral intentions reported. Specifically, women demonstrated extremely high intentions to make lifestyle changes (88-90% “yes”), but generally low intentions to engage in other risk-reducing behaviors (11-25% “yes”; see Table 11). About half of the sample said that they did not intend to have RRM or RRO, and did not intend to take medication for chemoprevention. This
flies in the face of previous research reporting uptake of lifestyle changes between 0-33%, and uptake as high as 74% in the case of RRO (see Table 1). Women were not eligible for the present study if they had previously undergone a risk-reducing mastectomy. For that reason, our sample included those who had not yet decided and women who, at least thus far, had ruled it out.

Strengths and Limitations

The present study has strengths. This theory-driven research fills a gap in the literature: research specifically designed to disentangle the direct effects and/or interactions between emotion and cognition to improve cancer decision making (Reyna et al., 2015). Furthermore, the sample included women with a range of high risk, whereas research has focused on BRCA1/2 carriers. This study is a first step in investigating the psychological processes at work in women at “moderately high” risk. Also investigated were decisions about lifestyle interventions – changes in diet, physical activity, and alcohol use. Lifestyle interventions may play a particularly important role for women who carry low- or moderate-penetrance mutations (Jatoi & Benson, 2016).

Limitations are also considered. First, our a priori power analyses for the bootstrapped mediation models were based on medium effect sizes for the component pathways. It may be that the component effects are small, and thus our experiment was underpowered to detect them. Relatedly, our power analyses were based on a beta of 0.80. For those effects where the 95% confidence interval is close to zero (e.g., ±0.01),
there is a chance of a false positive result. The sample size provided adequate power for
the primary analyses, and, by design, was underpowered for exploratory analyses.
However, this is a preliminary examination of our theoretical model; further
investigations are needed. In particular, studies focusing on targeted groups (e.g., people
with tendencies to overestimate, clinically significant breast cancer risk-related distress,
under age 50, or high efficacy) may provide further clarification. Second, determining
the directionality of the relationship between perceived risk and behavior is difficult
(Brewer, Weinstein, Cuite, & Herrington, 2004), and requires multiple assessments or
experimental paradigms. Using a cross-sectional design, analyses were repeated using
reversed models to clarify the direction of effects among variables. As breast cancer risk-
management decision-making is complex and changes with age (Bayraktar & Arun,
2017; Hoskins et al., 2012, 2008; Leonarczyk & Mawn, 2015; Stan et al., 2013; Taylor &
Tischkowitz, 2014), future research should examine the longitudinal dynamics in
perceived risk, emotional responses, and decision-making.

Finally, our results may be affected by the composition of our sample. First, our
sample was drawn from three sources, and included women accrued from a high-risk
breast clinic, from the community, and undergraduate students. Beyond
sociodemographic differences, these samples may have significant differences in their
experiences with breast cancer and their knowledge of risk reduction options. Although
exploratory subgroup analyses focusing on the clinic sample did not demonstrate any
significant differences from the full sample, a considerably smaller sample size made it
more difficult to detect effects. Further, as a first effort one wants a heterogeneous
sample; if you can find effects there it increases the likelihood of finding effects with select samples. Second, some participants were identified via medical chart review, while others were self-identified. Although previous research has demonstrated the validity of self-identification of high-risk status (Flória-santos et al., 2016), confirmation of family history with a family member may help to distinguish between truly high risk women and those who merely perceive themselves as high risk. Lastly, there is systemic under-representation of minority women in studies of breast cancer risk management. Although there is a general perception that some racial/ethnic minorities may be more hesitant to undergo genetic cancer risk assessment than non-Hispanic whites (Komenaka et al., 2016), and results of a national sample of newly diagnosed breast cancer patients under 40 years of age showed that Hispanic women were half as likely to undergo genetic testing compared to non-Hispanic whites (Levy et al., 2011), studies demonstrate that racial/ethnic minority patients would consider genetic cancer risk assessment if given the opportunity (Benkendorf et al., 1997; Hughes et al., 1997; Kinney et al., 2006; Vadaparampil et al., 2010). Similar to prior research, our sample was also predominantly Caucasian, educated, and with above-average income. Thus, the generalizability of the findings to other ethnic and minority groups or to the underserved is unknown.

Future Directions

The results can aid in the development of risk communication and decision support interventions. Specifically, emotional predictors of behavioral intentions had more influence, compared to models specifying cognitive predictors. Clinicians should
therefore focus their time and effort on emotions about risk. Although interventions that successfully change risk perceptions often change health behaviors (Sheeran, Harris, & Epton, 2014), it is generally easier to change affect than it is to change risk perceptions (Lerman et al., 1997; Weinstein & Klein, 1995). Thus, interventions targeting affective perceptions of risk would be more effective than interventions attempting to correct misperceptions of risk, which is, ironically, the primary focus of many genetic counseling interventions. Such emotion-focused interventions are essential in today’s world of shared and informed patient decision making (Politi & Street, 2011).

Second, decision-making models and decisions in particular are not the product of the individual alone: providers and health systems also play a role. Supportive patient-provider relationships have been demonstrated to reduce cancer-related worry, depression, and anxiety (Brown, Boles, Mullooly, & Levinson, 1999; Takayama, Yamazaki, & Katsumata, 2001; Torbit et al., 2016), as well as modifying intentions for risk-reducing behavior (Paskett et al., 2004). Furthermore, healthcare organizations may not incentivize (or even disincentivize) some risk-reducing options. Reasons for the lower uptake of some options could be due to systemic factors such as cost, inadequate insurance coverage, and limited availability of services and providers (Wideroff et al., 2003). The Social Amplification of Risk Framework (SARF) might be used to examine such macro-level effects (Kasperson et al., 1988; Pidgeon, Kasperson, & Slovic, 2003). This conceptualization of risk and decision making emphasizes social determinants of health and multilevel influences on disease. SARF describes how psychological, social, and cultural factors, alone and in concert, amplify or attenuate perceptions of risk and to
alter behavior related to a particular hazard. To our knowledge, it is the only framework that attempts to display risk perception as a dynamic process that is affected by multiple domains of influence and, in turn, affects broader institutions and societies. Thus, its use in the context of breast cancer risk management might provide unique insight into the complicated dynamics between person and system.

Finally, future research could benefit from modifications in study design and data analysis. Regarding study design, further tests with other diseases would be valuable. Experimental tests of these theoretical relationships also are needed (Weinstein, 2007). Emotional components might be experimentally manipulated through emotion induction paradigms, for example. Further work examining more direct and perhaps implicit measures of affective experience might provide richer data on the nature and operation of such associations. Finally, there is a pressing need to assess theorized models in relation to concrete behavior, not just behavioral intentions (Webb & Sheeran, 2006). Regarding data analysis, estimation of the quadratic relations between cognitive components or affective of risk and behavior may provide further insight into these complicated relationships (Janis, 1967; Leventhal, 1970; M. D. Schwartz, Taylor, & Willard, 2003) alongside the linear associations assessed here.
Conclusion

Until now, the risk-management decision-making processes of women at high risk for breast cancer have been referred to as “complex.” Theory abounds, but there is a dearth of quantitative, theory-driven research in this area. The present study offers novel insights about risk management decision making in the specific context of breast cancer prevention. Through the generation of an integrative decision-making model, we sought to clarify the role of cognitive components in making decisions about risk management, as well as further understanding the emotional processes surrounding the breast cancer risk. Our results highlight the need for modifications to our existing set of health decision-making models. Specifically, emotion regulation emerges as important, and perceived severity as unimportant in risk management decision-making. In working with women at high risk for breast cancer, one must consider ways to use affect as an intervention target/tool to change individuals’ behavioral intentions.
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Appendix A: Tables
Table 1. Breast cancer risk reduction strategies.

<table>
<thead>
<tr>
<th>Strategy</th>
<th>BC Risk Reduction</th>
<th>Emotional Costs</th>
<th>Physical Costs</th>
<th>Financial Costs</th>
<th>Estimated Uptake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk-reducing surgery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mastectomy</td>
<td>90%</td>
<td>• Changed body image</td>
<td>• Surgical complications (e.g., infection, flap necrosis)</td>
<td>• $15,000-$55,000</td>
<td>20-44%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Altered sexual function</td>
<td>• Poor cosmetic result</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Loss of sensation</td>
<td>• Cost-effective when compared to long-term intensive surveillance.</td>
<td></td>
</tr>
<tr>
<td>Oophorectomy</td>
<td>50%</td>
<td>• Reduced quality of life</td>
<td>• Premature menopause</td>
<td>• $7,000-$37,000</td>
<td>45-74%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Altered sexual function</td>
<td>• Increased risk of cardiovascular disease, osteoporosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemoprevention</td>
<td>50%</td>
<td>• Fear of side effects</td>
<td>• Side effects (e.g., menopausal symptoms)</td>
<td>• $100/month</td>
<td>5-17%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Mood swings</td>
<td>• Increased risk of endometrial cancer, blood clots, stroke</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Depression</td>
<td></td>
<td>• Cost-effectiveness data not available.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Altered sexual function</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lifestyle changes (e.g., diet, physical activity, alcohol consumption)</td>
<td>30-40%</td>
<td>• None</td>
<td>• None</td>
<td>• Cost estimates not available.</td>
<td>0-33%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Cost-effectiveness data not available.</td>
<td></td>
</tr>
</tbody>
</table>
Table 2. Sociodemographic and risk characteristics for participants (N = 103).

<table>
<thead>
<tr>
<th></th>
<th>Mean (SD)</th>
<th>Range</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td>43.1 (17.5)</td>
<td>18-87</td>
<td></td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High School degree or GED</td>
<td></td>
<td></td>
<td>22 (21.4%)</td>
</tr>
<tr>
<td>Some college</td>
<td></td>
<td></td>
<td>24 (23.3%)</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
<td></td>
<td></td>
<td>30 (29.1%)</td>
</tr>
<tr>
<td>Postgraduate degree</td>
<td></td>
<td></td>
<td>27 (26.2%)</td>
</tr>
<tr>
<td><strong>Employment Status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed full time</td>
<td></td>
<td></td>
<td>45 (43.7%)</td>
</tr>
<tr>
<td>Employed part time</td>
<td></td>
<td></td>
<td>30 (29.1%)</td>
</tr>
<tr>
<td>Full time student</td>
<td></td>
<td></td>
<td>12 (11.7%)</td>
</tr>
<tr>
<td>Retired</td>
<td></td>
<td></td>
<td>10 (9.7%)</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td>6 (5.8%)</td>
</tr>
<tr>
<td><strong>Household Income</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;$25,000</td>
<td></td>
<td></td>
<td>6 (5.8%)</td>
</tr>
<tr>
<td>$25,001-$50,000</td>
<td></td>
<td></td>
<td>14 (13.6%)</td>
</tr>
<tr>
<td>$50,001-$75,000</td>
<td></td>
<td></td>
<td>24 (23.3%)</td>
</tr>
<tr>
<td>$75,001-$100,000</td>
<td></td>
<td></td>
<td>17 (16.5%)</td>
</tr>
<tr>
<td>$100,001-$200,000</td>
<td></td>
<td></td>
<td>26 (25.2%)</td>
</tr>
<tr>
<td>&gt;$200,000</td>
<td></td>
<td></td>
<td>12 (11.7%)</td>
</tr>
<tr>
<td><strong>Health Insurance Coverage</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public insurance</td>
<td></td>
<td></td>
<td>15 (14.6%)</td>
</tr>
<tr>
<td>Employer-sponsored</td>
<td></td>
<td></td>
<td>81 (78.6%)</td>
</tr>
<tr>
<td>Private (self-purchased)</td>
<td></td>
<td></td>
<td>6 (5.8%)</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td></td>
<td></td>
<td>87 (84.5%)</td>
</tr>
<tr>
<td>African American</td>
<td></td>
<td></td>
<td>6 (5.8%)</td>
</tr>
<tr>
<td>Biracial/Multiracial</td>
<td></td>
<td></td>
<td>7 (6.8%)</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td>3 (2.9%)</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Latina</td>
<td></td>
<td></td>
<td>3 (2.9%)</td>
</tr>
<tr>
<td>Not Latina</td>
<td></td>
<td></td>
<td>100 (97.1%)</td>
</tr>
<tr>
<td><strong>Partner Status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not partnered</td>
<td></td>
<td></td>
<td>43 (41.7%)</td>
</tr>
<tr>
<td>Partnered</td>
<td></td>
<td></td>
<td>60 (58.3%)</td>
</tr>
<tr>
<td>Relationship length (years)</td>
<td>20.9 (14.7)</td>
<td>1-52</td>
<td></td>
</tr>
<tr>
<td><strong>Body Mass Index (BMI)</strong></td>
<td>28.0 (7.1)</td>
<td>17-59</td>
<td></td>
</tr>
<tr>
<td><strong>Comorbidities</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charlson Comorbidity Index (CCI)</td>
<td>0.2 (0.6)</td>
<td>0-3</td>
<td></td>
</tr>
<tr>
<td>Age-adjusted CCI</td>
<td></td>
<td></td>
<td>0.9 (1.2)</td>
</tr>
<tr>
<td>Lifetime breast cancer risk (%)</td>
<td>32.5 (17.3)</td>
<td>9-65</td>
<td></td>
</tr>
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</table>
Table 3. Sociodemographic differences between groups.

<table>
<thead>
<tr>
<th></th>
<th>Total (N = 103)</th>
<th>Group 1 (n = 65)</th>
<th>Group 2 (n = 20)</th>
<th>Group 3 (n = 18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (M, S.D.)</td>
<td>43.1 (17.5)</td>
<td>53.3 (12.3)</td>
<td>31.3 (9.5)</td>
<td>19.4 (14.5)</td>
</tr>
<tr>
<td>Education (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High School/GED</td>
<td>22 (21.4%)</td>
<td>6 (9.2%)</td>
<td>2 (10.0%)</td>
<td>14 (77.8%)</td>
</tr>
<tr>
<td>Some college</td>
<td>24 (23.3%)</td>
<td>17 (26.2%)</td>
<td>3 (15.0%)</td>
<td>4 (22.2%)</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
<td>30 (29.1%)</td>
<td>21 (32.3%)</td>
<td>9 (45.0%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Postgraduate degree</td>
<td>27 (26.2%)</td>
<td>21 (32.3%)</td>
<td>6 (30.0%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Employment Status (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed full time</td>
<td>45 (43.7%)</td>
<td>34 (52.3%)</td>
<td>11 (55.0%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Employed part time</td>
<td>30 (29.1%)</td>
<td>18 (27.7%)</td>
<td>5 (25.0%)</td>
<td>7 (38.9%)</td>
</tr>
<tr>
<td>Full time student</td>
<td>12 (11.7%)</td>
<td>0 (0.0%)</td>
<td>1 (5.0%)</td>
<td>11 (61.1%)</td>
</tr>
<tr>
<td>Retired</td>
<td>10 (9.7%)</td>
<td>10 (15.4%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Other</td>
<td>6 (5.8%)</td>
<td>3 (4.6%)</td>
<td>3 (15.0%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Health Insurance Type (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public insurance</td>
<td>15 (14.6%)</td>
<td>14 (21.5%)</td>
<td>1 (5.0%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Employer-sponsored</td>
<td>81 (78.6%)</td>
<td>50 (76.9%)</td>
<td>16 (80.0%)</td>
<td>15 (83.3%)</td>
</tr>
<tr>
<td>Private (self-purchased)</td>
<td>6 (5.8%)</td>
<td>1 (1.5%)</td>
<td>2 (10.0%)</td>
<td>3 (16.7%)</td>
</tr>
<tr>
<td>Partner Status (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not partnered</td>
<td>43 (41.7%)</td>
<td>13 (20.0%)</td>
<td>12 (60.0%)</td>
<td>18 (100.0%)</td>
</tr>
<tr>
<td>Partnered</td>
<td>60 (58.3%)</td>
<td>52 (80.0%)</td>
<td>8 (40.0%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Body Mass Index (M, S.D.)</td>
<td>28.0 (7.1)</td>
<td>29.1 (7.4)</td>
<td>28.0 (7.9)</td>
<td>24.0 (2.5)</td>
</tr>
<tr>
<td>Unadjusted CCI (M, S.D.)</td>
<td>0.2 (0.6)</td>
<td>0.3 (0.7)</td>
<td>0.1 (0.2)</td>
<td>0.0 (0.0)</td>
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</table>
Table 4. Parameter estimates from Principal Components Analysis of emotion regulation items (EACS and ERQ).

<table>
<thead>
<tr>
<th>Scale</th>
<th>Item #</th>
<th>Content</th>
<th>Component 1</th>
<th>Component 2</th>
<th>Component 3</th>
<th>Communalities (h²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EACS</td>
<td>5</td>
<td>“I let my feelings come out freely.”</td>
<td>.78</td>
<td>.01</td>
<td>.19</td>
<td>.64</td>
</tr>
<tr>
<td>ERQ</td>
<td>6</td>
<td>“I control my emotions by not expressing them.”</td>
<td>.78</td>
<td>-.02</td>
<td>.16</td>
<td>.63</td>
</tr>
<tr>
<td>ERQ</td>
<td>9</td>
<td>“I am careful not to express negative emotions.”</td>
<td>.77</td>
<td>-.03</td>
<td>-.01</td>
<td>.59</td>
</tr>
<tr>
<td>EACS</td>
<td>7</td>
<td>“I allow myself to express my emotions.”</td>
<td>.76</td>
<td>-.01</td>
<td>.29</td>
<td>.67</td>
</tr>
<tr>
<td>EACS</td>
<td>2</td>
<td>“I keep my emotions to myself.”</td>
<td>.76</td>
<td>.07</td>
<td>-.04</td>
<td>.59</td>
</tr>
<tr>
<td>EACS</td>
<td>6</td>
<td>“I take time to express my emotions.”</td>
<td>.69</td>
<td>&lt;.01</td>
<td>.42</td>
<td>.65</td>
</tr>
<tr>
<td>ERQ</td>
<td>10</td>
<td>“I change how I’m thinking to feel less negative.”</td>
<td>&lt;.01</td>
<td>.84</td>
<td>.03</td>
<td>.71</td>
</tr>
<tr>
<td>ERQ</td>
<td>7</td>
<td>“I change how I’m thinking to feel more positive.”</td>
<td>-.13</td>
<td>.82</td>
<td>-.10</td>
<td>.69</td>
</tr>
<tr>
<td>ERQ</td>
<td>8</td>
<td>“I control my emotions by changing how I think.”</td>
<td>-.14</td>
<td>.81</td>
<td>-.08</td>
<td>.67</td>
</tr>
<tr>
<td>ERQ</td>
<td>3</td>
<td>“I change what I’m thinking to feel less negative.”</td>
<td>.28</td>
<td>.78</td>
<td>-.17</td>
<td>.71</td>
</tr>
<tr>
<td>ERQ</td>
<td>1</td>
<td>“I change what I’m thinking to feel more positive.”</td>
<td>.23</td>
<td>.65</td>
<td>-.28</td>
<td>.56</td>
</tr>
<tr>
<td>ERQ</td>
<td>5</td>
<td>“I make myself think in a way that helps me stay calm.”</td>
<td>-.22</td>
<td>.65</td>
<td>-.06</td>
<td>.48</td>
</tr>
<tr>
<td>EACS</td>
<td>1</td>
<td>“I take time to figure out my feelings.”</td>
<td>.07</td>
<td>-.04</td>
<td>.83</td>
<td>.69</td>
</tr>
<tr>
<td>EACS</td>
<td>2</td>
<td>“I explore my feelings.”</td>
<td>.18</td>
<td>-.16</td>
<td>.80</td>
<td>.70</td>
</tr>
<tr>
<td>EACS</td>
<td>3</td>
<td>“I realize my feelings are valid/important.”</td>
<td>.13</td>
<td>-.25</td>
<td>.68</td>
<td>.54</td>
</tr>
<tr>
<td>EACS</td>
<td>4</td>
<td>“I acknowledge my emotions.”</td>
<td>.37</td>
<td>.03</td>
<td>.63</td>
<td>.55</td>
</tr>
<tr>
<td>ERQ</td>
<td>4</td>
<td>“I am careful not to express positive emotions.”</td>
<td>.26</td>
<td>-.19</td>
<td>.26</td>
<td>.17</td>
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</tbody>
</table>
Table 5. Summary statistics for participants (N = 103) on study measures.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Mean (SD)</th>
<th>Observed Range</th>
<th>α</th>
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<tbody>
<tr>
<td>Perceived Severity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Susceptibility (%)</td>
<td>3.92 (1.98)</td>
<td>0-9</td>
<td></td>
</tr>
<tr>
<td>Perceived Seriousness</td>
<td>6.99 (2.31)</td>
<td>1-10</td>
<td></td>
</tr>
<tr>
<td>Net Positivity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mastectomy</td>
<td>2.07 (11.07)</td>
<td>-25-25</td>
<td></td>
</tr>
<tr>
<td>Oophorectomy</td>
<td>3.14 (11.91)</td>
<td>-23-25</td>
<td></td>
</tr>
<tr>
<td>Chemoprevention</td>
<td>-0.91 (10.66)</td>
<td>-25-25</td>
<td></td>
</tr>
<tr>
<td>Diet</td>
<td>7.55 (10.39)</td>
<td>-23-25</td>
<td></td>
</tr>
<tr>
<td>Physical Activity</td>
<td>6.45 (10.76)</td>
<td>-16-25</td>
<td></td>
</tr>
<tr>
<td>Alcohol Use</td>
<td>6.06 (10.93)</td>
<td>-20-25</td>
<td></td>
</tr>
<tr>
<td>Overall Attitudes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mastectomy</td>
<td>-1.43 (4.79)</td>
<td>-10-10</td>
<td></td>
</tr>
<tr>
<td>Oophorectomy</td>
<td>-0.38 (5.90)</td>
<td>-10-10</td>
<td></td>
</tr>
<tr>
<td>Chemoprevention</td>
<td>-0.45 (5.02)</td>
<td>-10-10</td>
<td></td>
</tr>
<tr>
<td>Diet</td>
<td>4.20 (4.02)</td>
<td>-5-10</td>
<td></td>
</tr>
<tr>
<td>Physical Activity</td>
<td>4.28 (3.81)</td>
<td>-4-10</td>
<td></td>
</tr>
<tr>
<td>Alcohol Use</td>
<td>4.25 (4.37)</td>
<td>-8-10</td>
<td></td>
</tr>
<tr>
<td>Ambivalence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mastectomy</td>
<td>4.47 (2.91)</td>
<td>0-10</td>
<td></td>
</tr>
<tr>
<td>Oophorectomy</td>
<td>3.58 (2.96)</td>
<td>0-10</td>
<td></td>
</tr>
<tr>
<td>Chemoprevention</td>
<td>3.47 (2.63)</td>
<td>0-9</td>
<td></td>
</tr>
<tr>
<td>Diet</td>
<td>3.37 (2.50)</td>
<td>0-10</td>
<td></td>
</tr>
<tr>
<td>Physical Activity</td>
<td>3.52 (2.59)</td>
<td>0-10</td>
<td></td>
</tr>
<tr>
<td>Alcohol Use</td>
<td>2.03 (2.22)</td>
<td>0-8</td>
<td></td>
</tr>
<tr>
<td>Impact of Events Scale (IES)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Score</td>
<td>10.81 (13.17)</td>
<td>0-75</td>
<td>0.90</td>
</tr>
<tr>
<td>Avoidance</td>
<td>6.46 (8.32)</td>
<td>0-40</td>
<td>0.84</td>
</tr>
<tr>
<td>Intrusion</td>
<td>4.34 (5.91)</td>
<td>0-35</td>
<td>0.84</td>
</tr>
<tr>
<td>Emotional Response to Risk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sadness</td>
<td>2.91 (2.84)</td>
<td>0-10</td>
<td></td>
</tr>
<tr>
<td>Anger</td>
<td>1.85 (2.64)</td>
<td>0-10</td>
<td></td>
</tr>
<tr>
<td>Anxiety/Fear</td>
<td>4.34 (2.75)</td>
<td>0-10</td>
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<tr>
<td>Emotional Approach Coping Scale (EACS)</td>
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</tr>
<tr>
<td>Emotional Expression</td>
<td>10.24 (3.33)</td>
<td>4-16</td>
<td>0.86</td>
</tr>
<tr>
<td>Emotional Processing</td>
<td>10.04 (2.93)</td>
<td>4-16</td>
<td>0.79</td>
</tr>
<tr>
<td>Emotion Regulation Questionnaire</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive Reappraisal</td>
<td>16.27 (6.31)</td>
<td>6-35</td>
<td>0.85</td>
</tr>
<tr>
<td>Expressive Suppression</td>
<td>17.64 (5.58)</td>
<td>5-28</td>
<td>0.79</td>
</tr>
</tbody>
</table>
Table 6. Correlations among cognitive factors (N = 103).

<table>
<thead>
<tr>
<th></th>
<th>Positivity</th>
<th>Attitudes</th>
<th>Ambivalence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Severity</td>
<td>Mast</td>
<td>Ooph</td>
</tr>
<tr>
<td>Severity</td>
<td>1</td>
<td>-.06</td>
<td>-.00</td>
</tr>
<tr>
<td>Mast</td>
<td>1</td>
<td>.45†</td>
<td>.29†</td>
</tr>
<tr>
<td>Ooph</td>
<td>1</td>
<td>.38†</td>
<td>.04</td>
</tr>
<tr>
<td>Chemo</td>
<td>1</td>
<td>.04</td>
<td>.20†</td>
</tr>
<tr>
<td>Diet</td>
<td>1</td>
<td>.34†</td>
<td>.07</td>
</tr>
<tr>
<td>PA</td>
<td>1</td>
<td>.23†</td>
<td>.01</td>
</tr>
<tr>
<td>Alcohol</td>
<td>1</td>
<td>-.03</td>
<td>.13</td>
</tr>
<tr>
<td>Mast</td>
<td>1</td>
<td>.42†</td>
<td>.30†</td>
</tr>
<tr>
<td>Ooph</td>
<td>1</td>
<td>.07</td>
<td>-.18</td>
</tr>
<tr>
<td>Chemo</td>
<td>1</td>
<td>.24</td>
<td>.11</td>
</tr>
<tr>
<td>Diet</td>
<td>1</td>
<td>.66†</td>
<td>.22</td>
</tr>
<tr>
<td>PA</td>
<td>1</td>
<td>.10</td>
<td>-.27†</td>
</tr>
<tr>
<td>Alcohol</td>
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<td>.11</td>
<td>.06</td>
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<tr>
<td>Mast</td>
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<td>.57†</td>
<td>.29†</td>
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<td>Ooph</td>
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<td>.48†</td>
<td>.33†</td>
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<td>Chemo</td>
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<td>.32†</td>
<td>.27†</td>
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<td>Diet</td>
<td>1</td>
<td>.62†</td>
<td>.09</td>
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<tr>
<td>PA</td>
<td>1</td>
<td>.04</td>
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</tr>
<tr>
<td>Alcohol</td>
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</tbody>
</table>

* Correlation is significant at the 0.05 level (2-tailed).
† Correlation is significant at the 0.01 level (2-tailed).
Table 7. Correlations among emotional factors (N = 103).

<table>
<thead>
<tr>
<th>IES Total</th>
<th>Sad</th>
<th>Angry</th>
<th>Anxiety</th>
<th>Expression</th>
<th>Processing</th>
<th>Reappraisal</th>
<th>Suppression</th>
</tr>
</thead>
<tbody>
<tr>
<td>IES Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sadness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Anger</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Emotion Reg.</td>
<td>Expression</td>
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<td></td>
</tr>
<tr>
<td>Processing</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Reappraisal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suppression</td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (2-tailed).
† Correlation is significant at the 0.01 level (2-tailed).
Table 8. Correlations between cognitive factors and emotional factors (N = 103).

<table>
<thead>
<tr>
<th>Cognitive Factors</th>
<th>Emotional Factors</th>
<th>Emotions about Risk</th>
<th>Emotion Regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IES Total</td>
<td>Sad</td>
<td>Angry</td>
</tr>
<tr>
<td>Severity</td>
<td>.24*</td>
<td>.21</td>
<td>.18</td>
</tr>
<tr>
<td>Mast</td>
<td>-.24*</td>
<td>-.07</td>
<td>-.10</td>
</tr>
<tr>
<td>Alcohol</td>
<td>.00</td>
<td>-.11</td>
<td>-.04</td>
</tr>
<tr>
<td>Mast</td>
<td>.02</td>
<td>-.09</td>
<td>-.18</td>
</tr>
<tr>
<td>Ooph</td>
<td>-.13</td>
<td>-.08</td>
<td>-.04</td>
</tr>
<tr>
<td>Chemo</td>
<td>-.10</td>
<td>-.02</td>
<td>-.04</td>
</tr>
<tr>
<td>Diet</td>
<td>.05</td>
<td>.16</td>
<td>.06</td>
</tr>
<tr>
<td>Alcohol</td>
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<td>-.03</td>
<td>-.08</td>
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</tr>
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<td>Ooph</td>
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<td>-.13</td>
</tr>
<tr>
<td>Chemo</td>
<td>-.14</td>
<td>-.08</td>
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<td>.03</td>
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<td>Alcohol</td>
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<td>.32*</td>
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<tr>
<td>Mast</td>
<td>.15</td>
<td>.36†</td>
<td>.34†</td>
</tr>
<tr>
<td>Ooph</td>
<td>.03</td>
<td>.32*</td>
<td>.17</td>
</tr>
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<td>.24</td>
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<tr>
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<td>PA</td>
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<td>.10</td>
<td>.05</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (2-tailed).
† Correlation is significant at the 0.01 level (2-tailed).
Table 9. Correlations among behavioral intentions (N = 103).

<table>
<thead>
<tr>
<th></th>
<th>Mast</th>
<th>Ooph</th>
<th>Chemo</th>
<th>Diet</th>
<th>PA</th>
<th>Alcohol</th>
<th>Global</th>
</tr>
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<tbody>
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<td>.25*</td>
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<td>.03</td>
<td>-.02</td>
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<td>.08</td>
<td>0.46†</td>
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<td>.01</td>
<td>.03</td>
<td>0.53†</td>
</tr>
<tr>
<td>Diet</td>
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<td></td>
<td>1</td>
<td></td>
<td>.42†</td>
<td>.06</td>
<td>0.40†</td>
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<tr>
<td>PA</td>
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<td>.02</td>
<td>0.36†</td>
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<tr>
<td>Alcohol</td>
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<td></td>
<td>1</td>
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<td>0.47†</td>
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<td>Global</td>
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* Correlation is significant at the 0.05 level (2-tailed).
† Correlation is significant at the 0.01 level (2-tailed).
Table 10. Correlations between behavioral intentions and cognitive factors/emotional factors (N = 103).

<table>
<thead>
<tr>
<th></th>
<th>Mast</th>
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<th>Chemo</th>
<th>Diet</th>
<th>PA</th>
<th>Alcohol</th>
<th>Global</th>
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<tr>
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<td>Mast</td>
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<td>.09</td>
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<td>.03</td>
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<tr>
<td>Ooph</td>
<td>.03†</td>
<td>.26†</td>
<td>.07</td>
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<td>.06</td>
<td>-.02</td>
<td>.03</td>
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<td>.35†</td>
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<td>.00</td>
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<td>.10</td>
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<td>.08</td>
<td>.06</td>
<td>.03</td>
<td>-.08</td>
<td>.11</td>
<td>.04</td>
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<td>.05</td>
<td>.08</td>
<td>-.01</td>
<td>.07</td>
<td>.10</td>
</tr>
<tr>
<td>Alcohol</td>
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<td>-.06</td>
<td>.02</td>
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<td>-.08</td>
<td>-.14</td>
<td>-.15</td>
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<tr>
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<td>.17</td>
<td>-.05</td>
<td>-.01</td>
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<td>.49†</td>
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<td>.45†</td>
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<td>.06</td>
<td>.13</td>
<td>.18</td>
<td>-.06</td>
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<td>.13</td>
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<td>.03</td>
<td>-.05</td>
<td>.08</td>
<td>.03</td>
<td>.11</td>
<td>.11</td>
</tr>
<tr>
<td>Alcohol</td>
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<td>-.11</td>
<td>.04</td>
<td>-.03</td>
<td>-.02</td>
<td>.11</td>
<td>-.01</td>
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<tr>
<td>Mast</td>
<td>-.04</td>
<td>.09</td>
<td>.11</td>
<td>-.27*</td>
<td>-.18</td>
<td>.03</td>
<td>.00</td>
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<td>.19</td>
<td>.14</td>
<td>-.22</td>
<td>-.02</td>
<td>-.04</td>
<td>.17</td>
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<tr>
<td>Chemo</td>
<td>.02</td>
<td>.29*</td>
<td>.34†</td>
<td>-.06</td>
<td>-.01</td>
<td>-.13</td>
<td>.20</td>
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<tr>
<td>Diet</td>
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<td>-.01</td>
<td>.00</td>
<td>-.25</td>
<td>.08</td>
<td>-.11</td>
<td>-.08</td>
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<td>.08</td>
<td>.14</td>
<td>-.11</td>
<td>-.09</td>
<td>-.05</td>
<td>-.08</td>
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<td>Alcohol</td>
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<td>-.10</td>
<td>-.10</td>
<td>-.01</td>
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<td>-.04</td>
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<td>.03</td>
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<td>-.01</td>
<td>.06</td>
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<td>Sadness</td>
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<td>-.07</td>
<td>.05</td>
<td>-.30†</td>
<td>-.09</td>
<td>-.20</td>
<td>-.12</td>
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<tr>
<td>Anger</td>
<td>.30†</td>
<td>.08</td>
<td>.05</td>
<td>-.22†</td>
<td>.03</td>
<td>-.09</td>
<td>.10</td>
</tr>
<tr>
<td>Anxiety</td>
<td>.02</td>
<td>-.04</td>
<td>-.07</td>
<td>-.32†</td>
<td>-.17</td>
<td>-.06</td>
<td>-.16</td>
</tr>
<tr>
<td>Express.</td>
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<td>-.14</td>
<td>-.14</td>
<td>.07</td>
<td>.16</td>
<td>-.05</td>
<td>-.09</td>
</tr>
<tr>
<td>Process.</td>
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<td>.06</td>
<td>.03</td>
<td>.13</td>
<td>.22*</td>
<td>.03</td>
<td>.12</td>
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<td>-.14</td>
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<td>-.03</td>
<td>-.11</td>
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<td>Suppress.</td>
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<td>-.06</td>
<td>.03</td>
<td>.11</td>
<td>.05</td>
<td>-.01</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (2-tailed).
† Correlation is significant at the 0.01 level (2-tailed).
Table 11. Intentions for risk-reducing options (N = 103).

<table>
<thead>
<tr>
<th>Measure</th>
<th>Mean (SD)</th>
<th>Range</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mastectomy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>26 (25.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>60 (58.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unsure</td>
<td>16 (15.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N/A – Already done</td>
<td>1 (1.0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Oophorectomy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>11 (10.7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>54 (52.4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unsure</td>
<td>16 (15.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N/A – Already done</td>
<td>21 (20.4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Chemoprevention</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>24 (23.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>45 (43.7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unsure</td>
<td>28 (27.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N/A – Already done</td>
<td>6 (5.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Diet</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>93 (90.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>5 (4.9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unsure</td>
<td>5 (4.9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Physical Activity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>91 (88.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>6 (5.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unsure</td>
<td>6 (5.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Alcohol Use</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>37 (35.9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>59 (57.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unsure</td>
<td>7 (6.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Global</strong></td>
<td>0.53 (2.27)</td>
<td>-4-6</td>
<td></td>
</tr>
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</table>
Table 12. Correlations between outcome measures and selected control variables (N=103).

<table>
<thead>
<tr>
<th></th>
<th>Mast</th>
<th>Ooph</th>
<th>Chemo</th>
<th>Diet</th>
<th>PA</th>
<th>Alcohol</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>-.23*</td>
<td>.22*</td>
<td>.06</td>
<td>.09</td>
<td>.09</td>
<td>-.21†</td>
<td>-.21†</td>
</tr>
<tr>
<td>Education</td>
<td>-.12</td>
<td>.10</td>
<td>.03</td>
<td>.27†</td>
<td>.28†</td>
<td>-.02</td>
<td>.08</td>
</tr>
<tr>
<td>BMI</td>
<td>-.03</td>
<td>.06</td>
<td>&lt;.01</td>
<td>.08</td>
<td>.20*</td>
<td>-.16</td>
<td>-.08</td>
</tr>
<tr>
<td>Lifetime risk (%)</td>
<td>.06</td>
<td>.28†</td>
<td>-.17</td>
<td>.09</td>
<td>.20*</td>
<td>-.06</td>
<td>.06</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (2-tailed).
† Correlation is significant at the 0.01 level (2-tailed).
Table 13. Results of mediation analyses representing cognitive pathway.

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Parameter</th>
<th>Estimates</th>
<th>S.E.</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A: Perceived Susceptibility &gt; Net Positivity</td>
<td>-0.24</td>
<td>0.55</td>
<td>(-1.33, 0.86)</td>
</tr>
<tr>
<td>Model 1: Risk-Reducing Mastectomy</td>
<td></td>
<td>B: Net Positivity &gt; Behavioral Intentions</td>
<td>0.02</td>
<td>0.01</td>
<td>(0.01, 0.03)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C: Perceived Susceptibility &gt; Behavioral Intentions</td>
<td>0.05</td>
<td>0.04</td>
<td>(-0.03, 0.13)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AB: Mediating Pathway</td>
<td>&lt;0.01</td>
<td>0.01</td>
<td>(-0.02, 0.02)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A: Perceived Susceptibility &gt; Net Positivity</td>
<td>-0.33</td>
<td>0.64</td>
<td>(-1.60, 0.95)</td>
</tr>
<tr>
<td>Model 2: Risk-Reducing Oophorectomy</td>
<td></td>
<td>B: Net Positivity &gt; Behavioral Intentions</td>
<td>0.01</td>
<td>0.01</td>
<td>(-0.01, 0.03)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C: Perceived Susceptibility &gt; Behavioral Intentions</td>
<td>0.03</td>
<td>0.04</td>
<td>(-0.05, 0.11)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AB: Mediating Pathway</td>
<td>&lt;0.01</td>
<td>0.01</td>
<td>(-0.03, 0.01)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A: Perceived Susceptibility &gt; Net Positivity</td>
<td>-0.18</td>
<td>0.55</td>
<td>(-1.27, 0.92)</td>
</tr>
<tr>
<td>Model 3: Chemoprevention</td>
<td></td>
<td>B: Net Positivity &gt; Behavioral Intentions</td>
<td>0.02</td>
<td>0.01</td>
<td>(0.01, 0.04)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C: Perceived Susceptibility &gt; Behavioral Intentions</td>
<td>0.03</td>
<td>0.04</td>
<td>(-0.05, 0.11)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AB: Mediating Pathway</td>
<td>&lt;0.01</td>
<td>0.01</td>
<td>(-0.03, 0.01)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A: Perceived Susceptibility &gt; Net Positivity</td>
<td>-1.36</td>
<td>0.51</td>
<td>(-2.38, -0.35)</td>
</tr>
<tr>
<td>Model 4: Diet</td>
<td></td>
<td>B: Net Positivity &gt; Behavioral Intentions</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>(-0.01, 0.01)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C: Perceived Susceptibility &gt; Behavioral Intentions</td>
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<td>0.02</td>
<td>(-0.02, 0.06)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AB: Mediating Pathway</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>(-0.01, 0.01)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A: Perceived Susceptibility &gt; Net Positivity</td>
<td>-1.62</td>
<td>0.52</td>
<td>(-2.66, -0.58)</td>
</tr>
<tr>
<td>Model 5: Physical Activity</td>
<td></td>
<td>B: Net Positivity &gt; Behavioral Intentions</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>(-0.01, 0.01)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C: Perceived Susceptibility &gt; Behavioral Intentions</td>
<td>0.01</td>
<td>0.03</td>
<td>(-0.04, 0.07)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AB: Mediating Pathway</td>
<td>&lt;0.01</td>
<td>0.01</td>
<td>(-0.01, 0.01)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A: Perceived Susceptibility &gt; Net Positivity</td>
<td>-0.23</td>
<td>0.55</td>
<td>(-1.29, 0.83)</td>
</tr>
<tr>
<td>Model 6: Alcohol Use</td>
<td></td>
<td>B: Net Positivity &gt; Behavioral Intentions</td>
<td>-0.01</td>
<td>0.01</td>
<td>(-0.03, 0.01)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C: Perceived Susceptibility &gt; Behavioral Intentions</td>
<td>-0.07</td>
<td>0.05</td>
<td>(-0.16, 0.02)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AB: Mediating Pathway</td>
<td>&lt;0.01</td>
<td>0.01</td>
<td>(-0.01, 0.02)</td>
</tr>
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</table>
Table 14. Results of moderation analyses representing emotional pathway (Moderator = ER Component #1).

<table>
<thead>
<tr>
<th>Model 1: Risk-Reducing Mastectomy</th>
<th>Parameter Estimates</th>
<th>S.E.</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$B_1$: IES &gt; Behavioral Intentions</td>
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<td>0.01</td>
<td>(-0.01, 0.02)</td>
</tr>
<tr>
<td>$B_2$: ER Component #1 &gt; Behavioral Intentions</td>
<td>-0.01</td>
<td>0.11</td>
<td>(-0.23, 0.21)</td>
</tr>
<tr>
<td>$B_3$: IES x ER Component #1 &gt; Behavioral Intentions</td>
<td>&lt;0.01</td>
<td>0.01</td>
<td>(-0.02, 0.02)</td>
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</table>

<table>
<thead>
<tr>
<th>Model 2: Risk-Reducing Oophorectomy</th>
<th>Parameter Estimates</th>
<th>S.E.</th>
<th>95% C.I.</th>
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</thead>
<tbody>
<tr>
<td>$B_1$: IES &gt; Behavioral Intentions</td>
<td>-0.01</td>
<td>0.01</td>
<td>(-0.02, 0.01)</td>
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<tr>
<td>$B_2$: ER Component #1 &gt; Behavioral Intentions</td>
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<td>0.10</td>
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</tr>
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<td>$B_3$: IES x ER Component #1 &gt; Behavioral Intentions</td>
<td>&lt;0.01</td>
<td>0.01</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model 3: Chemoprevention</th>
<th>Parameter Estimates</th>
<th>S.E.</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$B_1$: IES &gt; Behavioral Intentions</td>
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<td>0.01</td>
<td>(-0.01, 0.02)</td>
</tr>
<tr>
<td>$B_2$: ER Component #1 &gt; Behavioral Intentions</td>
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<td>0.11</td>
<td>(-0.32, 0.11)</td>
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<tr>
<td>$B_3$: IES x ER Component #1 &gt; Behavioral Intentions</td>
<td>&lt;0.01</td>
<td>0.01</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model 4: Diet</th>
<th>Parameter Estimates</th>
<th>S.E.</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$B_1$: IES &gt; Behavioral Intentions</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
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</tr>
<tr>
<td>$B_2$: ER Component #1 &gt; Behavioral Intentions</td>
<td>&lt;0.01</td>
<td>0.06</td>
<td>(-0.13, 0.12)</td>
</tr>
<tr>
<td>$B_3$: IES x ER Component #1 &gt; Behavioral Intentions</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
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</tr>
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</table>

<table>
<thead>
<tr>
<th>Model 5: Physical Activity</th>
<th>Parameter Estimates</th>
<th>S.E.</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$B_1$: IES &gt; Behavioral Intentions</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>(-0.01, 0.01)</td>
</tr>
<tr>
<td>$B_2$: ER Component #1 &gt; Behavioral Intentions</td>
<td>-0.01</td>
<td>0.07</td>
<td>(-0.14, 0.12)</td>
</tr>
<tr>
<td>$B_3$: IES x ER Component #1 &gt; Behavioral Intentions</td>
<td>&lt;0.01</td>
<td>0.01</td>
<td>(-0.01, 0.01)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model 6: Alcohol Use</th>
<th>Parameter Estimates</th>
<th>S.E.</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$B_1$: IES &gt; Behavioral Intentions</td>
<td>-0.01</td>
<td>0.01</td>
<td>(-0.02, 0.01)</td>
</tr>
<tr>
<td>$B_2$: ER Component #1 &gt; Behavioral Intentions</td>
<td>0.05</td>
<td>0.12</td>
<td>(-0.19, 0.30)</td>
</tr>
<tr>
<td>$B_3$: IES x ER Component #1 &gt; Behavioral Intentions</td>
<td>-0.01</td>
<td>0.01</td>
<td>(-0.03, 0.01)</td>
</tr>
</tbody>
</table>
Table 15. Results of moderation analyses representing emotional pathway (Moderator = ER Component #2).

<table>
<thead>
<tr>
<th>Parameter Estimates</th>
<th>S.E.</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1: Risk-Reducing Mastectomy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B&lt;sub&gt;1&lt;/sub&gt;: IES &gt; Behavioral Intentions</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>B&lt;sub&gt;2&lt;/sub&gt;: ER Component #2 &gt; Behavioral Intentions</td>
<td>-0.17</td>
<td>0.11</td>
</tr>
<tr>
<td>B&lt;sub&gt;3&lt;/sub&gt;: IES x ER Component #2 &gt; Behavioral Intentions</td>
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<td>0.01</td>
</tr>
<tr>
<td>Model 2: Risk-Reducing Oophorectomy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B&lt;sub&gt;1&lt;/sub&gt;: IES &gt; Behavioral Intentions</td>
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<td>0.01</td>
</tr>
<tr>
<td>B&lt;sub&gt;2&lt;/sub&gt;: ER Component #2 &gt; Behavioral Intentions</td>
<td>-0.02</td>
<td>0.12</td>
</tr>
<tr>
<td>B&lt;sub&gt;3&lt;/sub&gt;: IES x ER Component #2 &gt; Behavioral Intentions</td>
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<td>0.01</td>
</tr>
<tr>
<td>Model 3: Chemoprevention</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B&lt;sub&gt;1&lt;/sub&gt;: IES &gt; Behavioral Intentions</td>
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<td>0.01</td>
</tr>
<tr>
<td>B&lt;sub&gt;2&lt;/sub&gt;: ER Component #2 &gt; Behavioral Intentions</td>
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<td>0.11</td>
</tr>
<tr>
<td>B&lt;sub&gt;3&lt;/sub&gt;: IES x ER Component #2 &gt; Behavioral Intentions</td>
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<td>0.01</td>
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<tr>
<td>Model 4: Diet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B&lt;sub&gt;1&lt;/sub&gt;: IES &gt; Behavioral Intentions</td>
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<td>&lt;0.01</td>
</tr>
<tr>
<td>B&lt;sub&gt;2&lt;/sub&gt;: ER Component #2 &gt; Behavioral Intentions</td>
<td>-0.07</td>
<td>0.06</td>
</tr>
<tr>
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<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Model 5: Physical Activity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B&lt;sub&gt;1&lt;/sub&gt;: IES &gt; Behavioral Intentions</td>
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<td>&lt;0.01</td>
</tr>
<tr>
<td>B&lt;sub&gt;2&lt;/sub&gt;: ER Component #2 &gt; Behavioral Intentions</td>
<td>-0.16</td>
<td>0.07</td>
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<tr>
<td>B&lt;sub&gt;3&lt;/sub&gt;: IES x ER Component #2 &gt; Behavioral Intentions</td>
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<td>&lt;0.01</td>
</tr>
<tr>
<td>Model 6: Alcohol Use</td>
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<td></td>
</tr>
<tr>
<td>B&lt;sub&gt;1&lt;/sub&gt;: IES &gt; Behavioral Intentions</td>
<td>&lt;0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>B&lt;sub&gt;2&lt;/sub&gt;: ER Component #2 &gt; Behavioral Intentions</td>
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<td>0.13</td>
</tr>
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<td>B&lt;sub&gt;3&lt;/sub&gt;: IES x ER Component #2 &gt; Behavioral Intentions</td>
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</tbody>
</table>
Table 16. Results of moderation analyses representing emotional pathway (Moderator = ER Component #3).

<table>
<thead>
<tr>
<th>Model</th>
<th>Risk-Reducing Mastectomy</th>
<th>Risk-Reducing Oophorectomy</th>
<th>Chemoprevention</th>
<th>Diet</th>
<th>Physical Activity</th>
<th>Alcohol Use</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Parameter Estimates</td>
<td>S.E.</td>
<td>95% C.I.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 1</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>B1:</td>
<td>IES &gt; Behavioral Intentions</td>
<td>0.01</td>
<td>0.01</td>
<td>(-0.01, 0.02)</td>
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<tr>
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<td>(-0.36, 0.08)</td>
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</tr>
<tr>
<td>B3:</td>
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<td>0.01</td>
<td>(-0.01, 0.01)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 2</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>B1:</td>
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<td>0.01</td>
<td>(-0.02, 0.01)</td>
<td></td>
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</tr>
<tr>
<td>B2:</td>
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<td>0.11</td>
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<tr>
<td>B3:</td>
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<td>&lt;0.01</td>
<td>(-0.01, 0.01)</td>
<td></td>
<td></td>
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<td>Model 3</td>
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<td></td>
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</tr>
<tr>
<td>B1:</td>
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<td>0.01</td>
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<tr>
<td>B2:</td>
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<td>0.11</td>
<td>(-0.18, 0.27)</td>
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<tr>
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<td>&lt;0.01</td>
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<td></td>
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<tr>
<td>Model 4</td>
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<tr>
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<tr>
<td>B2:</td>
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<td>0.06</td>
<td>(-0.04, 0.20)</td>
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<tr>
<td>B3:</td>
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<td></td>
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<tr>
<td>Model 5</td>
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<tr>
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<td>&lt;0.01</td>
<td>(-0.01, 0.01)</td>
<td></td>
<td></td>
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<tr>
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<td>0.07</td>
<td>(-0.10, 0.16)</td>
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<td>Model 6</td>
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<td>0.01</td>
<td>(-0.02, 0.01)</td>
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<td>(-0.02, 0.01)</td>
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</table>
Appendix B: Figures
Figure 1. Integrated dual-pathway decision-making model.
Figure 2. National Cancer Institute (NCI) Gail Model Breast Cancer Risk Assessment Tool (from http://www.cancer.gov/bcrisktool/).
Figure 3. Cognitive pathway of the integrated dual-pathway decision-making model to be tested (3a) and corresponding operational statistical model (3b).

3a. Theoretical Cognitive Pathway.

3b. Operationalized Cognitive Pathway.
Figure 4. Emotional pathway of the integrated dual-pathway decision-making model to be tested (4a) and corresponding operational statistical model (4b).

4a. Theoretical Emotional Pathway.

4b. Operationalized Emotional Pathway.
Figure 5. Study Flow.

Group 1: High Risk Breast Clinic
- Approached = 110
  - Declined = 26 (24%)
    - "Not interested" = 12
    - "Too busy" = 12
    - Other = 2
  - Non-compliant = 17 (15%)
    - Did not respond to requests to schedule = 17
  - Ineligible = 2 (2%)
    - Hx breast cancer = 1
    - Non-English speaker = 1
  - Completed = 65 (59%)

Group 2: Study/Search Website
- Approached = 54
  - Declined = 8 (15%)
    - "Not interested" = 1
    - "Too busy" = 3
    - Lack of compensation = 3
    - Other = 1
  - Non-compliant = 20 (37%)
    - Did not respond to requests to schedule = 16
    - Ended early = 2
    - No-show = 2
  - Ineligible = 6 (11%)
    - Hx breast cancer = 6
  - Completed = 20 (37%)

Group 3: Research Experience Pool
- Approached = 30
  - Declined = 1 (3%)
    - "Too busy" = 1
  - Non-compliant = 11 (37%)
    - Did not respond to requests to schedule = 11
  - Completed = 18 (60%)

Total N = 103
Figure 6. Results for Cognitive Pathway.

6a. Mastectomy

6b. Chemoprevention

6c. Diet

6d. Physical Activity
Figure 7. Results from Emotional Pathway.

Conditional Effect of IES on Mastectomy Intentions

Conditional Effect of IES on Chemoprevention Intentions
Figure 8. Exploratory moderated mediation.
Figure 9. Results of moderated mediation predicting mastectomy intentions.
Figure 10. Results of exploratory moderated mediation.
Figure 11. Revised Theoretical Model.
Figure 12. Theoretical Model Incorporating Experiential Risk Perceptions.
Appendix C: Measures
Screening Items for Study Search and Research Experience Pool

1. Do you have a family history of breast cancer? If yes, what family member(s) have been affected?
2. Have you ever been told that you are at high risk for breast cancer?
3. Have you ever been referred for counseling based on your high risk for breast cancer?
4. Have you ever been tested for a BRCA1 or BRCA2 mutation? If so, what was the result?
**Sociodemographics**

Year born: __________

Home zip code: __________

Gender:
1. Male
2. Female

How many individuals (including yourself) are living in your household? __________

How many children under the age of 18 are living in your home? __________

What is your ethnicity?
1. Latina/Hispanic ancestry
2. Not Hispanic

What is your racial/ethnic group? (Choose yes or no for each; you may choose yes for more than one.)
1. Caucasian/White Yes/No
2. African-American/Black Yes/No
3. Asian Yes/No
4. American Indian/Alaskan Native Yes/No
5. Native Hawaiian/Other Pacific Islander Yes/No
6. Other: __________ Yes/No

Have you ever been or are you currently married?
1. Single, never married
2. Currently married
3. Not married, but in a relationship with a significant other
4. Separated or divorced
5. Widowed

Are you currently living with a romantic partner?
1. Yes
2. No

How long have you been married? If you are living with a romantic partner, how long have you been living together?
__________ years
What is the highest level of formal education that you have completed?
1. Less than high school
2. Completed high school/GED
3. Some college (includes technical, vocational, or certificate program and Associate’s degree)
4. Bachelor’s degree
5. Postgraduate or professional degree (includes Master’s, MD, PhD, and JD)

Do you currently work for pay?
1. Yes
2. No

What is your current job status?
1. Employed full-time
2. Employed part-time
3. Unemployed
4. Homemaker
5. Disabled
6. Retired

What are/were your household (family) gross wages or income last year (pre-tax)?
1. Less than $25,000
2. $25,001 - $50,000
3. $50,001 - $75,000
4. $75,001 - $100,000
5. $100,001 - $200,000
6. More than $200,000
7. I don’t know.
8. I prefer not to answer.

What kind of health insurance do you currently have?
1. Public insurance (e.g., Medicaid, Medicare)
2. Employer-sponsored health insurance
3. Private insurance (self-purchased)

Have you ever been diagnosed with breast cancer?
1. Yes
2. No

If yes, what was the year of your diagnosis? __________

If no, what have you been told your lifetime risk of breast cancer is (percentage)? __________%
Your Health (Charlson Comorbidity Index; Deyo et al., 1992)

Have you ever been diagnosed with any of the following conditions?

<table>
<thead>
<tr>
<th>Condition</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myocardial Infarction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Congestive Heart Failure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peripheral Vascular Disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cerebrovascular Disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dementia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COPD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rheumatologic Disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peptic Ulcer Disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes with chronic complications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hemiplegia or paraplegia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Renal (kidney) disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any malignancy, including leukemia and lymphoma</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate or severe liver disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metastatic solid tumor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AIDS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Describe Yourself (STAI; Spielberger, 1968, 1977)

A number of statements which people have used to describe themselves are given below. Please read each statement and check each item, indicating the how you generally feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

<table>
<thead>
<tr>
<th></th>
<th>Almost Never</th>
<th>Sometimes</th>
<th>Often</th>
<th>Almost Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I feel pleasant.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>I tire quickly.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>I feel like crying.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>I wish I could be as happy as others seem to be.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>I am losing out on things because I can’t make up my mind soon enough.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>I feel rested.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>I am “calm, cool, and collected”.</td>
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<td>8.</td>
<td>I feel that difficulties are piling up so that I cannot overcome them.</td>
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<tr>
<td>9.</td>
<td>I worry too much over something that really doesn’t matter.</td>
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<tr>
<td>10.</td>
<td>I am happy.</td>
<td></td>
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<tr>
<td>11.</td>
<td>I am inclined to take things hard.</td>
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<tr>
<td>12.</td>
<td>I lack self-confidence.</td>
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<tr>
<td>13.</td>
<td>I feel secure.</td>
<td></td>
<td></td>
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<tr>
<td>14.</td>
<td>I try to avoid facing a crisis or difficulty.</td>
<td></td>
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<tr>
<td>15.</td>
<td>I feel blue.</td>
<td></td>
<td></td>
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<tr>
<td>16.</td>
<td>I am content.</td>
<td></td>
<td></td>
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<tr>
<td>17.</td>
<td>Some unimportant thought runs through my mind and bothers me.</td>
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<tr>
<td>18.</td>
<td>I take disappointments so keenly that I can’t put them out of my mind.</td>
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<tr>
<td>19.</td>
<td>I am a steady person.</td>
<td></td>
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<tr>
<td>20.</td>
<td>I get in a state of tension or turmoil as I think over my recent concerns and interests.</td>
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</tbody>
</table>
Impact of Events Scale (IES; Horowitz, Wilner, & Alvarez, 1979)

Below is a list of comments made by people after stressful life events. Please check each item, indicating how frequently these comments have been true in describing your feelings about your risk of breast cancer DURING THE PAST SEVEN DAYS. If they did not occur during that time, please mark the “not at all” column.

<table>
<thead>
<tr>
<th></th>
<th>Not at All</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I thought about how my life had been before I found out about my risk for breast cancer.</td>
<td></td>
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<tr>
<td>2. I thought about how my life might have been different if I was not at high risk for breast cancer.</td>
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<tr>
<td>3. I felt the need to discuss my risk of breast cancer or my feelings about being at high risk.</td>
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<tr>
<td>4. I talked with someone about my thoughts, feelings, or experiences about my risk for breast cancer.</td>
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<tr>
<td>5. I thought about my risk when I didn't mean to.</td>
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<tr>
<td>6. I avoided letting myself get upset when I thought about it or was reminded of being at high risk.</td>
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<tr>
<td>7. I tried to remove my risk status from my memory.</td>
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<tr>
<td>8. I had trouble falling asleep or staying asleep because pictures or thoughts about my cancer risk came into my mind.</td>
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<tr>
<td>9. I had waves of strong feelings about my risk.</td>
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<tr>
<td>10. I had dreams involving my cancer risk.</td>
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<tr>
<td>11. I stayed away from reminders of my risk.</td>
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<tr>
<td>12. I felt as if my risk status was not real.</td>
<td></td>
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<tr>
<td>13. I tried not to talk about it.</td>
<td></td>
<td></td>
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<tr>
<td>14. Pictures about my risk popped into my mind.</td>
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<tr>
<td>15. Other things kept making me think about my risk.</td>
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<tr>
<td>16.</td>
<td>I was aware that I still had a lot of feelings about my risk, but didn't deal with them.</td>
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<td>-----</td>
<td>--------------------------------------------------------------------------------------------</td>
<td></td>
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<tr>
<td>17.</td>
<td>I tried not to think about it.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>18.</td>
<td>Any reminder brought back feelings about my risk.</td>
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<tr>
<td>19.</td>
<td>My feelings about it were kind of numb.</td>
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</tbody>
</table>
**My Emotions**

1. How sad does your risk of breast cancer make you?

   0------1------2------3------4------5------6------7------8------9------10
   Not at all                     Extremely

2. How angry does your risk of breast cancer make you?

   0------1------2------3------4------5------6------7------8------9------10
   Not at all                     Extremely

3. How anxious or afraid does your risk of breast cancer make you?

   0------1------2------3------4------5------6------7------8------9------10
   Not at all                     Extremely
Responding to Stress (EACS; Stanton et al., 2000)

We are interested in how people respond when they confront stressful experiences. By "stressful" we mean situations that are difficult or troubling to you, either because they upset you or because it takes considerable effort to deal with them.

There are many ways to deal with stress. This questionnaire asks you to indicate what you do, feel, and think in regards to managing your risk of breast cancer.

<table>
<thead>
<tr>
<th></th>
<th>I don’t do this at all.</th>
<th>I usually do this a little bit.</th>
<th>I usually do this a medium amount.</th>
<th>I do this a lot.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I take time to figure out what I’m really feeling about my risk for breast cancer.</td>
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<tr>
<td>2.</td>
<td>I explore my feelings about my risk of breast cancer to get a thorough understanding of them.</td>
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<tr>
<td>3.</td>
<td>I realize that my feelings about my risk of breast cancer are valid and important.</td>
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<tr>
<td>4.</td>
<td>I acknowledge my emotions about my risk for breast cancer.</td>
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<tr>
<td>5.</td>
<td>I let my feelings about my risk come out freely.</td>
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<tr>
<td>6.</td>
<td>I take time to express my emotions about my risk.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>I allow myself to express my emotions about my risk.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>I feel free to express my emotions about my risk.</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
My Emotions (ERQ; Gross & John, 2003)

We would like to ask you some questions about your emotional life, in particular, how you control (that is, regulate and manage) your emotions about your risk of breast cancer. The questions below involve two distinct aspects. One is about your emotions, or what you feel like inside. The other is about your expression of emotions, or how you show your emotions in the way you talk, gesture, or behave. Although some of the following questions may seem similar to one another, they differ in important ways.

Read each item and then pick a number that indicates how much the statement describes you.

1---------------2----------------3----------------4----------------5----------------6---------------7
strongly agree neutral strongly disagree

1. When I want to feel more positive emotion about my risk (such as joy or amusement), I change what I’m thinking about.
2. I keep my emotions about my risk to myself.
3. When I want to feel less negative emotion about my risk (such as sadness or anger), I change what I’m thinking about.
4. When I am feeling positive emotions about my risk, I am careful not to express them.
5. When I’m faced with a stressful situation, I make myself think about it in a way that helps me stay calm.
6. I control my emotions about my risk by not expressing them.
7. When I want to feel more positive emotion about my risk, I change the way I’m thinking about the situation.
8. I control my emotions about my risk by changing the way I think about the situation I’m in.
9. When I am feeling negative emotions about my risk, I make sure not to express them.
10. When I want to feel less negative emotion about my risk, I change the way I’m thinking about the situation.
My Breast Cancer Risk

1. What is your personal risk of being diagnosed with breast cancer in your lifetime? Please indicate by making an “X” on the line below.

   For reference, the mid-point means that you have the same chance of being diagnosed as not being diagnosed, similar to a coin flip.

   ____________________________________________________________________
   It definitely will not happen. | It definitely will happen.

2. If you were to develop breast cancer, how serious would it be? Think about the impact of breast cancer globally, including its effects on your personal life, your professional life, and your emotional life.

   0-------1-------2-------3-------4-------5-------6-------7-------8-------9-------10
   Not at all serious | Extremely serious
Thought-Listing Task (Cacioppo & Petty, 1981)

We are interested in your thoughts about *six options for reducing breast cancer risk*.

**Instructions:**

In this booklet, there are six options, one listed on each page.
- Go through the pages one at a time.
- On each page list all the thoughts that you have about that option.
- Try to list one thought on a line.
- List as many thoughts as come to mind

**EXAMPLE:** If we were interested in your thoughts about reducing the amount of salt (sodium) in your diet, the page might read as follows:

Reducing the amount of salt (sodium) in your diet.

1. *I like the way my food tastes with salt on it.*
2. *My doctor told me that I should watch how much salt I eat.*
3. *When I eat a lot of salt, I feel bloated.*

Some thoughts that you have about the prompts on the following pages might be positive, some might be negative, and some might be both positive and negative. All of those thoughts are fine. Please record all different types of thoughts.

The options on the following pages might require more detailed descriptions of your thoughts. Please write as much as you would like, for up to five minutes per page.

**REMEMBER TO:**
- Use your own frame of reference. Do not worry about what other people might think about a particular option.
- Ignore spelling, grammar, and punctuation.
- *Please be candid and truthful in writing down your thoughts about these options. This information will be kept confidential.*
Having breast surgery (mastectomy).
Having my ovaries removed (oophorectomy).
Taking oral tamoxifen, raloxifene, or an aromatase inhibitor (AI).
Making dietary changes
(e.g., decreasing the amount of fat you eat, increasing the amount of fiber you eat, etc.)
Increasing your physical activity.
Reducing your consumption of alcohol.
Now, go back through each page and put a plus sign ("+") if that thought is positive. Put a minus sign ("-") if that thought is negative.

EXAMPLE: If we were asked you to categorize your thoughts about reducing the amount of salt (sodium) you eat, the page might read as follows:

Reducing the amount of salt (sodium) in your diet.

1. I like the way my food tastes with salt on it.  
   
2. My doctor told me that I should watch how much salt I eat.  
   
3. When I eat a lot of salt, I feel bloated.  

In this example, thought #1 is rated as negative because it is a bad thing about reducing salt in your diet, while thoughts #2 and #3 are rated as positive because they are good things about reducing salt in your diet.
Now, go back through each page and rate each thought on how confident you are about it. Please use the following scale:

1 = I have no confidence in this thought.
2 = I have a little bit of confidence in this thought.
3 = I have a medium amount of confidence in this thought,
4 = I have a lot of confidence in this thought.
5 = I have an extreme amount of confidence in this thought.

**EXAMPLE:** If we were asked you to rate your confidence in your thoughts about reducing the amount of salt (sodium) you eat, the page might read as follows:

Reducing the amount of salt (sodium) in your diet.

1. I like the way my food tastes with salt on it. _-_ 5 ___
2. My doctor told me that I should watch how much salt I eat. _+_ 3 ___
3. When I eat a lot of salt, I feel bloated. _+_ 5 ___

In this example, thoughts #1 and #3 are rated a 5 because you are very confident in them. Though #2 is rated a 3 because you only have a moderate amount of confidence in the fact that your doctor told you to reduce the amount of salt that you eat.
Finally, please go back though each page and rate each thought on how much it would affect your behavior. Please use the following scale:

1 = This thought would not affect my behavior at all.
2 = This thought would affect my behavior a little bit.
3 = This thought would affect my behavior a medium amount,
4 = This thought would affect my behavior a lot.
5 = This thought would affect my behavior an extreme amount.

EXAMPLE: If we were asked you to rate your thoughts about reducing the amount of salt (sodium) you eat, the page might read as follows:

Reducing the amount of salt (sodium) in your diet.

1. I like the way my food tastes with salt on it. _-_ 5 5
2. My doctor told me that I should watch how much salt I eat. _+ _3 _3
3. When I eat a lot of salt, I feel bloated. _+ _5 _2

In this example, thought #1 is rated a 5 because it would affect your choice to reduce salt in your diet an extreme amount. Thought #3, on the other hand, is rated a 2 because it would affect your choice to reduce salt in your diet a little bit.
Your Attitudes

Ignoring the potential negative aspects of these behaviors, how positive do you feel about these behaviors? Please answer using the following scale:

0--------1---------2---------3--------4--------5--------6--------7--------8---------9--------10
Not positive at all                      Extremely positive

1. Having breast surgery (mastectomy).
2. Having my ovaries removed (oophorectomy).
3. Taking oral tamoxifen, raloxifene, or an aromatase inhibitor (AI).
4. Making dietary changes (e.g., decreasing the amount of fat you eat, increasing the amount of fiber you eat, etc.).
5. Increasing your physical activity.
6. Reducing your consumption of alcohol.

Ignoring the potential positive aspects of these behaviors, how negative do you feel about these behaviors? Please answer using the following scale:

0--------1---------2---------3--------4--------5--------6--------7--------8---------9--------10
Not negative at all                      Extremely negative

1. Having breast surgery (mastectomy).
2. Having my ovaries removed (oophorectomy).
3. Taking oral tamoxifen, raloxifene, or an aromatase inhibitor (AI).
4. Making dietary changes (e.g., decreasing the amount of fat you eat, increasing the amount of fiber you eat, etc.).
5. Increasing your physical activity.
6. Reducing your consumption of alcohol.
**Future Behaviors**

1. Do you plan to have breast surgery (mastectomy) in the future?
   - a. Yes
   - b. No
   - c. Unsure

2. If yes or unsure, when would you have breast surgery (mastectomy)?
   _____ years from now

3. Do you plan to have your ovaries removed (oophorectomy) in the future?
   - a. Yes
   - b. No
   - c. Unsure

4. If yes or unsure, when would you have your ovaries removed (oophorectomy)?
   _____ years from now

5. Do you plan to take oral tamoxifen, raloxifene, or an aromatase inhibitor (AI) in the future?
   - a. Yes
   - b. No
   - c. Unsure

6. If yes or unsure, when would you take oral tamoxifen, raloxifene, or an aromatase inhibitor (AI)?
   _____ years from now

7. Do you plan to make dietary changes (e.g., decreasing the amount of fat you eat, increasing the amount of fiber you eat, etc.) in the future?
   - a. Yes
   - b. No
   - c. Unsure

8. If yes or unsure, when would you make dietary changes (e.g., decreasing the amount of fat you eat, increasing the amount of fiber you eat, etc.)?
   _____ years from now

9. Do you plan to increase your physical activity in the future?
   - a. Yes
   - b. No
   - c. Unsure
10. If yes or unsure, when would you increase your physical activity?
   _____ years from now

11. Do you plan to reduce your consumption of alcohol in the future?
   a. Yes
   b. No
   c. Unsure

12. If yes or unsure, when would you reduce your consumption of alcohol?
   _____ years from now