

# Factors associated with intentions for breast cancer risk management: Does risk group matter?

Claire C. Conley<sup>1,2</sup> | Doreen M. Agnese<sup>3</sup> | Susan T. Vadaparampil<sup>2</sup> | Barbara L. Andersen<sup>1</sup>

<sup>1</sup> Department of Psychology, The Ohio State University, Columbus, Ohio

<sup>2</sup> Health Outcomes and Behavior Program, H. Lee Moffitt Cancer Center, Tampa, Florida

<sup>3</sup> Department of Surgical Oncology, The Ohio State University, Columbus, Ohio

## Correspondence

Claire C. Conley, PhD, H. Lee Moffitt Cancer Center, 12902 Magnolia Dr, MFC-CRISP, Tampa, FL 33612.

Email: claire.conley@moffitt.org

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## Abstract

**Objective:** National guidelines provide breast cancer (BC) risk management recommendations based on estimated lifetime risk. Despite this specificity, it is unclear if women's risk management intentions are or are not guideline concordant. To address this knowledge gap, women at varying risk levels reported intentions for risk-reducing behaviors. Factors associated with intentions, informed by the Health Beliefs Model, were also studied.

**Methods:** Women with elevated BC risk ( $N = 103$ ) were studied and categorized by risk level: moderate (15%-20%), high (greater than or equal to 20%), or very high ( $BRCA1/2$  positive). Participants self-reported BC susceptibility, self-efficacy, and benefits, barriers, and intentions for risk-reducing mastectomy (RRM), risk-reducing salpingo-oophorectomy (RRSO), chemoprevention, improving diet or physical activity, and reducing alcohol use.

**Results:** Groups significantly differed in RRSO intentions ( $P < .01$ );  $BRCA1/2$  positive women had greater intentions for RRSO. Groups did not differ in intentions for RRM, chemoprevention, or lifestyle changes ( $P_s > .28$ ). In hierarchical linear regression models examining Health Belief Model (HBM) factors, perceived susceptibility was associated with intentions for RRM ( $\beta = .169$ ,  $P = .08$ ). Perceived benefits was associated with intentions for RRM ( $\beta = .237$ ,  $P = .02$ ) and chemoprevention ( $\beta = .388$ ,  $P < .01$ ). Self-efficacy was associated with intentions for physical activity ( $\beta = .286$ ,  $P < .01$ ).

**Conclusions:** Consistent with guidelines,  $BRCA1/2$  positive women reported greater intentions for RRSO, and risk groups did not differ in intentions for lifestyle changes. Notably, women's intentions for RRM and chemoprevention were guideline discordant; groups did not differ in intentions for these behaviors. Accounting for the effects of risk group, modifiable health beliefs were also associated with risk management intentions; these may represent targets for decision support interventions.

## KEYWORDS

breast cancer, Health Beliefs Model, intentions, oncology, risk management

## 1 | BACKGROUND

In the United States, one in eight (12.4%) women will be diagnosed with breast cancer (BC) during their lifetime.<sup>1</sup> However, a subset of women carry elevated risk based on personal and family health history factors. Women with 15% to 20% lifetime risk are considered intermediate risk, while women with greater than or equal to 20% lifetime risk are categorized as high risk.<sup>2</sup> Following the sequencing of the two major BC susceptibility genes, an additional group of "very high" risk women was identified: pathogenic mutations in *BRCA1* and *BRCA2* genes confer 50% to 80% lifetime BC risk.

Risk stratification based on personal history, family history, and genetic mutations informs a personalized prevention approach: applying standard public health interventions differentially based on risk and, thereby, reducing costs.<sup>3</sup> To this end, national guidelines present options for risk reduction based on women's risk classification.<sup>2</sup> For all high-risk women—with or without a *BRCA1/2* mutation—lifestyle changes (diet, physical activity, and limiting alcohol consumption) are recommended. For those without a *BRCA1/2* mutation, chemoprevention with tamoxifen is FDA approved for women aged 35 or older, and raloxifene is approved for postmenopausal women.<sup>4</sup> Options for those with a *BRCA1/2* mutation include risk-reducing mastectomy (RRM) and risk-reducing salpingo-oophorectomy (RRSO).<sup>2</sup>

Despite specific recommendations based on risk level, there is a mismatch of treatments to risk groups.<sup>5</sup> Available studies exploring whether high-risk women are more likely to change their lifestyles have yielded contradictory results.<sup>6</sup> Only 12% to 17% of high-risk women use chemoprevention agents for risk reduction.<sup>7,8</sup> Conversely, a sizable percentage of non-*BRCA* carriers receive RRM and/or RRSO in the absence of data showing that greater risk reduction is achieved in this group.<sup>9,10</sup> Together, these findings raise concerns about whether women select risk-reduction options based on their risk level.<sup>5</sup> Prior research demonstrates that risk awareness is one of many factors impacting risk management decisions for high-risk women.<sup>11</sup> Age, ethnicity, partner status, education, physician recommendation, family BC history, personal medical history, concerns about complications/side effects, and anxiety/distress are commonly associated with intentions for RRM, RRSO, and/or chemoprevention.<sup>12–14</sup> However, existing studies are primarily retrospective. Thus, research providing further insight into the risk management intentions of high-risk women is timely and necessary.

Guided by Hochbaum's Health Belief Model (HBM),<sup>15</sup> the present study aims to understand risk management intentions among women at varying risk levels. The HBM includes four key variables. *Perceived susceptibility* refers to an individual's subjective feelings about the likelihood of a health threat.<sup>16</sup> *Perceived benefits* and *perceived barriers* refer to the perception of positive or negative attributes related to the health action.<sup>16</sup> *Self-efficacy* is an individual's confidence in her ability to act in a particular way.<sup>17</sup> These HBM variables have been previously linked to engagement in risk management behaviors such as mammography<sup>18</sup> and adherence to chemoprevention.<sup>19</sup>

HBM factors may impact patients' intentions for BC risk reduction, and clarifying their effects has the potential to improve understanding of decision making. However, no studies to date have examined health

beliefs among women at varying levels of BC risk. To fill this gap, we report on behavioral intentions among a heterogeneous sample of women at varying levels of lifetime risk. Women (N = 103) completed self-report measures of perceived BC susceptibility, self-efficacy, and intentions for risk-reducing behaviors, as well as a novel "thought listing" task to assess perceived benefits and barriers of risk-reducing behaviors. We hypothesized (a) women with higher lifetime risk would report greater intentions for RRM and RRSO, (b) *BRCA1/2* carriers would report lower intentions for chemoprevention, and (c) all risk groups would report similar intentions for diet, physical activity, and reductions in alcohol use. Second, guided by the HBM, we hypothesized (a) women with higher perceived susceptibility, perceived benefits, and self-efficacy would report greater intentions for risk reducing behaviors and (b) women with higher perceived barriers would report lower intentions for risk reducing behaviors.

## 2 | METHODS

### 2.1 | Participants

Sociodemographic characteristics are provided in Table 1. The sample (N = 103) was primarily Caucasian (85%), non-Hispanic (97%), in early adulthood (M = 43, SD = 18 y, range = 18–87), partnered (58%), and had some college education (79%). The majority worked full time (44%) or part time (29%) and had an annual household income of greater than or equal to \$50,000 (78%).

### 2.2 | Procedures

Study procedures were approved by the Institutional Review Board at The Ohio State University (protocol #2015C0148). A cross-sectional design with three intact groups was used. Eligibility criteria included the following: female gender, age 18 to 90, able to speak/read English, above average risk of BC. Women were eligible if their BC risk status met at least one of the following criteria:

1. Documented *BRCA1/2* mutation (n = 15).
2. Previous diagnosis of atypical hyperplasia, fibroadenoma, or lobular carcinoma in situ (n = 6).
3. Gail model<sup>20</sup> score of greater than or equal to 1.67 (n = 41). The Gail model incorporates a variety of risk factors to objectively estimate a person's lifetime risk of developing BC.
4. In the absence of criteria 1 to 3, strong family history (n = 41), ie, BC in multiple first-degree relatives and/or multiple successive generations with BC and/or multiple members with bilateral and/or premenopausal and/or male BC.<sup>21</sup>

Exclusion criteria were as follows: Gail model<sup>20</sup> score less than 1.67; concurrent diagnosis of organic brain syndrome, dementia, or intellectual disability; non-English speaking; significant sensory deficit; major mental illness; and/or prior cancer diagnosis.

**TABLE 1** Sociodemographics for all participants (N = 103) and by risk group; results of analyses of variance comparing risk groups

| Variable                           | Total<br>(N = 103) | Moderate<br>Risk<br>(n = 25) | High<br>Risk<br>(n = 63) | Very High<br>Risk<br>(n = 15) | P    |
|------------------------------------|--------------------|------------------------------|--------------------------|-------------------------------|------|
| Age (M, SD)                        | 43.1 (17.5)        | 56.3 (9.1)                   | 37.1 (17.8)              | 46.6 (13.7)                   | <.01 |
| Education: % $\geq$ college degree | 57 (55.3%)         | 16 (64.0%)                   | 30 (47.6%)               | 11 (73.3%)                    | .20  |
| Employment (%)                     |                    |                              |                          |                               | .03  |
| Full time                          | 45 (43.7%)         | 11 (44.0%)                   | 26 (41.3%)               | 8 (53.3%)                     |      |
| Part time                          | 30 (29.1%)         | 6 (24.0%)                    | 20 (31.7%)               | 4 (26.7%)                     |      |
| Other                              | 28 (27.2%)         | 8 (32.0%)                    | 17 (27.0%)               | 3 (20.0%)                     |      |
| Household income: % $\geq$ 75,001  | 55 (55.3%)         | 16 (64.0%)                   | 42 (66.7%)               | 7 (46.7%)                     | .87  |
| Health insurance type: % public    | 15 (14.6%)         | 7 (28.0%)                    | 6 (9.5%)                 | 2 (13.3%)                     | .18  |
| Race: % Caucasian                  | 87 (84.5%)         | 24 (96.0%)                   | 51 (81.0%)               | 12 (80.0%)                    | .16  |
| Ethnicity: % Latina                | 3 (2.9%)           | 0 (0.0%)                     | 3 (4.8%)                 | 0 (0.0%)                      | .38  |
| Partner Status: % yes              | 60 (58.3%)         | 22 (88.0%)                   | 25 (39.7%)               | 13 (86.7%)                    | <.01 |

To accrue a heterogeneous sample, two strategies were used. Firstly, women from a high-risk breast clinic at an NCI-designated Comprehensive Cancer Center were accrued (n = 65). A research assistant identified eligible participants via review of the appointment rosters and approached both new and returning patients following their appointment with their physician. Secondly, women who self-identified as high risk for BC (n = 38) responded to an advertisement listed on the cancer center website from August 2016 to February 2017. Interested participants contacted the study team via phone or email and were screened for eligibility.

Of the 194 women approached regarding study participation, 103 (53%) consented to study participation, including release of medical records, and participated. Medical charts were abstracted to determine risk level (Gail Model<sup>20</sup> and *BRCA1/2* status) with resultant classification as follows: "moderate risk" (lifetime risk 15%-20%; n = 25), "high risk" (lifetime risk greater than or equal to 20%, unknown *BRCA* status; n = 63), and "very high risk" (*BRCA1/2* mutation carrier; n = 15). Participants completed a 60-minute interview in person (66%) or via telephone (34%), as preferred. Six risk reduction strategies were studied: RRM, RRSO, chemoprevention, diet, physical activity, and alcohol use.

## 2.3 | Measures

### 2.3.1 | Perceived susceptibility

Patients estimated their personal risk of experiencing BC in their lifetime on a scale from 0% (definitely will not happen) to 100% (definitely will happen).<sup>18</sup>

### 2.3.2 | Perceived benefits and barriers

A thought-listing task<sup>22</sup> was used to elicit perceived benefits and barriers for engaging in risk-reducing behaviors. Patients were given a notebook with six lined pages and the following instructions:

*We are interested in your thoughts about six options for reducing breast cancer risk. In this booklet, there are six options, one listed on each page. Go through the pages one at a time. On each page list all the thoughts that you have about that option. Try to list one thought on a line. List as many thoughts as come to mind.*

Each page header had one of the six risk-reducing behaviors. Patients rated each listed thought on valence (positive or negative), confidence (1 = "not at all" to 5 = "extremely"), and importance (1 = "not at all" to 5 = "extremely"). Positively rated thoughts and negatively rated thoughts were tallied and weighted by confidence and importance ratings in a multiplicative manner.<sup>22</sup> The sum scores were divided by total number of thoughts to control for verbosity. This resulted in two total scores: (a) number of perceived barriers and (b) number of perceived benefits. Possible scores for each ranged from 0 to 25; higher scores indicate more perceived barriers and more perceived benefits.

### 2.3.3 | Self-efficacy

The "Personal Control" item from the Brief Illness Perceptions Questionnaire (BIPQ)<sup>23</sup> was tailored to reflect BC risk: "How much control do you feel you have over your risk of breast cancer?" Participants responded on an 11-point Likert scale from 0 ("absolutely no control") to 10 ("extreme amount of control").

### 2.3.4 | Behavioral intentions

Patients were first asked if they had previously received RRM, RRSO, or chemoprevention. Women who had not previously received these interventions (n = 102 for RRM; n = 81 for RRSO; n = 97 for chemoprevention) were asked about future intention to engage in each risk reduction strategy. All women were queried regarding future

intentions for diet, physical activity, and alcohol use. Participants could respond “yes” (1), “no” (–1), or “unsure” (0) for each behavior.

## 2.4 | Analytic strategy

All analyses were conducted using IBM SPSS 25. Preliminary analyses, using chi-square tests or analyses of variance (ANOVAs), determined sociodemographic differences, if any, between risk groups (Table 1). For primary analyses, chi-square analyses tested for differences between groups in behavioral intentions. Hierarchical multiple linear (HLM) regression analyses examined factors associated with behavioral intentions for each strategy. Variables were entered in the following order: (a) control variables, (b) risk group (0 = moderate, 1 = high, 2 = very high), and (c) HBM variables (perceived susceptibility, perceived benefits, perceived barriers, and self-efficacy). Variables with a significance level of less than or equal to .1 remained in the final models.

Chi-square and HLM analyses for RRM, RRSO, and chemoprevention were conducted removing women who had received these procedures, ie, n's of 102 for RRM, 81 for RRSO, and 97 for chemoprevention. Analyses for diet, physical activity, and alcohol use were conducted with N = 103 women.

### 2.4.1 | Power

For HLM, data from 103 individuals were required to detect a medium-sized ( $f^2 = 0.15$ ) effect at 80% power,  $\alpha = .05$  with seven independent variables in the model. With N = 82 (as in the RRSO model), power was adequate ( $\beta = .80$ ) to detect a medium-to-large effect ( $f^2 = 0.19$ ) with  $\alpha = .05$  and seven independent variables.

## 3 | RESULTS

### 3.1 | Preliminary and descriptive analyses

Risk groups significantly differed in age ( $P < .01$ ), employment status ( $P = .03$ ), and partner status ( $P < .01$ ). As age and partner status were significantly correlated ( $r = 0.42$ ,  $P < .01$ ), age was retained as a control variable along with employment status.

Summary statistics for HBM variables are reported in Table 2, and participants' intentions for risk-reducing behaviors within risk group are presented in Figure 1. As expected, intentions to engage in risk-reducing behaviors varied widely, with the greatest differences appearing between intentions to have medical interventions versus engaging in health behavior changes. Overall, only 25% planned to pursue RRM in the future; 11% reported intentions for RRSO. While 23% planned to utilize chemoprevention for risk-reduction, this behavior also elicited the highest percentage of “unsure” responses (27%). In contrast, women reported generally high intentions to improve diet (90% “yes”) and increase physical activity (88% “yes”). Although much lower, a substantial minority (36%) planned to reduce alcohol intake.

## 3.2 | Primary analyses

### 3.2.1 | Behavioral intentions by risk group

There were no significant differences in intentions for RRM, chemoprevention, diet, physical activity, or reduction in alcohol use by risk group (all  $P$ s  $> .28$ ; see Figure 1). Significant differences were only found for RRSO ( $P < .01$ ): BRCA positive women were more likely to report intentions for RRSO (75% “yes”) than women at moderate (0% “yes”) or high risk (13% “yes”).

### 3.2.2 | Factors associated with behavioral intentions

The final HLM models examining factors associated with behavioral intentions are presented in Table 3. Greater perceived BC susceptibility ( $\beta = .169$ ,  $P = .08$ ) and greater perceived benefits for mastectomy ( $\beta = .227$ ,  $P = .02$ ) were associated with greater intentions for RRM. Greater perceived benefits was associated with greater intentions for chemoprevention ( $\beta = .388$ ,  $P < .01$ ).

Risk group was associated with intentions for RRSO ( $\beta = .248$ ,  $P = .03$ ) and diet change ( $\beta = .186$ ,  $P = .06$ ); higher risk was related to greater intentions for risk-reducing behavior.

Finally, women who reported greater self-efficacy also reported greater intentions for increasing physical activity ( $\beta = .286$ ,  $P < .01$ ).

## 4 | DISCUSSION

The present study examines the frequency of and factors associated with BC risk management intentions in women with varying levels of risk. Despite the existence of BC risk reduction guidelines and providers' motivations to provide evidence-based recommendations, high-risk women are the ones who ultimately choose which reduction strategy(s) to pursue. These data show that all women—regardless of their estimated BC risk—were equally likely to report intentions to improve their health behaviors, as guidelines suggest. Based on guidelines, womens' intentions for mastectomy and chemoprevention would be expected to differ by risk group, but this was not the case. Only intentions for RRSO followed the anticipated trend of greater intentions covarying with heightened risk. Guided by the HBM, the data further indicate that perceived susceptibility, perceived benefits, and perceived barriers may explain the equivalence of risk groups on intentions for RRM and chemotherapy.

No group differences were observed in intentions for diet, physical activity, and reductions in alcohol use. In addition, the vast majority of women (99%) reported intentions for at least one health behavior change. Although intentions to improve health behaviors are often overoptimistic,<sup>24</sup> and many lifestyle risk factors are not easily modified,<sup>25</sup> these findings are encouraging for high-risk women's engagement in these important strategies for BC prevention. One HBM variable was significantly associated with intentions for health behavior change: self-efficacy. Higher self-efficacy was associated with greater intentions for increasing physical activity. Although the

**TABLE 2** Summary statistics for HBM measures for all participants (N = 103) and by risk group and results of ANOVAs comparing risk groups

| Variable                 | Total<br>(N = 103) | Moderate<br>Risk<br>(n = 25) | High<br>Risk<br>(n = 63) | Very High<br>Risk (n = 15) | P                   |
|--------------------------|--------------------|------------------------------|--------------------------|----------------------------|---------------------|
| Perceived susceptibility | 56.2 (20.2)        | 53.8 (16.6)                  | 55.5 (19.8)              | 63.5 (26.2)                | .31                 |
| RRM                      |                    |                              |                          |                            |                     |
| N                        | 102                | 25                           | 63                       | 14                         |                     |
| Perceived benefits       | 8.3 (6.9)          | 12.1 (7.4)                   | 7.0 (6.4)                | 7.4 (5.9)                  | .01 <sup>a</sup>    |
| Perceived barriers       | 6.1 (5.4)          | 5.2 (5.8)                    | 6.6 (5.6)                | 5.7 (4.1)                  | .53                 |
| RRSO                     |                    |                              |                          |                            |                     |
| N                        | 81                 | 17                           | 60                       | 4                          |                     |
| Perceived benefits       | 7.6 (7.4)          | 13.4 (8.7)                   | 6.0 (6.5)                | 8.0 (2.5)                  | <.01 <sup>a</sup>   |
| Perceived barriers       | 5.7 (6.1)          | 1.3 (3.1)                    | 6.9 (6.3)                | 5.7 (5.6)                  | <.01 <sup>a</sup>   |
| Chemoprevention          |                    |                              |                          |                            |                     |
| N                        | 97                 | 22                           | 60                       | 15                         |                     |
| Perceived benefits       | 6.2 (6.3)          | 9.7 (7.2)                    | 5.1 (5.5)                | 5.5 (6.2)                  | .01 <sup>a,b</sup>  |
| Perceived barriers       | 7.1 (6.1)          | 6.7 (6.1)                    | 7.5 (6.2)                | 6.0 (6.0)                  | .66                 |
| Diet                     |                    |                              |                          |                            |                     |
| Perceived benefits       | 11.1 (7.0)         | 11.6 (7.3)                   | 10.5 (7.1)               | 12.4 (6.3)                 | .60                 |
| Perceived barriers       | 3.8 (5.0)          | 5.4 (5.6)                    | 3.2 (4.3)                | 3.5 (6.1)                  | .16                 |
| Physical activity        |                    |                              |                          |                            |                     |
| Perceived benefits       | 10.4 (7.1)         | 9.8 (6.9)                    | 10.4 (7.3)               | 11.3 (7.5)                 | .83                 |
| Perceived barriers       | 4.1 (4.7)          | 6.1 (5.8)                    | 3.2 (3.8)                | 4.7 (5.4)                  | .03 <sup>a</sup>    |
| Alcohol use              |                    |                              |                          |                            |                     |
| Perceived benefits       | 9.6 (7.8)          | 13.3 (9.2)                   | 8.5 (7.1)                | 8.0 (6.2)                  | .02 <sup>a,b</sup>  |
| Perceived barriers       | 3.5 (4.9)          | 2.9 (4.8)                    | 3.6 (4.7)                | 4.5 (6.2)                  | .64                 |
| Self-efficacy            | 4.6 (2.7)          | 4.1 (2.4)                    | 4.4 (2.7)                | 6.5 (2.1)                  | <.01 <sup>b,c</sup> |

Abbreviations: ANOVAs, analyses of variance; HBM, Health Belief Model; RRM, risk-reducing mastectomy; RRSO, risk-reducing salpingo-oophorectomy.

<sup>a</sup>Moderate risk (15%-20%) vs high risk ( $\geq 20\%$ ).

<sup>b</sup>Moderate risk (15%-20%) vs very high risk (BRCA+).

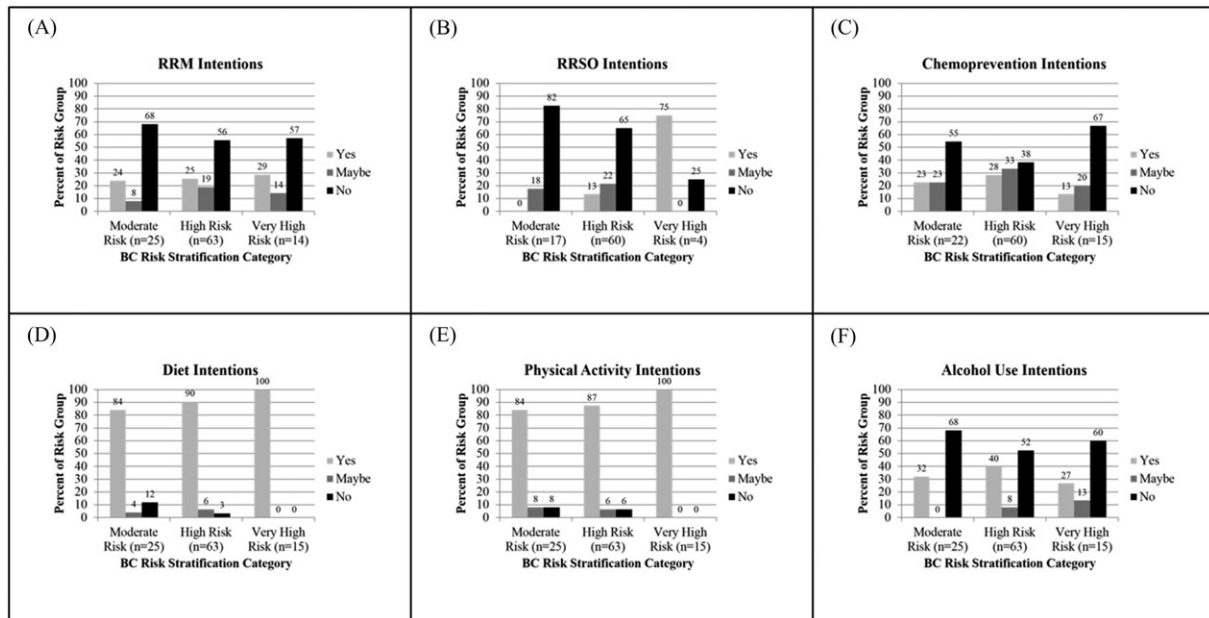
<sup>c</sup>High risk ( $\geq 20\%$ ) vs very high risk (BRCA+).

relationship between self-efficacy and physical activity is well established,<sup>26</sup> it is notable that in this study, self-efficacy was not specific to engaging in physical activity; rather, self-efficacy was generally related to ability to affect BC risk. Furthermore, the results of the present study indicate that sociodemographic factors (employment status, age) and clinical factors (BC risk group) may affect intentions to improve health behaviors. To maximize the potential benefits of health behavior interventions for BC prevention, researchers might consider targeting women who are at moderate risk, older, and/or working full time.

In this sample, overall intentions for future RRM (25% "yes") were similar to rates of uptake observed in prior studies (20%-54%), while overall intentions for chemoprevention (23% "yes") were higher than previously observed (12%-17%).<sup>7,8</sup> Although the overall intentions for future risk reduction are promising, the striking lack of group differences provides evidence for the previously noted concern that women's risk management intentions are not guideline

concordant.<sup>5</sup> Nearly a quarter of participants without *BRCA1/2* mutations intended to have RRM in the future. *BRCA1/2* carriers reported intentions for RRM similar to noncarriers (29% "yes"), contradicting prior findings that *BRCA1/2* carriers choose RRM more frequently than other high-risk women.<sup>13</sup> Similarly, despite the limited evidence for the efficacy of chemoprevention for BC prevention in *BRCA1/2* carriers,<sup>4</sup> *BRCA1/2* carriers reported intentions for chemoprevention similar to noncarriers. The fact that risk groups are equivalent in intentions for these major medical treatments is problematic, as there are significant risks associated with both RRM and chemopreventive medications.

In contrast to RRM and chemoprevention, women with higher lifetime risk did report greater intentions for RRSO. This finding is consistent with the literature on RRSO<sup>9</sup> and national guideline recommendations for the management of hereditary breast and ovarian cancer<sup>2</sup> and may indicate that the "very high" risk women are being informed of RRSO as a risk reduction option, either through their



**FIGURE 1** Frequency of behavioral intentions by risk groups

**TABLE 3** Results of final hierarchical multiple regression models, including significant sociodemographic characteristics, risk group, and HBM factors associated with intentions for six breast cancer risk-reducing behaviors

| Model             | N   | Block | Independent Variable     | Adjusted $R^2$ | Standardized $\beta$ | t                   |
|-------------------|-----|-------|--------------------------|----------------|----------------------|---------------------|
| RRM               | 102 | 1     | Age                      | 0.068          | -.293                | -3.032**            |
|                   |     | 2     | Perceived susceptibility |                | -.169                | -1.780 <sup>†</sup> |
|                   |     |       | Perceived benefits       | 0.154          | -.237                | -2.485*             |
| RRSO              | 81  | 1     | Age                      | 0.070          | -.189                | -1.650 <sup>†</sup> |
|                   |     | 2     | Risk group               | 0.112          | -.248                | -2.169*             |
| Chemoprevention   | 97  | 1     | Age                      | 0.002          | -.242                | -2.390*             |
|                   |     | 2     | Perceived benefits       | 0.127          | -.388                | -3.826**            |
| Diet              | 103 | 1     | Risk group               | 0.025          | -.186                | 1.900 <sup>†</sup>  |
| Physical activity | 103 | 1     | Employment status        | 0.047          | -.218                | -2.339*             |
|                   |     | 2     | Self-efficacy            | 0.121          | -.286                | -3.077**            |
| Alcohol use       | 103 | 1     | Age                      | 0.034          | -.208                | -2.142*             |

Abbreviations: HBM, Health Belief Model; RRM, risk-reducing mastectomy; RRSO, risk-reducing salpingo-oophorectomy.

\*\* $P < .01$  (two-tailed).

\* $P < .05$  (two-tailed).

<sup>†</sup> $P < .10$  (two-tailed).

own research, by their providers, or in the process of genetic counseling and testing. Women at moderate lifetime risk, on the other hand, appropriately did not plan for future RRSO.

This finding raises the question: Are the factors driving RRSO intentions different from those influencing intentions for RRM and chemotherapy? Although no HBM variables were significantly associated with intentions for RRSO, HBM variables were associated with intentions for RRM and chemoprevention. Consistent with our hypotheses, women with higher perceived susceptibility reported greater intentions for RRM; however, perceived susceptibility was not associated with intentions for any other risk-reducing behavior.

This is particularly notable given that perceived susceptibility has historically been identified as a key element in risk management decision making among high-risk women.<sup>18</sup> There may be features unique to RRM (eg, 90% reduction in BC risk<sup>27</sup>) impacting the relationship between perceived susceptibility and intentions for this behavior. Second, more perceived benefits was significantly associated with greater intentions for RRM and chemoprevention. Contrary to our hypothesis, perceived barriers did not associate with any behavioral intentions. This is surprising, as benefits and barriers are consistently the strongest predictors of health behaviors across HBM studies.<sup>28</sup> These results may have implications for future interventions; to change



behavioral intentions, focusing on benefits rather than barriers may result in a greater effect.

## 5 | CONCLUSIONS

Until now, few studies have provided insight into the complex risk management decision-making processes of women across the broad spectrum of elevated risk. Anchored in behavior change theory, the present study offers novel insights about risk management intentions among women in different risk groups. With replication, results may enable the revision or extension of existing interventions to support BC risk management decision making. For women at high risk for BC, health beliefs may play a unique role in BC risk management intentions, above and beyond lifetime risk.

### 5.1 | Study strengths and limitations

Although the complexity of risk management decisions for women at high risk has been recognized<sup>29</sup> for over 20 years and examined qualitatively,<sup>30,31</sup> there is a dearth of quantitative, theory-driven research. Guided by the HBM, this study meets this need and was designed to test for co-occurring effects of sociodemographic, clinical, and HBM variables on BC risk management decision making. Second, research to date has focused on the “very high” risk women: *BRCA1/2* carriers, who account for 3% to 10% of all BC diagnoses. This study is an important first step in investigating the psychological processes at work in women at “moderate” risk. Relatedly, decisions about lifestyle interventions were studied; these behaviors may play a particularly important role for “moderate” risk women.<sup>32</sup>

Study limitations include the following: (a) the loss of participants from RRSO and chemoprevention analyses due to prior therapies, leading to a post hoc power level of  $\beta < .80$  for these models; (b) the cross-sectional design obviates causal conclusions regarding predicted pathways; (c) active surveillance (ie, mammography and/or screening MRI) is one option for risk management in this population, but was not assessed as a potential outcome; (d) date of initial risk assessment was not collected, and we were unable to assess the relationship between time since women became aware of their risk and behavioral intentions; (e) minority women are underrepresented in studies of BC risk management,<sup>33</sup> and similar to prior research, this sample was predominantly Caucasian, educated, and with above-average income and health insurance coverage.

### 5.2 | Clinical implications

Study results may inform future BC risk management decision support interventions. First, specific subpopulations of high-risk women may require personalized prevention interventions. For example, the lack of risk group differences in intentions for RRM indicate a need for educational interventions in which moderate risk women are taught about prevention strategies for their risk level. Second, factors associated with intentions for risk-reducing behaviors may be potential

targets for decision support interventions. Many such interventions focus on correcting inaccurate perceived susceptibility.<sup>34</sup> However, in this study, perceived susceptibility was associated with RRM intentions only. Although interventions that successfully change perceived susceptibility often change health behaviors,<sup>35</sup> other intervention targets (eg, perceived benefits and/or self-efficacy) may be necessary to affect risk management intentions among high-risk women, particularly for behaviors other than RRM.

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## CONFLICT OF INTEREST

The authors have no conflicts of interest to report.

## ORCID

Claire C. Conley  <https://orcid.org/0000-0001-7695-2428>

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