RISK REDUCING BEHAVIORS IN A COMMUNITY SAMPLE OF WOMEN WITH A FAMILY HISTORY OF BREAST CANCER

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This study was designed to examine and explain the use of risk-reducing behaviors in a group of women recruited from the community who had a family history of breast cancer. An empirically derived model was developed that included variables hypothesized to influence adherence intentions, early detection behaviors, and high-risk clinic contact intentions. The model included the background variables of age, objective risk, education, income, and healthcare communication and the proximal variables of perceived risk, cancer specific distress, and attitude. This study also prospectively examined the use of high-risk services. Participants included women (N = 187) with a family history of breast cancer who had no prior contact with a high-risk or familial breast cancer clinic or program. Study hypotheses were tested with correlational analyses, structural equation modeling (SEM), and logistic regression. Results of SEM found that the proposed variables accounted for 42% of the variance in adherence intentions, and 23% of the variance in both early detection behaviors and clinic contact intentions. Approximately 24% of the women who participated in this study contacted the high-risk clinic to receive additional information about their risk. Predictors of clinic contact included higher objective risk, higher clinic contact intentions, lower perceived risk, and higher cancer distress. Implications of these findings are discussed.

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INTRODUCTION

Motivating people to engage in cancer risk-reducing behaviors has proven challenging, but remains critically important. Cancer risk-reduction has been difficult to pursue, in part because many of the risk factors associated with cancer were not thought to be modifiable. Behavioral factors such as tobacco use and energy balance have been increasingly featured in etiological models and can clearly be changed. Family history, genetic predisposition, and most reproductive factors are not easily altered. However, with increased understanding of cancer etiology, increased methods and utilization of cancer screening, and the development of chemoprevention agents, risk-reduction has become gradually more promising. During the last two decades, advances in science and technology have refined risk-reducing cancer strategies, thus providing the potential to dramatically decrease cancer morbidity and mortality.

The use of risk-reducing behaviors for breast cancer is important for women with a family history of breast cancer. With the exception of age, family history is the strongest known risk factor for development of disease. Family history and age, together with reproductive history, risk can be readily assessed and risk reduction is possible. However, there is evidence that a significant minority of women at increased risk for breast cancer do not use risk reduction strategies as recommended (Botkin et al., 2003; Lerman et al., 2000). Although there are obvious advantages to using risk-reducing behaviors such as assessment (e.g., calculated risk estimates and genetic testing), early detection (e.g., mammography, clinical breast exam, and self breast

exam), and in some cases prevention strategies (e.g., chemoprevention and risk-reducing surgeries), several barriers have been identified that prevent women from taking full advantage of these strategies. These barriers include demographic variables, healthcare communication and knowledge, and physiological and psychological distress that might result from the use of risk-reducing strategies. To facilitate optimal use of risk-reducing strategies, clinics with programs that specialize in familial or high-risk breast cancer assessment and intervention have been developed. Such programs can provide women with comprehensive information about their risk and recommend strategies to decrease their risk. In short, it is important that women with a family history of breast cancer are aware of risk-reducing strategies and engage in risk assessment and reduction programs if the full benefits of scientific and technological advances are to impact morbidity and mortality due to this disease. To facilitate optimal use it will be important that models of these key health behaviors are developed. This research proposed such a model to examine some of the barriers to use of risk-reducing behaviors, with the ultimate goal of enhancing acceptability and use of risk-reducing options.

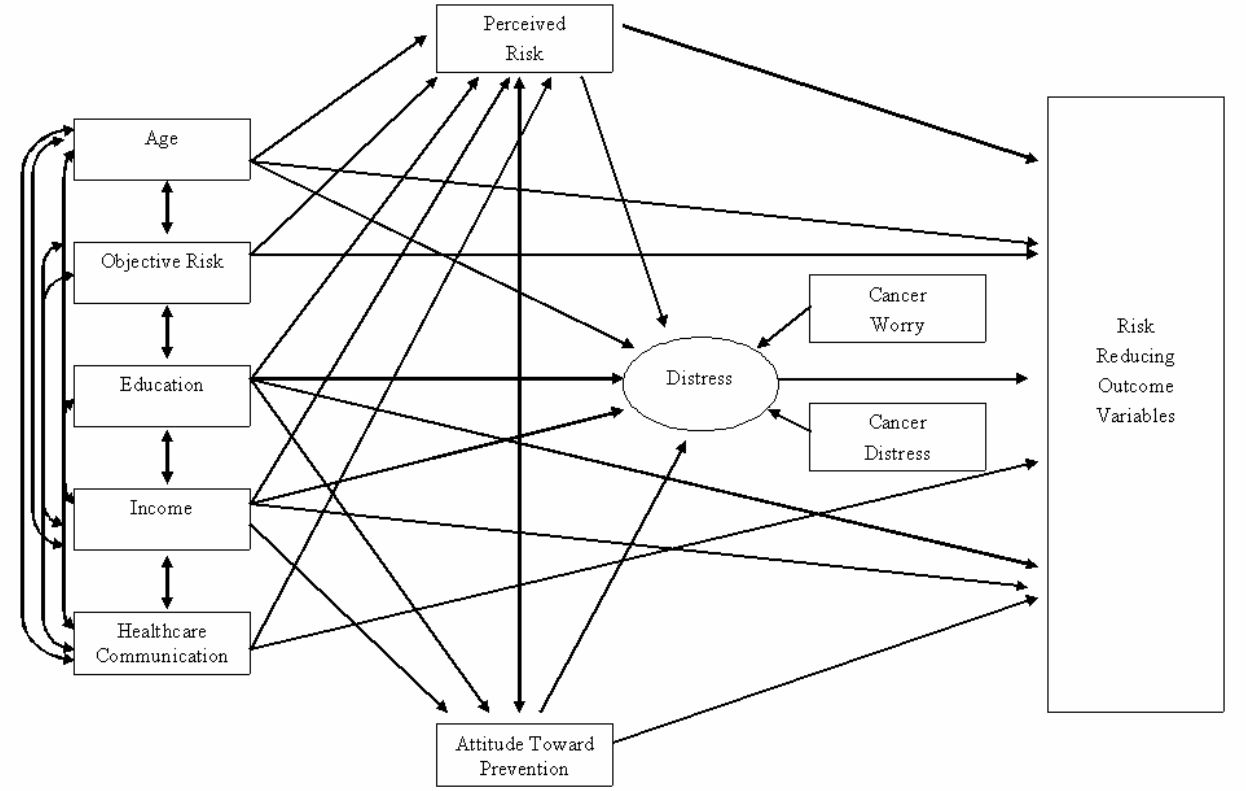
STUDY PURPOSE

This study aimed to provide a better understanding of variables that predict the use of risk-reducing behaviors in *all* women at increased risk for breast cancer and this aim is reflected in the recruitment strategy. A key aim was to broaden the diversity of the sample of women studied. As others have noted (e.g., DiLorenzo et al., 2006), what is known about variables that are associated with engagement has been gleaned primarily from samples recruited in settings that specialize in high risk treatment. With few exceptions, samples have consisted of women who were recruited based on participation in other research (e.g., research isolating the *BRCA1/2* gene), through a family member with cancer, or who have self-referred to a high risk clinic. These sample characteristics may provide biased information about predictors of behavior and may not generalize to women at high risk from the community at large. Little is known about the use of risk-reducing behaviors in women from the general community. Greater diversity of the samples must be achieved if we are to move beyond this and develop ways of enhancing risk reduction in all women. In this research, the sample was made up of women recruited from the community with a family history of breast cancer in a first degree relative.

This study aimed to explain and model pathways between variables that have been associated with risk reducing behaviors. Although several demographic, health, cognitive, and affective variables have been associated with the use of risk-reducing behaviors, what we know about the relationships of these variables to each other and their subsequent relationships with

risk-reducing behaviors is limited. This study aimed to provide better understanding about distal and proximal pathways to behavior. Background variables such as age, objective risk, income, and education can be conceptualized as distal background variables, whereas variables such as perceived risk, attitudes toward behaviors, and cancer specific distress can be considered more proximal predictors of behavior that are based on one's high risk status and may mediate the impact of distal variables on outcomes. A critical question in this study was: are background variables (e.g., distal) or cognitive and affective variables (e.g., proximal) better at predicting the use of risk-reducing strategies? If both are independently predicting behavior, do background variables also affect more proximal cognitive or affective variables, and if so, what proximal processes are associated with these relationships? The proposed study tested an empirically derived model that included background and dispositional variables known to be associated with risk-reducing behavior using structural equation modeling (SEM) techniques to identify pathways to risk-reducing behaviors (see Figure 1).

Figure 1. Full hypothesized model.



In summary, for risk-reducing behaviors to affect disease occurrence as intended, it is critical to understand what factors influence use so that compliance can be altered. Perhaps most importantly, it is necessary to study these factors in a more "general population" of women with a family history of breast cancer than has been studied in the past so that promotion of risk-reducing behaviors can be widely employed to impact breast cancer incidence and severity.

To orient the reader before introducing the study's aims, hypotheses, and methods, this dissertation will 1) briefly review risk factors for breast cancer and strategies for risk reduction, and 2) provide a review of variables included in the proposed model that are known to be associated with risk-reducing behaviors in women at high risk for breast cancer and present pathways of possible mediation in the model.

BACKGROUND

RISK FACTORS AND RISK REDUCING BEHAVIORS

Lifetime risk of breast cancer among American women is approximately 13%, with a 3% risk of dying from the disease. The strongest known risk factors for or correlates of breast cancer include heritable genes, older age, family history, and history of atypical breast biopsy. Other risk factors include race or ethnicity, earlier age at menarche, and nulliparity or older age at first birth (United States Preventative Services Task Force [USPSTF], 2002). Dietary factors and smoking may also be related to breast cancer risk, but the evidence supporting these factors is less conclusive (i.e., Nkondjock & Ghardirian, 2004). Due to the relatively high incidence of breast cancer, there are general guidelines for all women to engage in early detection procedures. For women with known risk factors for disease, use of behaviors that can reduce their risk of life-threatening illness is particularly important. Presently, clinics that specialize in high risk assessment and counseling are the "gatekeepers" to recommendation and availability of these services. This suggests that one of the first steps toward increased optimal use of risk-reducing behavior is increasing women's attendance at high risk clinics.

Risk Assessment

For more than a decade, programs and trials have used equations combining weighted risk factors to produce risk estimates. These formulations have traditionally accounted for age, family history of breast cancer, reproductive history, and a combination of other risk factors. One such formulation, the Gail model, is the most commonly used tool to estimate a woman's overall risk of developing breast cancer "over the next five years" (Euhus, Leitch, Huth, & Peters, 2002). In this model, risk estimates are based on current age, age at menarche, age at first live birth, family history of breast cancer in first degree relatives, and history of breast biopsy (Gail et al., 1989). Other formulations are also used and for women who are thought to be at high risk by such models, traditional recommendations have been aimed at early detection procedures. More recently, risk assessment models have been used to identify candidates for genetic testing or prevention strategies.

About 10 years ago investigators identified two penetrant breast and ovarian cancer susceptibility genes, *BRCA1* and *BRCA2* (Miki et al., 1994; Wooster et al., 1995). The prevalence of inherited *BRCA1/2* mutations in the general population is small (.01-.02 percent; Haber, 2002), accounting for 5-10% of breast cancer cases (Easton, Bishop, Ford, & Crockford, 1993; Newman, Austin, Lee, & King, 1988). However, women who carry mutations in one of these genes have a 50-80% life time risk of developing breast cancer and up to two thirds are likely to develop ovarian cancer by age 70 (Ford et al., 1998). Mutations in these genes are associated with early onset breast cancer (Claus, Schildkraut, Thompson, & Risch, 1996), with risk beginning to increase near the age of 25 (Meijers-Heijboer et al., 2001). Management

options for women with mutations include early detection procedures such as mammography, clinical and self-breast exam, and prevention strategies including chemoprevention and risk-reducing surgeries.

Early Detection

During the last two decades decreased breast cancer mortality rates have been attributed to better early detection strategies (Peto, Boreham, Clarke, Davies, & Beral, 2000). In 1987, only 30% of women over 40 reported mammography use within the previous two years. Strikingly, in 1998, 68% of women over 40 reported having a mammogram in the last two years (Breen, Wagener, Brown, Davis, & Ballard-Barbash, 2001). Other recommended early detection strategies include clinical breast exams and self breast exams. Standard recommendations for early detection behaviors are routinely suggested for all women (American Cancer Society [ACS], 2004). There is some thought that women with a family history should engage in early detection starting at younger ages and with more frequency than women at average risk, but no general consensus has been made regarding appropriate age and frequency for these women (i.e., Helzlsouer, 1999).

Mammography Screening. Screening mammography may decrease mortality caused by breast cancer and can identify disease in its early stages in asymptomatic women (Sabatino et al., 2004). There are well-established guidelines suggesting yearly mammograms for all women over the age of 40 (ACS, 2004; USPSTF, 2002). These suggestions include women at increased risk, although it has been suggested that these women should start screening at younger ages (Burke et al., 1997) and screen more frequently (Komenaka et al., 2004). However, there is currently no

consensus regarding age or frequency of mammograms for women who are at high risk by virtue of family history alone or by family history and BRCA1/2 mutation status. Although the benefits of annual mammography screening are widely known, many women, including many at high risk, do not perform mammography screening behaviors as recommended (Bastani, Marcus & Hollatz-Brown, 1991; Hyman, Baker, Ephraim, Moadel, & Phillip, 1994; McCaul, Branstetter, Schroeder, & Glasglow, 1996).

Clinical and Breast Self Exam. Along with regular mammography screening, most recommending organizations suggest periodic clinical breast exams (CBE) as the most effective screening method, recommending CBE for all women (Morrison, 1994). CBE has the potential to detect up to 5% of early-stage breast cancers that are not detected by other methods (Sabatino et al., 2004; Stefanek, Hartmann, & Nelson, 2001). In randomized clinical trials, the percent of breast cancers detected by CBE alone has ranged from 3%-45% (i.e., Stefanek et al.). The ACS (2004) suggests that women over 40 years old should have an annual CBE and that younger women (20-39) should have a CBE every 3 years. Some studies investigating surveillance among women with BRCA1/2 mutations have recommended that these women undergo CBE two to four times a year (Scheuer et al., 2002). Although mammography use greatly increased during the 1990s, the use of CBE remained largely unchanged during this same time period despite widespread recommendations (Adams, Florence, Thorpe, Becker, & Joski, 2003). Unchanging rates have been attributed to ambiguity regarding the benefits of CBE. Several other clinical and patient barriers have also been cited as barriers; these include embarrassment, patient refusal, lack of confidence in performing exam, lack of time, and primary reliance on mammography (i.e., Meissner, Breen, & Yabroff, 2003).

Breast self exam (BSE) reflects an attempt to have women examine their own breasts in addition to having regular CBE. The accuracy, efficacy, and compliance of BSE is unknown (i.e., Stefanek et al., 2001). Although only retrospective studies have shown that BSE are efficacious in detecting disease (Foster & Costanza, 1984), BSE has been recommended as a good health behavior. The ACS (2004) recommends that all women over the age of 20 engage in monthly self-exams. For women at high genetic risk, the Cancer Genetics Studies Consortium recommended monthly breast self-examination beginning between 18-21 years of age.

Prevention

The goal of primary prevention is to prevent the development of disease. For women at average risk for breast cancer there are no recommendations for prevention. For women at high risk, however, there are a limited number of options for primary prevention (chemoprevention, risk-reducing surgeries). The medical efficacy and long-term outcomes of these prevention strategies are still being explored and there is an iatrogenic risk inherent in available strategies (i.e., Helzlsouer, 1999).

Chemoprevention. Hormone-based interventions are often used in breast cancer therapy due to its association with endogenous and exogenous estrogens (Clemons & Goss, 2001). In women at high risk for breast cancer, it has been recommended that physicians discuss chemoprevention as an option and inform their patients of the benefits and possible dangers of various therapies (USPSTF, 2002). The use of tamoxifen, a selective estrogen receptor modulator (SERM) with both estrogen agonist and antagonist properties, has been approved for use as a preventive agent

in women ages 35 years and older with a 5-year risk of breast cancer of at least 1.67% based on Gail model calculations (Food and Drug Administration [FDA], 1998). A recent meta-analysis using all available data concluded that a reduction rate of 30-40% in breast cancer was achieved with tamoxifen (Cuzick et al., 2003). Several significant side effects from tamoxifen treatment have been noted, including symptomatic side effects (hot flashes), increased risk for thromboembolic events, and increased risk for endometrial cancer. Additionally, it is not known whether or not chemoprevention reduces risk in women with a genetic mutation. Raloxifen, a different SERM, is currently being investigated as better chemoprevention agent. Raloxifen has been shown to reduce breast cancer and does not appear to be associated with increased endometrial cancer (Cauley et al., 2001).

Risk-Reducing Surgery. Traditionally, women undergoing risk-reducing surgery for breast cancer have been limited to high risk by virtue of family history of cancer. The discovery of BRCA1/2 genes allows for a more distinct assessment of risk, and genetic testing information is important for women considering these prevention surgeries. For women at high risk, risk-reducing mastectomy (RRM) and risk-reducing oophorectomy (RRO) for ovarian cancer with some suggested influence on breast cancer, are options for prevention to reduce their risk of cancer in the future (Garofalo & Baum, 2003).

Most studies of RRM have been retrospective. In women with a family history of cancer, studies have suggested that RRM may provide risk reductions rates of up to 90% (Hartmann et al., 1999; Hartmann et al., 2001; Rebbeck et al. 2004). Follow-up time in these studies has ranged from 6-13.4 years. One prospective study investigated the differences in rates of breast cancer diagnosis in *BRCA1/2* mutation carriers who elected RRM (n = 76) or increased

surveillance (n = 63). This study found that after approximately three years of follow up, none of the women who had surgery developed breast cancer while eight (12%) of the women who used increased surveillance developed breast cancer (Meijers-Heijboer et al., 2001). Although the majority of studies on RRM efficacy have had short follow-ups and none involved randomization, available research suggests that RRM does appear to significantly reduce the risk of breast cancer. More prospective studies, longer follow up, larger samples, and controls for bias associated with self assignment to condition are needed to establish the protective effect and optimal timing for surgery as well as to identify any long-term physiological or psychological complications of RRM (Eisen, Rebbeck, Wood, & Webber, 2000; Garofalo & Baum, 2003; Rebbeck et al.).

RRO is a surgical option available to women at increased risk for ovarian cancer. Several studies have shown that bilateral oophorectomy is beneficial in reducing the risk of ovarian cancer and a limited number of studies have also documented reduction of risk of breast cancer attributable to oophorectomy. Among women with *BRCA1/2* mutations, RRO has been shown to reduce the risk of breast cancer by 50-70% and to virtually eliminate risk of ovarian cancer (Rebbeck et al., 1999; Rebbeck et al., 2002). Although the suggestion has been made that women with *BRCA1/2* mutations should undergo RRO once childbearing is complete (Rebbeck, 2000; Eisen et al., 2000), more information is needed to thoroughly assess the risk and benefits involved (Burke et al., 1997). Women who undergo RRO experience immediate surgical menopause (Rebbeck, 2000), and premature menopause has been associated with an increased risk of osteoporosis and cardiovascular disease (i.e., Rebbeck et al.). In addition to the relative dearth of reports on the medical efficacy of this procedure, reports of psychosocial implications of RRO are limited; some studies of surgically induced menopause have reported lower libido

and lower sexual satisfaction after surgery (Dennerstein, Wood, & Burrows, 1977; Nathorst-Boos, von Schoultz, & Carlstorm, 1993).

Compared to twenty years ago, there are several viable options for risk reduction in women at high risk for breast cancer. As medical science continues to advance and refine these options, it will be important for behavioral scientists to work toward understanding how to promote the use of risk-reducing behaviors. To do this, it will be necessary to identify variables that influence engagement and to understand how these variables interact to influence engagement. Although perhaps more important, it is necessary that women at increased risk based on a family history of breast cancer are informed that there are available options for risk reduction and that these strategies can be explored through clinics and centers that specialize in cancer prevention for high risk populations.

FACTORS AFFECTING RISK REDUCING BEHAVIORS

Theory and empirical investigation suggest several factors that are associated with health behaviors. Many factors have been studied in a broad spectrum of behavior including smoking cessation (Norman, Conner, & Bell, 1999), condom use (Smith & Stasson, 2000), and exercise (Lowe, Bennett, Walker, Milne, & Bozionelos, 2003). Despite recent advances in options for risk reduction, there is limited information about factors that affect risk-reducing behaviors for women at increased risk for breast cancer (i.e., Stefanek et al., 2001). Investigators have identified variables that predict early detection behaviors (mammography, clinical and self breast exams) in general populations of women, although less work has been done exclusively with

high risk women, and information about risk assessment and prevention is incomplete. Factors that have received at least mild empirical support for associations with risk-reducing behaviors for breast cancer include age, objective risk, socioeconomic status variables such as income and education, healthcare use and communication, perceived risk, cancer specific distress, and attitudes toward behaviors. Age, objective risk, socioeconomic, and healthcare use and communication variables can be conceptualized as more distal background variables, whereas perceived risk, cancer specific distress, and attitudes toward behavior can be considered more proximal predictors of behavior that are based on one's high risk status and that may impact the effects of background variables on risk-reducing behavior. These factors are included in the proposed model of pathways to risk-reducing behaviors (Figure 1). Current work offers little explanation about interactions between these variables and the unique variance each holds when predicting risk-reducing behaviors. The proposed model hypothesizes some direct and indirect pathways to behavior.

Age

Age is included as a predictor variable in the proposed model because although the direction of the relationship varies across behaviors, age has consistently been associated with risk-reducing behaviors. The consistency with which age influences these behaviors points to the importance of understanding the relationship between age and behavior, and identifying variables that may mediate this relationship. Most current work suggests that genetic testing is most widely used by women under the age of 50 (Lerman et al., 1997; Meijers-Heijboer et al., 2000), although some work has found no association between age and genetic testing (Kelly et al., 2004; Lee et al.,

2002; Lerman et al., 1996; Lodder et al., 2003). It is generally believed that the earlier increased risk status is identified, the more benefit the use of risk-reducing behaviors can provide. It is important to understand why younger women are more likely to engage in genetic testing as a risk assessment method and the specific factors that influence this relationship.

One of the primary values of genetic testing or any risk assessment method is identification of who will benefit most from intensive or early surveillance. Studies evaluating mammography use in women at high risk generally suggest that adherence is highest among women in their late 30s, 40s, and 50s (Diefenbach, Miller, & Daly, 1999; Schwartz et al., 2003). In some cases, it may be beneficial that women who reach a certain degree of increased risk employ mammography screening earlier than their late 30s. However, even among younger women found to carry a mutation in *BRCA1/2* (i.e., lifetime risk of 50-80%), there is evidence that adherence to mammography screening may be poor. In one prospective study, Lerman et al. (2000) found that women age 25-39 years old were less likely to engage in mammography after testing than women who were over 40. In this sample, among the younger age group a significant minority (36%) of carriers of a genetic mutation did not use mammography in the year following testing. Peshkin et al. (2002) found that only 39% of women age 25-39 identified to have a genetic mutation had a mammogram in the year following testing compared to 74% of women over 40. These findings among women at the highest risk may suggest that younger women (< 40) are at risk for poor adherence to screening practices. Although age can not be modified, it is important to understand what modifiable (i.e., proximal) variables may mediate the relationship between age and behavior to influence change in screening practices among younger women at increased risk.

Research investigating predictors of chemoprevention and risk-reducing surgery use is limited. However, available research suggests that age appears to be related to these behaviors. In two retrospective studies, older age was associated with the use of chemoprevention (Lovegrove, Rumsey, Harcourt, & Cawthorn, 2000; Tchou, Hou, Rademaker, Jordan, & Morrow, 2004). Although there are benefits of chemoprevention in women over 50, its value is optimized when it is used at younger ages because the greatest risk/benefit ratio for chemoprevention is in premenopausal women. Like chemoprevention, RRO has consistently been related to older age (Botkin et al., 2003; Meijers-Heijboer et al., 2000; Scheuer et al., 2002; Schwartz et al., 2003). However, RRM may be associated with younger age. Only one prospective study (Scheuer et al.) and one cross-sectional study (Meijers-Heijboer et al., 2000) have evaluated the impact of age on the use of RRM, but both reported that the use of RRM was associated with younger age.

Among women at high risk for breast cancer, there are specific ages when the use of risk-reducing behaviors may provide the most benefit. The importance of age in the utility of risk-reducing behaviors as well as the suspected influence of age on these behaviors should encourage investigators to begin considering age as a primary variable instead of a control variable in models predicting these behaviors. Further, as age is not a modifiable variable, it will be important to understand the relationship between age and other variables that may be modifiable.

Objective Risk

In general population samples, there is often a positive relationship between the objective risk markers of family history and early detection behaviors (Aiken, West, Woodward, & Reno, 1994; McCaul, Branstetter, et al., 1996). However, it is less clear how *degree of risk* among women with a family history of disease affects the use of risk-reducing behaviors. Further, it is not well understood whether objective risk accounts for unique variance when predicting risk-reducing behavior or if objective risk has its effect through some other more proximal variable such as perceived risk. Among women at higher objective risk, some studies have not found a relationship between objective risk markers and risk-reducing behavior (i.e., Botkin et al., 2003; Kelly et al., 2004; Meiser et al., 2003), although other studies have found that risk is positively related to behavior. Calculated objective risk has been related to the use of genetic testing (Lee et al., 2002; Lerman et al., 1997; Meijers-Heijboer et al., 2000); and after testing, having a genetic mutation in *BRCA1/2* has predicted the use of RRM and RRO (Hatcher, Fallowfield, & Ahern., 2001; Lerman et al., 1996; Schwartz et al., 2003). History of abnormal biopsy, another objective risk factor for disease, has also been associated with RRM and with chemoprevention use (Bober, Hoke, Duda, Regan, & Tung, 2004; Hatcher et al.; Tchou et al., 2004). When considering these findings, it is important to note that women in these studies are often self-referred to high-risk clinics and the results may not represent women at large with a family history of breast cancer (i.e., women who do not voluntarily present for high risk consultation). It could be that women in these studies actually are at greater increased risk or believe themselves to be at a high degree at increase risk; therefore noted relationships may not generalize to more

diverse samples of women with a family history of disease. Ideally, women at the highest risk would engage more fully in risk-reducing behaviors, although this relationship is not clear from in the current literature. The relationship between degree of risk and risk-reducing behavior is important to explore. Understanding this relationship will become particularly necessary as risk-reducing options become more refined and availability of these options becomes more widespread.

Socioeconomic Factors

Other than age, there are few demographic variables exhibiting consistent relationships with risk-reducing behaviors. Demographic variables such as education level, income, and having health insurance appear to have little influence on risk-reducing behaviors for breast cancer except for use of mammography. However, the absence of relationships must be couched in the limited range of socioeconomic variation studied. To date, samples in studies investigating risk-reducing behaviors (with the exception of mammography) have been recruited almost exclusively from major academic centers and/or specialty cancer clinics where the demographic profile of the samples is homogeneous. There is limited information about more diverse populations and about women who do not initiate care or seek information from high risk cancer settings.

Studies of mammography have been conducted in large community samples and consequently, the results are less limited by these factors. In these studies, socioeconomic variables, particularly education, insurance, and income, have been implicated as being important in predicting mammography (Lerman et al., 1991; Lerman, Daly, Masny, & Balshem, 1994; Rimer et al., 1996), suggesting that other risk-reducing behaviors may also be influenced

by these factors. Studies that have considered these factors in risk-reducing behaviors also point toward a significant relationship. For example, Lerman et al. (1997) found that insurance status was related to the uptake of genetic testing, and another study found dramatically different rates of use of genetic testing when testing was offered free of charge compared to when individuals were required to pay (Lee et al., 2002). Despite limited evidence of the impact of socioeconomic variables on risk-reducing behaviors outside of mammography, education level is hypothesized to be a main predictor in the proposed model. Education level, as well as other indicators of socioeconomic status, will be important to consider as research on risk-reducing behaviors begins to focus on more diverse population samples.

Healthcare Use and Communication

Recruitment strategies in past work (e.g., high risk settings) allow for the assumption that all of the women in these studies regularly use health care services and have communicated with a healthcare professional about their risk of breast cancer. Women captured by this type of research may not represent women in the general population. The present study observed risk reduction in a group of women at increased risk who were drawn from the community, thus it will be important to understand how their past healthcare utilization as well as their communication and familiarity with risk reduction affects behavior. For example, it is conceivable that women are not participating in risk-reducing behaviors because they are 1) not active in healthcare systems and/or 2) because they have limited information and awareness of the importance of risk-reducing behaviors.

Although limited data are available, there is some research that implicates physicians' recommendation as an important predictor of risk-reducing behaviors. In a group of women at average risk for breast cancer, when several variables were measured, physicians' recommendation was found to be the variable that accounted for the most variance in mammography use (Aiken et al., 1994). Bober et al. (2004) found that among high-risk women, those that reported that their physician had recommended the use of chemoprevention were more likely to choose chemoprevention as a risk-reducing behavior than those that did not report such a recommendation. Kinney, Richards, Vernon, and Vogel (1998) found similar results, reporting that compared to women who said their physician advised against chemoprevention, women who reported that their physician recommended chemoprevention were 13 times more likely to use this risk-reducing behavior. In a recent study looking at the impact of physicians' recommendation on the use of prostate screening, it was found that recommendation had a strong effect on the use of screening (*OR* = 236.3, 70.5-791.4; Rutten, Meissner, Breen, Vernon, & Rimer, 2005).

Similarly, being aware of risk-reducing strategies and having more information about these strategies is also likely to be related to use of risk-reducing behaviors. Again, largely because most of this work has been done in populations that are already participating in some sort of risk-reducing arena, it is not well understood how communication and information might impact the use of screening and prevention. Lerman et al. (1996) reported that individuals who understood more about genetic tests were more likely to use testing than those that were not. While some studies have found similar results (Thompson et al., 2002), others have suggested that knowing about risk or risk-reducing behaviors is negatively related to behavior outcomes or intentions (Kinney et al., 2001; Lodder et al., 2003). Reasons for these differences are not easy to

explain, and studying a more diverse population to look at this relationship may lend more informative results about the impact of healthcare use and communication on risk-reducing behaviors.

Perceived Risk

Perceived risk can be defined in a variety of ways, but it is generally considered to reflect people's beliefs about their vulnerability to a specific disease. Although some research has shown that individuals may be overly optimistic and *under*estimate their personal risk of health problems and disease (Green, Grant, Hill, Brizzolara, & Belmont, 2003; Weinstein, 1982; Weinstein & Klein, 1995), other research has suggested that individuals may *over*estimate their risk of disease (i.e., Croyle & Lerman, 1999). Women's perceptions of their risk of breast cancer tend to be significantly overestimated or exaggerated (Bowen et al., 2003; Croyle & Lerman, 1999). Importantly, findings also suggest that an individual's estimation of their risk, independent of their objective risk, may influence whether they engage in risk-reducing behaviors (Croyle & Lerman; Rimer & Real, 2003). Perceived risk is included as a predictor of behavior in the proposed model.

Perceived Risk and Behavior. Models predicting health behaviors have proposed that perceived risk is a motivator of precautionary health behavior (Ajzen, 1991; Rogers, 1983; Rosenstock, 1990; Weinstein, 1988), and empirical research has often assessed this variable. Research has found that perceived risk is both positively and negatively related to health behaviors, and some research has suggested that there is a curvilinear relationship between perceived risk and health

behaviors. Most intuitive of these findings is the positive relationship between perceived risk and risk-reducing behavior; if people feel that they are at risk, they are likely to view risk-reducing behaviors as decreasing their risk of morbidity and mortality due to disease. A common explanation for a negative relationship between perceived risk and health behaviors is that high perceived risk inhibits behavior due to excessive levels of fear or distress leading to avoidance (Chaffee & Roser, 1986; Kash, Holland, Halper, & Miller, 1992). A curvilinear relationship suggests that individuals with the lowest and highest perceived risk (or levels of anxiety) are least likely to engage in risk-reducing behaviors and that people with moderate perceived risk are most likely to engage in these behaviors (e.g., Hailey, 1991).

Results of two meta-analyses that considered the relationship between perceived risk and breast cancer screening behavior supported studies finding a positive relationship between these two variables. Studies included in these meta-analyses included women at average risk and at increased risk. McCaul et al. (1996) analyzed the results of 19 studies and found that in 18 of these studies, perceived risk was positively associated with mammography (r = .16). They concluded that high perceived risk did not interfere with mammography screening and that there was no empirical support for a curvilinear relationship between perceived risk and mammography. However, the size of this effect is small, suggesting a rather weak positive association. In 2004, Katapodi, Lee, Facione, and Dodd examined 13 additional studies and found that the relationship between perceived risk and mammography was still positive in the majority of these studies. McCaul, Branstetter et al.'s findings also provided evidence that the highest levels of perceived risk were associated with excessive breast self-examination and increased frequency of screening behavior.

Perceived Risk and Risk-Reducing Behaviors. Although for certain behaviors the evidence is limited, studies investigating the relationship between perceived risk and risk-reducing behaviors in women at high risk for breast cancer have generally reported a positive relationship between perceived risk and risk-reducing behaviors. Some studies have failed to find this relationship, but no study has reported a negative relationship between perceived risk and risk-reducing behaviors. A limited number of studies have examined the relationship between perceived risk and genetic testing behavior (Kelly et al., 2004; Lee, Bernhardt, & Helzlsouer, 2002). These studies did not find a relationship between these two variables, but positive relationships between perceived risk and genetic testing intentions have been documented (Bowen et al., 2003; Jacobsen et al., 1997). Several cross-sectional studies have reported a positive relationship between mammography use and perceived risk samples limited to high risk women (Bowen et al.; Burnett et al., 1999, Schwartz et al., 1999), although two prospective studies have failed to find a relationship between perceived risk and screening (Diefenbach et al., 1999; Schwartz, Taylor, & Willard, 2003). Prospective data suggest that increased perceived risk is related to the use of chemoprevention (Bober, Hoke, Duba, Regan, & Tung, 2004) and studies of intentions for chemoprevention concur with these findings (Julian-Reynier et al., 2001; Meiser et al., 2003). The one study that investigated the relationship between perceived risk and RRM use in high risk women reported a positive relationship between these variables (Hatcher et al., 2001), and intentions for RRM studies have reported positive (Meiser et al., 2000) and no relationships (Meiser et al., 2003). One prospective study found that perceived risk was related to the use of RRO in high risk women (Schwartz et al., 2003), and two intention studies found a positive relationship between perceived risk and RRO intentions (Julian-Reynier et al.; Meiser et al.).

As stated above, most women in these studies have a relatively high perceived risk, thus the assessment of risk in many studies is limited to differing degrees of high perceived risk, with infrequent measurement of underestimation or accurate estimation of risk. This leaves the implications of high perceived risk unclear and suggests the importance of understanding its relationship to other predictor variables. The ability to determine how perceived risk alone predicts behavior in high risk populations may be limited. Psychological variables, such as fear or worry, may mediate cognitive variables like perceived risk (i.e., Weinstein, 1988). Research has shown that educational efforts aimed at changing a woman's perceived risk of breast cancer often have minimal effect. Resistance to changes in cognitions may reflect the interaction of affective variables with perceived risk; it is possible that a focus on psychological variables might change perceived risk. Studies investigating the relationship between perceived risk, psychological factors, and behavior are limited. McCaul and Mullens (2003) recently suggested that our knowledge about the relative contributions of cognition and affect is limited by the lack of investigation of the interaction of these constructs.

Cancer Specific Distress

General psychological distress does not appear to be elevated in women with a high risk for cancer (Butow et al., 2005; Coyne, Benazon, Gaba, Calzone, & Weber, 2000); however, these women may experience significant distress specific to their high risk status. In one study, about one third of women with first degree relatives who had breast cancer reported that they worried so much about being diagnosed with breast cancer that it interfered with their daily life (Lerman et al., 1993). Other research has also found increased levels of worry in women with a family

history of breast or ovarian cancer (Andersen et al., 2002; McCaul, Branstetter, O'Donnell, Jacobson, & Quinlan, 1998). Women at high risk may have intrusive thoughts about their cancer risk (Erblich, Bovbjerg, & Valdimarsdottir, 2000; McCaul et al.; Valdimarsdottir et al., 1995), with some women having levels of intrusive thoughts comparable to women with a diagnosis of breast cancer (Lerman et al.). Further, women at high risk can experience significant levels of cancer specific distress when undergoing early detection screening procedures (e.g., mammography; Gurevich et al., 2004; Valdimarsdottir et al., 2002).

Most work investigating the relationship between cancer specific distress and behaviors has examined the influence of distress on early detection behaviors. In general population samples and high risk samples, cancer specific distress has been associated with both increases and decreases in early detection procedures for breast cancer. For example, Lerman et al. (1991) reported that although half of women receiving an abnormal mammography result reported anxiety about the result, anxiety did not interfere with subsequent screening. In fact, in this study, women with the least concerns about their results were least likely to obtain repeat mammography. Other studies have also shown that breast and ovarian cancer worry predict screening behaviors (Bowen et al., 2003; McCaul et al., 1998), with levels of worry incrementally associated with screening behavior (Andersen et al., 2002). McCaul, Schroeder, and Reid (1996) found that women with the highest levels of worry were most likely to participate in screening for breast cancer, while women with the lowest levels of worry were least likely to participate in screening. Still, some work has reported that cancer anxiety is related to a decrease in early detection behaviors among women at high risk (i.e., Kash, Holland, Osborne, & Miller, 1995; Kash et al., 1992),

Although less work has been done, there is some research looking at the relationship between genetic testing, chemoprevention, and RRO and cancer specific distress. Two studies have investigated the relationship between cancer distress and mastectomy intentions, but to our knowledge there are no studies that have reported investigating the relationship between cancer specific distress and RRM behavior. Cancer specific distress has predicted interest in genetic testing (Bowen et al., 2003; Kinney et al., 2001), although the picture is less clear for actual behavior. Three prospective studies have assessed distress specific to disease and genetic testing use. Kelly et al. (2004) assessed distress specific to disease status by tailoring six items from the Profile of Mood States (POMS; Lebo & Nesselroade, 1978) and found no association with genetic testing use. Two other studies used the intrusions scale of the Impact of Event Scale (IES; Horowitz, Wilner, & Alvarez, 1979), with one study reporting a positive relationship (Lerman et al., 1997) and the other reporting no association (Thompson et al., 2002). It is possible that variations in sample sizes may account for these differences ($N = 149$ and $N = 76$; respectively), with the latter having insufficient power to detect an effect.

Only one study was identified that considered cancer specific distress and chemoprevention use. In a prospective study, Bober et al. (2004) assessed both cancer specific distress (measured by the IES) and cancer worry. Results of this study found that both cancer specific distress and cancer worry were increased among women who accepted chemoprevention compared with women who declined. Although no studies have investigated the relationship between cancer specific distress and RRM use, two intention studies using the same assessment method (IES) have reported inconsistent results. Meiser et al. (2000) found that cancer distress was related to RRM intentions while another study by the same group (Meiser et al., 2003) found no relationship. One possible explanation for inconsistent findings may be that in the study that

found a relationship, women were recruited from a familial cancer clinic. In the study that found no association, the sample was drawn from the general population. It will be important in future work to understand if this relationship is a product of recruitment strategies, and if so, it will be necessary to better define the relationship between distress and behavior in more general populations of women. Only one study has evaluated the relationship between cancer specific distress and RRO (Schwartz et al., 2003). This relatively large ($N = 289$) prospective study found that cancer worry was associated with RRO use, while cancer distress (IES) was not. In future work, it will be important to clarify the nature of the relationship between these two cancer specific distress measures and their relative impact on risk-reducing behaviors.

Attitudes Toward Risk Reducing Behaviors

With the exception of basic demographic and health information, perceived risk, and distress, few variables have consistently been examined when investigating risk-reducing behaviors. However, when attitudes toward risk reducing behavior are assessed in relation to behavior, significant relationships are often found. Further, attitudes toward behavior have been included as important in many theoretical models of health behavior. Attitudes refer to peoples' overall evaluation or opinion about behavior or person (Ajzen, 1991). The more favorable an individual's attitude toward a behavior, the more likely the individual will intend to engage in the behavior. Attitude is measured in relation to the specific behavior under investigation, and has been conceptualized as the level of enjoyment expected and belief in efficacy and importance of a behavior. McCaul, Sandgren, O'Neill, & Hinsz (1993) found that general attitudes toward self-exams predicted a significant portion of the variance in intentions to adhere to a regimen of

breast and testicular self-exams. Similarly, in a community sample general attitudes about genetic testing for colon and breast cancer predicted intentions to undergo genetic testing (Braithwaite, Sutton, & Steggles, 2002). Components of attitudes toward behavior have also predicted use of health behaviors. One study found that women who felt that they would benefit from the mammography were more likely to complete annual mammography (Pakenham, Pruss, & Clutton, 2000).

When attitudes toward risk reducing behaviors are assessed, the relationship is often significant, thus warranting the continued investigation of this relationship. Lerman et al. (1996) reported the perceived importance of genetic testing was related to test use in a high risk sample. Positive genetic testing intentions have been related to increased perception of benefits and decreased perceived costs of testing (Capelli et al., 2001). Other work has reported that genetic testing use was significantly associated with women's attitudes toward risk-reducing surgeries (Lodder et al., 2003), and belief in the efficacy of chemoprevention was significantly related to its uptake (Bober et al., 2004).

OTHER MODEL RELATIONSHIPS

It is important to understand the relationship between the background variables in this model and the more proximal variables. Although all of the model variables have been related to behavior, it is likely that their relationships with each other impact their relationship with risk-reducing behaviors. The model in this study suggests that perceived risk, attitudes toward risk reducing behavior, and cancer distress may indirectly impact the outcomes through their relationships with the background variables.

Perceived Risk

As others have noted, there are a limited number of studies that highlight the influence of demographic characteristics on perceived risk for breast cancer (e.g., Katapodi et al., 2004). This may partially be because perceived risk predicts more variance on behavioral outcomes than demographic (background) variables. Perceived risk may mediate the relationships between age, objective risk, and education and risk-reducing behaviors.

Although women of all ages have a high perceived risk of cancer (Lerman, Kash, & Stefanek, 1994), younger women may experience the highest levels of perceived risk (Katapodi et al.; Meiser et al., 2002). Relationships between age and risk-reducing behaviors are not consistent, for some behaviors older age is more predictive and for others younger age is more predictive. However, the relationship between high perceived risk and behavior is consistent; thus, perceived risk might act as an indirect path or mediator of the impact of age on outcomes.

Objective risk is related also related to perceived risk, but again perceived risk appears to be more predictive of behavior than objective risk. There is evidence that engagement in health behaviors is not always logical, nor is one's perceived risk. Meiser et al. (2001) found that women with the lowest levels of objective risk actually had the highest levels of perceived risk. The cognitive component of perceived risk is not captured by measures of objective risk; thus, the impact of objective risk on behaviors might be accounted for in perceived risk. It may be the component of risk that causes women to overestimate their risk best predicts behavior rather than objective risk, thus suggesting that perceived risk may at least partially mediate the relationships between objective risk and behaviors.

Results investigating the impact of socioeconomic variables on perceived risk are inconsistent. In one community based sample, Bosompra et al. (2000) found that socioeconomic status was negatively related to perceived risk, while other studies have found no relationships (Bunn, Bosompra, Ashikaga, Flynn, & Worden, 2002). However, work investigating risk-reducing behaviors has largely been done in women with high levels of resources and this work has consistently found high levels of perceived risk and perceived risk has consistently related to behavior. This might suggest that socioeconomic status in the case of breast cancer is related to increased perceived risk. Additionally, given the inconsistent relationships seen between socioeconomic variables and risk-reducing behaviors, it can be hypothesized that perceived risk is mediating any effect that socioeconomic variables have on outcome variables.

The amount of healthcare communication that women receive may increase their perceived risk for breast cancer. Women that receive more cancer information are more likely to think about their risk. Audrain-McGovern et al. (2004) suggested that a lack of access or attention to healthcare may cause women to be unaware of their objective risk, which in turn would not increase their perceived risk. The hypothesized model did not expect healthcare communication to be related to perceived risk.

Attitudes Toward Risk Reducing Behavior

The availability of literature examining the relationship between risk-reducing behavior attitudes and education, objective risk, and health use and communication is sparse; further, attitudes toward risk reducing behaviors are not often assessed with common measures. Some work has found a positive association between attitudes toward the benefits of risk reducing behaviors and

age (Cameron & Reeve, 2006). Based on past work in risk-reducing behaviors where most women have many socioeconomic resources, there are implications that these women are more interested in risk-reduction, and it may be that these women also have better attitudes toward risk-reduction. Like perceived risk, attitudes toward behavior are largely considered a cognitive variable. The incongruent relationship between perceived risk and objective risk suggests that objective risk may have even less effect on cognitive factors that are not directly related to risk, in this case attitudes. Objective risk in a sample of women at similar risk is not likely to be related to the formation of attitudes about risk-reduction. Attitudes toward risk reducing behavior, like perceived risk, might account for some of the variance seen between age and socioeconomic variables and risk-reducing behaviors.

Cancer Specific Distress

Similar to relationships between age and perceived risk, there is evidence that younger women experience more cancer specific distress than do older women. This is a fairly consistent finding in risk-reducing behavior literature. In a recent study done in a large community sample, Simon, Steptoe, and Wardle (2005) found that before and after screening for colon cancer, socioeconomic status was negatively related to bowel cancer worry. However, like relationships found with perceived risk, cancer worry appears to be relatively high in studied samples of women at increased risk for breast cancer, which may suggests that women with more resources have more worry about breast cancer. In studies with samples of women at a similar risk for breast cancer, it is unlikely that objective risk will impact distress. It is more likely that perceived risk will impact distress.

Individuals who report higher levels of perceived risk for cancer live with the expectation that they may develop and experience a life threatening disease. Understandably, this perception may lead to increased levels of psychological distress. Some research has shown that individuals with increased perceptions of risk have increased levels of general worry (Gerend, Aiken, & West, 2004; McGregor et al., 2004) and anxiety (Rothemund, Paepke, & Flor, 2001). Other studies have reported that high perceived risk was related to high levels of cancer specific worry (Collins, Halliday, Warren, & Williamson, 2000). Results of a meta-analysis found a positive relationship between emotional distress and perceived risk across seven studies (Katapodi et al., 2004). However, there is little work that addresses the relationships among perceived risk, distress, and behavior.

When an individual is faced with a personal health threat, emotional factors may alter the cognitive processing of risk-related information (Croyle & Lerman, 1999) and dictate the use of risk-reducing behaviors. Increasing attention has been paid to the direct and indirect influences that emotion may have on health behaviors (McCaul & Mullens, 2003). A recent study found that when assessing the relative impact of perceived risk and cancer worry on genetic testing interest, although both worry and perceived risk were related to these outcomes, when worry was controlled, perceived risk was not associated with testing interest (Cameron & Reeve, 2006). Other research suggests that worry can predict health behaviors independent of the contribution of perceived risk (McCaul, Reid, Rathge, & Martinson, 1996; Schwartz, Lerman, Miller, Daly, & Masny, 1995). Similarly, the impacts of the cognitive variable of attitudes toward risk-reducing behaviors on risk-reducing behaviors might be mediated by cancer distress.

STUDY AIMS AND HYPOTHESES

The goal of this research was to evaluate predictors of risk-reducing behavior in a community sample of women with a family history of breast cancer. This study assessed several factors known to affect risk-reducing behaviors and estimated the variance associated with background variables (age, objective risk, education, income, Healthcare Communication) and proximal variables (perceived risk, cancer distress, attitudes toward risk-reducing behaviors) in predicting the outcomes of risk-reducing behaviors and intentions (adherence intentions, early detection behavior, clinic contact intentions, clinic contact). This study had five primary aims and one secondary aim.

The first aim was to examine the relationship between background variables and risk-reducing behaviors and intentions. The second aim was to examine the relationship between the predictor variable of perceived risk and the outcome variables, examine the relationship between perceived risk and the background variables, and to examine perceived risk as a mediator between the background variables and the outcomes variables. The third aim was to examine the relationship between the predictor variable of attitudes toward risk-reducing behaviors and the outcome variables, examine the relationship between attitudes toward risk-reducing behaviors and the background variables, and to examine attitudes toward risk-reducing behavior as a mediator between the background variables and the outcome variables. The fourth aim was to examine the relationship between cancer specific distress and the outcome variables, examine the

relationship between perceived risk and the background variables, and to examine cancer distress as a mediator between the background variables and the outcome variables. The final aim was to test a model (see Figure 1) of these variables to look at the relative influence of each variable on risk-reducing behaviors.

A secondary aim was to examine how these variables affect whether women contacted a high-risk breast cancer clinic. For Aims 1-4, correlational analyses were used to test study hypotheses. For Aim 5, SEM was used to test the hypotheses within the proposed model and to explain unique variance among the predictor and outcome variables. To test the secondary aim, logistic regression analysis was used. The statistical plan for this project is further explained below in the data analysis section.

PRIMARY AIM 1: This aim is represented in Figure 2. The first aim of this study was to examine the relationships between the outcome variables and the background variables, namely age, objective risk, education, income, and healthcare communication.

Hypotheses for Aim 1

Age was expected to be positively related to early detection behaviors, and negatively associated with adherence intentions and clinic contact intentions.

Objective risk was expected to be positively related to early detection behaviors, adherence intentions, and clinic contact intentions.

Education was expected to be positively related to early detection behaviors, adherence intentions, and clinic contact intentions.

Income was expected to be positively related to early detection behaviors, adherence intentions, and clinic contact intentions.

Healthcare communication variables were expected to be positively related to early detection behaviors, adherence intentions, and clinic contact intentions.

Figure 2. Representation of Aim 1.

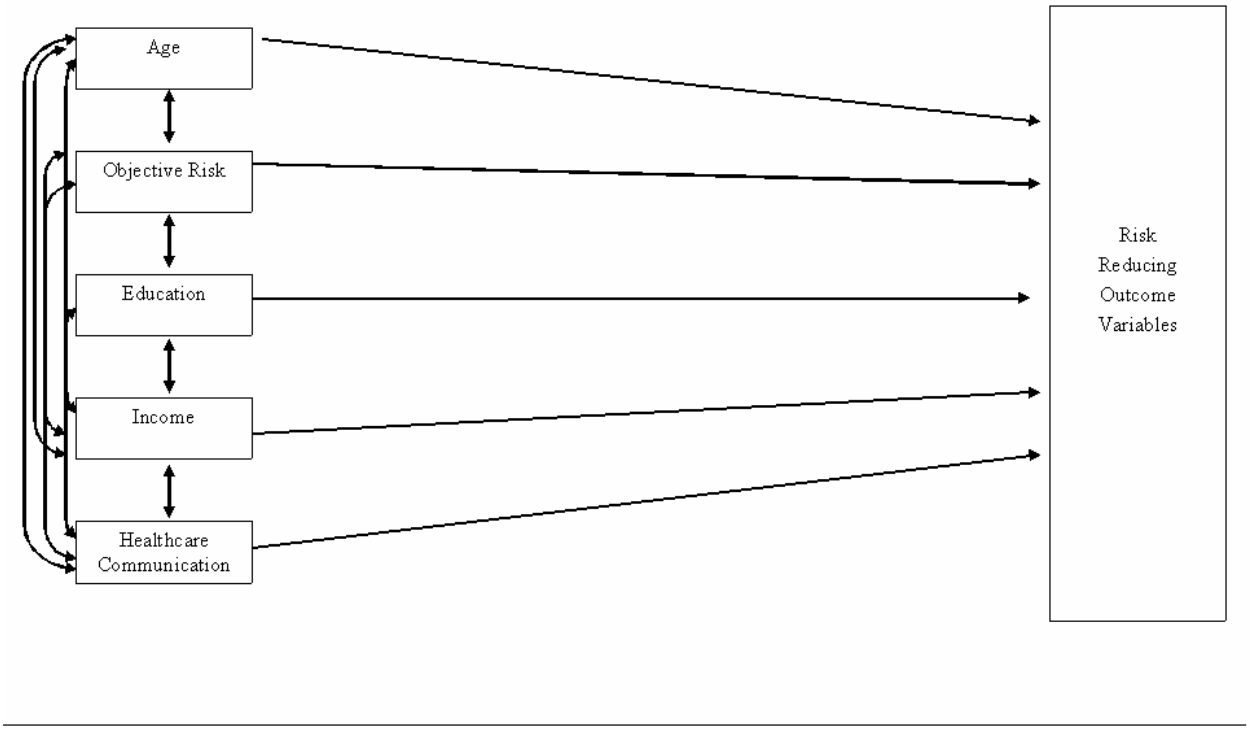


Figure 2. Representation of Aim 1.

PRIMARY AIM 2: Aim 2 is represented in Figure 3. There were three objectives for Aim 2. The first was to examine the relationship between perceived risk and each outcome variable. The second objective was to investigate the relationships between the background variables and perceived risk. The third objective was to investigate perceived risk as a mediator of the relationship between age and outcomes, objective risk and outcomes, education and outcomes, and income and the outcomes.

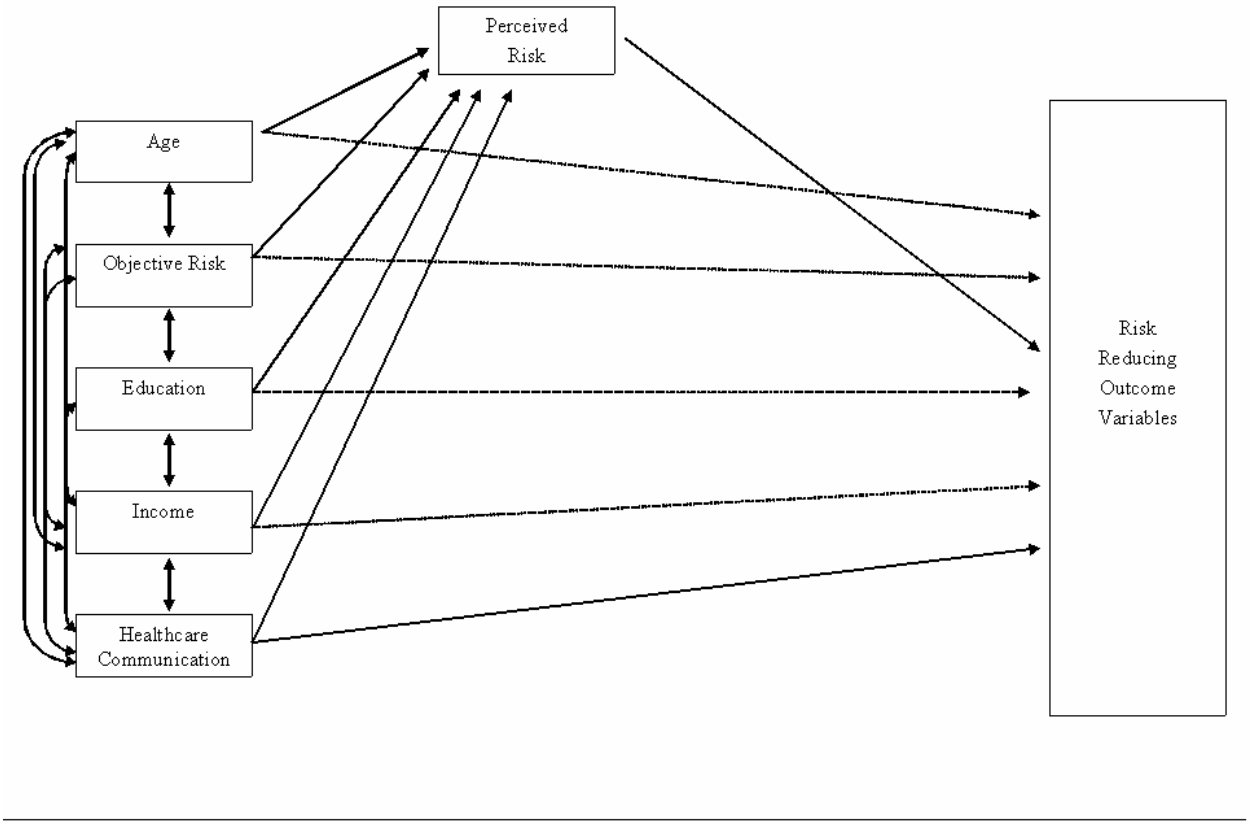
Hypotheses for Aim 2

Perceived risk was expected to be positively related to early detection behaviors, adherence intentions, and clinic contact intentions.

Age was expected to be negatively related to perceived risk.
Objective risk was expected to be positively related to perceived risk.
Education was expected to be positively related to perceived risk.
Income was expected to be positively related to perceived risk.
Healthcare communication was expected to be positively related to perceived risk.

Perceived risk was expected to at least partially mediate the relationship between age and outcomes, the relationship between objective risk and outcomes, and the relationship between education and outcomes, and between income and the outcomes.

Figure 3. Representation of Aim 2.



Note. Dotted lines represent proposed mediation based on the relationships between perceived risk and the outcome variables.

Figure 3. Representation of Aim 2.

PRIMARY AIM 3: Aim 3 is represented in Figure 4. Like Aim 2, there were three objectives for Aim 3. The first was to examine the relationship between attitudes toward risk-reducing behaviors and the outcome variables. The second objective was to investigate the relationships between the background variables and attitudes toward risk-reducing behaviors. Finally, attitudes toward risk-reducing behaviors were investigated as a mediator between age and outcomes, education and outcomes, and income and the outcomes.

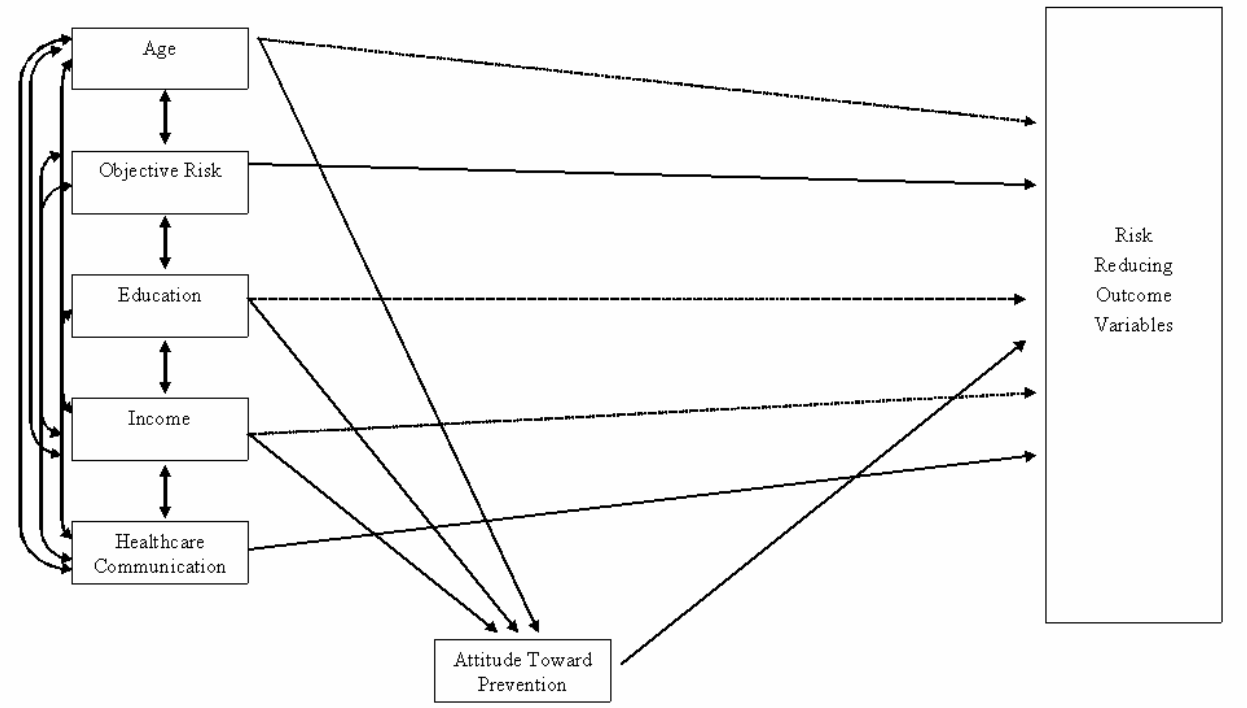
Hypotheses for Aim 3

Attitudes toward risk-reducing behaviors were expected to be positively related to early detection behaviors, adherence intentions, and clinic contact intentions.

Age was expected to be positively related to attitudes toward risk-reducing behaviors.
Education was expected to be positively related to attitudes toward risk-reducing behaviors.
Income was expected to be positively related to attitudes toward risk-reducing behaviors.
Objective risk was not expected to be related to attitudes toward risk-reducing behavior.
Healthcare communication was not expected to be related to attitudes toward risk-reducing behavior.

Attitudes toward risk-reducing behavior were expected to at least partially mediate the relationship between age and outcomes, between education and outcomes, and between income and outcomes.

Figure 4. Representation of Aim 3.



Note. Dotted lines represent proposed mediation based on the relationship between attitude toward prevention and the outcome variables

Figure 4. Representation of Aim 3.

PRIMARY AIM 4: Aim 4 is summarized in Figure 5. There were several objectives for Aim 4. First, the relationship between cancer specific distress and each outcome behavior was investigated. Next, the relationship between perceived risk and cancer specific distress, and attitudes toward risk-reducing behavior and cancer specific distress were examined. As well, the relationship between cancer specific distress and the background variables was examined. Finally, cancer specific distress was examined as a mediator of the relationships between the outcomes and perceived risk, attitudes toward risk-reducing behavior, age, education, and income.

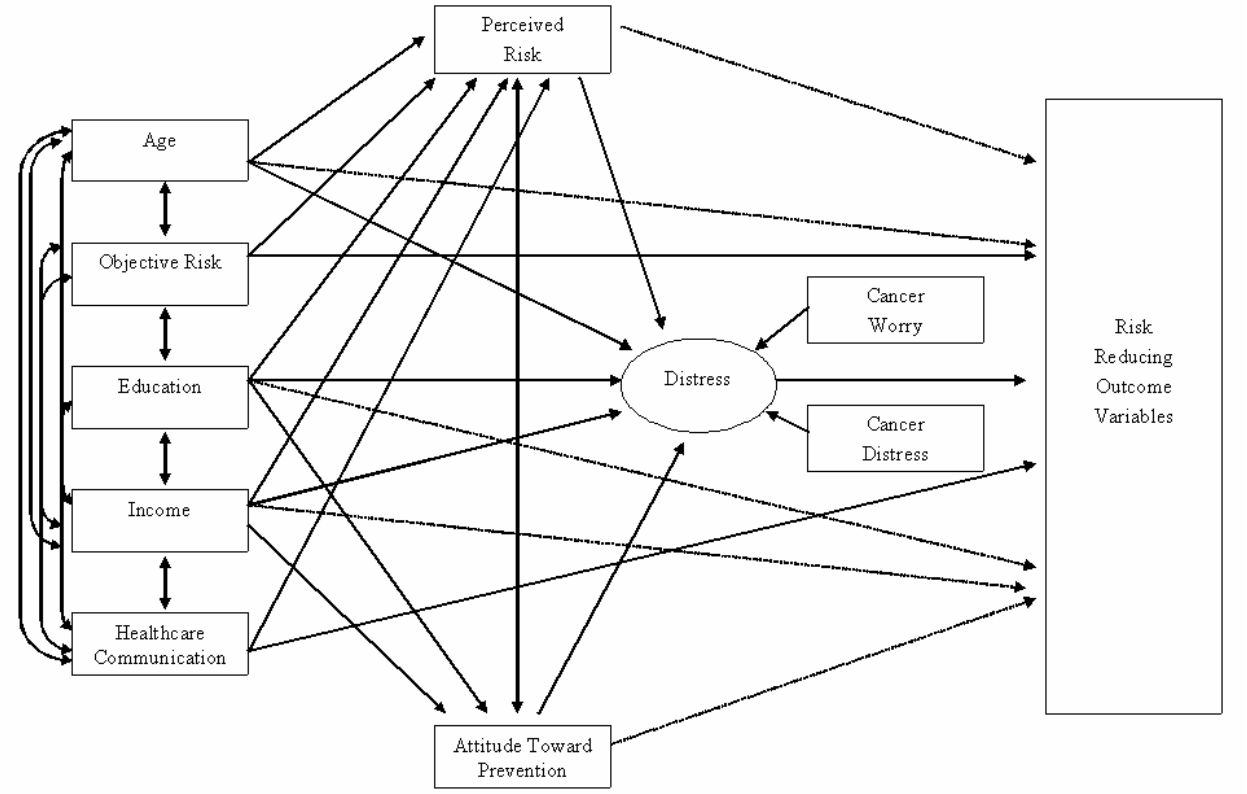
Hypotheses for Aim 4

Cancer specific distress was expected to be positively related to early detection behaviors, adherence intentions, and clinic contact intentions.

Perceived risk was expected to be positively related to cancer specific distress.
Attitudes toward risk-reducing behavior were expected to be positively related to cancer specific distress.
Age was expected to be negatively related to cancer specific distress.
Education and income were expected to be positively related to cancer specific distress.
Objective risk and healthcare communication were not expected to be related to cancer specific distress.

Cancer specific distress was expected to at least partially mediate the relationship between perceived risk and outcome variables, the relationship between attitudes toward risk-reducing behaviors and outcome variables, the relationship between age and outcome variables, the relationship between education and outcome variables, and the relationship between income and outcome variables.

Figure 5. Representation of Aim 4.



Note. Dotted lines represent pathways hypothesized to be mediated.

Figure 5. Representation of Aim 4.

PRIMARY AIM 5: This aim included testing these hypotheses in the complete proposed model using SEM to account for unique variance in relationships among the predictors and outcome variables (see Figure 1). The overall objective of this aim was to explain and model the pathways between variables that predict risk-reducing behaviors in women at high risk for breast cancer.

It was expected that background variables (age, objective risk, education, income, healthcare communication) would predict outcome variables (adherence intentions, early detection behavior, and clinic contact intentions) within the SEM model.

It was also expected that the proximal variables (perceived risk, cancer specific distress, cancer worry, attitudes toward risk-reducing behavior) would predict the outcome variables in this study within the SEM model.

Background variables were predicted to be related to the proximal variables in this model.

It was expected that when unique variance between the model variables is accounted for by this analysis technique, that some of the relationships found in Aims 1-4 would not be found.

Secondary Aim 1: To explore whether or not the variables included in the proposed model were associated with actual clinic contact after women had been given risk information and a brochure to contact the high risk clinic. Further, the outcome variables of adherence and clinic contact intentions was explored as predictors of clinic contact in this sample.

Hypotheses for Secondary Aim 1

Age was expected to be negatively related to clinic contact.

Objective risk was expected to be positively related to clinic contact.

Education level was expected to be positively related to clinic contact.

Healthcare communication was expected to be positively related to clinic contact.

Perceived risk was expected to be positively related to clinic contact.

Cancer specific distress was expected to be positively related to clinic contact.

Attitudes toward risk-reducing behavior were expected to be positively related to clinic contact.

Clinic contact intention was expected to be positively related to actual clinic contact.

METHODS

PARTICIPANTS

A total of 203 individuals who contacted study coordinators were eligible and scheduled for a study session. Of scheduled participants, 187 (92%) signed consent and completed the study session. All participants received and completed an initial follow-up phone call, and 143 of 149 possible participants completed the second follow-up phone call.

RECRUITMENT PROCEDURES

Two methods of recruitment were used for this study. First, print and online advertisements were posted throughout Pittsburgh in community settings such as retail stores, restaurants, and university buildings. Potential subjects were asked to contact the study coordinators by phone and were screened using a phone screening script. Second, women were recruited through the Quality of Life Registry at the University of Pittsburgh, Division of General Internal Medicine (DGIMR; IRB #0302087; Primary Investigator: Rachel Hess, M.D., MSc). The DGIMR research project includes prospective evaluation of subjects for eligibility in future research studies. All patients seen in the division's practices are screened for participation in this registry of potential

research participants. Eligible patients who consent become part of the Prospective Subject List (PSL). By doing this, patients are consenting to be contacted for studies for which they might meet eligibility criteria. All women who were added to the PSL from January 2005 through October 2005 were contacted by mail and asked if they would consider participating in the current study. Figure 6 outlines the process of participant recruitment for this study. All participants were enrolled in this study between October 24, 2005 and May 2, 2006.

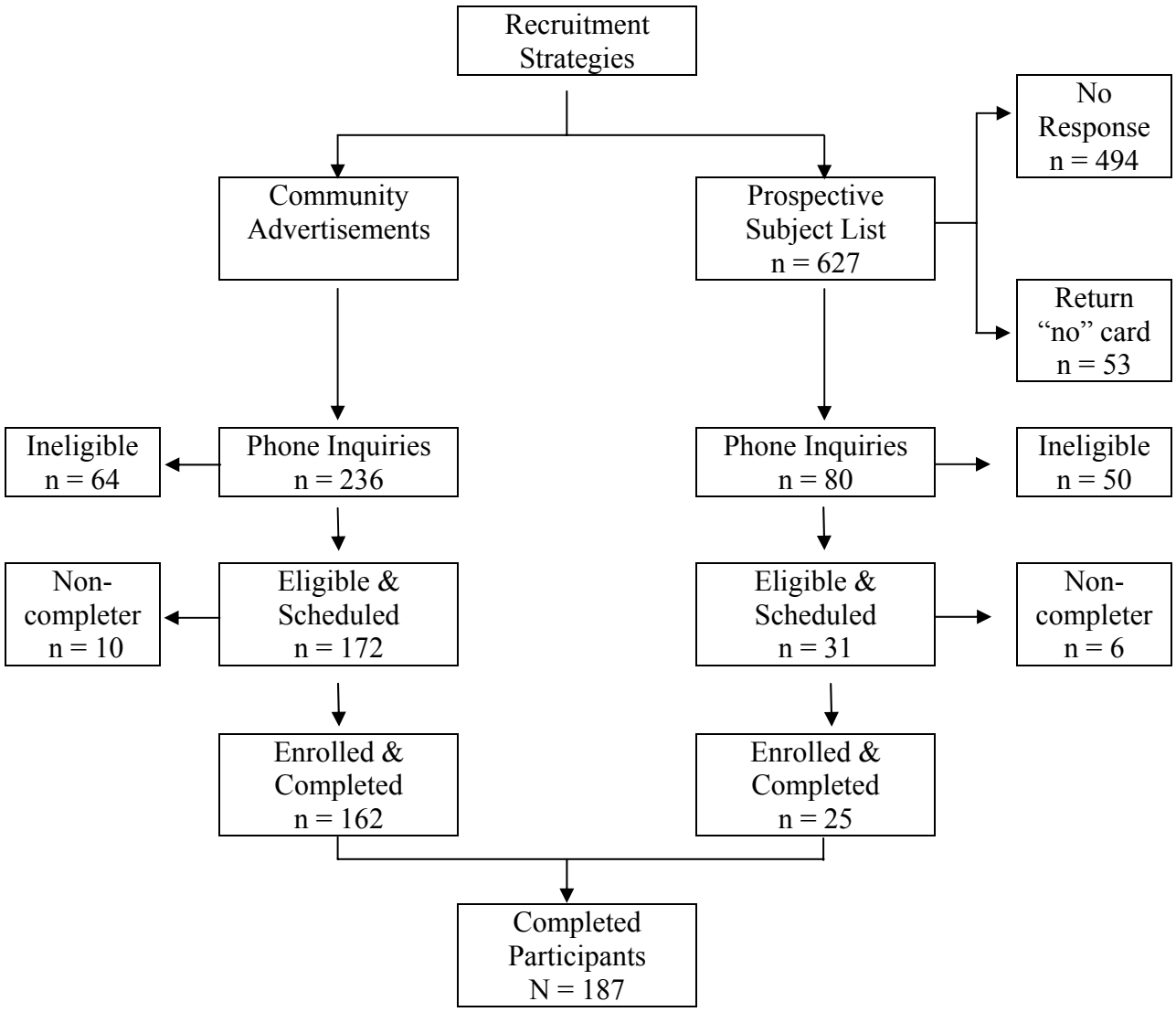


Figure 6. Recruitment flow chart.

STUDY PROCEDURES

When potential participants contacted the study by phone, eligibility was assessed. Eligible participants a) were female in gender, b) were 22-69 years old, c) had a first degree relative with a history of breast cancer, d) had no prior contact with a high risk breast clinic or program, d) were able to read and write English, and e) were able to give informed consent. If the participant met eligibility criteria for this study, an appointment was made to complete study procedures and information was gathered to generate breast cancer risk information for the participant. All study appointments took place at the University of Pittsburgh Cancer Institute Department of Behavioral Medicine and Oncology, Montefiore Hospital, or the Hillman Cancer Center. At the appointment informed consent was obtained after a discussion of the purpose and nature of the study. Then, participants completed all study measurements. Upon completion of study measurements, all participants were given a tailored standardized form with information about her breast cancer risk. This form was generated from a website created and maintained by the Harvard Center for Cancer Prevention within the Harvard School of Public Health (www.yourdiseaserisk.com). This information did *not* include a Gail Score for the participant. The participant was also given a standard brochure about a high risk breast cancer clinic located at Hillman Cancer Center. The participant was instructed to read through her standardized objective risk and the clinic brochure and then completed a question asking about her intentions for contacting the high risk clinic. Participants were told they would be contacted by phone in two weeks.

Two weeks after the study appointment, the investigator called the participant and asked if she had contacted a high risk clinic. If the participant indicated that she had contacted the clinic by leaving a message for a follow-up call, talking with someone to receive additional information, and/or making an appointment at the clinic, this was the last contact the investigator had with the participant. If she indicated that she had not contacted the clinic, the participant was asked if she intended to contact the clinic. If she indicated that she did not intend to contact the clinic, this was the final contact between the investigator and the participant. However, if the participant indicated that she had not contacted the clinic, but intended to call the clinic, she was contacted again four weeks later. At this final call, both behavior and intentions about contacting the clinic were assessed again. Participants received $35.00 by postal mail approximately four weeks after completing the study session.

MEASURES

Background Variables

Demographic variables. Information on age, race, marital status, education level, employment status, and household income were collected.

Objective Breast Cancer Risk. To determine objective breast cancer risk, information needed to calculate a lifetime and 5-year Gail score (Gail et al., 1989) was collected. Risk factors included

in the Gail calculation are: age, age at menarche, age at first live birth, number of benign breast biopsies, and number of first-degree relatives with breast cancer. A woman's Gail Score is expressed as the percentage risk she has of developing breast cancer in her lifetime and in the next five years. Additionally, to better describe the sample, participants were asked whether or not their sister or mother had died as a result of breast cancer.

Predictor Variables

Demographic and Background Variables. Age, objective risk, education, and income were used as predictor variables. Objective risk measurement was calculated using the Gail model (Gail et al., 1989). Four additional constructs were used as predictor variables including: 1) Healthcare Communication, 2) Perceived Risk, 3) Attitudes Toward Risk Reducing Behavior, and 4) Cancer Specific Distress.

1. Healthcare Communication. Fifteen questions were asked about participants' familiarity with risk-reducing options and their communication about risk reduction for breast cancer with health care professionals. Communication has been assessed many ways in past research and is often assessed with only one item addressing communication about a specific health behavior (e.g., "Has you physician recommended that you have a mammogram?). To our knowledge, there are no standardized assessment tools to assess communication about breast cancer risk. For this reason, several questions inquiring about healthcare communication were included in this study and subsequent principal component analyses were done to extract factors of common items. Table 1 provides each question as assessed, the range of possible response, the range of response,

the study mean of each response, and the standard deviation for each item.[1] Results of principal component analyses are presented in the results section.

[1] Table 2 does not include the Healthcare Service Utilization item. This item response is included in the text below.

Table 1. Descriptive statistics for the healthcare communication items.

		Possible Range	Study Range	X	SD
1.	How often have you talked with your healthcare provider about your increased risk of breast cancer based on your family history of the disease?	1-5	1-5	2.8	1.2
2.	How often have you asked your healthcare provider if there are things you can do to lower your risk of getting breast cancer?	1-5	1-5	2.1	1.2
3.	How familiar are you with the genetic test for breast cancer risk?	0-4	0-4	1.1	1.2
4.	To what extent have you heard about genetic testing for breast cancer in the news or media?	0-4	0-4	1.2	1.2
5.	How familiar are you with chemoprevention (medication) that can lower your risk of developing breast cancer?	0-4	0-4	.76	1.1
6.	To what extent have you heard about chemoprevention (medication) for breast cancer in the news or media?	0-4	0-4	.70	1.1
How often or strongly has a healthcare provider recommended that you do any of the following:					
7.	Have yearly mammograms done.	1-4	1-4	2.9	1.3
8.	Have clinical breast exams done (when a healthcare provider checks your breast for lumps).	1-4	1-4	3.4	.93

9.	Do self breast exams (when you check your breasts for lumps).	1-4	1-4	3.4	.85
10.	Go to a specialty high-risk clinic or cancer genetic program.	1-4	1-4	1.1	.48
11.	Get genetic testing done.	1-4	1-4	1.1	.40
12.	Consider taking medication (chemoprevention like tamoxifen or raloxifen) to lower your risk of breast cancer.	1-4	1-4	1.1	.32
13.	Consider having surgery to remove your breasts or ovaries to lower your risk of breast cancer.	1-4	1-4	1.1	.30
14.	Made any recommendations for prevention regarding your increased risk of breast cancer based on family history.	1-4	1-4	1.7	.95

a. Healthcare Service Utilization. Because much of the work to date on healthcare communication has been done in samples recruited through medical settings, it was important to assess whether or not a community recruited sample was using healthcare services. To assess use of healthcare services in this community sample, participants were asked about the last time they had an appointment with a health care provider. Participants provided answers on this scale: 1) 1-3 months since last visit, 2) 4-6 months since last visit, 3) 7-12 months since last visit, 4) More than 1 year since last visit, 5) More than 2 years since last visit, and 6) More than 5 years since last visit.

b. Communication about Risk. Participants were asked two questions about their communication with healthcare professionals about their breast cancer risk. They were asked if they had talked with a health care professional about their increased risk of breast cancer based on family history, and if they had inquired about options to reduce their risk. These two questions were answered on a 1 = "Never" to 5 = "A lot" Likert-type scale.

c. Prevention Familiarity. Based on questions asked by Cameron & Reeve (2006), four questions about familiarity and informational media exposure to risk-reducing options were asked. Participants were asked about their familiarity with genetic testing and chemoprevention and whether or not they had heard about these options in the news or media. These four questions were answered on a 0 = "Not at all" to 4 = "A great deal" Likert-type scale.

d. Healthcare Provider Recommendation. Healthcare communication is often assessed with one or two questions that inquire whether an individual's physician has recommended certain health behaviors (e.g., Bober et al., 2004; Rutten et al., 2005). In this study, participants were asked to report if a healthcare professional had recommended the use of eight risk-reducing behaviors including mammograms, clinical breast exams, breast self exams, high-risk clinic consultation, genetic testing, chemoprevention, prophylactic oophorectomy, and prophylactic mastectomy. These eight questions were all answered on a 1 = "Never" to 4 = "Strongly recommended" Likert-type scale.

2. Perceived Risk. There is no general agreement about how to measure perceived risk and perceived risk has been measured in several ways in the literature. This is largely because it is not clear how people think about and rate risk. Recent work has suggested the importance of measuring absolute and comparative perceptions of risk, as well as affective perceptions of risk (e.g., Zajac et al., 2006). Conviction of perceived risk has also been noted as important in understanding how individuals assess their health risks.

A total of 12 items assessing perceived risk, including questions that assessed absolute, comparative, affective perceptions, and convictions of perceptions, were included in this study and dispersed throughout the questionnaire packet including four items that make up a standardized scale of perceived risk. After study materials were completed, principal component analyses were done to extract factors of common items. Principal component analyses were done to ascertain if the disparate measurements of perceived risk in past work are in fact capturing similar constructs or if there are differences in these items. Table 2 provides each question as

assessed, the range of possible response, the range of response, the study mean of each response, and the standard deviation for each item. Results of principal component analyses are reported in the results section.

Table 2. Descriptive statistics for perceived risk items.

		Possible Range	Study Range	X	SD
1.	What do you think is the average woman's percentage risk of developing breast cancer in the future?	0-100%	1-90	26.0	19.0
2.	What do you think is your percentage risk of developing breast cancer in the future?	0-100%	1-96	41.3	23.5
3.	Compared to other women your age what do you believe is the likelihood that you will develop breast cancer in the future?	-3 to 3	-3 to 3	1.4	1.1
4.	I feel at risk for breast cancer.	1 to 12	1-12	8.1	2.8
5.	What do you think is the average women's risk of developing breast cancer?	1 to 12	1-10	5.2	2.1
6.	What do you think is your risk for developing breast cancer in the future?	1 to 12	1-12	7.1	2.4
7.	My body will fight off breast cancer in the future.*	1-5	1-5	3.3	.96
8.	The chances that I might develop breast cancer are pretty high.*	1-5	1-5	3.7	.98
9.	No matter what I do, there's a good chance of developing breast cancer.*	1-5	1-5	3.2	1.1
10.	I expect to be free of breast cancer in the future.*	1-5	1-5	2.8	.97

Think about how you have answered the questions about your risk of breast cancer throughout all these questions today:					
11.	How **confident** are you in your estimates of your risk for breast cancer?	1 to 12	1-12	7.13	3.0
12.	How much do you **believe** in how you rated your risk for breast cancer?	1 to 12	1-12	8.35	2.8

Note. * = question from the ADQ.

a. Absolute Perceived Risk. Two items were included that measured absolute perceived risk. Women were asked to rate other women's and their own risk of getting breast cancer on a 0% to 100% scale by marking an "X" on a line with graduated risk marked (e.g., 0%, 0.5%, 1-10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%).[2] An additional question based on work by Weinstein and Klein (2005) asked women to rate their other women's risk and their own risk after reading this sentence: "Some factors that may suggest increased risk for breast cancer including getting older, having a family history of breast cancer, starting your period at an earlier age, having no children or having children after turning 30." This question was answered on a 1 = "No Chance" to 12 = "Certain to happen" Likert-type scale.

b. Comparative Perceived Risk. To measure comparative risk, women were asked to this question: "Compared to other women your age what do you believe is the likelihood that you will develop breast cancer in the future?" (i.e., Weinstein & Klein, 1995). This question was answered on a -3 = "Much below average" to 3 = "Much above average" Likert- type scale.

c. Affective Perceived Risk. Affective perceived risk was measured with one item based on work by Weinstein et al. (in press). The question was: "I feel at risk for breast cancer". This question was answered on a 1 = "Strongly Disagree" to 12 = "Strongly Agree" Likert-type scale.

d. Conviction of Perceived Risk. Participants were additionally asked two questions about their confidence and belief in their ratings of risk. The first question asked:

[2] It should be noted for the reader that these two questions were placed early in the assessment packet and were grouped following questions that asked readers about their objective risk factors (e.g., number of relatives with breast cancer, age at first menses, number of biopsies).

"Think about how you have answered questions about your risk of breast cancer throughout all these questions today. How **confident** are you in your estimates of your risk for breast cancer?". This question was answered on a 1 = "Not Confident at All" to 12 = "Very Confident" Likert-type scale. The second question asked: "Think about how you have answered questions about your risk of breast cancer throughout all these questions today. How much do you **believe** in how you rated your risk for breast cancer?". This question was answered on a 1 = "Not at all" to 12 = "A great deal" Likert-type scale.

e. Perceived Susceptibility. To understand how individual items commonly used in the literature to assess perceived risk would factor in with a standardized scale of risk, perceived risk was also assessed with the perceived susceptibility scale from the Adherence Determinants Questionnaire (ADQ; DiMatteo et al., 1993). The ADQ assesses 7 elements of patients' adherence to medical treatment and prevention. Several of these scales were used in this study. On the form used in this study the questions were worded to specifically refer to breast cancer. Several of the questions inquired about "prevention and surveillance". Included in the instructions was this sentence: *Prevention and surveillance recommendations refer to things you have been told to do to lessen your risk of breast cancer or to increase the likelihood of detecting breast cancer early.* The four items that make up the perceived susceptibility scale of the ADQ were included in this study to understand how items that were part of a validated instrument would factor in with items of risk (e.g., Comparative, Absolute, Affect, Conviction) used in the literature.

3. Attitudes Toward Risk-Reducing Behavior. There are few standardized assessment instruments for attitudes toward health prevention behavior in general, and to our knowledge, none for attitudes about prevention or risk reducing behaviors for breast cancer. There is little consistency of items used across studies and the literature on attitudes related to risk-reducing behaviors often relies on limited number of items to assess these concepts (e.g., Cameron and Reeve, 2006, Lodder et al., 2003). For these reasons, this study included 17 items to assess attitudes toward risk reducing behavior including a standardized scale from the ADQ. After study materials were completed, principal component analyses were done to extract factors of common items. Table 3 provides each question as assessed, the range of possible response, the range of response, the study mean of each response, and the standard deviation for each item. Results of principal component analyses are reported in the results section.

Table 3. Descriptive statistics for attitudes toward risk-reducing behavior items.

		Possible Range	Study Range	X	SD
1.	Getting advice and counseling from a high risk clinic can help reduce a woman's chances of dying from breast cancer.	1-6	1-6	4.5	1.4
2.	Getting advice and counseling from a high-risk clinic would help a woman in making decisions about whether and when to have children.	1-6	1-6	4.1	1.4
3.	A woman should do all she can to find out about her risk of developing breast cancer for the sake of her family and loved ones.	1-6	1-6	4.8	1.3
4.	The medical community will provide treatment for women at high-risk for breast cancer that will prolong their health and well-being.	1-6	1-6	4.27	1.2
5.	A woman at increased risk for breast cancer should seek out information at a high-risk clinic to find out what she can do to lower her risk of disease.	1-6	2-6	4.7	1.1
6.	A woman at increased risk should have genetic testing in order to find out her exact genetic risk.	1-6	1-6	3.8	1.4

7.	A woman with a positive genetic test result (i.e., a genetic mutation that increases risk of breast cancer) should take chemoprevention (medication) to lower her risk of developing breast cancer.	1-6	1-6	3.7	1.3
8.	A woman with a positive genetic test result (i.e., a genetic mutation that increases risk of breast cancer) should have prophylactic mastectomy (surgical removal of the breasts) in order to reduce her cancer risk.	1-6	1-6	2.4	1.2
9.	A woman with a positive genetic test result (i.e., genetic mutation that increases risk of breast cancer) should have a prophylactic oophorectomy (surgical removal of the ovaries) to reduce her risk of breast cancer.	1-6	1-6	2.4	1.2
10.	I'll be just as healthy if I avoid the prevention surveillance recommendations.*	1-5	1-5	1.9	.92
11.	Following prevention and surveillance recommendations will help me to be healthy.*	1-5	1-5	4.2	.71
12.	Following prevention and surveillance recommendations is better for me than not following them.*	1-5	1-5	4.3	.71
13.	The benefits of prevention and surveillance recommendations outweigh any difficulty I might have in following them.*	1-5	2-5	4.1	.70
14.	Prevention and surveillance recommendations are too much trouble for what I get out of it.*	1-5	1-5	1.8	.90

15.	Because prevention and surveillance recommendations are too difficult, they are not worth following.*	1-5	1-5	1.6	.71
16.	I believe that prevention and surveillance recommendations will help to prevent my getting breast cancer.*	1-5	1-5	3.7	.89
17.	It's hard to believe that prevention and surveillance recommendations will help me.*	1-5	1-5	2.0	.83

Note. * = question from the ADQ.

a. Attitudes Toward Risk Reducing Behaviors. Attitudes Toward Risk Reducing Behavior was measured with nine items that were modeled after questions used by Cameron and Reeves (2006). These nine questions are numbered 1-9 in Table 4. These questions were important to include in this study because the attitudes of women with a family history of breast cancer about high-risk clinic use and its benefits, and in turn these attitudes relationship with behavior, have not been well studied. All nine questions were answered on a 1 = "Strongly disagree" to 6 = "Strongly agree" Likert-type scale.

b. Attitudes Toward Prevention and Surveillance. To understand how a standardized scale used in past literature to assess attitudes about the benefits and costs of prevention and surveillance would factor with the above mentioned attitude questions, attitudes toward prevention and surveillance were also assessed with the benefits and costs scale from the ADQ (ADQ; DiMatteo et al., 1993). Attitudes about the benefits and costs of prevention and surveillance were measured with eight questions (items 10-17 in Table 4) that make up the perceived utility of adhering scale on the ADQ.

4. Cancer Specific Distress

a. Cancer Worry. Four items assessing cancer specific worry were modified from the Lerman Cancer Worry Scale (CWS; Lerman et al., 1991). This scale is widely used in cancer research and has shown good internal consistency (alpha = .73; McGregor et al., 2004). An additional question about cancer worry was included that has been used

in past research (e.g., Andersen et al., 2004). These five questions demonstrated good reliability in this study (Cronbach's alpha = .87). Table 4 provides each question as assessed, the range of possible response, the range of response, the study mean of each response, and the standard deviation for each item. The final worry variable used in this study was created from converting each item to a z-score and by finding the mean of the five converted scores.

Table 4. Descriptive statistics for cancer worry items.

		Possible Range	Study Range	X	SD
1.	Please rate the extent to which you think about getting breast cancer.	1-7	1-7	3.64	1.6
2.	How often do you worry about breast cancer?	1-7	1-7	3.2	1.6
3.	How many days out of the last 7 did you worry about breast cancer?	0-7	0-7	1.1	1.5
4.	How much do you worries about breast cancer affect your mood?	1-7	1-7	1.7	1.2
5.	How much do your worries about breast cancer affect your ability to perform daily activities?	1-7	1-7	1.3	.94

b. Cancer Distress. The intrusion and avoidance scales from Impact of Event Scale-Revised (IES-R; Weiss & Marmar, 1997) were used to assess the experience of intrusive and avoidant thinking related to "being at higher risk for the occurrence of breast cancer". One item on from the IES-R was modified to fit the present study population. The original item was: "I found myself acting or feeling like I was back at that time". The question was modified to read: "I found myself acting or feeling as though I did when I first realized my risk". Both scales had 8 items, for a total of 16 items. Each question was rated on a 5-point scale: 0 = not at all, 1 = a little bit, 2 = moderately, 3 = quite a bit and 4 = extremely. The IES-R is a well validated instrument, has been widely used in cancer research, and has consistently demonstrated good internal consistency (Cronbach's alpha = .83-.89; Cella et al., 2002), as it did in the present study (Cronbach's alpha = .91). The final cancer distress score in this study was calculated by averaging the sample scores (X = 7.10; SD = 8.6).

Outcome Variables

Four different outcomes were measured. These included 1) Early Detection Behaviors, 2) Clinic Contact Behavior, 3) Clinic Contact Intentions, and 4) Adherence Intentions.

1. Early Detection Behaviors. The use of early detection behaviors, including mammography, clinical breast exam, and self-breast exam, was assessed. As noted earlier, the American Cancer Society (ACS; 2004) recommends that women 40 and over undergo yearly mammography.

Women in their 20s are advised to begin clinical breast exams every 3 years, and to perform breast self exam regularly. For women with a family history of breast cancer, the ACS suggests that women discuss with their health care provider the possibility of starting these behaviors at earlier ages and/or performing these behaviors more frequently. Although there is no clear consensus about the exact age to begin mammography in women with a family history, some expert opinion suggests that 30 years of age is an appropriate time to initiate mammography if a woman is not considering pregnancy (V.Vogel, personal communication, August 14, 2005).

Women were asked if they had ever had a mammogram, clinical breast exam, or breast self exam. Then women were asked how many mammograms they had in the last two years, if they had a clinical breast exam within the last two years, and if they had performed a breast self exam in the last six months. Last, due to general age stipulations of mammography, women under the age of 40 were asked if they had talked with a health care professional about the possibility of beginning mammography at an early age because of their family history of disease. Responses to this item were used to measure adherence for mammography in women under 40. Past research has indicated that self-reports of early detection behavior use (e.g., mammography) are reliable (King, Rimer, Trock, Balshem, & Engstrom, 1990). The results of these assessments are presented below in the results section.

2. Clinic Contact Behavior. Clinic contact behavior was measured at two time points. As described in detail above, participants received a telephone call 2 weeks after completing the study session and 6 weeks after the study session to inquire about whether they had contacted the high risk clinic. Clinic contact was a binary outcome of either Yes or No. Results are presented below.

3. Clinic Contact Intentions. After women had completed all study questionnaires, they were given an estimate of their objective risk (e.g., Harvard Risk Index), told about the high-risk breast cancer clinic, and given a brochure about the clinic. Clinic contact intentions were assessed with one paper pencil question: Do you intend to contact the high-risk clinic? This question was assessed with a Likert-type scale with 1 = "Definitely no" and 5 = "Definitely yes". This same question was asked verbally at a two and six week follow-up phone call. Results are presented below.

4. *Adherence Intentions*. To assess adherence intentions, the four questions that make up the adherence intentions subscale of the ADQ (described above) were used. Insert questions. All questions are answered on a 5-point Likert-type scale ranging from 1 = "Strongly disagree to 5 = "Strongly agree". This subscale has demonstrated fair to good internal consistency (DiMatteo et al., 1993; alpha = .73 to .94) across three different health adherence domains. The Cronbach alpha score for this scale in the present study was .72.

STATISTICAL ANALYSES

Because this study was designed to evaluate and validate concepts that have been studied in several different ways and with several diverse items and scales, several items were included as measures related to healthcare communication, perceived risk, and attitudes toward risk reducing behaviors. To reduce these items to a small number of factors and to concisely describe the constructs, principal component analyses were used. A scree plot with eigenvalues greater than 1.0 with oblimin rotation was used to extract components of these constructs. The results of principal component analyses are documented. Next, to examine the data and test the hypotheses in Aim 1-4, correlational analyses assessed relationships among continuous variables, analyses of variance (ANOVA) were used to assess relationships between one continuous and one categorical variable, and χ^2 analyses were used to look at the relationship between two categorical variables.

Mediation was tested as outlined by Baron and Kenny (1986). For mediation to occur, first, an independent variable (IV) must be related to a dependent variable (DV) and a third variable (mediator) must be related to both the IV and the DV. Next, if these criteria are met, it is possible to test for mediation by examining the relationship between the IV and the DV controlling for the mediator. If the magnitude of the relationship between the IV and DV is decreased, according to Baron and Kenny, mediation has occurred. In this study, possible mediation was determined based on the results of the bivariate relationships. Once possible mediation was determined by the results of the bivariate relationships, partial correlations were run to test for mediation.

When mediation according to Baron and Kenny (1986) was detected, the Sobel test was used to determine if the indirect effect of the independent variable on the dependent variable via the mediator was significant (Sobel, 1982). The following formula was used to do this:

$$z = a \times b / \sqrt{(b^2 \times Sa^2 + a \times Sb^2)}$$

where a = path coefficient from the independent variable to the mediator, Sa^2 = the standard error of a, b = path coefficient form the mediator to the dependent variable, and Sb^2 = standard error of b. The Sobel's z value must be sufficiently large, yielding a p-value of .05 for significant mediation to be identified. If the association between the IV and DV has been reduced to a non-significant level, full mediation has occurred. If the association between the IV and the DV is still significant, partial mediation has occurred. Investigators have recently highlighted the importance of evaluating the statistical significance of mediation (Preacher & Hayes, 2004). Sobel tests were run as outlined by Jose (2004).

Structural Equation Modeling

The hypothesized model was tested with SEM. The model was estimated using EQS modeling software. To account for any non-normal data in the model, robust methods with Satorra-Bentler χ^2 statistics were used to test the overall model fit (Satorra & Bentler, 1994) in all analyses and robust statistics were used to interpret parameter estimates. These methods have been found to outperform the standard estimator when using non-normal data (i.e., Curran, West, & Finch, 1996). The primary task in the model testing procedure is to determine the "goodness of fit" between the hypothesized model (structural model) and the sample data. The structure of the hypothesized model is imposed on the data to examine the observed data fit (e.g., goodness of

fit). The null hypothesis for model fit is that the estimated model fits the data well. Overall goodness of fit was evaluated using the Satorra-Bentler χ^2 test , the robust comparative fit index (CFI; Bentler, 1990), and the robust root mean square error of approximation (RMSEA; Steiger & Lind, 1980). Good model fit was defined as a non-significant χ^2 value (> .05), comparative fit index of greater than .05, and/or a RMSEA value less than or equal to .06 (Hu & Bentler, 1998). To create the best model fit changes suggested by SEM modification indexes were used. The Lagrange Multiplier test was used in determining parameters that were appropriate to add and the Wald *W* statistic was used to determine which parameters were appropriate to delete (Chou & Bentler, 1990). The Satorra-Bentler scaled χ^2 difference test was used for both nested models (Satorra & Bentler, 2001). To compare these two non-nested models, the Akaike Information Criterion (AIC) and Consistent AIC (CAIC) differences were examined (Akaike, 1987; Bozdogan, 1987). Once the best model was identified, to estimate the path coefficients (parameter estimates), maximum likelihood estimations (MLE) were used. Further, indirect effects were estimated statistically as the product of direct effects that comprised them.

Logistic Regression

The secondary aim of this study was to prospectively follow the participants after they were given risk information and information about the high risk clinic to understand how the proposed factors might be related to behavior to seek out this resource. The outcome variable of clinic contact was a binary outcome variable (yes/no), thus logistic regression was used to examine what predictors were associated with clinic contact. Predictor variables included age, objective risk, education, income, Healthcare Communication, Perceived Risk, Cancer Distress, attitudes

toward information seeking and attitudes toward the worth of prevention and surveillance. Further, the previous outcome variables of adherence intentions and clinic contact intention were examined as predictors of clinic contact. First, the predictor variables were analyzed using ANOVA and two-sided Pearson χ^2 tests for univariate analyses. Chi-Square tests were used to examine the relationship between the outcome and race. Factors that were significant were included in simultaneous multiple logistic regression analysis if they were associated with clinic contact with a P value of 0.05 or less. Other research has had smaller sample sizes (e.g., N = 149) than the current sample size using six predictors in a logistic regression model to look at a related outcome (e.g., genetic testing; Lerman et al., 1997).

RESULTS

First, participant characteristics will be described. Next, results of the principal component analyses and descriptive results for healthcare communication, perceived risk, and attitudes toward risk –reducing behavior will be presented; this will be followed by the descriptive results of other model variables. Then preliminary correlational and univariate data for all study variables will be presented briefly with the use of text and tables. This will be followed by the results of the hypotheses for Aims 1-5. Aims 1-4 were tested with correlational analyses and Aim 5 tested the full hypothesized model using SEM. Finally, the results of the logistic regression equation for secondary Aim 1 will be described.

PARTICIPANT CHARACTERISTICS

Participants (N = 187) who completed the study session had a mean age of 42.0 (SD =12.0; *range* = 22-69). The majority of participants were Caucasian (n = 145; 77.5%), 38 (20.3%) were African American/Black, 2 (1.1%) were Hispanic, 1 (0.5%) was Native American/Alaskan Native, and 1 (0.5%) selected "other" race. Ninety-four (50.3%) participants were married or living with a partner, 25 (13.4%) were divorced, 59 (31.6%) were never married, and 9 (4.8%) were widowed. In this sample, 15 (8.0%) participants had less than a high school or a high

school education, 47 (25.1%) had some college education or vocational training beyond high school, 74 (25.1%) earned a college degree, and 77 (41.4%) reported some graduate work or having a graduate degree. Most participants (*n* = 146; 78.1%) were employed. Nineteen participants (10.2%) reported an income of less than $10,000, 58 (31.0%) reported an income of $10,001-$30,000, 33 (17.6%) reported an income of $30,001-$50,000, 29 (15.5%) reported an income of $50,001-$70,000, 44 (24.0%) reported an income over $70,000, and 4 (2.1%) participants did not report this information.

Most of the participants reported a family history of breast cancer in their biological mother only (*n* = 149; 79.6%), 26 (13.9%) reported a history only in a sister, and 12 (6.5%) reported that their mother and at least one sister had a history breast cancer. Forty-two (22.5%) women reported that their mother died as a result of breast cancer and 6 (3.2%) women reported the death of a sister due to breast cancer. The average 5-year Gail Score risk for this sample was 1.40% (*range* = 0 - 5.70; *SD* =1.18) and the average lifetime Gail Score was 17.31% (*range* = 6.4 - 34.7; *SD* = 4.2). A 5-year Gail Score equal to or greater than 1.67% is considered "increased risk"; 41.2% (*n* = 77) of this sample were at increased risk according to this assessment tool.

Because Gail Scores are most valid for women ages 35 or older, scores for this age group were considered separately. For women over the age of 35 (*n* = 129), the average Gail Score 5-year risk was 1.93% (*range* = .08-5.7; *SD* = 1.0) and lifetime risk was 16.8% (*range* = 6.0-34.7; *SD* =4.6). Seventy-seven (59.7%) of these women were considered at "increased risk" according to this assessment tool.

Thirty-five women (18.7%) reported a history of breast biopsy with benign results. The objective risk information that was provided to the women (e.g., tailored risk information from

yourdiseaserisk.com) gave women a categorical rating of their risk. Based on this assessment tool, participant's risk was classified as below average (n = 3; 1.6%), average (n = 9; 4.8%), above average (n = 99; 52.9%), much above average (n = 74; 39.6%), and very much above average (n = 2; 1.1%).[3] Demographic and breast cancer information is summarized in Table 5.

[3] Information on biopsy history and www.yourdisesaserisk.com statistics is reported for descriptive purposes only.

Table 5. Summary of demographic and breast cancer history information.

	N = 187	
	n	%
Race		
Caucasian	145	77.5%
African-American/Black	38	20.3%
Other	4	2.1%
Marital Status		
Married or Living with a partner	94	50.3%
Divorced	25	13.4%
Never married	59	31.6%
Widowed	9	4.8%
Education		
Less than high school/high school degree	15	8.0%
Some college/vocational training	47	25.1%
College graduate	47	25.1%
Postgraduate work degree	77	41.4%
Employment Status		
Currently Employed	146	78.1%
Homemaker	6	3.2%
Currently Unemployed	4	2.1%
Retired	5	2.7%

Disability	18	9.9%
Other	8	4.3%
Household income		
Less than $10,000	19	10.2%
$10,001 - $30,000	58	31.0%
$30,001 - $50,000	33	17.6%
$50,001 - $70,000	29	15.5%
More than $70,000	44	24.0%
Refused	4	2.1%
Family History of Breast Cancer		
Mother only with breast cancer history	149	85.1%
Sister only with breast cancer history	26	14.9%
Mother & sister with breast cancer history	12	6.4%
Mother death due to breast cancer	42	22.5%
Sister death due to breast cancer	6	3.2%
5-year Gail score risk (full sample)		
< 1.67	110	58.8%
$\geq$ 1.67	77	41.2%
5-year Gail score risk (age $\geq$ 35)		
< 1.67	52	40.3%
$\geq$ 1.67	77	59.7%
History of breast biopsy		
Yes	152	81.3%

No	35	18.7%
Harvard Risk Index		
Below Average	3	1.6%
Average	9	4.8%
Above Average	99	52.9%
Much Above Average	74	39.6%
Very Much Above Average	2	1.1%

Note. Participant's average age = 42.0 (*SD* = 12.0, *range* = 22-69).

Analyses were done to examine differences between women recruited through community advertisements and the PSL. Women recruited through community advertisements were younger than were women recruited through the PSL, F (1, 185) = 15.9, $p < .001$ (M = 40.7; SD =11.9 vs. M = 50.6; SD =8.3), and had a lower 5-year Gail Score than did women recruited from the PSL, F (1, 185) = 16.4, $p < .001$(M = 1.26; SD =1.14 vs. M = 2.25; SD =1.07). There were no differences in life-time Gail Score, race, marital status, education, employment, income, family history of breast cancer, family death, or biopsy history.

PREDICTOR VARIABLES

Healthcare Communication

In this sample, 62.6% of participants reported seeing a healthcare professional in the last three months, 20.3% reported a visit in the last 4-6 months, 10.4% reported 7-12 months since their last visit, 3.8% reported a month since last visit, and 1.1% reported more than 2 years since last visit. The individual items possible range or responses, and descriptive results for healthcare communication are summarized in Table 1. The principal component analysis for healthcare communication variables was run with all 15 items. Four components were extracted and were labeled healthcare communication, provider recommend prevention, familiarity with prevention, and provider recommend early detection. Table 6 summarizes the results of the principal

component analysis. The eigenvalues for the four factors were, 3.99, 2.44, 2.16, and 1.40, respectively. The four components accounted for 66.3% of the total variance among the items. Based on the strength of the factor and theoretical implications, the factor of health care communication was selected to test the hypotheses.

Table 6. Final principal component analysis of healthcare communication.

	Model	
	Factor Loading	Proportion of Variance Explained
1. Healthcare Communication		**.266**
How often have you talked with your healthcare provider about your increased risk of breast cancer based on your family history?	.846	
How often have you asked your healthcare provider if there are things you can do to lower your risk of getting breast cancer?	.858	
How strongly has a health care provider made any recommendations for prevention regarding your increased risk of breast cancer based on family history?	.725	
2. Provider Recommends Prevention		**.162**
How often has your provider recommended going to a specialty high risk clinic or cancer genetic program?	-.805	

	How often has your provider recommended that you get genetic testing done?	-.808	
	How often has your provider recommended that you consider taking medication to lower your risk of breast cancer?	-.831	
	How often has your provider recommended surgery to remove your breast or ovaries to lower your risk of breast cancer?	-.893	
3.	**Familiarity with Risk Reduction**		**.144**
	How familiar are you with the genetic test for breast cancer risk?	.702	
	To what extent have you heard about genetic testing in the news or media?	.740	
	How familiar are you with chemoprevention (medication) that can lower your risk of developing breast cancer?	.892	
	To what extent have you heard about chemoprevention (medication in the news or media)?	.879	
4.	**Provider Recommends Early Detection**		**.090**
	How long since you have had an appointment with your health care provider?	.616	
	How often has your health care provider recommended yearly mammograms?	-.718	
	How often has your health care provider recommended clinical breast exams?	-.710	
	How often has your health care provider recommended self breast exams?	-.652	

Perceived Risk

All perceived risk items, possible range of response, and descriptive statistics from this sample are summarized in Table 2. All items that assessed a woman's own perceived risk (8 items) were included in the principal component analysis (see Table 7). In the initial analysis, one item had a factor loading of 0.43, so the principal component analysis was rerun excluding this item. In the final analysis, the two components that were extracted were labeled perceived risk and conviction of perceived risk. The eigenvalues for the two factors were 4.31 and 1.43, respectively. The two components accounted for 63.7% of the total variance among these 9 items. The items analyzed and the results of the principal component analysis are summarized in Table 5. The first perceived risk factor was used to test the hypotheses.

Table 7. Final principal component analysis of perceived risk items.

	Model	
	Factor Loading	Proportion of Variance Explained
1. Perceived Risk		**.478**
What do you think is your percentage risk of developing breast cancer in the future?	.680	
What do you think is your risk for developing breast cancer in the future?	.843	
I feel at risk for breast cancer.	.855	
The chances that I might develop breast cancer are pretty high.	.784	
No matter what I do, there's a good chance of developing breast cancer.	.627	
I expect to be free of breast cancer in the future.	.612	
Compared to other women your age what do you believe is the likelihood you will develop breast cancer in the future?	.846	
2. Conviction of Perceived Risk		**.159**

How confident are you in your estimates of your risk for breast cancer?	.926
How much do you believe in how you rated our risk for breast cancer?	.862

Note. The item "My body will fight off breast cancer in the future" was removed from the final analysis due to an initial factor loading of 0.424.

Attitudes Toward Risk -Reducing Behavior

All attitudes toward risk reducing behavior items, the range of possible responses, and the descriptive statistics from this study are summarized in Table 3. The initial principal component analysis was run with the 17 attitudes toward risk reducing behavior items assessed. Three of the items from the ADQ utility scale had low factor loadings (.32, .34, and .41), thus these three items were removed and the principal component analysis was rerun with a four factor solution imposed The final four factors had eigenvalues of 3.55, 2.21, 1.61, and 1.24, respectively. These items were labeled 1) attitudes toward information seeking, 2) attitudes toward the utility of prevention and surveillance, 3) attitudes toward prevention strategies, and 4) attitudes toward worth of prevention and surveillance. The four components accounted for 61.5% of the total variance among the final 14 items. The removed items and final principal component analysis are summarized in Table 8. The first factor, attitudes toward information seeking, was used to test the hypotheses. Attitudes toward worth of prevention and surveillance was also examined in relation to the hypotheses because the individual items (see Table 7) represent a broad concept of perceived benefits of following prevention and surveillance, and perceived benefits has been proposed as important in predicting health behaviors (i.e., Rosenstock, 1974).

Table 8. Principal component analysis of attitudes toward risk-reducing behavior items.

	Model	
	Factor Loading	Proportion of Variance Explained
1. Attitudes Toward Information Seeking		**.254**
Getting advice and counseling at a high risk clinic can help reduce a woman's chances of dying from breast cancer.	.862	
Getting advice and counseling from a high risk clinic would help women in making decisions about whether and when to have children.	.717	
A woman should do all she can to find out about her risk of developing breast cancer for the sake of her family and loved ones.	.520	
The medical community will provide treatment for women at high risk for breast cancer.	.659	
A woman at increased risk should seek out information at a high risk clinic to find out what she can do to lower her risk of disease.	.475	

2.	**Attitudes Toward the Utility of Prevention and Surveillance**		**.158**
	I'll be just as healthy if I avoid the prevention and surveillance recommendations.	.821	
	Prevention and surveillance recommendations are too much trouble for what I get out of it.	.588	
	It's hard to believe that prevention and surveillance recommendations will help me.	.644	
3.	**Attitudes Toward Prevention Strategies**		**.115**
	A woman at increased risk should have genetic testing in order to find out her exact genetic risk.	-.489	
	A woman with a positive genetic test result should take chemoprevention to lower her risk of developing breast cancer.	-.597	
	A woman with a positive genetic test results should have prophylactic mastectomy in order to reduce her own cancer risk.	-.840	
	A woman with a positive genetic test result should have a prophylactic oophorectomy to reduce her risk of breast cancer.	-.934	
4.	**Attitudes Toward the Worth of Prevention and Surveillance**		**.088**
	Following prevention and surveillance recommendations is better for me than not following them.	.745	
	The benefits of prevention and surveillance recommendations outweigh any difficulty I might have in following them.	.854	

Note. The items “Following prevention and surveillance recommendations will help me to be healthy”, “Because prevention and surveillance recommendations are too difficult, they are not worth following”, and “I believe that prevention and surveillance recommendations will help to prevent my getting breast cancer” were included in the initial principal component analysis, but were removed due to low factor loadings (.319, .408 and .339, respectively).

Cancer Specific Distress

Cancer Worry. Individual items and descriptive statistics are summarized in Table 4. One item had a different range of possible scores than the others, so all items were converted to z-scores and the mean of z-scores created the final worry variable used in this study.

Cancer Distress. The sample mean of the IES avoidance and intrusion scale was 7.10 (SD =8.6; range = 0-49).

OUTCOME VARAIBLES

Early Detection Behaviors

Early detection behaviors were considered separately for women 40 and over (n = 110) and women under 40 (n = 77). Among the older women, 94.5% reported a history of mammography with 79.1% having two or more mammograms in the last two years, 12.7% reported one mammogram in the last two years, and 8.2% reported no mammogram in the last two years. In the older group, 98.2% reported a history of clinical breast exam ever, 92.7% reported a history in the last two years, 89.1% reported a history of breast self exam, and 75.5% reported doing a breast self exam in the last six months. In women under 40, 32.9% reported a history of

mammography, while 77.6% reported talking with a health care provider about beginning mammography before the age of 40 due to their family history. In the younger group, 97.4% reported a history of clinical breast exam, 90.8% had a clinical breast exam in the last two years, 90.8% reported breast self exam ever, and 68.4% reported doing a breast self exam in the last six months.

When considering all women in this sample, 69.8% reported ever having a mammogram, 97.3% reported a history of clinical breast exam with 91.4% having a clinical breast exam in the last 2 years, and 89.3% reported a history of breast self exam with 72.2% reporting self exam in the last six months. Others have also reported finding similar levels of adherence in community samples (e.g., 91% of community recruited sample of women 40 years and older reported history of mammography; Lipkus, Biradavolu, Fenn, Keller, & Rimer, 2001). This information is summarized in Table 9, which includes the χ^2 statistics for differences between the age groups for shared behaviors. The only significant difference between age groups, as expected, was the use of mammography, χ^2 (df =1, N = 186) = 80.4; $p < .001$.

Table 9. Rates of early detection behaviors by age.

	Age Category		Total	χ^2 *(df = 1, n =186)*
	≥ 40	*< 40*		
	n = 110	n = 77	N = 187	p value
History of Mammography	94.5%	32.9%	69.8%	<.001
Mammography in last 2 years	91.8%	-	-	-
Talk with provider about early mammography	-	77.6%	-	-
History of Clinical Breast Exam	98.2%	97.4%	97.3%	.54
Clinical Breast Exam in last 2 years	92.7%	90.8%	91.4%	.41
History of Breast Self Exam	88.9%	90.8%	89.3%	.45
Breast Self Exam in last 6 months	75.5%	68.4%	72.2%	.19

Composite Score for Early Detection Behaviors. Early detection behaviors are often considered separately in the literature although their collective and individual importance, particularly for women with a family history of disease, warranted examination of a composite score of these behaviors. Composite scores for women 40 and over (n = 110) were created from the item measuring adherence to mammograms over the last two years,[4] history of clinical breast exam, clinical exam in the last two years, history of breast self exam, and breast self exam in the last six months. Each yes answer to these questions was given a score of 1 and each no question was given a score of 0. The possible range of scores for this composite was 0-5. The mean score for women 40 or over in this sample was 4.3 (range 1-5; SD =1.0).[5]

The composite score for women under 40 (n = 77) was created from the items assessing whether or not the women talked with a healthcare provider about early mammography, history of clinical breast exam, clinical exam in the last two years, history of breast self exam, and breast self exam in the last six months. Each yes answer to these questions was given a score of 1 and each no question was given a score of 0. The possible range of scores for this composite was 0-5. The mean score of women under 40 in this sample was 4.3 (range 1-5; *SD* =1.0). Finally, the composite scores for both age groups combined into one variable to create a composite score for the group. Other researchers have also used different adherence criteria across age groups to construct an adherence score (e.g., mammography; Bowen, Alfano, McGregor, & Andersen, 2004). The combined mean was 4.3 (range 1-5; *SD* =1.0).

[4] The importance of repeat adherence, referring to regularly completed mammography, has been suggested in recent literature because the greatest benefit of mammography is achieved with regular screening (i.e., Clark, Rakowski, & Bonacore, 2003; Rakowski et al., 2003), thus adherence in this study was described as two mammograms in the last two years.

[5] There was one 40 year old participant who had only had one mammogram in the last two years, because she was adherent on all other measures, due to her age, she was also coded as adherent on the mammogram item. Additionally, there were two 41 year olds who had only had one mammogram, but also due to their age and adherence on other measures, there mammography score was coded as adherent.

ANOVAs and bivariate correlations were used to explore the relationships between the individual early detection behaviors and the composite score of early detection behaviors and other study variables. As would be expected, the results generally suggest that the composite score shares similar relationships with other study variables as do the individual behaviors (see Table 10). In fact, other research has found that clinical breast exams are predictors of mammography (i.e., Wallace, MacKenzie, & Weeks, 2006). The combined composite score is used in all further analyses that include early detection behavior unless otherwise noted.

Table 10 . ANOVAs (F score reported) for individual behaviors and study variables and correlation (r's reported) for the early detection behavior combined variable and study variables.

	Mammo Adhere	Talk with Provider	Overall Mammo Adhere	CBE History	CBE Frequency	BSE History	BSE Frequency	Early Detection Combined
degrees of freedom	*(1, 108)*	*(1, 74)*	*(1, 184)*	*(1, 184)*	*(1, 184)*	*(1, 184)*	*(1, 184)*	*(1, 184)*
Age	4.1*	3.1	2.4	.66	.62	.27	.89	.09
5-year risk	8.4**	4.0*	5.0*	.002	1.8	.20	.97	.12
Lifetime risk	6.5**	2.9	9.6**	1.17	2.8	2.3	.25	.16*
Harvard Risk Index	3.5	.24	2.7	.26	.66	.24	.55	.05
Education	1.8	.83	2.5	2.3	6.0*	12.1**	1.2	.22**
Income	5.5*	7.9**	14.0**	2.7	5.4*	11.4**	6.4*	.33**
Communication	5.0*	28.3**	28.9**	.17	3.3	7.0**	10.9**	.35**
Recommend Prevention	.63	3.8*	2.9	.95	.05	.02	.04	.05
Familiarity with Prevention	.32	4.7*	4.2*	.69	5.7*	.92	.53	.16*

Recommend Early Detection	17.5**	28.1**	38.5**	9.0**	30.0**	2.6	4.9*	.41**
Perceived Risk	6.4*	.66	7.3**	1.4	3.7*	.009	.62	.15*
Conviction Perceived Risk	.21	.54	.84	3.4	.16	1.7	1.4	.12
Cancer Worry	1.1	1.6	2.9	.52	.32	.41	.41	.04
Cancer Distress	.13	1.5	1.5	.001	1.2	1.6	2.1	-.07
Attitude Information	4.0*	.06	3.0	1.4	3.5	.50	.84	.09
Attitude Utility	4.4	3.8*	6.3*	2.2	6.1*	.04	.04	.15*
Attitude Prevent Surgery	.05	1.6	.45	1.6	1.0	.48	.02	.02
Attitude Worth	1.2	.82	1.2	13.5**	10.6**	.18	2.4	.21**
Adherence Intentions	9.1**	18.69**	23.3**	10.3**	22.3**	1.9	3.2	.36**
Clinic Contact Intentions	.31	.001	.05	.55	1.6	.25	.05	.02

Note. Mammo Adhere includes only women 40 years old or over (n = 110). Talk with provider includes only women under the age of 40. *p < .05. **p < .01.

Clinic Contact Intentions

At baseline, the mean score for this question was 3.4 (*SD* =1.2; Definitely no = 5.9%, 2 = 16.6%, 3 = 31.6%, 4 = 19.3%, and Definitely yes = 26.7%). At the two week call, the mean score was 3.2 (*SD* =1.2; Definitely no = 10.8%, 2 =16.8%, 3 = 30.5%, 4 = 23.4%, Definitely yes = 18.6%); at six weeks (*n* = 120), the mean score was 3.5 (*SD* =1.1; Definitely no = 4.2%, 2 = 14.2%, 3 = 30.0%, 4 = 26.6%, Definitely yes = 25.0%).

Clinic Contact Behavior

All participants completed the first follow-up call and 143 of a possible 149 completed the last follow-up call. At the two week call, 20 participants had contacted the clinic; at the six week call, 23 additional participants had contacted the clinic. In total, 43 (23.4) participants reported contacting the clinic and 138 (76.2) reported not contacting the clinic.

Adherence Intentions

In this study, the sample mean for the ADQ adherence intentions scale was 17.3 (*SD* =2.1; *range* = 11-20).

PRELIMINARY ANALYSES

Correlational coffecients were used to describe the relationships between each continuous predictor and outcome variable described above. Table 11 shows all relationships among background variables (age, 5-year risk, lifetime risk, Harvard Risk Index, education, and income), Table 12 shows the relationship among background variables and predictor variables (healthcare communication factors, perceived risk factors, cancer worry, cancer distress, attitude factors), Table 13 shows the relationship between the outcome variables (adherence intentions, early detection behavior, and clinic contact intentions) and background and predictor variables, and Table 14 shows the relationship between the predictor variables.

ANOVAs were used to describe relationships between the continuous study variables and categorical study variables (e.g., race, martial status). Table 15 and Table 16 summarize the significant relationships between race and marital status, respectively, with other study variables.

Table 11. Pearson correlations between background variables.

	Age	5-year risk	Lifetime risk	Harvard Risk Index	Education	Income
Age	-					
5-year risk	.86**	-				
Lifetime risk	-.20**	.19*	-			
Harvard Risk Index	.09	.23**	.25**	-		
Education	-.13	-.09	.27**	.16*	-	
Income	.19*	.17*	.22**	.01	.42**	-

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

Table 12. Pearson correlations between background and predictor variables.

	Age	5-year risk	Lifetime risk	Harvard Risk Index	Education	Income
Communication	.04	.07	.11	.03	.08	.17*
Rec Prevention	.04	.11	.11	.11	-.13	-.06
Familiarity with Prevention	.12	.19*	.18*	.12	.17*	.31**
Rec Early Detection	.38**	.36**	.01	.07	.04	.21**
Perceived Risk	-.10	.04	.23*	.07	-.14	-.04
Conviction Perceived Risk	.11	.11	-.06	.01	-.13	-.10
Cancer Worry	-.14	-.12	-.07	-.04	-.27**	-.15*
Cancer Distress	-.08	-.16*	-.12	-.14	-.20**	-.22**
Attitude Information	.19**	.20**	-.04	-.03	-.12	-.15*
Attitude Utility	.07	.10	.14	-.02	.12	.20**
Attitude Prevention	.13	.05	-.11	-.06	-.36**	-.03
Attitude Worth	.13	.16*	.015	.02	.05	.12

Note. Rec = Recommend. * = $p < .05$, ** = $p < .01$.

Table 13. Pearson correlations between outcome measures and background and other predictor variables.

	Adherence Intentions	Early Detection Behaviors	Contact Intentions	Contact Intentions 2-week	Contact Intentions 6-week
Age	.25**	.09	.06	-.02	.07
5-year risk	.23**	.12	.05	-.06	-.05
Lifetime risk	.01	.16*	-.06	-.12	-.21*
Harvard Risk Index	-.05	.05	.03	-.13	.06
Education	.02	.22**	-.30**	-.23**	-.24*
Income	.19*	.33**	-.28**	-.16*	-.27*
Communication	.36**	.35**	.06	-.08	-.14
Recommend Prevention	-.10	.05	.07	-.02	-.05
Familiarity with Prevention	.17*	.16*	-.14	-.06	-.15
Recommend Early Detection	.46**	.41**	.11	.04	.03
Perceived Risk	.06	.15*	.09	.09	.17*
Conviction Perceived Risk	.14	.12	.10	.09	.19*
Cancer Worry	.01	.04	.17*	.26**	.25**
Cancer Distress	.01	-.07	.24**	.23**	.22*
Attitude Information	.23**	.09	.34**	.26**	-.05
Attitude Utility	.50**	.15*	.11	.02	.04
Attitude Prevention	.03	.02	.35**	.35**	.32**

Attitude Worth	.57**	.21**	.18*	.04	-.04

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

Table 14. Pearson correlations predictor variables.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. Communication	-											
2. Recommend Prevention	.15*	-										
3. Familiarity with Prevention	.24**	.17*	-									
4. Recommend Early Detection	.35**	.16*	.17*	-								
5. Perceived Risk	.12	.21**	-.03	.10	-							
6. Conviction Perceived Risk	.22**	.11	.02	.16*	.30**	-						
7. Cancer Worry	.06	.18*	.05	-.04	.42**	.24**	-					
8. Cancer Distress	.07	.25**	-.10	.01	.21**	.18*	.54**	-				
9. Attitude Information	.19*	.11	-.04	.28**	.11	.06	.16*	.10	-			
10.Attitude Utility	.20**	-.17*	-.01	.31	.11	.10	-.15*	-.11	.11	-		
11.Attitude Prevention	-.03	.15*	-.05	.16*	.19*	.09	.28**	.16*	.41**	.04	-	
12.Attitude Worth	.12	-.07	-.08	.25**	.07	.12	.02	.02	.08	.29**	-.04	

Note. * = p < .05, ** = p < .01

Table 15. Significant relationships between race and other study variables.

	Caucasian *M (SD)*	African American /Black *M (SD)*	*df*	*F*	*p*
Lifetime Risk	18.7(3.0)	11.8(3.8)	1, 181	143.2	<.001
Education	3.3(.85)	2.0(.94)	1, 180	60.1	<.001
Income	3.4(1.3)	2.0(.94)	1, 177	29.7	<.001
Familiarity with Prevention	.4.2(3.7)	2.6(3.6)	1,181	6.1	.014
Cancer Worry	-.10(.64)	.40(1.2)	1,181	12.2	.001
Cancer Distress	6.2(7.5)	10.5(11.7)	1, 181	7.4	.007
Attitude Utility	12.6(1.7)	11.7(2.5)	1,176	5.3	.023
Attitude Prevention Strategies	11.9(3.73)	13.5(4.6)	1, 178	4.4	.037
Early Detection Behavior	4.4(0.9)	3.8(1.3)	1, 180	12.5	.001
Clinic Contact Intentions	3.3(1.2)	3.9(1.3)	1, 181	7.4	.006
2 week clinic contact intentions	3.0(1.2)	3.9(1.7)	1, 161	14.6	<.001
6 week clinic contact intentions	3.4(1.1)	4.3(.91)	1,114	13.5	<.001

Note. Variables examined with no significant relationships included age, 5-year risk, Harvard Risk Index, healthcare communication, provider recommend prevention, provider recommend early detection, perceived risk, conviction of perceived risk, attitude information, attitude worth prevention, and adherence intentions.

Table 16. Significant relationships between partner status and other study variables.

	Marriage-like Relationship (n = 94)	Never Married (n = 59)	Divorced (n = 25)	Widowed (n = 9)	df	F	p
Age	42.9(10.7)	36.0(11.0)	47.2(9.5)	58.6(5.9)	3, 183	15.6	<.001
5-year risk	1.4(1.0)	.96(1.2)	1.92(1.26)	2.4(.97)	3,183	8.0	<.001
Education	3.2(.91)	3.0(1.1)	2.6(1.0)	2.2(.97)	3,182	4.32	.006
Income	3.7(1.4)	2.4(1.0)	2.8(1.0)	2.6(1.4)	3, 179	16.29	<.001
Attitude Prevention Strategies	11.7(3.7)	12.1(4.1)	13.8(3.2)	14.4(5.4)	3, 180	2.76	.044
Adherence Intentions	17.5(1.9)	16.6	17.7(1.9)	17.4(2.1)	3, 179	2.76	.043
6 week clinic contact intentions	3.28(1.2)	3.6(.92)	4.3(1.0)	5.0(0.0)	3, 97	4.6	.005

Note. Variables examined with no significant relationships included lifetime risk, yourdiseaserisk.com rating , cancer worry, cancer distress, healthcare communication, provider recommend prevention, familiarity with prevention, provider recommend early detection, perceived risk, perceived risk conviction, attitude information, attitude utility, attitude prevention, attitude worth, early detection behaviors, baseline clinic contact intentions, 2 week clinic contact intentions.

TESTING THE HYPOTHESES

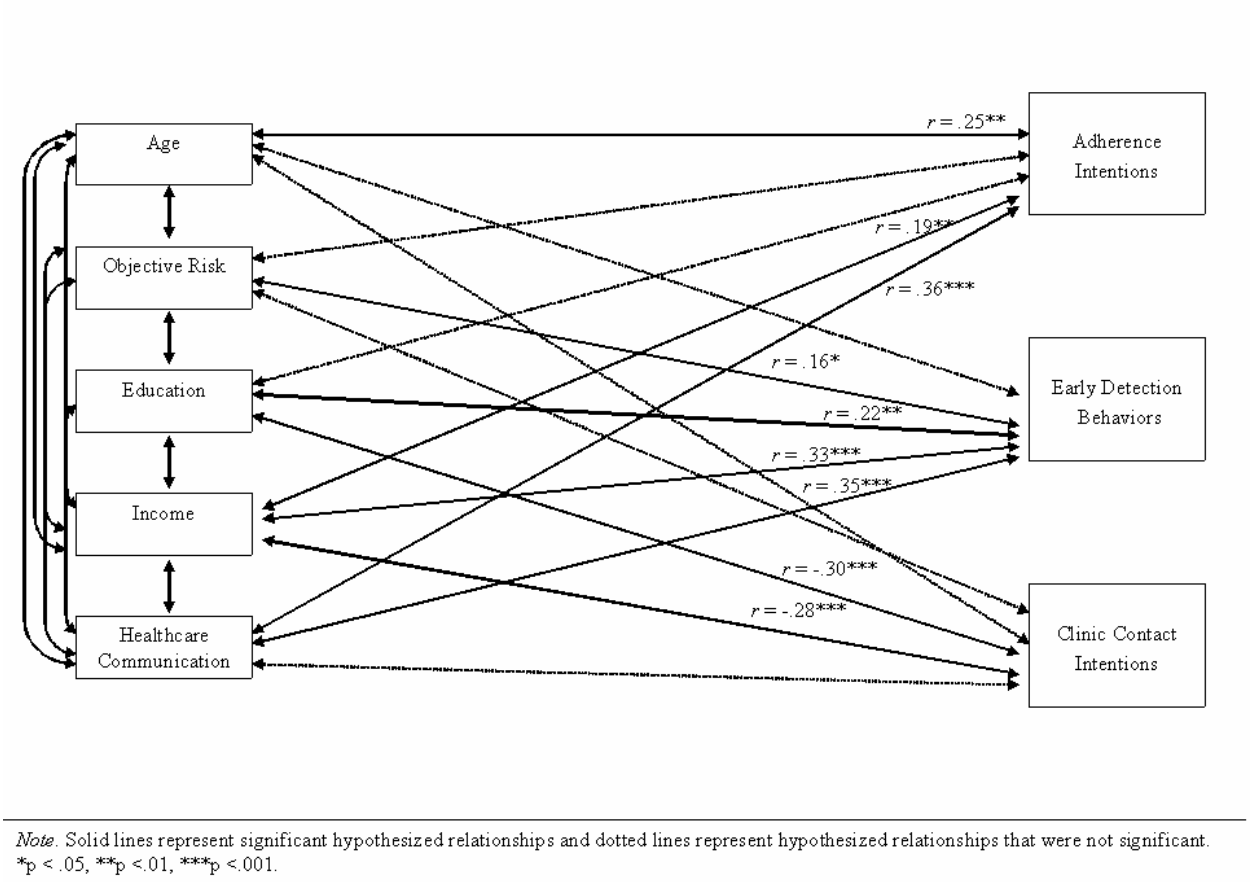
When testing the hypotheses, the variables of age, lifetime objective risk, education, income, Healthcare Communication (factor 1), Perceived Risk (factor 1), Attitudes Toward Information Seeking and Attitudes Toward Worth of Prevention and Surveillance (factor 1 and 4), Cancer Worry, Cancer Distress, adherence intentions, composite score of early detection behavior, and clinic contact intentions at baseline were used.

Primary Aim 1

The hypotheses and results for this aim are summarized in Figure 7. The first aim of this study was to examine the relationship between the outcome variables (adherence intentions, early detection behavior, and clinic contact) and age, objective risk, education, income, and healthcare communication (see Table 13). It was expected that age would be positively related to early detection behaviors and negatively related to adherence intentions and clinic contact intentions. In this sample, the only significant relationship was a positive association between age and adherence intentions ($r = .25$, $p = .001$). Objective risk was expected to be positively associated with all the outcomes, but was only related to early detection behaviors ($r = .16$; $p = .03$). Education was expected to be positively related to all outcomes; early detection behaviors supported this hypothesis ($r = .22$; $p = .002$), while clinic contact intention was negatively related to education ($r = -.30$; $p < .001$), and adherence intentions were not related. As expected,

income was positively related to both early detection behaviors (r = .33; p < .001) and adherence intentions (r = .19; p = .01), however contrary to expectations, it was negatively related to clinic contact intentions (r = -.28; p < .001). Consistent with predictions, healthcare communication was positively associated with early detection behaviors (r = .35; p < .001) and adherence intentions (r = .36; p < .001).

Figure 7. Results for Aim 1.



Note. Solid lines represent significant hypothesized relationships and dotted lines represent hypothesized relationships that were not significant.
*p < .05, **p <.01, ***p <.001.

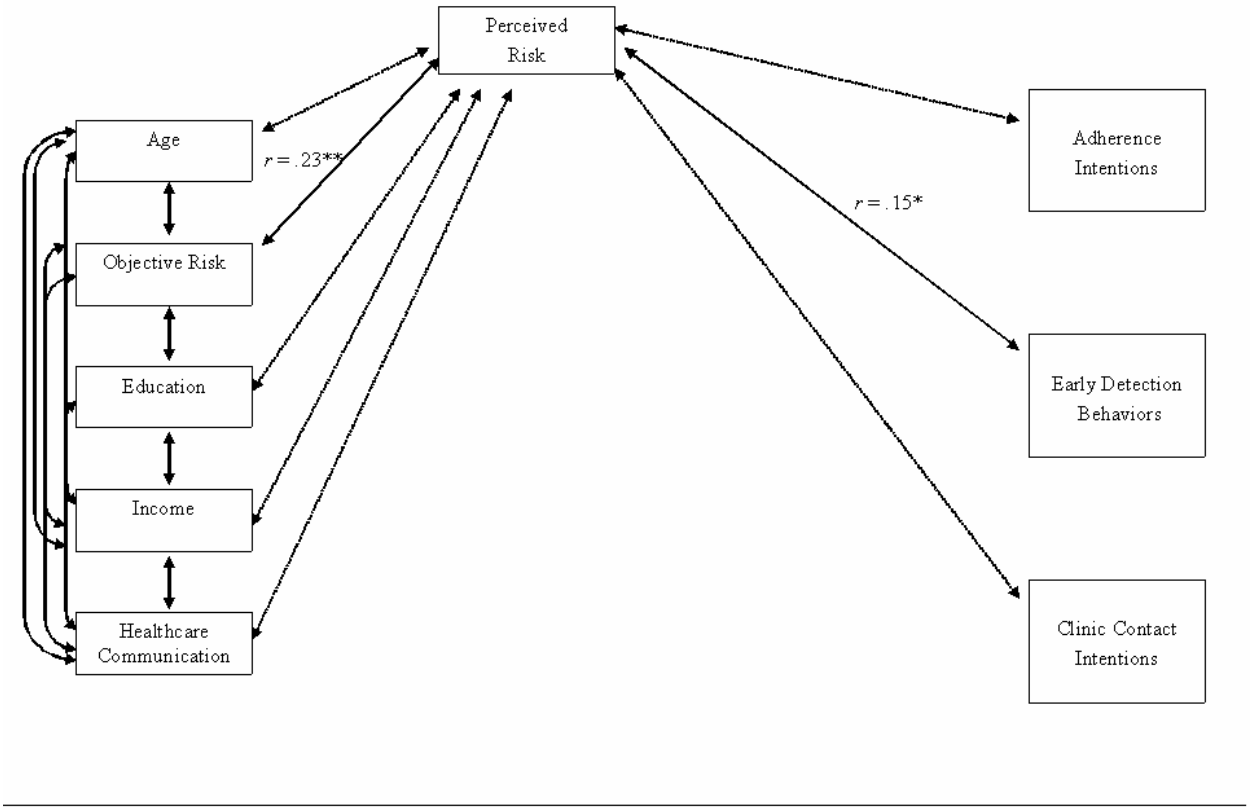
Figure 7. Results for Aim 1.

Primary Aim 2

The hypotheses and results of this aim are presented in Figure 8. The first objective for Aim 2 was to examine the relationship between perceived risk and each outcome variable (see Table 13). The only relationship found was between perceived risk and early detection behaviors (r = .15; p = .04). Perceived risk was not related to adherence intentions or clinic contact intentions. The second objective of this aim was to investigate the relationships between the background variables and perceived risk (see Table 12). It was expected that age would be negatively related to perceived risk; no relationship was found. It was also expected that perceived risk would be positively related to objective risk, education, income, and healthcare communication. The only relationship found was between perceived risk and objective risk (r = .23; p = .002). Finally, perceived risk was investigated as a mediator of the relationship between age and outcomes, objective risk and outcomes, education and outcomes, and income and the outcomes. Based on the above bivariate results (e.g., Baron & Kenny, 1986), the only testable relationship was examining perceived risk as a mediator of objective risk and early detection behavior. To test the mediating hypothesis, partial correlations were done controlling for perceived risk and examining whether objective risk accounted for any residual variation in early detection behaviors; the resulting correlation was decreased (r = .11; p = .14) suggesting mediation. However, when testing the statistical significance of the mediation with the Sobel test (outlined above in the Statistical Analyses section), the change in the relationship between objective risk and early detection behaviors when controlling for perceived risk was not significant (z = 1.52; p

= .13). This suggests that objective risk and perceived risk influence early detection behavior along separate pathways.

Figure 8. Results for Aim 2.



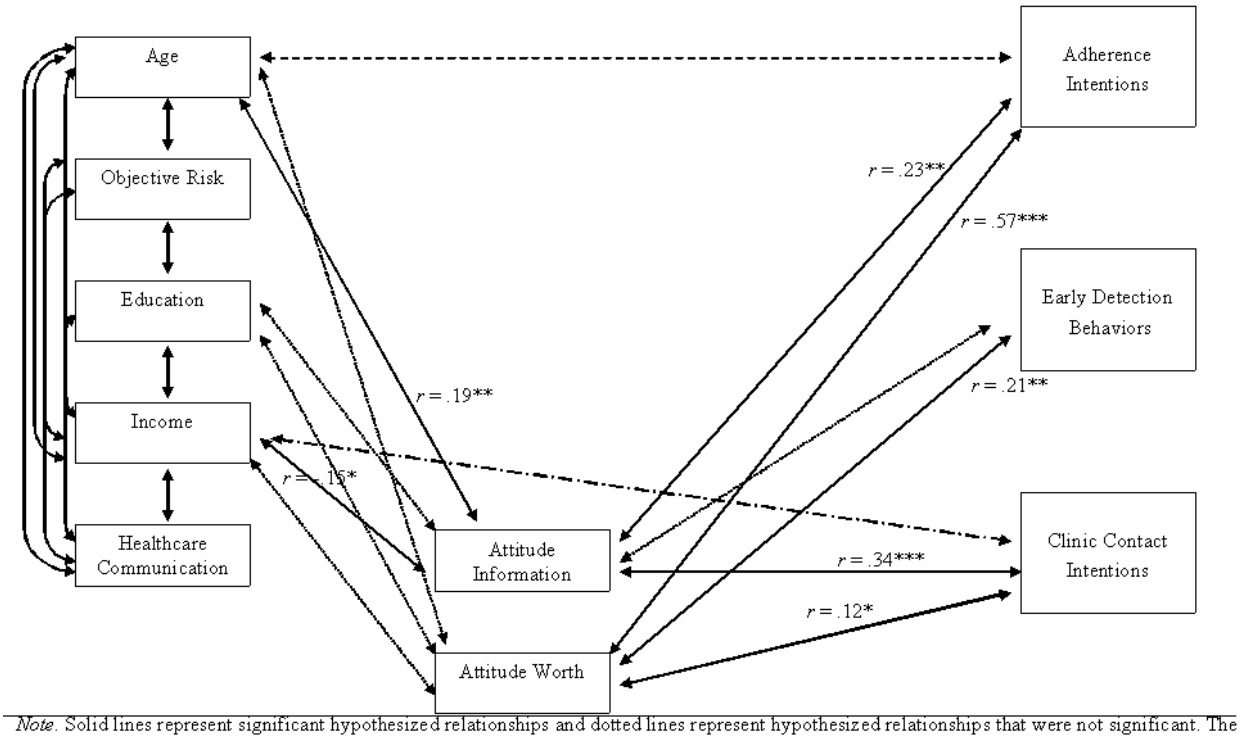
Note. Solid lines represent significant hypothesized relationships and dotted lines represent hypothesized relationships that were not significant.
*p < .05, **p <.01, ***p <.001.

Figure 8. Results for Aim 2.

Primary Aim 3

The hypotheses and results for Aim 3 are represented in Figure 9. The first objective of this aim was to examine the relationship between attitudes and the outcome variables (see Table 13). Attitude Information was positively related to adherence intentions ($r = .23$; $p = .002$) and clinic contact intentions ($r = .34$; $p < .001$), but not to early detection behaviors. As expected, Attitude Worth was positively related to early detection behaviors ($r = .21$; $p = .005$), adherence intentions ($r = .57$; $p < .001$), and clinic contact intentions ($r = .18$; $p = .02$).

Figure 9. Results for Aim 3.



Note. Solid lines represent significant hypothesized relationships and dotted lines represent hypothesized relationships that were not significant. The dashed line represents hypothesized mediation that was significant. The dash dot line represents the significant suppressor effect that attitude Information had on the relationship between income and clinic contact intentions. *p < .05, **p <.01, ***p <.001.

Next the relationship among the background variables and attitudes were examined. It was expected that attitudes would be positively related to age, education, and income, but not related to objective risk and healthcare communication (see Table 12). Attitude Information was positively related to age (r = .19; p = .009), healthcare communication (see Table 14; r = .19; p = .01), and negatively associated with income (r = -.15; p = .05). Attitude Worth was not related to the background variables. It was expected that attitudes would at least partially mediate the relationship between age, education, and income, and the outcomes. Education could not be tested in mediational relationships because of the lack of necessary bivariate results (Baron & Kenny, 1986); the results of testable relationships are reported below.

To examine whether or not Attitude Information mediated the relationship between age and adherence intentions, partial correlations were done controlling for Attitude Information; there was a decrease in the relationship (r = .20; p = .009) between age and adherence intentions. However, when testing for statistical significance using the Sobel test (z = 1.88; p = .06) the change in the relationship between age and adherence intentions when controlling for Attitude Information was not statistically significant and did not indicate mediation. These results suggests that age and Attitude Information influence adherence along separate pathways.

To examine Attitude Information as a mediator of the relationship between income and adherence intentions, partial correlations were done controlling for Attitude Information. Unexpectedly, Attitude Information was not a mediator of this relationship, rather it had a suppressor effect and by controlling this variable the degree of relationship between the income and adherence intentions increased (r = .22; p = .004). Suppression occurs when a variable increases the predictive validity of another variable when controlled for in a statistical equation (Tzelgov & Henik, 1991). However, when testing for statistical significance of this change,

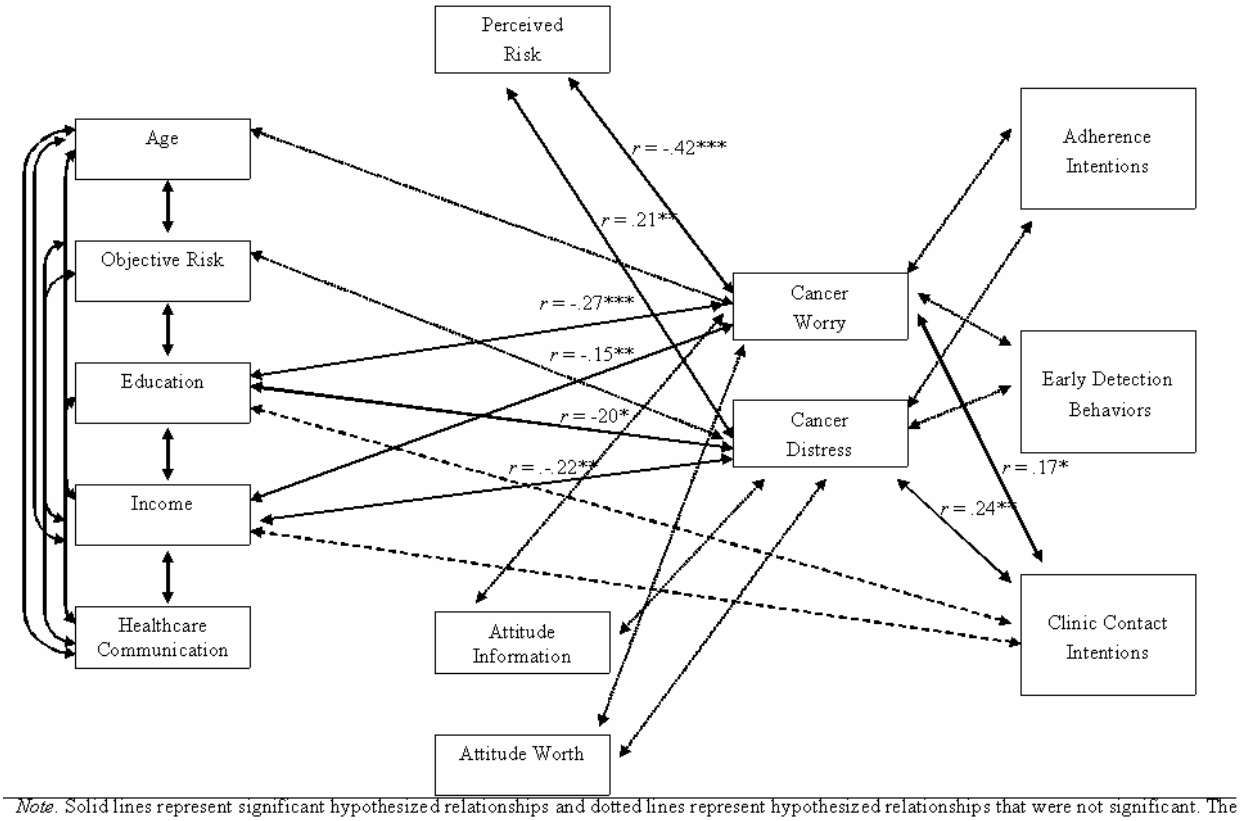
Sobel tests revealed that the change was not significant (z = -1.76; p = .07). This suggests that Attitude Information and income influence adherence intentions along separate pathways.

To examine Attitude Information as a mediator of the relationship between Attitude Information and clinic contact intentions, partial correlations were done controlling for Attitude Information. Again, Attitude Information was not a mediator of this relationship, but rather a suppressor, and the relationship between income and clinic contact intentions increased (r = -.24; p = .001); however, results of the Sobel test indicate that the change in relationship was not significant (z = -1.82; p = .07).

Primary Aim 4

The hypotheses and results of Aim 4 are summarized in Figure 10. There were several objectives, beginning with the relationships among Cancer Worry and Cancer Distress and each outcome behavior. Both Cancer Worry and Cancer Distress were predicted to be positively related to outcomes. However, the only relationships found were between clinic contact intentions and Cancer Worry (r = .17; p = .02) and Cancer Distress (r = .24; p = .001; see Table 13). The second objective of this aim was to test the relationship between perceived risk and Cancer Worry and Cancer Distress, and attitudes and Cancer Worry and Cancer Distress. Both Cancer Worry and Cancer Distress were positively related to perceived risk (see Table 14; r = .42; p < .001 and r = .21; p = .004, respectively). As predicted, Attitude Information was related to Cancer Worry (r = .16; p = .03); contrary to expectations Attitude Worth was not related to either cancer specific distress variable.

Figure 10. Results for Aim 4.



Note. Solid lines represent significant hypothesized relationships and dotted lines represent hypothesized relationships that were not significant. The dashed line represents hypothesized mediation that was significant. Cancer distress partially mediated the relationship between education and clinic contact intentionsand between income and clinic contact intentions. *p < .05, **p <.01, ***p <.001.

Figure 10. Results for Aim 4.

It was hypothesized that age, education, and income would all be positively related to cancer specific distress (see Table 12). Contrary to these hypotheses, in this sample, age was not related to either Cancer Worry or Cancer Distress. Also unexpectedly, education was negatively related to Cancer Worry ($r = -.27$; $p < .001$) and Cancer Distress ($r = -.20$; $p = .008$), as was income ($r = -.15$; $p = .05$ and $r = -.22$; $p = .003$, respectively). As hypothesized, neither objective risk nor communication was related to cancer specific distress (see Table 14).

Cancer Worry and Cancer Distress were expected to at least partially mediate the relationships between perceived risk and the outcomes, and age and the outcomes. No direct relationships met criteria to test for these mediational relationships (e.g., Baron & Kenny, 1986). Cancer Distress also was expected to at least partially mediate the relationship between attitudes and outcome variables. The only testable relationship was that of Cancer Worry mediating the relationship between Attitude Information and clinic contact intentions. Partial correlations were done controlling for Cancer Worry and examining whether Attitude Information accounted for any residual variation in clinic contact intentions. The relationship between cancer worry and clinic contact intentions was decreased when controlling for attitude information ($r = .11$; $p = .15$). However, the results of the Sobel test ($z = 1.97$; $p = .05$) suggest that the difference was not significant and that both Attitude Information and Cancer Worry influence clinic contact intentions along separate pathways.

Cancer Worry and Cancer Distress were hypothesized to at least partially mediate the relationship between education and outcome variables. Two testable relationships were identified. Partial correlations were done controlling for Cancer Worry and examining whether education accounted for any residual variation in clinic contact intentions. Although the resulting correlation decreased ($r = .28$; $p < .001$), results of the Sobel test were not significant ($z = -1.35$;

p = .17). This suggests that both education and Cancer Worry influence clinic contact intentions along separate pathways.

Partial correlations were also done controlling for Cancer Distress and examining whether education accounted for any residual variation in clinic contact intentions. The resulting correlation was decreased (r = -.28; p < .001) although the results of the Sobel test suggest that the difference was not significant (z = -1.91; p = .06). This suggests that Cancer Distress and education influence clinic contact intentions along separate pathways.

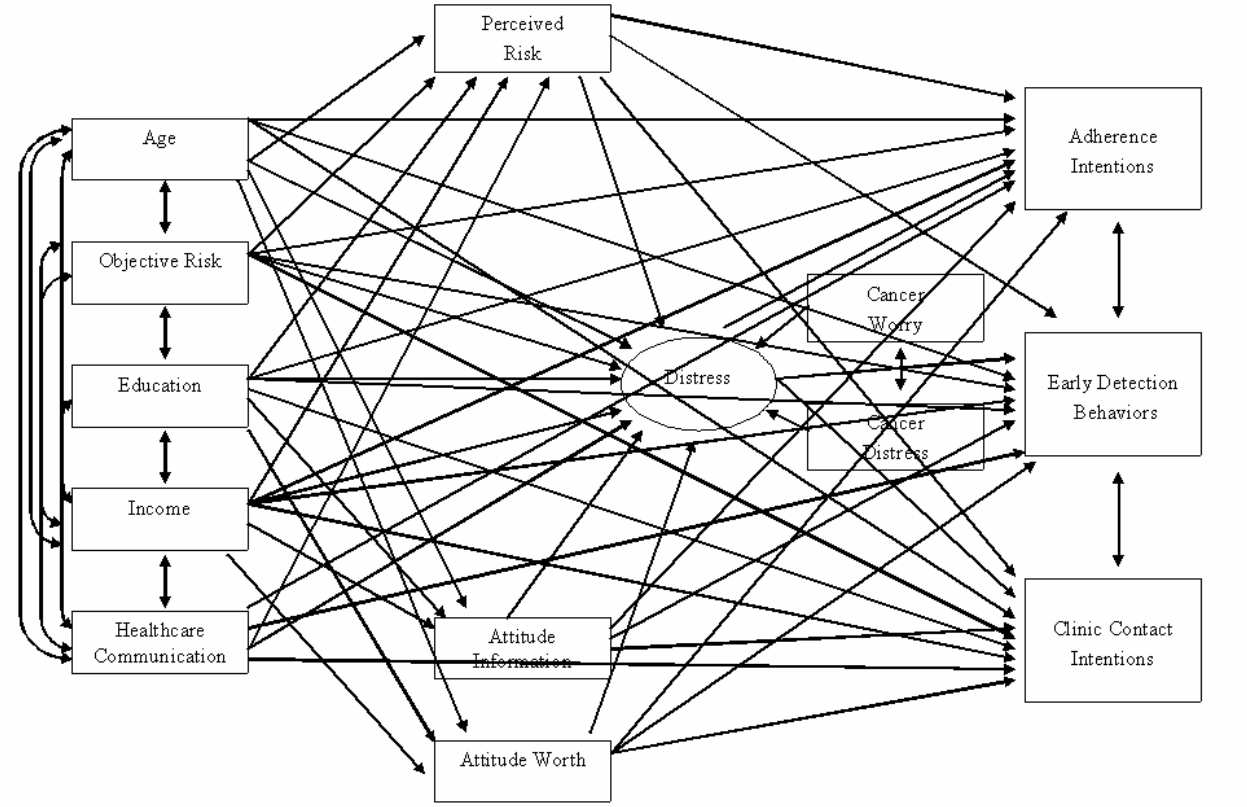
Finally, Cancer Worry and Cancer Distress were expected to at least partially mediate the relationship between income and outcome variables. Partial correlations were done controlling for the influence of Cancer Worry and examining whether income accounted for any residual variation in clinic contact intentions. The resulting correlation was decreased (r = -.26; p < .001), however Sobel tests suggest that the mediation was not statistically significant (z = 1.31; p = .19), suggesting that income and Cancer Worry impact clinic contact intentions along separate pathways. Partial correlations were done controlling for the influence of Cancer Distress and examining whether income accounted for any residual variation in clinic contact intentions. The resulting correlation was decreased (r = -.24; p = .001) significantly (z = 1.96; p = .04). This suggests that Cancer Distress partially mediates the relationship between income and clinic contact intentions.

Primary Aim 5

The last primary aim of this study involved testing the hypotheses using SEM as to account for unique variance among the predictor variables and outcomes, and to better explain the

relationships between these variables. Initially, SEM using EQS software was used to test the fit of the proposed model examining all hypothesized pathways (Figure 11). This model did not converge, thus results were not interpretable. The failure of the initial model to converge was due to parameter values with illogical values known as "Heywood cases" (e.g., negative error variances). Heywood cases are usually caused by misspecification of the model, a combination of small sample sizes and only two indicators per latent variable, and/or bad starting values in maximum likelihood estimation**.** Due to this, as well as the ratio of variables in the model and the number of participants, it was determined that the model should be respecified. To respecify the model and evaluate the fit of the revised model to the same data, the study hypotheses and the results of bivariate analyses were given close attention when determining initial pathways. The respecified model is represented in Figure 12. The respecified model data did converge making it possible to validate the measurement model and then examine the fit of the structural model.

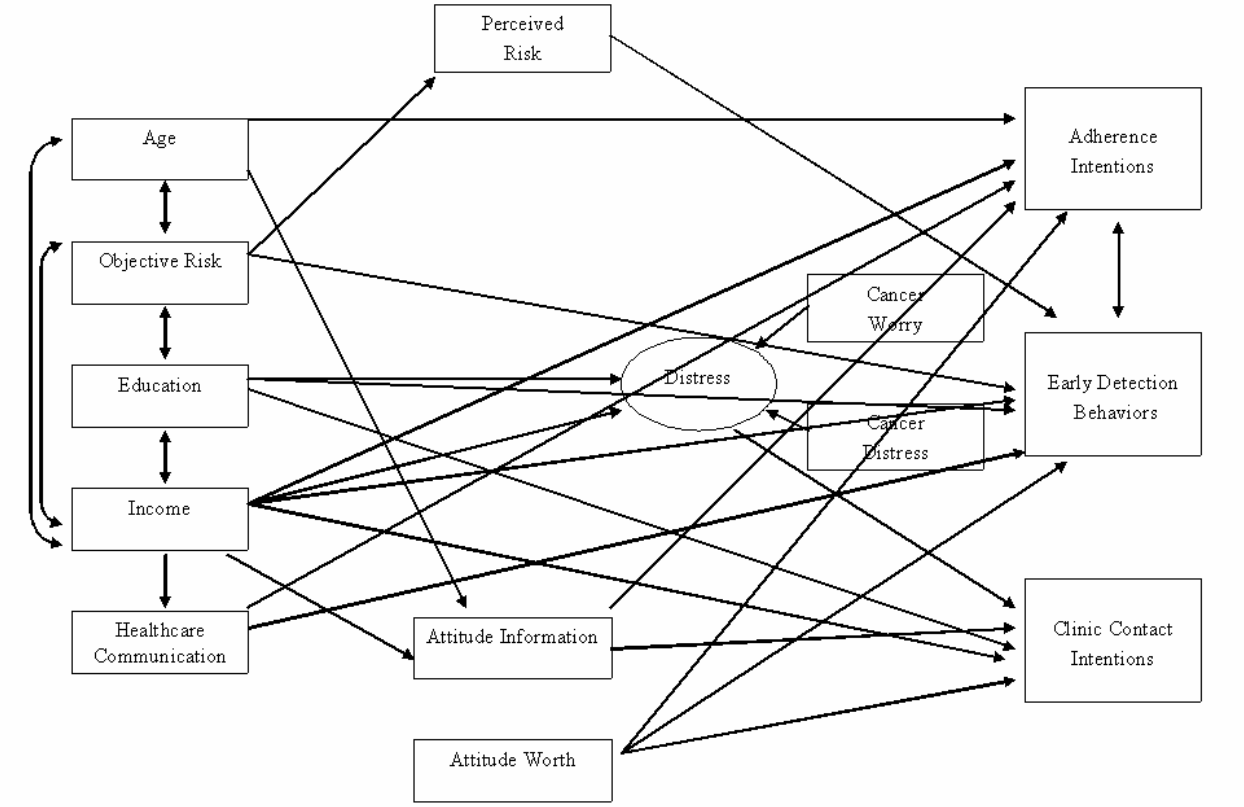
Figure *11*. Full hypothesized model tested with structural equation modeling.



Note. Correlation modeled between dependent variables represents the correlation between the error terms (e.g., cancer worry and cancer distress, adherence intentions and early detection behaviors, early detection behaviors and clinic contact intentions).

Figure 11. Full hypothesized model tested with structural equation modeling.

Figure 12. Respecified model.



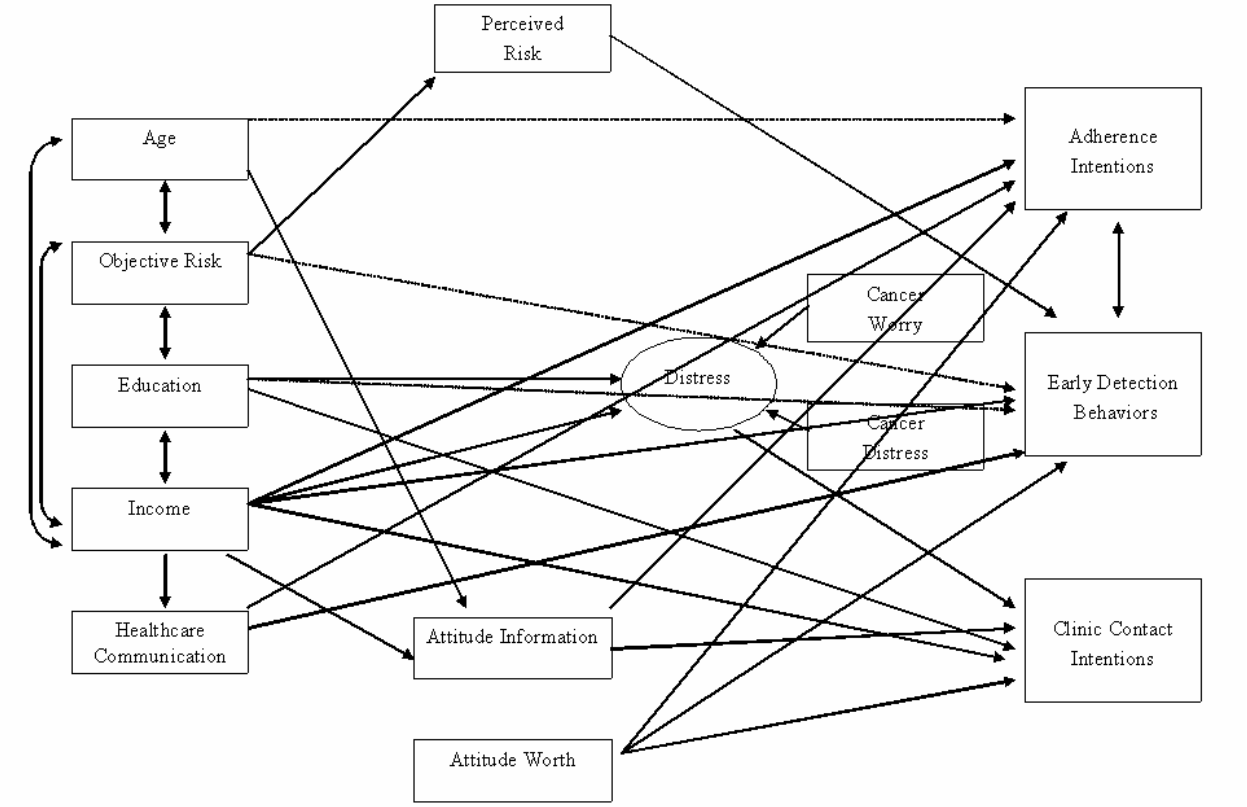
Note. Correlation modeled between dependent variables represents the correlation between the error terms (e.g., adherence intentions and early detection behaviors).

Figure 12. Respecified. Model.

Although the respecified model did converge, it was rejected, as it did not meet the minimum criteria of goodness of fit. Model modification indexes were used until an acceptable model was produced. The first modifications were made to parameters that were dropped based on non-significant parameter estimates and Wald W indexes. Parameters that were dropped included adherence intentions predicted by age and early detection behavior predicted by objective risk and education. This new model is shown in Figure 13. The second model did not meet goodness of fit criteria, using the same modification criteria as above, the parameter of education predicting the factor Cancer Distress was dropped. The third model is shown in Figure 14. The third model did not meet goodness of fit criteria and again using the overlap between nonsignficant parameter estimates and Wald W indexes, two additional parameters were dropped: clinic contacted predicted by income and early detection behaviors predicted by perceived risk were excluded from the fourth model. Model 4 is shown in Figure 15. The fit again was not acceptable, and based on results of the Lagrange Multiplier index, a path was added predicting Attitudes Toward Information Seeking from healthcare communication (Figure 16). Again, the model did not meet fit criteria, and modification indexes resulted in the addition of a path from perceived risk to the factor score of Cancer Distress. This model is shown in Figure 17, and the model fit was acceptable (Satorra-Bentler χ^2 (52, N = 173) = 59.74; p = .22; CFI = .98, RMSEA =.029). Based on modification indexes, two additional models were tested. In the first model, perceived risk predicted by education was added and clinic contact intention predicted by the latent variable Cancer Distress was dropped (Figure 18). Again, although the model was significant, based on modification indexes, parameters were added that predicted clinic contact intention from the latent variable distress and early detection behaviors from perceived risk. The last tested model is displayed in Figure 19. Chi-square difference tests were

used to determine the best model (See Table 17). The best model was the final model represented in Figure 19 (Satorra-Bentler χ^2 (50, N = 173) = 51.95; p = .40; CFI = .99, RMSEA =.015).

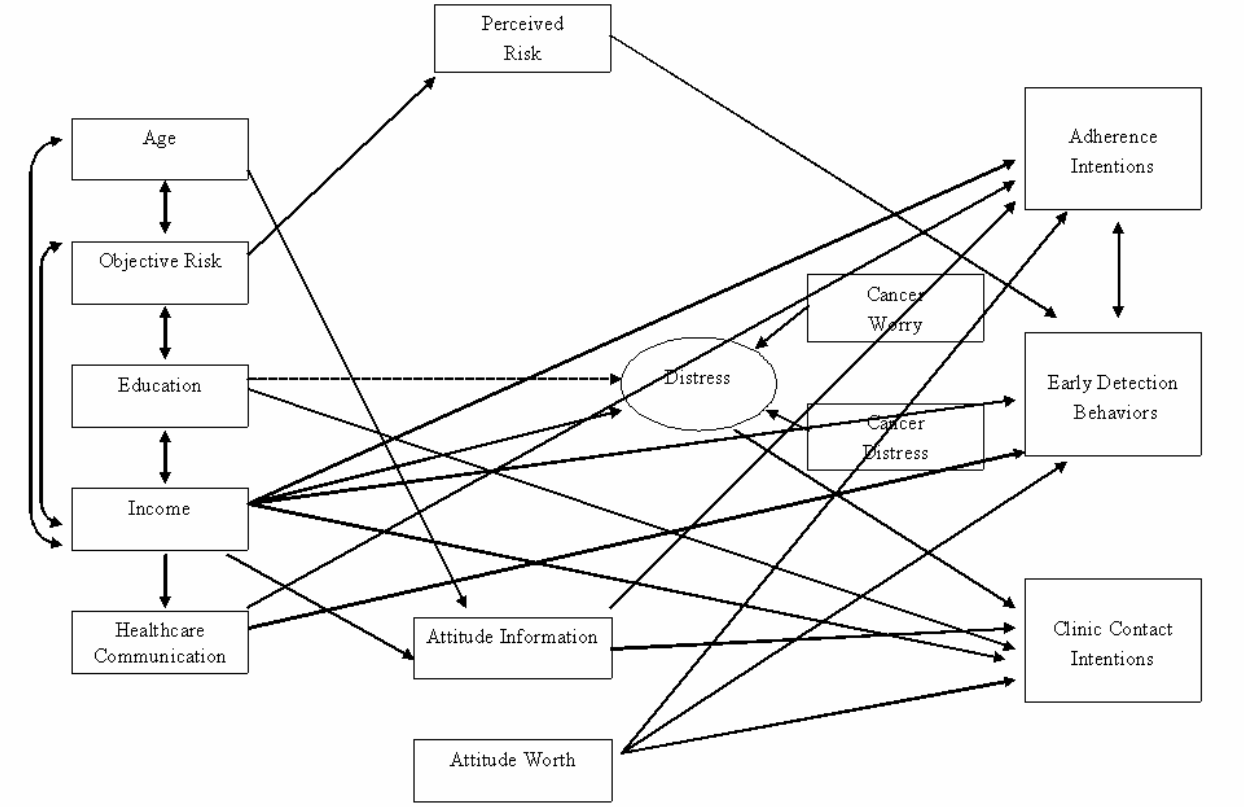
Figure 13. Respecified model 2.



Note. Dotted lines represent pathways "trimmed" from the model. Correlation modeled between dependent variables represents the correlation between the error terms (e.g., adherence intentions and early detection behaviors).

Figure 13. Respecified Model 2.

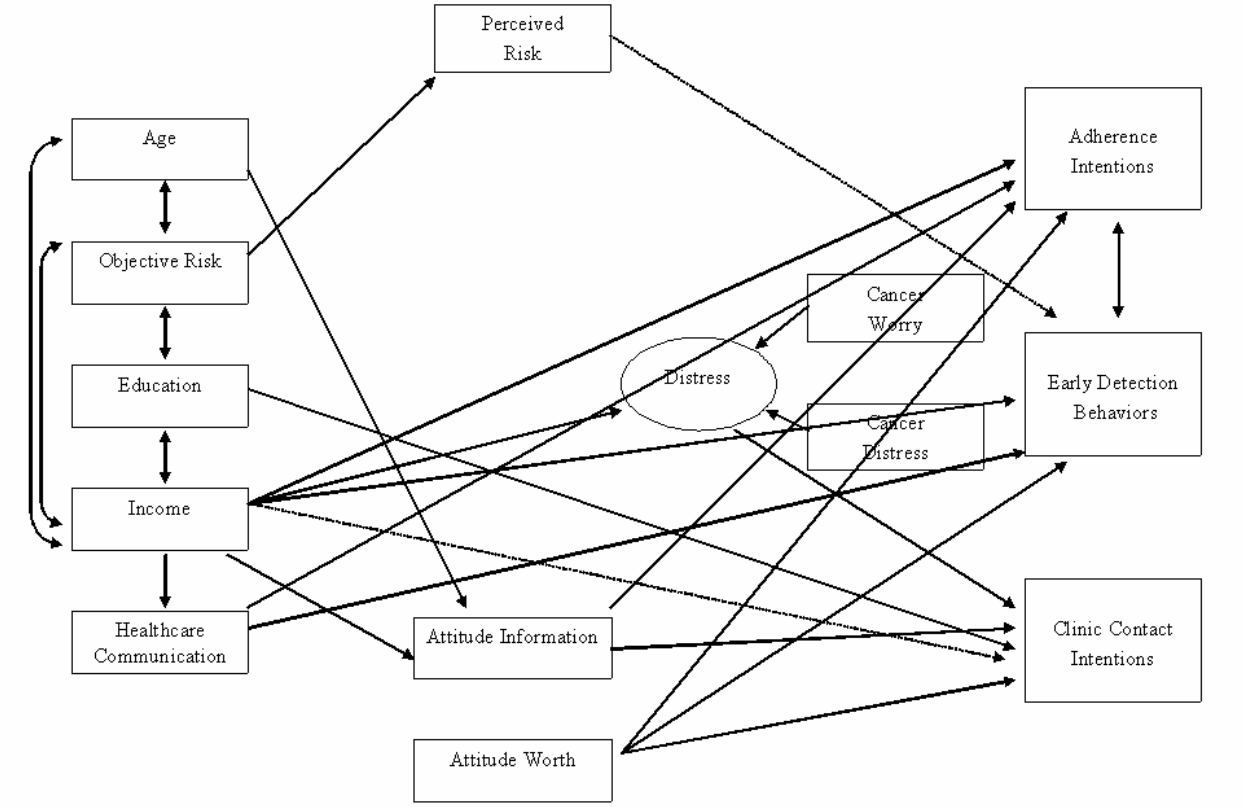
Figure 14. Respecified model 3.



Note. Dotted lines represent pathways "trimmed" from the model. Correlation modeled between dependent variables represents the correlation between the error terms (e.g., adherence intentions and early detection behaviors).

Figure 14. Respecified Model 3.

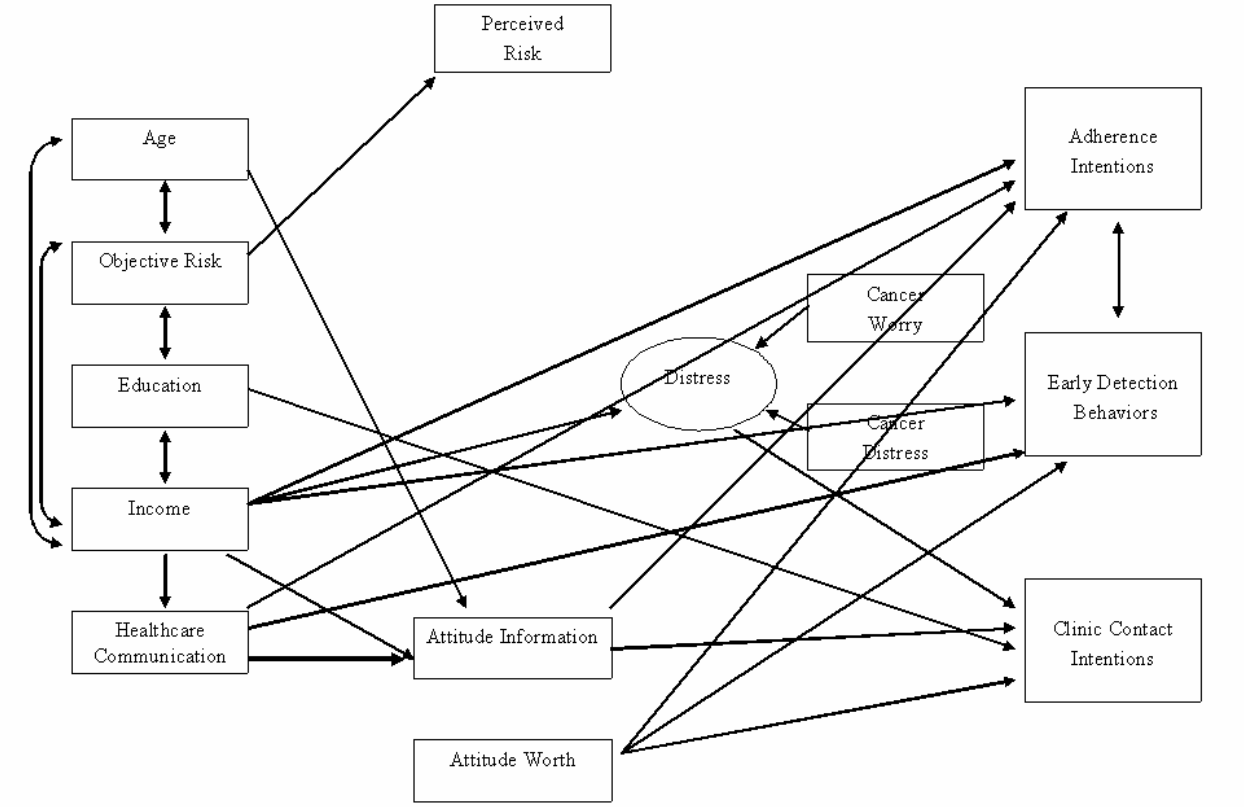
Figure 15. Respecified model 4.



Note. Dotted lines represent pathways "trimmed" from the model. Correlation modeled between dependent variables represents the correlation between the error terms (e.g., adherence intentions and early detection behaviors).

Figure 15. Respecified Model 4.

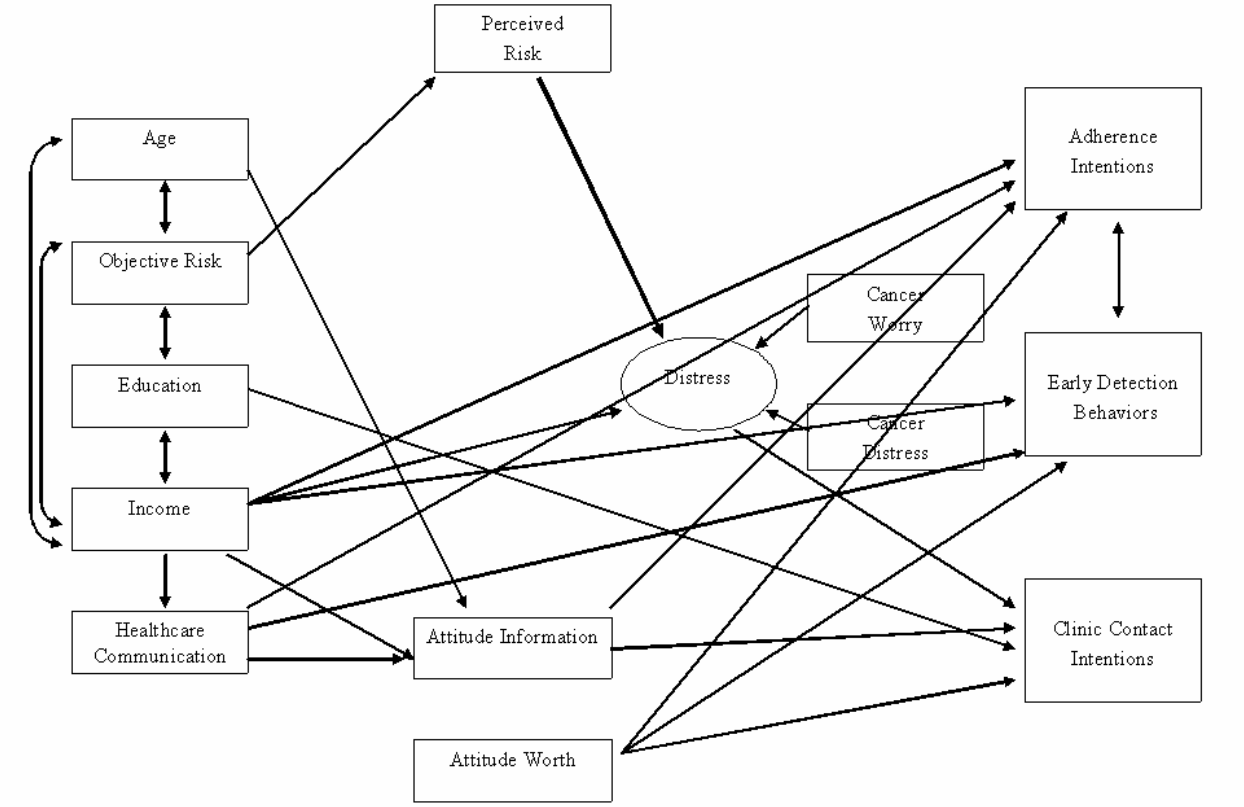
Figure 16. Respecified model 5.



Note. Bolded line represents added pathway. Correlation modeled between dependent variables represents the correlation between the error terms (e.g., adherence intentions and early detection behaviors).

Figure 16. Respecified model 5.

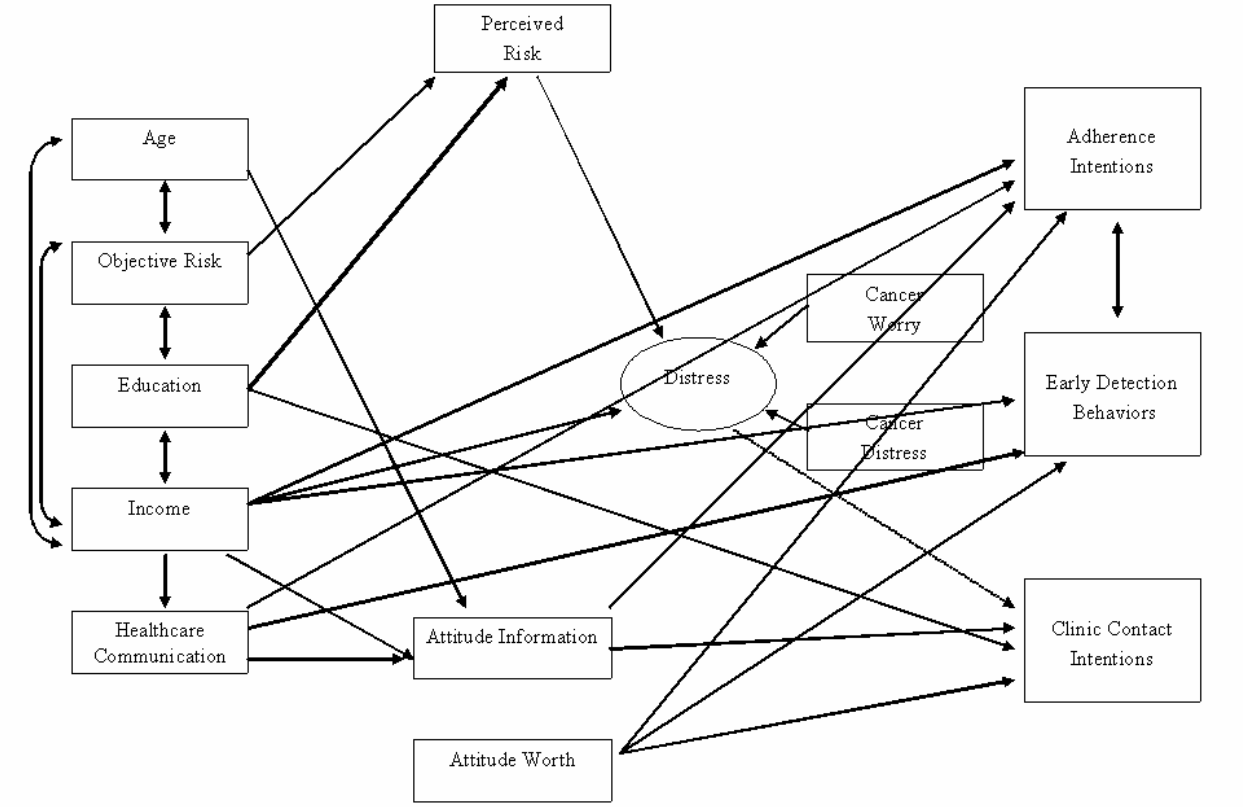
Figure 17. Respecified model 6.



Note. Bolded line represents added pathway. Correlation modeled between dependent variables represents the correlation between the error terms (e.g., adherence intentions and early detection behaviors).

Figure 17. Respecified model 6.

Figure 18. Respecified model 7.



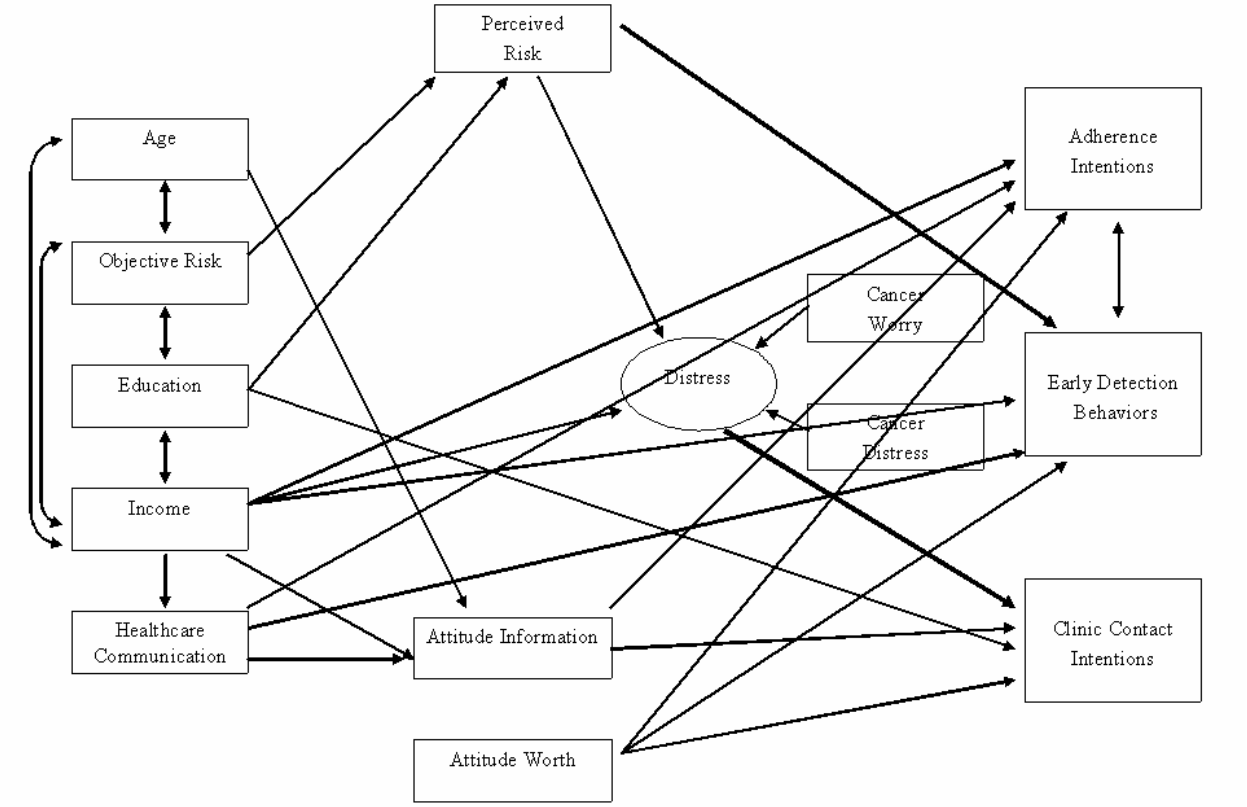
Note. Dotted lines represent pathways "trimmed" from the model. Bolded line represents added pathway. Correlation modeled between dependent variables represents the correlation between the error terms (e.g., adherence intentions and early detection behaviors).

Figure 18. Respecified model 7.

Table 17. Goodness of fit difference tests summary for model with latent factor.

Model	Chi-Square	Santorra-Bentler Chi-Square	df	p	CFI	RMSEA	ΔX2	Δdf	p
1	86.29	76.75	48	.005	.908	.059			
2	90.61	79.77	51	<.001	.908	.057			
3	92.31	80.29	52	.006	.908	.920			
4	99.59	86.54	54	.003	.896	.059			
5	91.97	80.00	53	.010	.914	.054			
6	67.34	59.74	52	.215	.975	.029			
7	63.32	56.52	52	.309	.984	.022			
8	57.32	51.95	50	.398	.994	.015	5.8	2	.05

Figure 19. Respecified model 8.

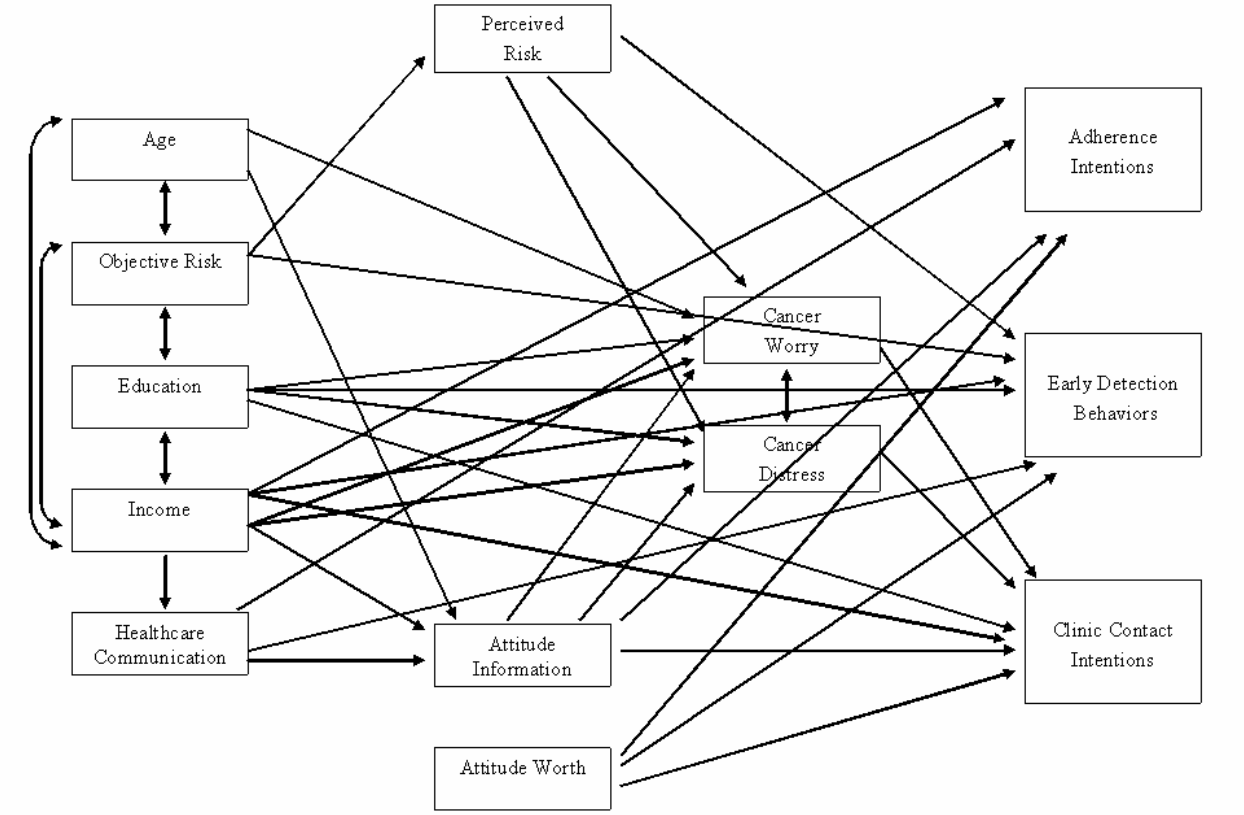


Note. Bolded line represents added pathway. Correlation modeled between dependent variables represents the correlation between the error terms (e.g., adherence intentions and early detection behaviors).

Figure 19. Respecified model 8.

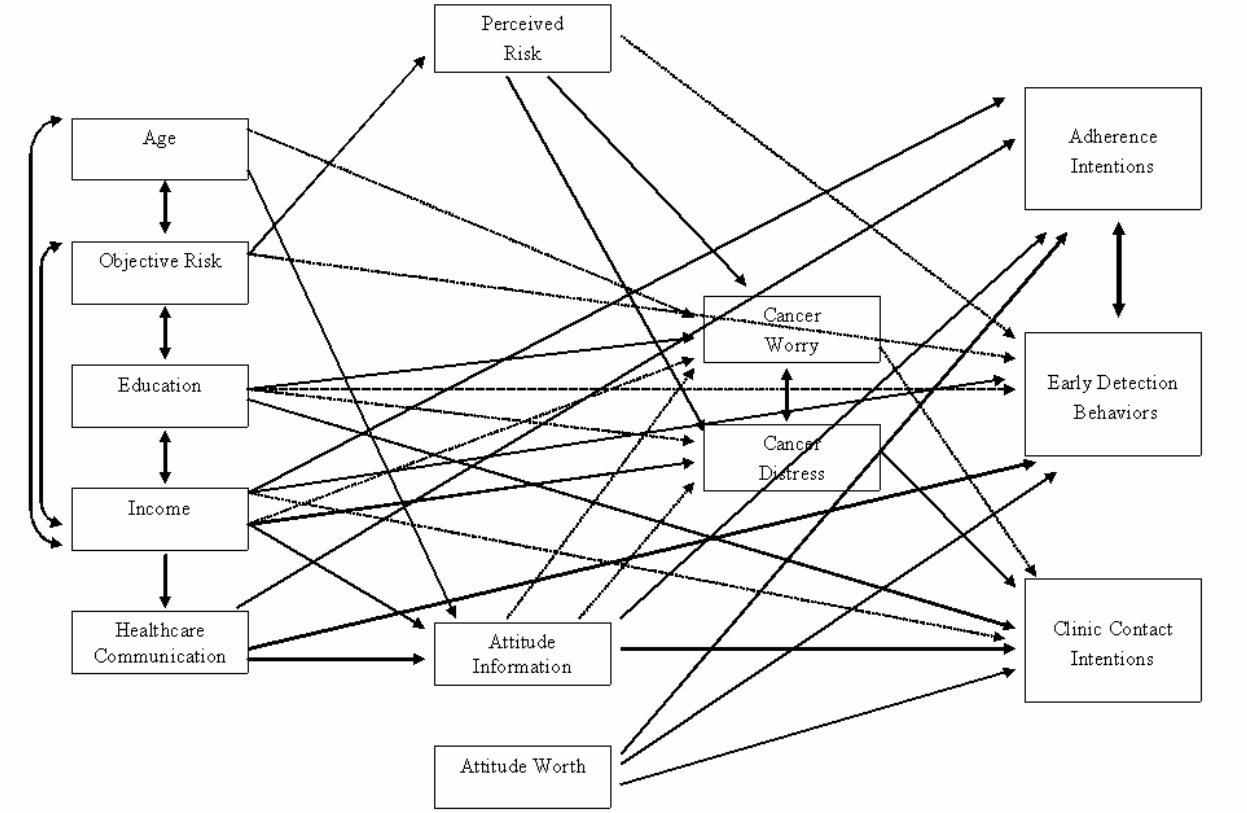
Because it has been suggested that latent factors should have at least three indicators (Comrey & Lee, 1992) and model modification indexes suggested that the latent variable indicators might be uniquely related to variables in the model, examining a model without the factor was indicated. Based on this, a new model was specified again using study hypotheses and bivariate relationships as a guide. The new model omitted the latent variable and used both indicators as observed variables only. This model is displayed in Figure 20. The model was acceptable based on χ^2 statistics, however, modification indexes suggested parameters that could be added or deleted from the model. In the first modification all parameters that had nonsignficant parameter estimates and were indicated based on the Wald W test were dropped and the error terms between adherence intentions and early detection behaviors were allowed to correlate based on LeGrange Multiplier indices. The second model is displayed in Figure 21. Again the model fit was acceptable, but based on LaGrange Multiplier indices, paths were added that predicted worry from age and perceived risk from education, and Wald W test indicated dropping the correlation between the error terms of adherence intentions and early detection behavior (Figure 22). The model fit was acceptable, however, LaGrange Multiplier test suggested adding perceived risk as a predictor of early detection behaviors and letting the error terms between adherence intentions and early detection behaviors correlate. The fourth model is displayed in Figure 23. One more model was run, again dropping the correlation between the error terms of adherence intentions and early detection behaviors (Figure 24). Several χ^2 difference tests were done to determine which model best explained the relationships between the variables (See Table 18.). The best model with observed variables only is represented in Figure 23 (Satorra-Bentler χ^2 (48, N = 173) = 36.54, p = .89, CFI = 1.0, RMSEA = .00).

Figure 20. Observed variables only model 1.



Note. Correlational depiction between cancer worry and cancer distress represents the relationships between the error terms of these variables.

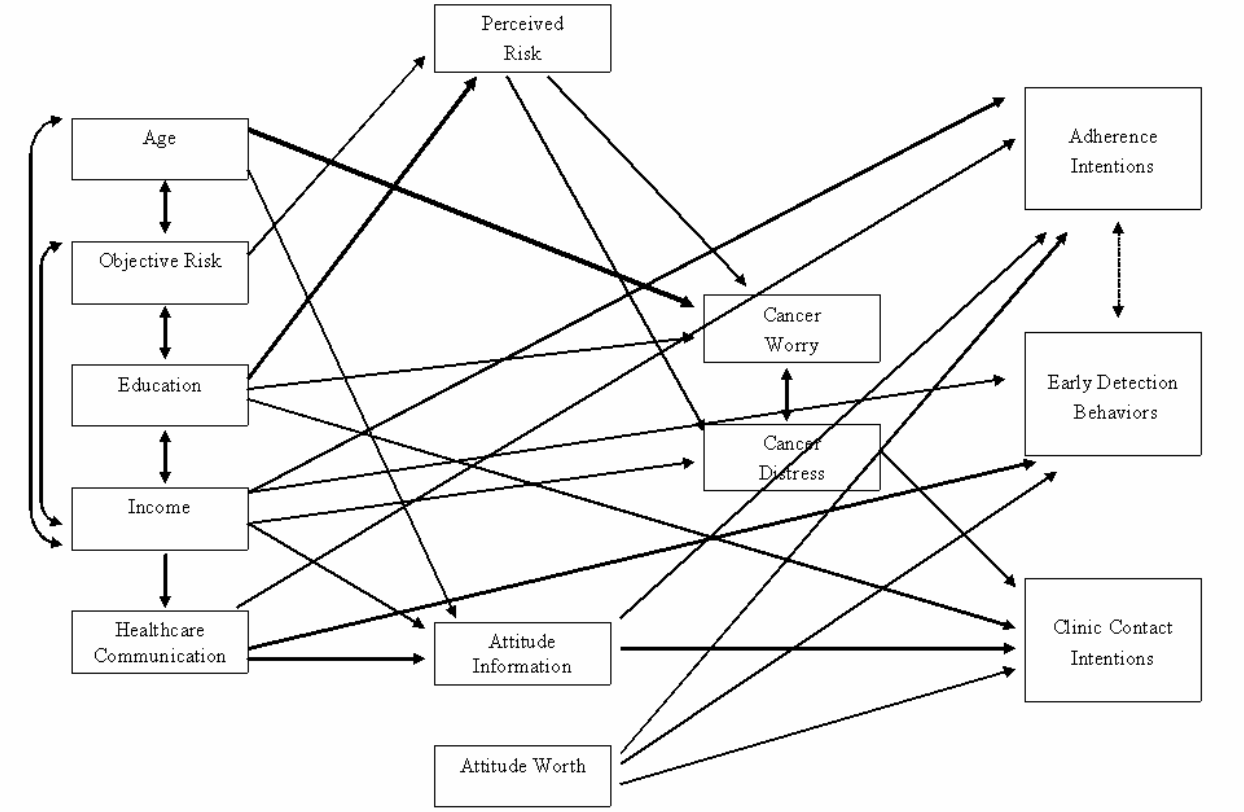
Figure 21. Observed variables only model 2.



Note. Dotted lines represent pathways "trimmed" from the model and bold lines indicate pathways added to the model. Correlational depiction between cancer worry and cancer distress represents the relationships between the error terms of these variables.

Figure 21. Observed variables only model 2.

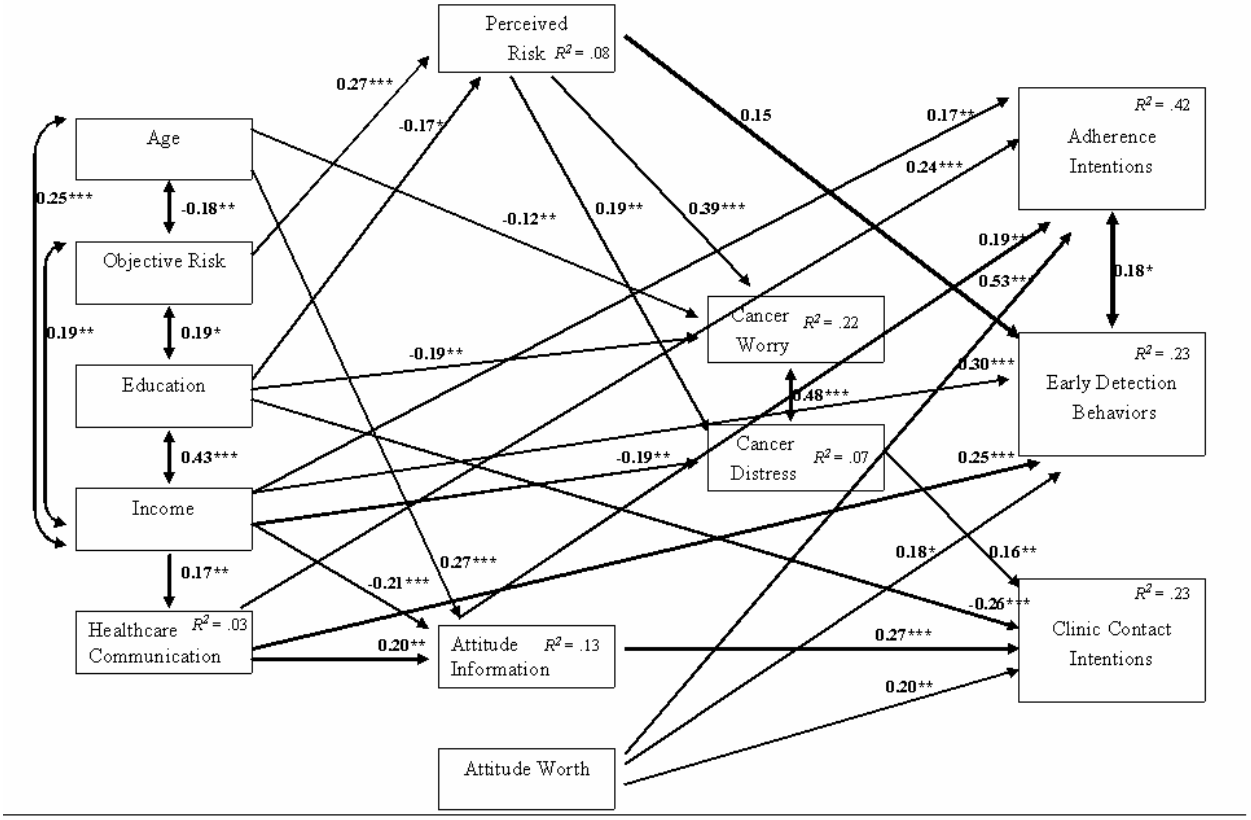
Figure 22. Observed variables only model 3.



Note. Dotted lines represent pathways "trimmed" from the model and bold lines indicate pathways added to the model. Correlational depiction between cancer worry and cancer distress and adherence intentions and early detection behaviors represents the relationships between the error terms of these variables.

Figure 22. Observed variables only model 3.

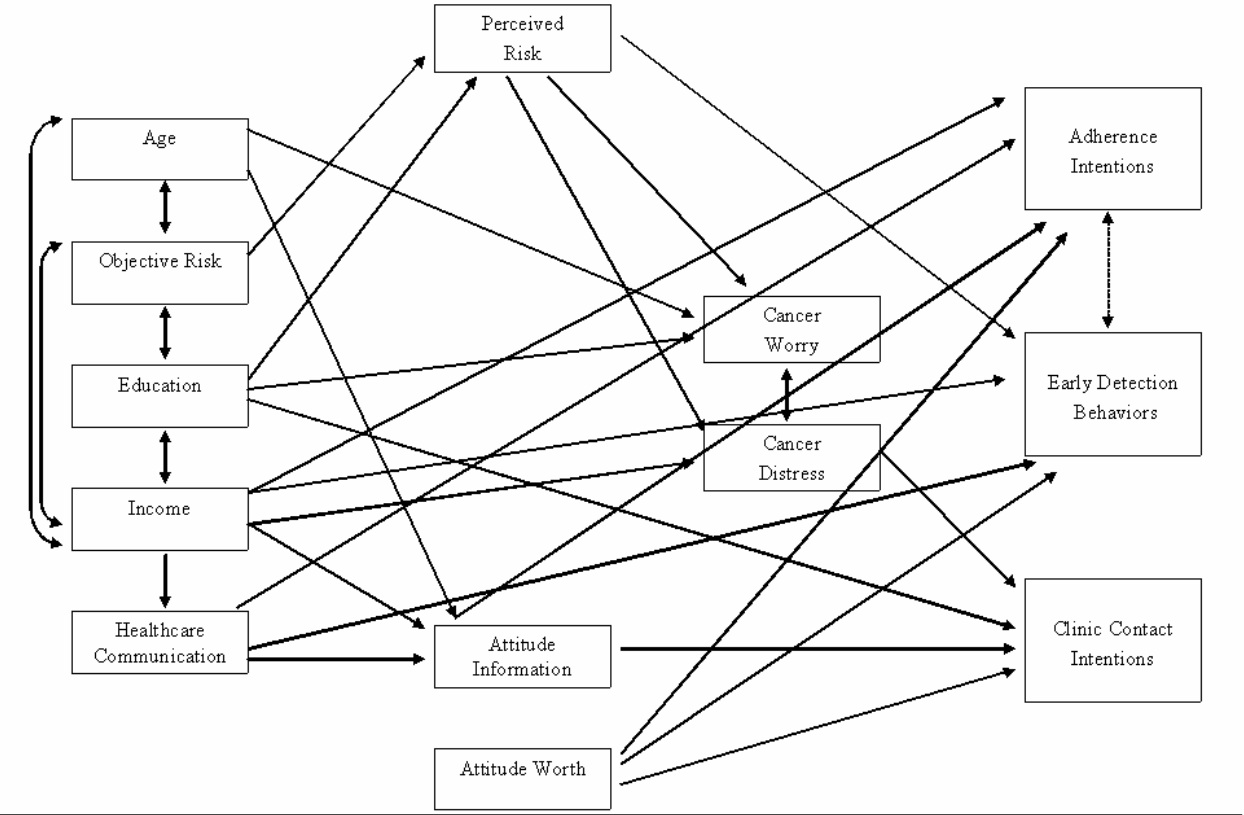
Figure 23. Observed variables only model 4. *Final Model.*



Note. Parameter estimates are standardized. Estimates shown between cancer worry and cancer distress, and between adherence intentions and early detection behaviors are the estimates between the error terms of these variables. * = p < .05, ** = p < .01, *** = p < .001.

Figure 23. Observed variables only. Model 4.

Figure 24. Observed variables only model 5.



Note. Dotted lines represent the deletion of a pathway from the previous model. Correlations between cancer worry and cancer distress, and between adherence intentions and early detection behaviors are the relationships between the error terms of these variables.

Figure 24. Observed variables only model 5.

Table 18. *Goodness of fit summary for model with no latent factor.*

Model	**Chi-Square**	**Santorra-Bentler Chi-Square**	**df**	**p**	**CFI**	**RMSEA**	***Difference Test Models***	**ΔX2**	**Δdf**	**p**
01	44.72	40.27	42	.54	1.0	.000				
02	55.07	48.57	51	.57	1.0	.000	*01 vs. 02*	8.33	9	.501
03	51.36	45.00	50	.08	1.0	.000	*02 vs. 03*	4.89	1	.027
04	40.89	36.54	48	.89	1.0	.000	*03 vs. 04*	6.25	2	.044
05	46.75	41.65	49	.11	1.0	.000	*04 vs. 05*	4.56	1	.033

To determine if the model that included the latent variable or the model with observed variables only was best explaining the relationships in the data, AIC and CAIC were examined (see Table 19). Models with the lower AIC and CAIC values are thought to be the best fit to the data (Akaike, 1987; Bozdogan, 1987). Based on this, it was determined that the model with observed variables only was best explaining the data and this model was used to interpret the parameters of the model. Again, this model is shown in Figure 23 and parameter estimates for this model are shown in Table 20.

Table 19. Summary of comparison of non-nested models.

Model	Model AIC	Model CAIC
04	-59.46	-258.82
8	-48.05	-255.72

Note. AIC = Akaike Informaiton Criterion. CAIC = Consistent AIC

Table 20. Standardized parameters for the final structural equation model predicting risk reducing behaviors.

	Effect	*z* value	Indirect effect	*z* value
Education → Clinic Contact Intentions	-.26***	-3.85		
Income → Adherence Intentions	.17**	3.17		
Income → Early Detection Behaviors	.30***	4.83		
Healthcare Communication → Adherence Intentions	.24***	4.43		
Healthcare Communication → Early Detection Behavior	.25***	4.18		
Objective Risk → Perceived Risk	.27***	3.46		
Education → Perceived Risk	-.17*	-2.14		
Attitude Information → Adherence Intentions	.19**	2.82		
Attitude Worth → Adherence Intentions	.53***	5.17		
Attitude Worth → Early Detection Behaviors	.18*	2.08		
Attitude Information → Clinic Contact Intentions	.27***	3.81		
Attitude Worth → Clinic Contact Intentions	.20**	2.67		
Age → Attitude Information	.28***	3.84		
Income → Attitude Information	-.24***	-3.19		
Healthcare Communication → Attitude Information	.20**	2.83		
Cancer Distress → Clinic Contact Intentions	.16*	2.74		
Perceived Risk → Worry	.39***	6.40		
Perceived Risk → Cancer Distress	.19**	2.60		

Age → Worry	-.12**	-2.38		
Education → Worry	-19**	-2.78		
Income → Cancer Distress	-.19**	-2.81		
Income → Healthcare communication	.17**	2.23		
Objective Risk → Worry			.11**	2.72
Education → Worry			-.07*	-2.04
Age → Adherence Intentions			.05*	2.47
Age → Clinic Contact Intentions			.08**	2.66
Income → Early Detection Behaviors			.04*	2.01
Income → Clinic Contact Intentions			-.09**	-2.74
Healthcare Communication → Clinic Contact Intentions			.06**	2.36

Note. Effects and indirect effects shown are standardized regression weights. * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

AIM 1 within SEM. The first aim of this study was to examine the relationship between the outcome variables of adherence intentions, early detection behaviors, and clinic contact intentions and the background variables of age, objective risk, education, income, and healthcare communication. It was hypothesized that both objective risk and age would be related to each outcome variable. Although bivariate results found that age was related to adherence intentions and lifetime risk was related to early detection behaviors, neither variable was a predictor in the context of the model. Education was expected to be positively related to each of the outcome variables and bivariate analyses found that education was positively related to early detection behaviors and unexpectedly negatively related to clinic contact intentions. Within the model, lower levels of education predicted higher intentions to contact the high risk clinic, $\beta = -.26$, $z = -3.85$, $p < .001$. Education was not related to adherence intentions or early detection behaviors in the model.

Initial analyses revealed that, as expected, income was positively related to adherence intentions and early detection behaviors. Contrary to hypotheses, income was negatively related to clinic contact intentions. Within the SEM model, income was not related to clinic contact intentions, but did predict adherence intentions and early detection behaviors, $\beta = .17$, $z = 3.17$, $p < .001$ and $\beta = .30$, $z = 4.83$, $p < .001$, respectively. Healthcare Communication performed similarly in the model as previously by positively predicting adherence intentions and early detection behaviors, $\beta = .24$, $z = 4.43$, $p < .001$ and $\beta = .25$, $z = 4.18$, $p < .001$, respectively. Although it was hypothesized that Healthcare Communication would also be related to clinic contact intentions, no relationship was found.

In summary, corroborating bivariate findings, education accounted for unique variance when predicting clinic contact intentions, income uniquely predicted early detection behaviors,

and Healthcare Communication predicted both adherence intentions and early detection behaviors. Contrary to bivariate analyses when shared variance among the model variables was accounted for by testing the hypotheses with SEM for Aim 1, age and objective risk were not related to the outcomes. Likewise, the relationships between education and early detection behaviors and between income and clinic contact intentions were no longer found.

AIM 2 within SEM. Next, the parameter estimates were examined to better explain the hypotheses in Aim 2. First, it was hypothesized that perceived risk would be positively related to each outcome variable. Bivariate relationships found a weak significant relationship between perceived risk and early detection behaviors; however, within the model perceived risk was not related to any of the outcome variables. Next, it was hypothesized that both age and Healthcare Communication would positively predict perceived risk, however, consistent with the bivariate findings neither of these relationships was found. As expected, higher objective risk predicted higher perceived risk $\beta = .27$, $z = 3.46$, $p < .001$. Contrary to predictions, education was not related to perceived risk in bivariate analyses. However, when using SEM it was found that education negatively predicted perceived risk $\beta = -.17$, $z = -2.14$, $p = .02$.

Both analyses methods supported the positive relationship between objective risk and perceived risk. When testing the model, as hypothesized education was a predictor of perceived risk even though bivariate analysis did not find a relationship between these two variables. The emergence of this relationship may be due to the ability of SEM to account for all variance in the model simultaneously and to also take into account any non-normal data that could influence the outcomes.

AIM 3 within SEM. The first objective of Aim 3 was to examine the relationship between the attitude factors and the outcome variables. Consistent with the bivariate relationships, the attitude factors were related to all outcome measures. First, adherence intentions was positively predicted by both Attitudes Toward Information Seeking and Attitudes Toward the Worth of Prevention and Surveillance, $\beta = .19$, $z = 2.82$, $p = .004$ and $\beta = .53$, $z = 5.17$, $p < .001$, respectively. Next, Attitudes Toward the Worth of Prevention and Surveillance positively predicted early detection behaviors $\beta = .18$, $z = 2.08$, $p = .04$. Finally, both Attitudes Toward Information Seeking and Attitudes Toward the Worth of Prevention and Surveillance predicted clinic contact intentions $\beta = .27$, $z = 3.81$, $p < .001$ and $\beta = .20$, $z = 2.67$, $p = .004$, respectively. The second objective of this aim was to examine the relationship between the background variables and the attitude factors. All relationships mirrored the bivariate findings. As expected, age positively predicted Attitudes Toward Information Seeking, $\beta = .27$, $z = 3.85$, $p < .001$, although it did not predict Attitudes Toward the Worth of Prevention and Surveillance. Contrary to expectations, education did not predict attitudes, although income negatively predicted Attitudes Toward Information Seeking, $\beta = -.24$, $z = -3.19$, $p < .001$. It was hypothesized that there would be not be a relationship between Healthcare Communication and the attitude factors, however it was found that Healthcare Communication positively predicted Attitudes Toward Information Seeking, $\beta = .20$, $z = 2.84$, $p = .005$. As expected, objective risk was not related to the attitude factors.

In summary, when testing Aim 3 hypotheses within the model, all findings between the attitude factors and the model variables were consistent with initial analyses. Attitudes Toward Information Seeking predicted adherence intentions and clinic contact intentions, Attitudes Toward the Worth of Prevention and Surveillance predicted all three outcome variables, and age predicted Attitudes Toward Information Seeking. Consistent with the initial analyses where

Attitudes Toward Information Seeking was suggested to mediate the relationship between age and adherence intentions, there was no relationship between age and adherence intentions. Also like the initial analyses, model results suggested that income did predict Attitudes Toward Information Seeking, and both of these variables uniquely influenced adherence intentions. The bivariate analyses suggested that Attitudes Toward Information Seeking suppressed the relationship between income and clinic contact intentions, and not surprisingly, in the final model there was not a relationship between income and clinic contact intentions. Last, supporting bivariate results, Healthcare Communication was related to Attitudes Toward Information Seeking.

AIM 4 within SEM. It was hypothesized that Cancer Distress would be related to the outcomes in this model. The bivariate results found that Cancer Worry and Cancer Distress were associated with the outcome of clinic contact, however, within the model the only relationship found was that of clinic contact intentions being predicted by the Cancer Distress, $\beta = .16$, $z = 2.74$, $p = .003$. Cancer Distress was not related to other outcomes and Cancer Worry was not related to any outcomes. As expected and in sync with the bivariate results, Perceived Risk positively predicted Cancer Worry and Cancer Distress, $\beta = .39$, $z = 6.4$, $p < .001$ and $\beta = .19$, $z = 2.60$, $p = .009$, respectively. Attitudes Toward Information Seeking were also expected to be positively related to Cancer Distress, although no significant relationships were found.

Next, the relationships among Cancer Worry and Cancer Distress and the background variables were explored. Age was hypothesized to negatively predict Cancer Worry and distress. Although no bivariate relationship was found, within the model age did negatively predict Cancer Worry $\beta = -.12$, $z = -2.38$, $p = .009$, but it did not predict Cancer Distress. Education and

income were hypothesized to be positively related to Cancer Worry and Cancer Distress, although bivariate results found negative associations. Within the model, education was found to negatively predict Cancer Worry β = -.19, z = -2.78, p = .003 but was not related to Cancer Distress. Interestingly, income negatively predicted Cancer Distress β = -.19, z = -2.81, p = .003, but was not related to worry. As hypothesized, neither objective risk nor Healthcare Communication was related to Cancer Worry or Cancer Distress.

Summarizing the results of modeling for Aim 4, bivariate results suggested that both Cancer Distress and Cancer Worry were related to clinic contact intentions; however, when shared variance was accounted for within the model, only Cancer Distress predicted clinic contact intentions. Mirroring the bivariate results, Perceived Risk did predict both cancer specific distress variables. Interestingly, bivariate results did not find age to be related to Cancer Worry, but consistent with the hypothesis, age was negatively predictive of worry within the model. Further, in initial analyses, both education and income were related to both specific distress variables. Within the model, only education predicted worry and only income predicted Cancer Distress. In bivariate analyses, Cancer Distress was suggested as a potential mediator between income and clinic contact intentions and consistent with this finding, in the model, income was not related to clinic contact intentions but did predict Cancer Distress.

Indirect Effects .In SEM, indirect effects are a test of change in direct effects after mediation has been entered into the model. In this model, significant indirect effects were evident for objective risk, education, age, income, and Healthcare Communication. Indirect effects are the product of the regression coefficients of the direct effects. For instance, in this model, objective risk and education had indirect effects on worry (β = .11; z = 2.72; p = .007 and β = .07; z = -2.04; p =

.02, respectively) working through Perceived Risk. Age had indirect effects on both adherence intentions and clinic contact intentions (β = .05; z = 2.47; p = .01 and β = .08; z = 2.66; p = .008, respectively) through its direct effect on Attitudes Toward Information Seeking. Income had an indirect effect on both early detection behaviors through its relationship with Healthcare Communication (β = .04; z = 2.01; p = .05), and income had an indirect effect on clinic contact intentions through its relationship with both Cancer Distress and Attitudes Toward Information Seeking (β = .09; z = -2.74; p = .003). Last, an indirect relationship was seen between Healthcare Communication and clinic contact intentions (β = .06; z = 2.36; p = .004) working through Attitudes Toward Information Seeking. Indirect effects are summarized in Table 20.

Other Model Pathways. There was no hypothesis made about the relationship between Healthcare Communication and income. However, when building this model it was found that Healthcare Communication was positively predicted by income, β = .17, z = 2.23, p = .007. There were also several significant covariances in the data. Among the background variables, age was related to objective risk and income, β = -.18, z = -2.38, and p = .009 and β = .25, z = 3.51, p < .001 respectively. Objective risk was also related to education and income, β = .19, z = 2.30, p = .02 and β = .19, z = 2.49, p = .006, respectively. Also, education and income were related, β = .43, z = 5.68, p < .001. In SEM modeling, among variables that are dependent variables, the error terms are allowed to correlate. In this model there was a significant covariance among the error terms of IES scores and Cancer Worry, β = .48, z = 4.09, p < .001. There was also a significant relationship between the error terms of adherence intentions and early detection behaviors, β = .18, z = 2.01, p = .04.

Model Summary. In summary, within the model, income accounted for 3% of the variance in Healthcare Communication. Model variables of objective risk and education accounted for 8% of the variance in Perceived Risk. Twenty-two percent of the variance in Cancer Worry was predicted by Perceived Risk, age, and education, while Perceived Risk and income accounted for 7% of the variance in Cancer Distress. Healthcare Communication, age, and education accounted for 13% of the variance in Attitudes Toward Information Seeking. Finally, when considering the outcomes of interest in this study, income, Attitudes Toward Information Seeking, Healthcare Communication, and Attitudes Toward Worth of Prevention and Surveillance predicted 42% of the variance in adherence intentions. Early detection behaviors were predicted by Healthcare Communication, Perceived Risk, income, and Attitudes Toward Worth of Prevention and Surveillance accounting for 23% of the variance in this outcome, and the variables of Cancer Distress, Attitudes Toward Information Seeking, education, and Attitudes Toward the Worth of Prevention and Surveillance accounted for 23% of the variance in clinic contact intentions.

Secondary Aim

The secondary aim of this study was to explore whether or not the variables included in the proposed model were associated with actual clinic contact after women had been given risk information and a brochure about the high risk clinic at their study appointment. In addition to examining the model variables of age, objective risk, education, income, Healthcare Communication, Perceived Risk, Cancer Worry, Cancer Distress, Attitudes Toward Information Seeking, and Attitudes Toward the Worth of Prevention and Surveillance, the outcome variables

of adherence intentions and clinic contact intentions were explored. First, the univariate analyses were done to determine which variables to include in the logistic regression equation.

As expected, results of univariate analyses found lifetime objective risk was positively related to clinic contact. This relationship was found at the two week follow-up $F(1,185)=6.55$; $p = .011$, with higher risk ($M = 19.55$; $SD = 4.5$ vs. $M = 17.04$; $SD = 4.1$) being related to clinic contact. As well, objective risk was related to overall clinic contact $F(1, 179) = 6.00$; $p = .015$, with higher lifetime risk being related to clinic contact ($M = 18.65$; $SD = 4.50$ vs. $M = 18.65$; $SD = 4.50$).

Higher Perceived Risk was expected to be related to clinic contact, but a marginally statistically significant relationship at the six-week follow up found the opposite, $F(1, 136) = 3.60$; $p = .06$. Those with a lower Perceived Risk were more likely to contact the clinic at six weeks ($M = -1.43$; $SD = 5.6$ vs. $M = .75$; $SD = 5.92$). Clinic contact at six weeks and overall was also related to IES Cancer Distress, $F(1,141)=4.00$; $p = .05$ and $F(1, 179) = 4.65$; $p = .03$ with higher levels of distress were related to clinic contact ($M = 10.65$; $SD = 11.71$ vs. $M = 6.75$; $SD = 7.85$ and $M = 9.65$; $SD = 10.55$ vs. $M = 6.42$; $SD = 7.86$). Baseline clinic contact intentions were related to clinic contact at 2-weeks, $F(1, 185) = 11.78$; $p = .001$, 6-weeks, $F(1, 141) = 6.42$; $p = .012$, and overall, $F(1.179) = 21.89$; $p < .001$ ($M = 3.34$; $SD = 1.21$ vs. $M = 4.30$; $SD = .92$, $M = 3.37$; $SD = 1.11$ vs. 4.00; $SD = 1.04$, $M = 3.20$; $SD = 1.20$ vs. $M = 4.14$; $SD = 1.0$, respectively). Further, higher 2-week clinic contact intentions were related to 6-week clinic contact, $F(1,141) = 16.05$; $p < .001$ and overall clinic contact $F(1,159) = 21.78$; $p < .001$ ($M = 3.33$; $SD = 1.01$ vs. $M = 4.26$; $SD = .75$ and $M = 3.03$; $SD = 1.23$ vs. $M = 4.26$; $SD = .75$, respectively). It was also expected that age, education, income, Healthcare Communication, and

the attitude factors would share positive relationships with clinic contact, although no relationships were found. Race was not related to clinic contact.

Based on these findings, objective risk, Perceived Risk, Cancer Distress as measured by the IES, and clinic contact intentions were included in the logistic regression equations predicting 2-week clinic contact, 6-week clinic contact, and overall clinic contact. At two weeks, the equation including objective risk, Perceived Risk, Cancer Distress, and baseline clinic contact intentions was significant in predicting clinic contact χ^2 (4, N = 182) = 19.30; p = .001. Women at higher objective risk for breast cancer (OR = 1.17; p = .02) and higher baseline intentions (OR = 2.35; p = .002) were more likely to contact the clinic. Next, the same variables plus clinic contact intentions at two weeks were entered to predict clinic contact at six weeks. The equation was again significant χ^2 (5, N = 138) = 30.12; p < .001, with higher lifetime risk (OR = 1.17; p = .03), lower Perceived Risk (OR = .86; p = .007), higher Cancer Distress (OR = 1.06; p = .06), and higher two week clinic contact (OR = 2.67; p < .001) predicting clinic contact.

Last, overall clinic contact was predicted using the variables of objective risk, Perceived Risk, Cancer Distress, and clinic contact intentions at baseline as predictors. The overall equation was significant χ^2 (4, N = 176) = 33.58; p < .001, with objective risk (OR = 1.18; p = .004), baseline intentions (OR = 2.17; p < .001), Cancer Distress (OR = 1.04; p = .04), and Perceived Risk (OR = .91; p = .03) all predicting clinic contact overall. These results suggest that objective risk and behavioral intentions are the most consistent predictors of high-risk clinic contact. Further, in this sample higher distress, but lower perceived risk appears to impact high-risk clinic contact overall.

DISCUSSION

After an extensive literature review examining predictors of risk-reducing behaviors, several hypotheses were made regarding predictors of adherence intentions, early detection behavior, clinic contact intentions, and clinic contact in a community sample of women with a family history of disease. Specifically, this study examined the role of distal background variables of age, objective risk, education, income, and healthcare communication on risk-reducing behaviors of adherence intentions, early detection behaviors, and high-risk clinic contact. This research also investigated the relationship between more proximal variables (perceived risk, cancer distress, attitudes toward risk reducing behavior) that were hypothesized to account for much of the influence of distal variables on these outcomes. These variables accounted for 42% of the variance in adherence intentions and 23% of the variance in both early detection behaviors and clinic contact intentions. Further, this study explored the relationships between the background variables and the proximal variables. Examining clinic contact prospectively, higher objective risk, lower perceived risk, higher cancer distress, and higher clinic contact intentions predicted risk-reducing behavior. Broadly, the proposed variables accounted for variance in the outcome measures of interests and some of the study hypotheses were supported while others were not supported.

Socioeconomic Variables

To help better understand the impact of socioeconomic status on health, this study was designed to examine difference in relation to other variables. The importance of examining these variables rather than simply controlling for them has been highlighted (Adler et al., 1994). There was also a clear relationship between socioeconomic resources (e.g., income and education) and risk-reducing behaviors in this sample. Not surprisingly, higher income was directly related to higher adherence intentions and increased early detection behaviors. This finding is consistent with other research suggesting that socioeconomic resources influence the use of health behaviors (e.g., mammography; Hedegaard, Davidson, & Wright, 1996; Lerman et al., 1991; Lerman, Daly, Masny, & Balshem, 1994; Rimer et al., 1996).

A more intriguing finding was the inverse relationships between clinic contact intentions and socioeconomic resources. It was expected that more resources would be related to better clinic contact intentions, but instead it was found that fewer socioeconomic resources were related to greater intention to contact a high-risk clinic. Specifically, lower levels of education were directly related to clinic contact intentions and lower income was indirectly related to clinic contact intentions through attitudes toward information seeking. Past research investigating adoption of individual risk-reducing behaviors such as genetic testing, chemoprevention, and risk-reducing surgeries has found little influence of socioeconomic variables on these behaviors. This lack of relationship may be due to the methods of recruitment characterizing past studies

(i.e., recruitment in high-risk clinics where women have either been referred by their own healthcare professional or have self-referred). One of the aims of this study was to examine the influence of socioeconomic variables on risk-reducing behaviors in a group of women recruited from the community. These findings are potentially important and have several implications.

First the relationship between clinic contact intention and income is particularly interesting because presumably the same group of women (e.g., those with fewer socioeconomic resources) who are reporting fewer intentions to adhere and fewer early detection behavior appear to have more positive attitudes about seeking out information than their more advantaged counterparts. Women with greater resources may have less positive attitudes about seeking out information because they feel as though they already have the information that they need, reflected by their higher levels of adherence to recommended behaviors (e.g., early detection behaviors). However, women with fewer resources may feel as though they are not as knowledgeable about risk-reduction, are more motivated to seek information, and have higher intentions to contact a high-risk clinic. In fact, one study found that a primary motivation for contacting a high risk clinic was to find out more information about screening options (Julian-Reynier et al., 1999).

The relationship between information seeking and resources might be partially explained by the condition characterized as the "knowledge gap" which suggests that knowledge about health is unequally distributed and people with more socioeconomic resources have more information than those with fewer resources (e.g., Viswanath et al., 2006). It is encouraging that the results of this study suggest that women with fewer resources are eager for information, reflected through not only their attitudes toward information seeking but also their intentions to contact a high-risk clinic. These findings highlight the need to decrease the "knowledge gap" by

providing less informed women with information, and suggest that by providing information women's use of risk-reducing behaviors may be increased.

Healthcare Communication

The power and centrality of healthcare communication to reduce cancer risks and incidence is being given increasing attention (e.g., Kreps, 2003; Viswanath, 2005; Wallace et al., 2006) and its importance in health behaviors such as mammography use, chemoprevention use, and prostate screening has been documented (Aiken et al., 1994; Beaulieu, Beland, Foy, & Falardeau, 1996; Bober et al., 2004; Rutten et al., 2005). Despite this, to date, communication has received limited attention as a cause for disparities in use of health services (i.e., Ashton et al., 2003). The importance of communication is highlighted by the study results, with higher levels of healthcare communication related to the use of each risk-reducing outcome. Women who reported that they had better communication were more likely to report intention to adhere to recommendations and higher levels of early detection behaviors. Additionally, healthcare communication indirectly affected intentions to contact the high-risk clinic. Women who reported better communication had more positive attitudes toward information, and this directly affected clinic contact intentions. Also, as one might expect, higher income was related to higher reported levels of healthcare communication.

Healthcare communication in the context of the current model of risk-reducing behavior adds important understanding to current knowledge. There has been limited work done aimed at understanding the role of healthcare communication on the use of risk-reducing behaviors. In this study communication was assessed with several items that measured the degree of

communication. In past work, physician's recommendations for a certain health behavior have been assessed and are often highly related to behavior (i.e., Aiken et al., 1994; Guerra, Dominguez, & Shea, 2005). However, results of this study suggest that there may be a gradient of effect for communication: the more communication one has with their healthcare provider, the more likely they are to act.

Additionally, this study adds to knowledge about communication which has been stymied in past work due to recruitment strategies (e.g., women recruited from high-risk clinics and/or other healthcare settings). Since women in this study were not recruited into the study based on their immediate healthcare activity, the impact of healthcare communication was more purely evaluated. The strong results in this study highlight the importance of communication in promoting the use of risk-reducing behaviors. Importantly, these results also show that women who have higher levels of communication with healthcare professionals are more amenable to seeking out information about reducing their risks, which affects risk-reducing behaviors.

This study accentuates the importance of healthcare communication and suggests that this is a variable that can be used as a mechanism for change in risk-reducing behaviors. The most obvious way to increase communication is to target healthcare professional's interactions with women who have a family history of breast cancer. However, interventions with women at increased risk may also be effective. Ashton et al. (2003) report the findings of four different randomized trials where coaching patients about communicating with their physicians has increased their communication behaviors and improved health outcomes. In women who are affected by healthcare communication deficits and do not adhere to risk-reducing recommendations, interventions with both patients and healthcare professions to increase communicate may increase participation in risk-reducing behaviors.

Age

Based on past literature, it was expected that age would be directly related to all three outcome variables. Suprisingly, there were no direct relationships between age and adherence intentions, early detection behaviors, or clinic contact intentions, although two indirect relationships were found. Women who were older had more positive attitudes about information seeking, had higher adherence intentions, and higher intentions to contact the high risk clinic. It is important to note that when investigating bivariate results, age held a strong association with adherence intentions (r = .25). However, when controlling for the impact of other variables within the model, the importance of attitudes about information seeking within this relationship became apparent. This finding suggests that younger women have more reservations about information seeking and that this affects their intention for risk-reduction. Understanding why younger women are less receptive to seeking out information and in turn have lower intentions for action is necessary because many health behaviors that have been suggested as protective against breast cancer (e.g., avoiding birth control pills, having children before the age of 35, eating a healthy diet, avoiding hormone replacement therapy) are most useful if adopted by younger women and may have more benefit the earlier they are introduced. Further, the benefits of chemoprevention and risk-reducing oophorectomy are thought to provide the most benefit to younger women (i.e., Gail et al., 1999).

One possible reason for less positive attitudes about information seeking among younger women may be the implications of risk-reducing behaviors. Chemoprevention and risk-reducing surgeries have harsh consequences, including chemically or surgically induced menopause,

changes in childbearing and sexual functioning, and body disfigurement. Women may be less knowledgeable about risk-reducing options that are less invasive and have fewer side effects (e.g., increased screening routines and genetic testing). In fact, some research has found that benefits such as reassurance and decreased levels of distressed are associated with these risk-reducing options (e.g., Claes et al., 2005; Lim et al., 2004). It is important that women with a family history of disease are amenable to recommendations about several health behaviors that appear to protect women against breast cancer and to decrease incidence and severity of disease.

The absence of a relationship between age and early detection behaviors was not expected. Past work has indicated that age influences early detection behaviors (Bowen et al., 2003; Diefenbach et al., 1999; Lerman et al., 2000). Failure to find this relationship may have been due to several factors. First, care was taken when designing this study to include women across the range of ages that could benefit from risk-reducing behaviors and to create an early detection variable that was relevant for all women. Relationships between age and early detection in other studies might be based on the outcome measurement and its applicability to certain ages. It is encouraging that these results suggest that women of all ages are adhering to early detection behaviors as recommended. However, based on the high levels of adherence in this study, it should be noted that women who responded to study advertisements may be particularly health conscious and adherent to early detection advice. Although other studies have found similarly high rates of adherence in community recruited samples (e.g., Lipkus, Biradovolu, Fenn, Keller, & Rimer, 2001), it is possible that the absence of a relationship between age and early detection may be due to limited variability in early detection behaviors.

Objective Risk

It was expected that objective risk would be related to the outcome variables within the model; but no direct or indirect relationships were found. Objective risk is clearly an important factor in determining the use of risk-reducing behaviors for breast cancer, so it is important to explore possible reasons for this lack of relationships. One possible explanation is the restricted range of risk in this sample. In general population samples that include women with and without a family history of disease, risk is often associated with early detection behaviors (Aiken et al., 1994; McCaul et al., 1996). However, women in this study all had a family history of disease, thus restricting the range of risk.

Another possibility for a lack of relationships within the model may be the outcomes measured. Early detection behaviors are readily accepted as commonplace for all women and particularly for women with a family history of disease. Further, the outcomes of intentions (adherence and clinic contact) may be easier to positively endorse, whereas actual behaviors might be more influenced by objective risk. Studies of women with family or personal histories have found objective risk to be related to risk-reducing behaviors such as genetic testing (Lee et al., 2002; Lerman et al., 1997) and risk-reducing surgeries (Hatcher et al., 2001; Schwartz et al., 2003). These behaviors require more initiative than the outcomes measured within the context of the study model. In fact, in the current study, when examining the secondary aim in this study, high-risk clinic contact was predicted by objective risk. Taken together with past research, these results may suggest that objective risk is less important when examining commonly accepted

behaviors such as early detection, but does affect behaviors that require more initiative such as high risk clinic contact, genetic testing, and risk-reducing surgeries.

Two other possible reasons for null findings should be mentioned. Many of the studies that have found links between objective risk and behaviors have been sampled from high-risk clinics or other medical settings. It may be that these samples actually do have women at higher risk than the present sample, thus accounting for the impact of objective risk on behaviors. Next, in this study lifetime risk, as opposed to 5-year risk, was used to test the hypotheses. Lifetime risk was chosen as the predictor variable in this study because of the wide range of ages included. Other studies have used a more definite time period to examine risk. In fact, when examining the bivariate findings in this study there was a positive association between 5-year risk and adherence intentions (r = .23). Thus, when evaluating literature it is important to consider how objective risk has been operationalized in the study.

PROXIMAL VARIABLES

A primary goal of this study was to understand the independent variance that perceived risk, cancer specific distress, and attitudes toward risk –reducing behaviors had on the outcome variables after accounting for the relationship between the background variables and outcomes. Many of the hypothesized relationships between perceived risk and cancer specific distress and the outcome variables were not found in this study. However, attitudes toward risk-reducing behaviors were a strong direct and indirect predictor of the outcomes. Further, there were several

relationships between the background variables and proximal variables that are important to explore.

Perceived Risk

Contrary to expectations, perceived risk was not related to adherence intentions or clinic contact intentions, and was only marginally related to early detection behaviors. In the bivariate findings, perceived risk was significantly associated with early detection behaviors (r = .15), but within the model, although the inclusion of a pathway from perceived risk to early detection made the overall model stronger, the direct relationship only approached significance. These findings are consistent with recent work in a large population based sample where no relationship was found between perceived risk and early detection behaviors (Bowen et al., 2004) and two other studies that found that perceived risk was not associated with interest in genetic testing (Braithwaite et al., 2002; Cameron and Reeve, 2006). However, despite these findings, the relationship between perceived risk and risk-reducing behaviors has been well established (i.e., Bober et al., 2004; Hatcher et al., 2001; Schwartz et al., 2003). There are several possibilities for the absence of this relationship in the present study.

A dominant issue in this study was limited variability in early detection behaviors; women in this sample were very compliant with recommendations for early detection. It may be that greater variability in early detection behaviors would have produced a stronger relationship with perceived risk. Similar to objective risk, the recruitment strategies for this study may have influenced the relationship between the outcome variables and perceived risk. Many studies that investigate risk-reducing behaviors recruit through a high-risk or other medical setting or through

a relative that had cancer (i.e., Schwartz et al., 1995; Isaacs et al., 2002). It is possible that women who have initiated contact with a high risk clinic or have a relative recently diagnosed with cancer have higher levels of perceived risk than the current community recruited sample and that these higher levels of perceived risk are more influential on intentions and behaviors.

Interestingly, lower perceived risk was related to actual clinic contact. Again, this finding is inconsistent with a large body of literature that suggests that higher perceived risk predicts risk-reducing behaviors for breast cancer (e.g., McCaul, Branstetter, Schroeder, & Glasgow, 1996). This finding is interesting and warrants further exploration. Consistent with other studies, women in this sample had high levels of perceived risks of developing breast cancer. One possible explanation for the finding between low perceived risk and behavior is that women in this sample who are contacting the high risk clinic have high enough risk perceptions, although relatively low within the sample, to motivate them to action, whereas women with the highest levels of perceived risk might be influenced by biased reasoning and avoidance of learning new information (e.g., Renner, 2004). Alternatively, Cameron et al. (2006) found that women with higher perceived risk were less inclined to believe that genetic testing would have positive benefits; a similar mechanism may have been at work in the current study in that women with the highest perceived risk did not contact the clinic because they did not believe it would be beneficial. These possibilities should be explored in future work.

Further, risk appraisals are thought to be only weakly associated with an action when the effectiveness of the action is unknown (e.g., Cameron et al., 2006). This may help in understanding the inverse relationship between perceived risk and clinic contact. Women in this study could not know what the effectiveness of contacting the high-risk clinic prior to consulting with the clinic, thus possibly affecting the relationship between perceived risk and behavior.

Also, as will be discussed below, cancer distress was positively related to clinic contact. Findings that distress was positively related to clinic contact while perceived risk was weakly negatively related to clinic contact are congruent with other findings that suggest that emotional reactions (e.g., cancer distress) may promote action even when cognitions (e.g., perceived risk) do not support fully support the action (Cameron et al., 2003).

Perceived Risk, Background Variables, and Cancer Specific Distress. As expected, women with a higher objective risk had higher perceived risk, and higher perceived risk was related to more cancer worry and cancer distress. Further, objective risk was indirectly related to worry through its direct relationship with perceived risk. Consistent with other work in community samples, lower levels of education were related to higher levels of perceived risk (e.g., Bosompra et al., 2000; Han, Moser, & Klein, 2006).

There are several reasons that these relationships are of interest. First, the relationship between perceived risk and cancer distress may reflect a personal overestimation of risk that is causing distress because the influence of objective risk has been controlled. In short, it may be the overestimation of risk that is causing distress and not actual risk. These findings are consistent with a recent study that found that family history of disease predicted perceived risk, which in turn predicted disease-specific worry (i.e., diabetes, heart disease, colon cancer, and breast cancer; DiLorenzo et al., 2006). Understanding the implications of overestimation of risk is important because of its impact on distress which has been related to risk-reducing behaviors in other studies (Bober et al., 2004; Lerman et al., 1997; Schwartz et al., 2003) and was related to high-risk clinic contact intentions and behaviors in this study.

Further, although the perceived risk measure in this study included both absolute risk items (e.g., what do you think is your percentage risk of developing breast cancer in the future) and comparative risk items (e.g., compared to other women your age what do you believe is the likelihood you will develop breast cancer in the future), recent work has suggested that these two ways of measuring risk might have differential relationships with worry (Zajac, Klein, & McCaul, 2006). In the current study relationships were seen between perceived risk and cancer worry and distress, with distress predicting intentions for clinic contact and actual clinic contact. However, findings by Zajac et al. suggest that absolute risk is more strongly related to worry about breast cancer than comparative risk. This will be important to explore in future work due to demonstrated relationships between risk perceptions and cancer distress and worry and also between worry and health behaviors. Additionally, given the lack of relationship between perceived risk and the risk-reducing outcomes in this study, it would be of interest to examine the relationship between absolute risk measures and the study outcomes.

These findings are also relevant for recent questions about the direction of the relationship between perceived risk and worry (e.g., Loescher, 2003). The results of the current study are consistent with those of DiLorenzo et al. (2006) and add strength to the suggestion that worry is a consequence of perceived risk and not a cause. The findings in the current study would suggest that the same relationships hold for perceived risk and distress, although cancer worry was more strongly related to perceived risk than was cancer distress (r = .39 vs. r = .19). In future work, it will be important to further delineate the relationships between perceived risk (e.g., absolute and comparative), cancer worry, cancer distress, and risk-reducing behaviors, particularly through the use of longitudinal investigation.

Cancer Distress

Contrary to expectations, cancer worry was not related to any of the measured risk reducing outcomes and cancer distress was related only to clinic contact intentions. When examining the bivariate results, both cancer worry and cancer distress were related to clinic contact intentions with cancer distress demonstrating the stronger relationship ($r = .24$ vs. $r = .17$). Within the model, when other variance was accounted for, the only relationship that remained was that higher levels of distress were related to higher clinic contact intentions. In a study examining the use of chemoprevention, Bober et al. (2004) also examined both cancer worry and cancer distress. In this study, both higher worry and distress were related to chemoprevention, although within their logistic regression equation, distress held the stronger relationship with chemoprevention use ($p < .0001$ vs. $p < .03$). Cancer worry reflects a measure of concern and thought about breast cancer risk; its content reflects less interference than does the cancer distress measure. On the other hand, the cancer distress measure (e.g., IES) was designed to capture symptoms consistent with post-traumatic stress disorder. These results suggest that distress rather than worry is more influential on risk-reducing intentions and behavior.

This possibility is further suggested by the results of the secondary aim in this study: cancer distress accounted for individual variance in the outcome of clinic contact behavior while worry was not related to clinic contact. Given the positive relationship between perceived risk and distress in this sample, it is of interest that women with lower perceived risk and higher cancer distress appear to be contacting the clinic most often. Perhaps there is an interaction between these two variables when examining their influence on high-risk clinic contact. This possibility should be explored in future work.

As with other study variables, it is important to note that the absence of relationships between cancer specific distress and the outcome variables might be due to the method of recruitment in this study. Women in this study may have had lower levels of worry and distress than those in other studies. In fact, in a study that examined methods of recruitment, women who were recruited through a mass mailing had less worry than women who were self-referred or referred from their physician or affected relatives (Andersen et al., 2004).

Consistent with other research, women who were younger and less educated reported more levels of cancer worry (Han et al., 2006). There were divergent relationships between education and income and cancer worry and distress. Women with less education reported greater cancer worry although no relationship was found between education and adherence intentions or early detection behaviors. However, women with less income reported greater cancer distress, with lower income being related to fewer adherence intentions and early detection behaviors. It may be that women with less economical resources may have less access to traditional healthcare where screening behaviors are often initiated. These women have a family history of breast cancer may realize their increased risk and know that they are not adhering to recommendations for risk-reduction (because of limited access to healthcare) which may cause cognitive dissonance thus increasing their levels of distress. These findings suggests the importance of considering individual socioeconomic factors when determining the impact of these factors on health behaviors.

In summary, the methods of analyses used in this study are able to reveal some distinctions between cancer worry and cancer distress. Taken together with the findings of Bober et al., it appears that distress may be more strongly related to risk-reducing behaviors that are less common. For instance, although this work did not find a relationship between worry and risk-

reducing adherence intentions or early detection behaviors, several other investigators have found this relationship. However, in this study, when the variance between worry and distress was accounted for, only distress predicted clinic contact intentions. Further, only distress predicted high-risk clinic contact, and although Bober et al. (2004) found both worry and distress were related to chemoprevention use, the relationship with distress was stronger.

Attitudes Toward Risk-Reducing Behavior

The proximal variables of attitudes toward risk-reducing behaviors were most consistently related to the outcome variables. Attitudes toward information seeking was directly related to adherence intentions and clinic contact intentions, and attitudes toward worth of prevention and surveillance was directly related to all outcomes in this study. Further, the construct of attitudes toward information seeking was the conduit for several indirect relationships in the model. Age worked through attitudes toward information seeking to indirectly influence both adherence intentions and clinic contact intentions. Additionally, healthcare communication indirectly influenced clinic contact intentions through its relationship with attitudes toward information seeking.

Attitudes toward risk-reducing behavior have not been widely investigated and are measured in different ways in the literature. In this study principal component analyses were used to extract factor scores of related items. The first factor used to test the hypothesis in this study was an attitudes toward information seeking scale that consisted of questions about women's attitudes about the value and utility of seeking information at a high-risk clinic or of risk-reduction overall. These questions were adapted from questions used by Cameron and

Reeve (2006) to assess attitudes toward prophylactic surgery and genetic testing. The second factor score was attitudes toward the worth of prevention and surveillance consisted of questions regarding women's attitude about the value of following prevention with questions from the ADQ (see Table 7). Two subcomponents of the attitude concept have been suggested: an affective component (e.g., enjoyable, not enjoyable) and an instrumental component (e.g., beneficial, not beneficial; Ajzen, 2006). Attitudes toward risk-reducing behavior as measured in this study are best thought of as an instrumental attitude measurement.

Overall, women in this study had high levels of positive attitudes about seeking out information from a high-risk clinic and positive attitudes about the worth of prevention and surveillance recommendations. Further, positive attitudes about risk reduction were related to all of the risk-reducing behaviors in this study. This is consistent with findings by Cameron and Reeve (2006) who used similar items to measure attitudes and found that attitudes were associated with interest in genetic testing. In a study that examined the influence of attitudes toward uncertainty investigators found that participants with more negative attitudes about uncertainty were much more likely to intend to use genetic testing than those with less negative attitudes about uncertainty (Braithwaite et al., 2002). The concept of attitudes toward uncertainty overlaps with the concept of attitudes toward information seeking in this study, and findings suggest that those who are more motivated to seek out information and understanding are more likely to use behaviors that can provide more information about disease status. These results suggest that women's attitude about health behaviors, and more specifically risk-reducing behaviors, are important components underlying use of these behaviors.

Attitudes Toward Risk-Reducing Behavior and Other Study Variables. Due to the consistent associations of attitudes toward risk-reducing behavior and the outcomes in this study and others, it is important to understand what influences attitudes that women have about risk-reduction. First, as discussed above, older age is related to more positive attitudes about risk-reduction and it will be important to explore the reasons why younger women have less positive attitudes towards risk reduction. Others have also found that younger women have less positive attitudes toward risk-reducing surgeries (Cameron & Reeve, 2006; Meiser et al., 1999). Lower income was related to more positive attitudes about information seeking, which is consistent with Cameron et al. findings that lower income was related to more positive attitudes toward prophylactic surgeries. This relationship is important to understand particularly given the negative relationships between income and adherence intentions and early detection behaviors. Importantly, higher levels of healthcare communication were related to more positive attitudes about information seeking. This finding continues to highlight the importance of healthcare communication on the use of health behaviors. As mentioned previously, interventions to improve communication and affect attitudes could be applied to either healthcare workers or women with a family history of breast cancer.

Somewhat perplexing was the finding that despite the relationship between attitudes toward the worth of prevention and surveillance with each outcome variable, none of the background variables were related to attitude worth. While there were no relationships between background variables and attitudes toward the worth of prevention and surveillance, attitudes toward information seeking was the conduit for several indirect relationships in the model. Age worked through attitudes toward information seeking to indirectly influence both adherence intentions and clinic contact intentions. Additionally, healthcare communication indirectly

influenced clinic contact intentions through its relationship with attitudes toward information seeking.

Finally, it is interesting that in the study by Cameron and Reeve (2006), perceived risk and worry were associated with attitudes toward genetic testing. In the present study, bivariate analyses showed that attitudes toward information seeking was related to cancer worry, although this relationship was not found when using SEM, and no relationship was seen between perceived risk and attitudes. One possible reason for this lack of finding is that the current study used attitude constructs that asked about high-risk clinic use and the use of prevention and surveillance, while Cameron and Reeve were specifically examining attitudes about genetic testing and prophylactic surgeries.

Race

Although race was not included as a predictor variable in the model predicting risk-reducing intentions and behaviors, the results of the preliminary analyses in this sample provide information about differences based on race that should be explored. This is particularly important because although as seen in this study, Caucasian women are at a higher objective risk for breast cancer, a higher percentage of African American women die as a result of breast cancer (Gwyn et al., 2004). African American women reported lower levels of early detection behavior, although higher intentions to contact a high-risk clinic at baseline and two- and six-week following baseline. Other studies have found that African American women with a family history of breast or ovarian cancer are less likely to undergo genetic counseling and genetic testing than white women with a family history of these diseases (Armstrong, Micco, Carney,

Stopfer, & Putt, 2005). Despite differences in clinic contact intentions, there were no differences between African American and white women in contacting the clinic. In addition, black women reported less familiarity with prevention, although they reported more positive attitudes about prevention strategies than white women. African American women also reported less positive attitudes about the utility of prevention and surveillance strategies. It should also be noted, that there were differences between education and income by race with white women reporting more socioeconomic resources. Future work should examine whether socioeconomic variables or race account for more of the variance in these outcomes.

SUMMARY AND FUTURE DIRECTIONS

The results of this study suggest that both distal background variables and proximal variables are important when examining the risk-reducing outcomes of adherence intentions, early detection behaviors, and clinic contact intentions. Further, the same results were found when examining high-risk clinic contact with both background variables (objective risk) and proximal variables (perceived risk, cancer distress) being related to the use of high risk services. These results suggest that there is work to be done in promoting risk-reducing behaviors at both a public health level (e.g., income affects risk-reducing behaviors) and on an individual level (e.g., attitudes affect risk-reducing behaviors).

There are several areas of future work suggested by this study, many of which have been noted throughout the discussion. To our knowledge, this is the first study that examined the use

of high-risk clinic contact in this context. Women in this study had no prior contact with a high-risk clinic and were simply given written information about a high-risk clinic and followed-up by phone. No specific recommendations were made. Within six weeks time, 24% (n = 43) of this sample had contacted the high risk clinic. It is possible that this observed percentage may have been higher if women were followed up longer because intentions to contact the clinic at the final assessment were still high for many women. This suggests that women are willing to seek out sources of information if presented with the opportunity. Many women in this study indicated that they did not know that resources for women at increased risk existed. This, together with the number of women who did contact the clinic, suggests the importance of disseminating information about such clinics and/or information related to risk-reduction. It is important to note the somewhat disparate findings between clinic contact intentions and actual clinic contact behavior. Women with lower education and lower income had higher intentions to contact the clinic. However, these variables were not related to actual clinic contact. This suggests that women with lower socioeconomic resources, although reporting higher intentions for behavior, their intentions are not being realized. This is an important finding to examine in future research to better understand the mechanisms behind this disparity.

Given the consistent relationships between the risk-reducing outcomes and attitudes toward risk-reducing behavior in this study and the relative dearth of information available on these relationships, one important area of work is improved understanding of attitudes in relation to risk-reduction. The construct that this study used to measure attitudes was similar to others (e.g., Cameron & Reeve, 2006), yet still unique. However, the strong relationships found between attitudes and risk-reducing intentions and behaviors suggest that this construct may be central in promoting our understanding. It will be important in future work to strengthen these

findings by replication and also to better understand the relationships between attitudes and health behaviors. One way to strengthen this relationship might be to increase healthcare communication. Healthcare communication was related to attitudes toward information seeking, and as well, healthcare communication was related to risk-reducing behaviors. Healthcare communication for risk-reducing behaviors may be improved by intervening directly with women at increased risk or with healthcare professionals. Future work should evaluate effective ways of implementing such communication systems and also evaluate the efficacy of both systems to determine the best way to increase healthcare communication.

The necessity to continue to understand the relationships between race, socioeconomic resources, and risk-reducing behaviors can not be overstated. Women who were African-American and women with lower socioeconomic resources are reporting lower levels of standard care (e.g., mammography, clinical breast exam, breast self exam) and lower levels of healthcare communication. Additionally, women with lower resources are reporting higher levels of distress than women with more resources. The results of this study suggested that women with fewer resources are eager to acquire information, but for a host of possible reasons have not received it. Again, implementing and increasing access to healthcare systems that are reliable for all women is an important area of future work.

Future work will need to examine the use of high-risk clinic contact and subsequently examine what predicts the adoption of recommendations given through the clinic. As stated earlier, the side effects of chemoprevention and prophylactic surgeries are not desirable. As others have suggested, it is critical to identify populations with an increased risk of serious cancer for which the benefits of risk-reduction outweigh the possible side effects (Lippman & Lee, 2006). When women at the highest levels of risk are identified through the high risk clinic,

it will be important to understand what factors influence the utilization of chemoprevention or preventative surgeries. Further, it may be beneficial to examine the use genetic testing and decisions about treatment in women who have been newly diagnosed with breast cancer. Are women with a new diagnosis routinely informed about genetic testing and/or the protective benefits of chemoprevention and risk-reducing surgeries? If they were informed, what factors would impact treatment decisions? This will be an important question to examine in the future.

LIMITATIONS

This study has several limitations. Perhaps the most significant limitation in this study is the limited variability found in early detection behaviors. It is not likely that all women with a family history of breast cancer are following recommendations for early detection as closely as those in this study. Although efforts were made to recruit in a diverse way throughout the community, there was likely a bias toward risk-reducing behaviors in the women who responded to study advertisements. Other recent work in community samples has also reported high levels of adherence to early detection behavior (Lipkus, Green, & Marcus, 2003). To adequately understand what variables are most predictive of early detection behaviors it will be necessary to sample women who are less adherent to recommendations than this sample. Additionally, although there is a wide range of income represented in this study, this is a sample of well-educated women with a large percentage of women in this sample having at least completed college and many having completed post-graduate work. These sample biases also suggest that

results of this study must be interpreted cautiously and may not be applicable to the general population.

Another limitation is the cross-sectional nature of the data for the main study hypotheses. Causal relationships can not be definitively discerned from the data used. A current project is underway to investigate these study variables over time and to better understand the impact of this project on behavior over time. It should also be noted that the original hypothesized structural equation model was not a good fit to the data; the model had to be respecified to test the hypotheses with SEM. Although it is not uncommon that hypothesized SEM models need to be respecified and it has been done in other research examining intentions for cancer screening (i.e., Manne et al., 2003), respecified models are based on post-hoc examination of the data. This suggests a strong need for findings to be replicated with future work.

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