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### Permalink

<https://escholarship.org/uc/item/1dz5g44k>

### Journal

Journal of Women's Health, 28(11)

### ISSN

1540-9996

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### Publication Date

2019-11-01

### DOI

10.1089/jwh.2018.7026

Peer reviewed

# An Intervention Tool to Increase Patient–Physician Discussion of Lifestyle Risk Factors for Breast Cancer

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## Abstract

**Background:** Risk assessment and discussion of lifestyle in primary care are crucial elements of breast cancer prevention and risk reduction. Our objective was to evaluate the impact of a breast cancer risk assessment and education tool on patient–physician discussion of behaviors and breast cancer risk.

**Materials and Methods:** We conducted a randomized controlled trial with an ethnically and linguistically diverse sample of women, ages 40–74, from two primary care practices. Intervention participants completed a tablet computer-based Breast Cancer Risk Assessment and Education (BreastCARE) intervention in the waiting room before a scheduled visit. Both patients and physicians received an individualized risk report to discuss during the visit. Control patients underwent usual care. Telephone surveys assessed patient–physician discussion of weight, exercise, and alcohol use 1 week following the visit.

**Results:** Among the 1235 participants, 27.7% (161/580) intervention and 22.3% (146/655) usual-care patients were high risk for breast cancer. Adjusting for clustering by physician, the intervention increased discussions of regular exercise (odds ratios [OR] = 1.94, 1.50–2.51) and weight (OR = 1.56, 1.23–1.96). There was no effect of the intervention on discussion of alcohol. Women with some college education were more likely to discuss their weight than those with high school education or less (OR = 1.75, 1.03–2.96). Similarly, non-English speakers were more likely to discuss their weight compared with English speakers (OR = 2.33, 1.04–5.22).

**Conclusions:** BreastCARE is a feasible risk assessment tool that can successfully promote discussions about modifiable breast cancer risk factors between patients and primary care physicians.

**Keywords:** lifestyle risk, patient–physician discussion, breast cancer risk assessment, health promotion

## Introduction

**B**REAST CANCER IS the most commonly diagnosed cancer for women in the United States.<sup>1</sup> Many risk factors for breast cancer, such as age, genetics, and a personal or family history of breast or ovarian cancer, are not modifiable. However, others are modifiable, including alcohol consumption, weight, and physical activity.<sup>2–4</sup> The National Comprehensive Cancer Network recommends that any thorough breast health program includes the use of risk reduction strategies<sup>5</sup> (surgery, chemoprevention, and lifestyle modification)<sup>6–13</sup> tailored to each individual's risk.

Unlike chemoprevention and surgery, which are intended for women at high risk, lifestyle modifications such as reducing weight and alcohol consumption and increasing physical activity are important options for all women. Higher body mass index and energy intake are both associated with higher breast cancer risk in pre- and postmenopausal women<sup>7,14–16</sup> and alcohol consumption, even as low as three to six drinks per week, is associated with an increase in breast cancer risk.<sup>17</sup> Depending on the amount of alcohol consumed, breast cancer risk is increased 9%–43%.<sup>8</sup> Breast cancer risk reduction for high to vigorous levels of physical activity (such as running, swimming, and tennis) has been

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found to be between 20% and 40%.<sup>6,18,19</sup> These breast cancer risks can be reduced through lifestyle modifications, although awareness of these behavioral risks is frequently lacking.<sup>3,4</sup>

Women are more likely to be informed about hereditary risk factors than lifestyle factors,<sup>2-4</sup> particularly alcohol consumption.<sup>4</sup> A woman's primary care physician can play a critical role in communication regarding these issues. Yet, beyond mammographic screening,<sup>20,21</sup> patient-physician discussions on breast cancer risk at best are typically limited to family history and genetic testing. Indeed, one study found that only half of primary care physicians reported counseling their patients about diet, physical activity, and alcohol.<sup>22</sup> This is especially pertinent given the potential societal benefits of preventing breast cancer as well other common chronic diseases through the same lifestyle behaviors.

The first step to improve the uptake of healthy behaviors is to identify women who are most likely to benefit. In the primary care setting, thorough breast cancer risk assessments may be challenging due to competing demands, time constraints, and lack of infrastructure.<sup>23,24</sup> Thus, there is a "movement" to incorporate risk assessments into clinical practice through the use of technology, such as through tablets and apps. To facilitate patient-physician discussion on this topic, we developed and tested a comprehensive Breast Cancer Risk Assessment and Education (BreastCARE) intervention. This intervention was tested with women and their primary care physicians in real-world primary care settings serving diverse populations using a randomized controlled trial design. In this article, we report on the impact of BreastCARE on patient-physician discussion of lifestyle factors and breast cancer risk. The primary outcome of the trial is reported elsewhere.<sup>25</sup>

## Material and Methods

### Study design

The study design has been reported on in detail previously.<sup>25</sup> In brief, patients were recruited from two primary care practices for a randomized controlled trial comparing the BreastCARE intervention before a provider visit to usual care. Data collection included two patient-reported surveys—a baseline survey which included a breast cancer risk assessment, and a follow-up survey—and chart abstraction data 6 months after the clinical visit.

### Setting and participants

The study period ran from June 2011 until the recruitment goal was met in August 2012. Women were recruited from two general medicine practices, one in an academic medical center and the other in an academic safety-net setting, both with ethnically and linguistically diverse patient populations. Eligible participants met six requirements: having an upcoming appointment in one of the participating sites; being between the ages of 40 and 74; speaking English, Spanish, or Chinese (Cantonese or Mandarin); having no personal history of breast cancer; being able to complete a telephone interview; and having a physician who agreed to their participation. To invite eligible patients to take part in the study, recruitment letters with opt-out postcards were mailed. After 1 week, a study recruiter contacted eligible participants who did not opt out.

### Intervention: BreastCARE

The BreastCARE intervention consisted of a tablet-based patient risk assessment tool that generates individually tailored risk assessments and printouts for patients and their physicians at the time of the visit. The tablet queries patients on breast cancer risk factors in a series of questions written at an eighth grade reading level, available in English, Spanish, traditional, and simplified Chinese characters. Following completion of the questions, two sets of reports were generated. The first, optimized for rapid scanning by physicians, was designed to efficiently prompt discussion with the patient of breast cancer risk. Patients received individually tailored reports with graphic appeal and using plain language to accommodate all levels of literacy and language preferences.<sup>26</sup>

A panel of experts determined the thresholds at which patients would be considered "high risk" for each measure in our assessment (see Measurements section). These thresholds were chosen to be clinically actionable cutoff points, above which a woman should be referred for genetic counseling or high-risk evaluation for chemoprevention.<sup>25</sup> For each woman identified as high risk, the patient report indicated that the patient was above average for women her age and suggested discussing this with her doctor. Both the woman and her physician were given information about which risk factors put her at high risk, including weight, exercise, and alcohol use when applicable.

### Study procedures

All participants completed a baseline survey, which was administered by telephone before her clinic visit. After completion of this baseline telephone survey, participants were randomized to BreastCARE or usual care. Random sequence codes, stratified by race/ethnicity to ensure balance, were matched to assignment in the intervention or usual-care group. At no point were women apprised of their intervention status. Physicians were not blinded, as receipt of the intervention handout indicated that a patient was in the intervention group.

If a woman was randomized to usual care, she completed a baseline breast cancer risk assessment during the initial telephone conversation after completing the baseline telephone survey. If a woman was assigned to the intervention group, she completed a tablet-based version of the same risk assessment at the clinic before her primary care appointment. Data collected in the baseline telephone survey and risk assessment (either by phone or by tablet in the clinic) included demographics and health information, breast cancer risk factors, lifestyle behaviors, and breast cancer risk assessment using three validated models, as described in detail below. A research assistant met with women from both groups 20 minutes before the primary care appointment to obtain signed consent. Usual-care patients then continued to their visit, whereas intervention patients received the BreastCARE intervention before continuing to their visit. To assess study outcomes, we contacted all participants a week after their initial visit for a follow-up telephone survey. Six months after the visit, we completed a review of each participant's electronic medical record (EMR). All interviewers and EMR abstractors were blinded to participants' study assignment.

The research protocol was approved by the Institutional Review Boards of both participating institutions.

### Measurements

**Descriptive variables.** *Demographic and health information* collected at baseline included: age, race/ethnicity, marital status, educational level, health insurance coverage, self-reported general health (“excellent/very good” vs. “good/fair/poor”),<sup>27</sup> number of primary care visits in the past year, and number of self-reported comorbidities<sup>28</sup> (0, 1–2, or 3+ comorbid conditions).

*Breast cancer risk factors* included age at menarche, age at first birth, age at menopause, breast biopsy history, hormone replacement therapy, Ashkenazi Jewish ancestry, and family history of ovarian and breast cancer. For women who had a prior mammogram, the breast density from their most recent mammogram report was abstracted from the EMR.

*Lifestyle behaviors/risk factors* included alcohol intake (drinks/day), weight and height to calculate body mass index (BMI), and regular exercise (physical activity less or greater than 4 hours per week, a threshold found in the literature for differences in breast cancer risk).

*Risk assessment* included three measures to estimate risk for breast cancer: the Referral Screening Tool (RST) for women with family history-based risk,<sup>29</sup> the Gail Model,<sup>30</sup> and the Breast Cancer Surveillance Consortium Model (BCSC) for women with available breast density from a prior mammogram.<sup>31</sup> Women were considered to be high risk if they met at least one of three criteria: (1) strong family history based on the RST,<sup>29</sup> (2) a BCSC score in top 5% of estimated 5-year risk within her age group,<sup>30</sup> (3) a Gail score in the top 5% estimated 5-year risk for her age group.<sup>31</sup> Additionally, women between the ages of 40 and 50 were considered to be high risk if their Gail or BCSC score was  $\geq 1.67$ , as supported by the literature.<sup>32</sup> All other women were classified as average risk.

**Outcomes.** The primary outcome was patient report of discussion of breast cancer-related behaviors during the primary care visit. At one-week follow-up, each woman was surveyed by phone as to whether during the clinic visit she and her physician discussed: the amount alcohol she drank, if any; how much she regularly exercised; and her weight. For those who had these discussions, they were also asked whether each of these behaviors was discussed in the context of breast cancer.

Documentation of discussion regarding these lifestyle behaviors (alcohol use, exercise, and weight) was also abstracted at the 6-month chart review.

### Statistical analysis

To adjust for patient clustering within physicians, we used generalized estimating equations regression to examine bivariate differences between the groups with respect to outcomes of self-reported discussion with physician of alcohol intake, regular exercise, and weight. We estimated odds ratios (OR) and 95% confidence intervals (CI) for women in the intervention group compared with the usual-care group. We repeated these analyses for the subset of women determined to be at high risk for breast cancer.

We additionally examined the factors associated with discussion of alcohol, exercise, and weight among women randomized to the intervention group. We estimated ORs and 95% CIs. Models predicting discussion of alcohol, exercise,

and weight among women in the intervention group included the following independent variables: age, race/ethnicity, marital status, education, study site, health insurance status, self-reported health status, concern about breast cancer (at baseline), perceived risk of breast cancer relative to other women of the same age, and objective breast cancer risk. We conducted all analyses in Stata Version 11.2.<sup>33</sup>

## Results

### Recruitment

Of the 3437 eligible participants who were reached by phone, 1635 agreed to participate. Among 1635 women who completed the baseline telephone survey, 812 were randomized to the intervention group and 823 to usual care. Six hundred three (74%) of women in the intervention group and 675 (82%) of women in usual care completed all initial study procedures (completed risk assessment by phone or tablet, and attended their scheduled appointment with their provider). A total of 1235 women completed the 1-week follow-up telephone survey (580 [96%] in the intervention group and 655 [97%] in the usual-care group).

### Description of study population

At baseline, intervention, and usual-care groups were well balanced with respect to demographic characteristics and breast cancer risk (Table 1). Most of the women were under the age of 65 years with good representation across racial/ethnic groups, including 13% who completed interviews in Spanish or Chinese. We only found differences by health insurance. Among insured women in the intervention group, private insurance was more common, whereas among insured women in the usual-care group, public insurance was more common.

The majority of women (75%) were at average risk for breast cancer. Twenty-five percent were identified as high risk. Distribution of risk was similar between the intervention and usual-care groups. Five percent consumed at least eight drinks of alcohol per week, 63% were overweight or obese (BMI  $\geq 25$  kg/m<sup>2</sup>), and 71% engaged in less than 4 hours of physical activity per week (76% intervention vs. 66% usual care).

### Discussion of lifestyle factors with physicians

Compared with women in usual care, women in the intervention group were significantly more likely to report discussions of regular exercise (75% vs. 61%) and weight (67% vs. 57%) in general, with even greater differences between the groups for discussion of exercise and weight and the risk of breast cancer (Table 2). The percentage of women who discussed alcohol intake with their physician was not significantly different between intervention and usual care. However, among women who did report discussing alcohol, a greater percentage of those in the intervention did so specifically in the context of breast cancer risk (28% vs. 13%). When restricted to high-risk women, results were similar across the entire sample (Table 2). The chart review at 6 months found that 20% of charts documented a conversation about alcohol, 37% about exercise, and 36% about health weight and diet. Chart review matched patient report of these conversations in 60% of cases for discussion of alcohol, 54% of exercise, and 58% of weight and diet.

TABLE 1. BASELINE CHARACTERISTICS OF PARTICIPANTS IN RANDOMIZED CONTROLLED TRIAL OF BREASTCARE BY INTERVENTION AND USUAL CARE GROUPS (N= 1235)

	Usual care group, N (%), N=655	Intervention group, N (%), N=580
Demographic characteristics		
Age (categories), years		
<50	163 (24.9)	170 (29.3)
50–65	379 (57.9)	313 (54.0)
>65	113 (17.3)	97 (16.7)
Race/ethnicity		
Asian or Pacific Islander	123 (18.8)	105 (18.1)
Black or African American	150 (22.9)	125 (21.6)
Latina	144 (22.0)	141 (24.3)
Non-Latina White	229 (35.0)	202 (34.8)
Native American or Other	9 (1.4)	7 (1.2)
Marital status		
Married/living with a partner	288 (44.3)	261 (45.2)
Separated/divorced/widowed/never married	362 (55.7)	316 (54.8)
Education		
High school diploma or less	216 (33.3)	175 (30.4)
Some college	155 (23.9)	167 (29.1)
College degree and higher	278 (42.8)	233 (40.5)
Language of interview		
English	572 (87.3)	507 (87.4)
Spanish or Cantonese	83 (12.7)	73 (12.6)
Health characteristics		
Clinic site		
University practice	435 (66.4)	411 (70.9)
Safety net practice	220 (33.6)	169 (29.1)
Health insurance		
Any private insurance	291 (44.4)	297 (51.2)
Only public insurance	350 (53.4)	265 (45.7)
No insurance	14 (2.1)	18 (3.1)
Primary care visits during last year		
0–1	176 (27.2)	164 (28.6)
2–3	211 (32.5)	214 (37.4)
4+	261 (40.3)	195 (34.0)
Comorbid conditions		
0	45 (6.9)	39 (6.7)
1–2	256 (39.1)	226 (39.0)
3+	354 (54.1)	315 (54.3)
Perception of health status		
Excellent/very good	211 (32.4)	203 (35.2)
Less than excellent/very good	441 (67.6)	373 (64.8)
Assessment of risk for breast cancer		
Risk category for breast cancer		
Average risk	509 (77.7)	419 (72.3)
High risk, Gail/Breast Cancer Surveillance Consortium Model	97 (14.8)	101 (17.4)
High risk by family history (Referral Screening Tool)	49 (7.5)	60 (10.3)
Alcohol consumption—at least eight drinks/week	39 (6.1)	25 (4.4)
Body mass index—overweight/obese	409 (63.3)	363 (63.5)
Physical activity less than 4 hours/week	399 (65.5)	435 (75.8)

Adapted from Kaplan *et al.*<sup>25</sup>

### Multivariable analysis

**Intervention effects.** Women in the intervention group were more likely than those in usual care to report discussing regular exercise (OR=1.94, 1.50–2.51) and weight (OR=1.56, 1.23–1.96) in general with their physician (Table 3). Results for discussion of regular exercise were similar among high-risk women (OR=1.99, 1.29–3.07). Women in the intervention group were also more likely than those in usual care to

report discussing alcohol (OR=2.23, 1.40–3.56), regular exercise (OR=6.22, 4.29–9.05), and weight (OR=6.05, 4.05–9.05) in the context of breast cancer.

**Predictors of discussion.** Among women in the intervention group, those with “excellent or very good” self-reported health were more likely than those with “less than excellent or very good” health to discuss alcohol consumption with their

TABLE 2. PATIENT–PHYSICIAN DISCUSSION OF LIFESTYLE BEHAVIORS, BREASTCARE INTERVENTION VERSUS USUAL CARE (N=1235), AND FOR ONLY THOSE PARTICIPANTS AT HIGH RISK FOR BREAST CANCER (N=307)

	All participants			High-risk only		
	Usual care group, N (%), N=655	Intervention group, N (%), N=580	p*	Usual care group, N (%), N=146	Intervention group, N (%), N=161	p*
Did you talk with your doctor about...						
How much alcohol you drink, if any	225 (34.9)	189 (33.0)	0.490	53 (36.6)	53 (33.1)	0.56
If yes, did you discuss alcohol and risk of breast cancer?	29 (13.0)	52 (27.7)	<b>&lt;0.001</b>	7 (13.2)	23 (43.4)	<b>&lt;0.001</b>
How much regular exercise you get	391 (60.7)	429 (75.0)	<b>&lt;0.001</b>	85 (58.6)	118 (73.8)	<b>0.008</b>
If yes, did you discuss exercise and risk of breast cancer?	38 (9.9)	160 (37.8)	<b>&lt;0.001</b>	7 (8.3)	46 (39.3)	<b>&lt;0.001</b>
Your weight	364 (56.5)	383 (67.0)	<b>&lt;0.001</b>	82 (56.6)	98 (61.3)	0.37
If yes, did you discuss weight and risk of breast cancer?	30 (8.3)	131 (34.6)	<b>&lt;0.001</b>	6 (7.4)	46 (46.9)	<b>&lt;0.001</b>

Bold values signifies statistical significance.

\*p Values from generalized estimating equations analyses accounting for clustering of observations by physician.

physicians (OR = 1.55, 1.01–2.38) (Table 4). Women with some college education were more likely to discuss their weight with their physicians than those with a high school education or less (OR = 1.75, 1.03–2.96), as were non-English speakers compared with English speakers (OR = 2.33, 1.04–5.22). None of these factors was predictive of discussion of regular exercise. The following factors were found not to be predictive of lifestyle discussions: age, race/ethnicity, marital status, clinic site, health insurance, concern about getting breast cancer, perceived risk of breast cancer, and objective breast cancer risk.

## Discussion

The BreastCARE intervention increased patient-reported discussion overall and specifically in the context of breast cancer risk of two of the three lifestyle factors associated with breast cancer: weight control and exercise. The intervention did not increase reported discussion of alcohol intake in general, but among those who reported having a discussion, it did increase discussion of alcohol specifically in the context of breast cancer risk. Potential explanations for this finding may be that some physicians did not feel comfortable discussing alcohol at the visit due to the sensitive nature of the subject.<sup>23,24</sup>

Discussion of alcohol use during a primary care visit faces various barriers, both from the perspective of providers and the healthcare system. Providers often feel that they do not have sufficient training or knowledge when it comes to counseling on alcohol use, and some primary care providers have been shown not to address positive screening results.<sup>34</sup> In addition, providers may have concerns of alienating patients by asking about alcohol use<sup>35</sup> or that the discussion of alcohol use may inhibit building rapport with patients.<sup>36</sup> In addition, lack of time during visits may prohibit discussion,<sup>36</sup> as well as not having the resources to treat patients with alcohol use problems.<sup>34</sup>

Furthermore, there was limited documentation of these discussions in patients' medical records and low agreement between this documentation and the patients' report of these discussions at their primary care visit. Altogether, this indicates that chart documentation should not be viewed as a gold standard for records of discussion of lifestyle factors to reduce risk of breast cancer. As EMRs continue to evolve, it will be important to develop valid methods for capturing information about these discussions that can be shared among a patient's care team given the overall health impact that these lifestyle factors hold.

Our findings highlight the potential to fill gaps in preventive care in breast cancer through lifestyle modification.

TABLE 3. ODDS OF PATIENT–PHYSICIAN DISCUSSION OF LIFESTYLE BEHAVIORS, BREASTCARE INTERVENTION VERSUS USUAL CARE (N=1235)

	Total population, aOR (95% CI)	High-risk women, aOR (95% CI)	Average-risk women, aOR (95% CI)
Discussed lifestyle behaviors			
Discussed alcohol intake if any	0.92 (0.72–1.18)	0.85 (0.54–1.35)	0.95 (0.72–1.24)
Discussed alcohol in context of breast cancer	2.23 (1.40–3.56) <sup>a</sup>	3.22 (1.46–7.08) <sup>a</sup>	1.80 (1.07–3.02) <sup>b</sup>
Discussed regular exercise	1.94 (1.50–2.51) <sup>c</sup>	1.99 (1.29–3.07) <sup>a</sup>	1.94 (1.45–2.59) <sup>b</sup>
Discussed exercise in context of breast cancer	6.22 (4.29–9.05) <sup>c</sup>	8.14 (3.41–19.4) <sup>c</sup>	5.83 (3.81–8.91) <sup>c</sup>
Discussed weight	1.56 (1.23–1.96) <sup>c</sup>	1.21 (0.81–1.82)	1.73 (1.29–2.31) <sup>b</sup>
Discussed weight in context of breast cancer	6.05 (4.05–9.05) <sup>c</sup>	9.06 (4.15–19.8) <sup>c</sup>	5.11 (3.22–8.12) <sup>c</sup>

Referent category = usual-care group; analyses account for clustering of patients by physician.

<sup>a</sup>p < 0.01.

<sup>b</sup>p < 0.05.

<sup>c</sup>p < 0.001.

CI, confidence intervals; aOR, adjusted odds ratio.

TABLE 4. PREDICTORS OF PATIENT–PHYSICIAN DISCUSSION OF LIFESTYLE BEHAVIORS (ALCOHOL CONSUMPTION, REGULAR EXERCISE, AND WEIGHT), BREASTCARE INTERVENTION PATIENTS (N=562)

	<i>Discussion of alcohol, aOR (95% CI)</i>	<i>Discussion of regular exercise, aOR (95% CI)</i>	<i>Discussion of weight, aOR (95% CI)</i>
Education			
High school diploma or less	Ref	Ref	Ref
Some college	1.17 (0.63–2.17)	1.33 (0.77–2.32)	1.75 (1.03–2.96) <sup>a</sup>
College degree and higher	0.97 (0.53–1.79)	1.34 (0.76–2.35)	1.15 (0.64–2.09)
Language of interview			
English	Ref	Ref	Ref
Spanish or Cantonese	0.86 (0.41–1.78)	0.84 (0.37–1.91)	2.33 (1.04–5.22) <sup>a</sup>
Perception of health status			
Less than excellent/very good	Ref	Ref	Ref
Excellent/very good	1.55 (1.01–2.38) <sup>a</sup>	1.17 (0.79–1.72)	0.98 (0.65–1.49)

<sup>a</sup> $p < 0.05$ .

Existing research suggests that women are generally ill informed of their personal risk of breast cancer and how lifestyle behaviors can influence that risk.<sup>2–4,37</sup> This is further compounded by the challenges of brief visits for complex patients leading to missed opportunities for physicians to discuss exercise, diet, and alcohol consumption with their patients, even when those conversations are not contextualized by breast cancer risk.<sup>22</sup> BreastCARE bridges these gaps by providing women a simple breast cancer risk assessment tool, by educating women on the role of exercise, weight, and alcohol in breast cancer risk, and by initiating conversations about lifestyle behaviors in the context of breast cancer risk.

A previous BreastCARE study found that women receiving the intervention were more likely to recognize lifestyle factors that would affect breast cancer risk.<sup>26</sup> Women's knowledge of lifestyle behaviors in context of breast cancer risk in combination with increased discussions between patients and their providers can improve recommendations for appropriate preventive efforts—such as recommendations for genetic counseling, surgery, chemoprevention, or lifestyle modifications—and quality of breast cancer risk discussions. Further implications are that preventive efforts can be better aligned with a patient's risk status, averting high medical costs and distress among patients at normal risk of breast cancer. Discussing and emphasizing lifestyle modifications can motivate women to engage in healthy behaviors that reduce the risks not just for breast cancer but also for other important common chronic diseases, such as chronic heart disease, stroke, and diabetes. Downstream cost savings through prevention can alleviate the societal burden of chronic disease, which is crucial given an aging population, wherein 50% of women 55 years of age and over have two or more chronic diseases.<sup>38</sup>

In addition to addressing challenges in breast cancer risk education and chronic disease prevention, BreastCARE advances current research by leveraging a diverse patient population and the tool's clinical feasibility. Our study is distinct from other breast cancer risk assessment studies using online risk assessments in that we were able to successfully recruit a racially and ethnically diverse sample that was nearly two-thirds non-white. Moreover, no differences by race/ethnicity

in discussion of breast cancer-related behaviors during the primary care visit were found. Online assessments tend to discourage participation among those with limited Internet access.<sup>29</sup> In contrast, our participants completed the tablet-based risk assessment at the point of care without difficulty. Our assessment and messages were available in three languages, calibrated to an eighth-grade reading level, which may have facilitated patients' understanding and contributed to the intervention's success.

Strengths of this study include the use of a randomized design and the high follow-up rates. The ethnic and linguistic diversity of our sample and the universal impact across these groups support the potential acceptability of BreastCARE for use with diverse populations. The setting in which this intervention was evaluated is an additional strength of the study. Primary care practices are the main source of preventive care, and therefore an optimal environment for a breast cancer prevention and risk reduction intervention. The tablet-based approach in the waiting room, which on average only took women 5 minutes to complete, saved physicians the time-consuming task of evaluating risk and identified for them those patients for whom it was clinically important to spend time on risk discussions during the visit. Furthermore, the BreastCARE intervention is easily exportable and could be incorporated into EMR systems in future adaptations.

There were several limitations to our study. The study was implemented in two academic teaching practices so the findings may not be generalizable to other settings, or to areas outside of San Francisco. A further limitation is that we only assessed discussion of lifestyle factors, not whether women actually adopted healthy lifestyles. The majority of information was also derived from patient self-report, which may result in an over- or underestimation of discussion. This limitation is mitigated in part by the fact that patients were blinded to the study goals.

In summary, BreastCARE demonstrated that an intervention combining an easy-to-use risk assessment tool with patient-centered risk reports at the point of care can successfully promote discussion of lifestyle breast cancer risk factors between patients and their primary care physician. BreastCARE represents a promising approach to stimulating

and enhancing discussions for high-risk women across race/ethnic groups and in diverse primary care delivery settings. While this improvement is impressive, there is still room for further advancement in increasing the percentage of discussions on breast cancer risk factors. Over half of women do not have a discussion of lifestyle behaviors in the context of their breast cancer risk. To address this, the addition of reminders to assessments to prompt providers to have these discussions after the initial visit may give providers more time to discuss lifestyle behaviors at subsequent visits. Next steps include scaling and dissemination of the intervention with integration into EMR systems. Other future research can assess whether interventions such as BreastCARE motivate women to modify lifestyle behaviors.

### Acknowledgments

This research was funded by the California Breast Cancer Research Program (150B-0158) and Susan G. Komen for the Cure (KG090504). Both trials were recorded under one NCT identifier based on recommendations from NIH ClinicalTrials.gov. The funding organizations were not involved in the design and conduct of the study; collection, management, analysis, or interpretation of the data; preparation, review, or approval of the article; or decision to submit the article for publication. All authors have made substantial contributions to conception and design, acquisition of data, analysis and interpretation of data, and the drafting or critical revision of the article for important intellectual content, and all have provided final approval of the version to be published. Drs. C.P.K. and J.L.-T. had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Trial Registration ClinicalTrials.gov Identifier: NCT01830933.

### Author Disclosure Statement

No competing financial interests exist.

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