Breast Cancer Res Treat (2015) 154:201–207
DOI 10.1007/s10549-015-3581-2

BRIEF REPORT

Explicating perceived barriers to mammography for the USCREEN project: concerns about breast implants, faith violations, and perceived recommendations

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Received: 4 August 2015 / Accepted: 19 September 2015 / Published online: 30 September 2015

Abstract In line with the health belief model, perceived barriers have proven to be a key determinant of intentions to screen for breast cancer. The standard measure of perceived barriers to breast cancer screening is an 11 item scale developed by Victoria Champion. However, perceived barriers emerge and change over time, and Champion's perceived barriers scale was last revised in 1999. Moreover, the original scale did not address barriers which may be more pronounced in particular populations, such as congruity of action with faith. As part of the Utah Screening Project, a sample of women 40–74 ($N = 341$, Mage = 51.19, SD = 8.11) were recruited from four Utah counties in 2014 to complete a survey. The results revealed that the four new perceived barrier items explained 6.4 % of intentions to screen, above and beyond other predictors. In addition to barriers identified in past research, the current study identified several novel barriers including (a) concerns about negative effects to breast implants, (b) perceived conflict with faith, and the (c) perception that mammography is no longer recommended. The new perceived barriers items are useful to researchers interested in exploring barriers not addressed by the original instrument. The barriers also suggest potential belief-based targets and channels (e.g., plastic surgery clinics, faith-based interventions) for delivering mammography interventions.

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Keywords Perceived barriers · Health belief model · Mammography · Breast implants · Faith · News coverage

Introduction

Breast cancer is the second leading cause of cancer death among women in the United States [1, 2]. Approximately 12.3 % of women (one in eight) will be diagnosed with breast cancer during their lifetime [3]. While there is debate over the necessary frequency of mammography, women ages 35–54 make up nearly one-third of breast cancer cases [3, 4]. Moreover, when detected early, in the localized stage, the female breast cancer survival rate is 98.5 % [2].

Despite the prevalence of female breast cancer and the optimistic outlook for early detection, approximately 40 % of breast cancer cases found at a later stage [3]. One source of this disparity is limited utilization of mammography screening; for example, a progress report from the National Cancer Institute found that only 74.3 % of women ages 40 and older had utilized mammography screening in the past 2 years from 1987 to 2010 [5]. Breast cancer screening rates plateaued during 2000–2010, ending at an average of around 67 %; short of the Healthy People 2010 target of 70 % [5]. Increasing mammography use remains an important public health goal.

The health belief model (HBM) posits that perceived barriers are a key determinant of behavioral intentions [6–10], and researchers have utilized the HBM to model intentions to screen for breast cancer [11–13]. To that end, Champion originally developed a 5 item scale in 1984 to assess perceived barriers; the scale was revised and expanded 15 years later, in 1999, to include 11 items [14]. Fifteen years have passed since the last revision, so the

goal of the present study is to examine whether the Champion perceived barriers scale would benefit from additional revision and/or expansion.

The present study was part of a larger project—the Utah Screening (USCREEN) Project—designed to improve mammography outcomes in the state of Utah. Utah has one of the lowest mammography rates in the U.S., a situation that has persisted for decades [15]. To address this gap, a series of studies were launched to identify and engage barriers to mammography.

One of the first goals of USCREEN was to build on past research to elucidate new or evolving barriers to mammography. The current Champion (1999) perceived barriers scale assesses barriers such as lack of knowledge about how to get screened for breast cancer, embarrassment, and fear of exposure to unnecessary radiation (see Appendix for all 11 items). The current perceived barriers scale does not include items capture concerns about breast implants, faith, or uncertainty about screening recommendations. Since the last revision of the scale, research has revealed that concerns about breast implant ruptures could be related to screening [16]. Faith has also been explored as a possible barrier to screening, with mixed results that suggest further research is of value [17–21]. Finally, mammography recommendations have been the topic of several contentious news stories since 2009, a situation that has created uncertainty about how the public currently perceives mammography recommendations and whether those perceptions are negatively related to screening behavior. To date, analyses of large self-report survey data suggest that there was no significant decline in screening following 2009 [22, 23], but analyses of clinical data in Minnesota suggest otherwise [24]. Thus, four new items were developed to address whether the predictive power of the HBM could be enhanced by measuring barriers related to breast implants (RQ1a), faith violations (RQ1b), and perceived screening recommendations (RQ1c).

Methods

Procedure

Participants were recruited from four counties in Utah: Weber, Davis, Salt Lake, and Utah. Screening disparities are more pronounced in certain states though the source of this variance is unclear. For example, breast cancer screening rates in Utah are among the lowest in the nation. In a 2012 Behavioral Risk Factor Surveillance System (BRFSS) survey, only 68.2 % of women ages 40 and older reported having a mammogram in the past two years, compared with the national average of 74.3 %. For ages 50–74, only 73.2 % of Utah women had a mammogram in the past two years compared with the national average of 78.7 %. While Utah has a below-average incidence rate of breast cancer, this could be partially attributed to lack of detection [15].

Recruitment was carried out at several large conventions focused on non-health topics and at four departments of motor vehicles (DMVs). More than 85 % of the sample was recruited at the latter. At all sites, the research team set up a table decorated with university logos and banners. A sign informed those passing by that they could win a $1000 gift card if they provided the research team with their contact information and were willing to be contacted in the future for research studies. Those who completed contact identification cards ($N = 3200$) did so, with the understanding, they could be contacted again for future studies. The contact identification cards included questions for age, sex, ethnicity/race, address, email, phone number, and whether or not the individual had ever screened for breast or colorectal cancer (separate questions). This recruitment effort was designed to gather potential participants for multiple studies, so both males and females 18 and older were recruited. Following recruitment, a subsample ($N = 1083$) of participants was identified who met the basic requirements of this study: female, 40–75, and never screened for breast cancer or more than 3 years behind on their screening (i.e., screening nonparticipants). All eligible participants were sent an email asking if they would like to participate in a brief study with the chance to win a $500 gift card to a store of their choice. A link to an online survey was included in the recruitment email. Two follow-up emails were sent out to encourage participation. Approximately 31.49 % of eligible participants completed the survey ($N = 341$).

Some readers might benefit from additional information about the mammography screening programs available in the state of Utah. All mammography screening in the state is self-initiated (i.e., testing), though Utah women aged 40–64 can visit free mammography screening clinics staffed and maintained by the Utah Cancer Control Program.

Participants

Utah women ($N = 341$) 40–75 ($M_{age} = 51.19$, $SD = 8.11$) completed a survey about mammography screening and barriers. Table 1 depicts education, household income, and race/ethnicity for the sample. The last demographic is different from the U.S. population as a whole, but more similar to Utah's demographic profile with the exception of fewer individuals identifying as Hispanic than is typical of the state (Hispanic population in Utah: 13.4 %).

Table 1 Demographics

	N	Percentage
Race/ethnicity		
Non-White	20	6.3
White	296	93.7
Religion		
Mormon	196	62.0
Not Mormon	145	38.0
Education level		
High school	32	10.1
Some college credit, no degree	76	24.1
Trade/technical/vocation training	20	6.3
Associate's degree	40	12.7
Bachelor's degree	84	26.6
Master's degree	40	12.7
Professional degree	12	3.8
Doctorate degree	12	3.8
Household income		
Less than $10,000	8	2.5
$15,000 to $24,999	8	2.5
$25,000 to $34,999	52	16.5
$35,000 to $49,999	36	11.4
$50,000 to $74,999	76	24.1
$75,000 to $99,999	72	22.8
$100,000 to $149,000	56	17.7
$150,000 to $199,999	8	2.5

Note Demographic characteristics for the sample of Utah women recruited in 2014 from four Utah counties. $N = 341$

Measurement

Intention

In line with past research [14, 25, 26], Participants responded to a single item, "I intend to get a mammogram within the next 6 months" using a 7-point scale ranging from *strongly disagree* to *strongly agree* ($M = 4.97$, $SD = 2.08$). Six months was included as a time interval as it has proven to be a meaningful timeline for assessing the accuracy of intentions [27]. Non-screeners who do not intend to screen in the next 6 months are far less likely to do so.

Covariates

Past research has identified several variables that are related to intentions to screen for breast cancer [28]. Participants responded to questions about their marital status, number of first degree relatives with a history of breast cancer, mammogram history, breast biopsy history, age, race/ethnicity, household income, highest level of education, and whether genetic testing had ever identified them as a carrier of BRCA1/BRCA2. In addition to these factors, participants also indicated whether they had seen/heard public service announcements or billboards from the ongoing 2014–2015 Utah Mammography Campaign sponsored by the Utah Department of Health. To assess exposure, participants were shown all billboard ads and one of the public service announcements—at the end of the study—and then asked whether they had seen each campaign element. Their responses were summed into a measure of exposure which was controlled for in the reported analyses. Means and standard deviations for all measures can be found in Table 3.

Perceived barriers

Participants responded to 15 items measured on a 5-point scale ranging from *strongly disagree* to *strongly agree*. Eleven of the items were from Champion's perceived barriers scale [9, 14]. Four new items were included based on consultation with the Utah Department of Health. All items are included in Appendix.

Other HBM variables

Measures for perceived benefits (6 items), susceptibility (3 items), and self-efficacy (9 items) were taken from previous research by Victoria Champion and colleagues [9, 14, 29]. Participants responded using a 5-point scale ranging from *strongly disagree* to *strongly agree*.

Results

Correlations

Table 2 reports bivariate correlations between intention and all of the possible covariates. Intention was positively related to having a first degree relative with breast cancer, biopsy history, and exposure to the mammography campaign. It was negatively related to marital status (married women more likely to screen) and mammography history. Given these findings, subsequent analyses controlled for all of the significant variables identified in the correlation analysis and whether or not a participant as Mormon. The latter is a key demographic characteristic of the state of Utah and a possible moderator of other relationships such as the belief that mammography is a violation of faith.

Hierarchical regression

RQ1a–RQ1c asked whether barriers related to breast implants, faith, and perceived recommendations were

Table 2 Correlation matrix

	1	2	3	4	5	6	7	8	9	10	11	12
1. Intention	–	−0.14*	0.19**	0.20***	−0.12*	−0.01	−0.05	0.04	−0.07	−0.01	−0.01	0.18**
2. Marital		–	0.06	0.12*	0.04	0.06	0.14*	−0.18**	−0.21***	0.03	0.03	0.15**
3. 1st degree			–	0.02	−0.08	0.19**	0.11	0.01	−0.29***	−0.07	−0.19**	0.07
4. Biopsy				–	0.06	−0.02	−0.11	0.00	−0.11	0.24***	0.03	0.29***
5. Mam Hist					–	−0.30***	−0.21***	−0.32***	−0.15**	0.16**	−0.02	−0.20**
6. Age						–	0.18**	−0.02	−0.07	−0.22***	0.26***	0.08
7. White							–	−0.03	−0.06	−0.11	0.12*	0.04
8. Income								–	0.04	0.24***	0.02	0.05
9. Education									–	−0.07	−0.05	0.02
10. BRCA1/2										–	0.06	0.12*
11. Mormon											–	0.09
12. Exposure												–

Note Bivariate correlations among variables

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

related to intentions to screen, above and beyond existing barrier measures and other constructs of the HBM. Hierarchical linear regression was utilized to address all three queries. Hierarchical linear regression allows analysts to examine the contribution of variables/groups of variables by block and to examine whether blocks of variables meaningfully enhance a model above and beyond other blocks. To that end, the variables were initially blocked as shown in Table 3. Exposure and significant predictors from the correlational analysis were placed in the first and second blocks, respectively. Exposure was placed in the first block to quantify the influence of the campaign which is incidental to this analysis. All four predictors of the HBM (barriers, benefits, self-efficacy, and susceptibility) were placed in block 3. For this block, barriers were measured using the 11-item Champion scale [9, 14]. Block four included the four new perceived barrier items.

The regression model was significant at all four blocks (reported at block 4): $r = 0.52$, $R^2 = 0.27$, $F(4, 297) = 6.24$, $p < 0.001$. The statewide mammography campaign explained 3.0 % of the variance in intentions to screen. Demographic covariates explained 10.2 % of the variance; all were significant except for mammography history and whether the participant identified as Mormon. The HBM variables accounted for 7.4 % of the variance in intention; however, only perceived susceptibility to breast cancer was statistically significant as an individual predictor. Those with greater perceived susceptibility were more likely to intend to screen.

In block 4, all four items were related to intentions to screen, and they explained approximately 6.2 % of the variance in screening intentions. Those with concerns about mammography's impact on implants and perceived violations of faith were less likely to intend to screen.

Table 3 Hierarchical linear regression predicting intentions to screen

	β	R^2 Δ	*M* (SD)
Block 1: exposure		0.03**	
Exposure	0.17**		0.38 (0.36)
Block 2: covariates		0.10***	
Marital	−0.19***		0.09 (0.28)
1st degree	0.20***		1.19 (0.45)
Biopsy	0.18**		0.15 (0.36)
Mam Hist	−0.09		0.47 (0.13)
Mormon	0.03		0.62 (0.49)
Block 3: HBM variables		0.07***	
Barriers (Champion Scale)	0.04		1.66 (0.59)
Benefits	0.11		4.26 (0.61)
Self-Efficacy	0.00		4.53 (0.90)
Susceptibility	0.28***		2.34 (0.75)
Block 4: new barriers items		0.06***	
Implants	−0.10†		1.35 (0.75)
Faith	−0.15*		3.30 (0.43)
News	−0.11		1.87 (1.14)
Recommend	−0.16*		1.54 (0.76)

Note Linear regression predicting intentions to screen. $N = 341$. For perceived barriers, see Appendix for labels and full items

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Greater awareness of negative news stories and the (false) belief that the ACS no longer recommends screening were also negatively related to screening.

A 15-item champion scale?

Given the additional variance explained by the new barrier items, it is logical to examine the psychometric implications of adding these items to the original Champion scale.

Adding the 4 new items to the Champion scale yields a reliable scale (alpha = 0.86). Consistent with this analysis, a principal axis exploratory factor analysis with direct oblimin rotation yields a single factor with an Eigen greater than 1 (Eigen value = 5.56) for the 15 item measure. Thus, psychometric analysis suggests that it may be logical to add these four items to the original Champion scale, notably in situations where researchers are interested in barriers related to implants, faith, and screening recommendations.

Discussion

A recent meta-analysis of HBM research revealed that perceived susceptibility and barriers may be the best predictors of intention [30]. The present study is consistent with this logic as perceived susceptibility and barriers explained 13.6 % of the variance in intentions to screen for breast cancer.

Prior to this study, no published study had examined whether Mormon women were less likely to screen for breast cancer. From a faith standpoint, there is no doctrine in the Mormon faith which discourages or prohibits screening. Yet, in a largely Mormon sample (62 %), faith-based concerns about screening were negatively related to screening intentions. As a follow-up, we utilized Utah's 2012/2013 BRFSS data to examine whether Mormon women were less likely to have mammograms [15]. Consistent with the findings of the present study, fewer Mormon women reported a mammogram (64.59 %) than Women of other faiths: Protestant (77.75 %), Catholic (70.02 %), Jewish (67.11 %), and no religion (68.61 %). Thus, it appears reasonable to hypothesize at this point that Mormon women are less likely to pursue mammography at least partially because it is perceived to conflict with perceptions of faith. Future research should continue to explore this possibility. A valuable next step would be interviews and focus groups with Mormon women exploring their perceptions of mammography in relation to faith.

Breast implants can complicate the accuracy of breast cancer screening, and previous research has suggested that women with breast implants are concerned about the possibility of rupture during mammography [16]. The current study extends past work by examining whether this concern is still significant relative to other mammography barriers. The data in hand suggest that implant concerns are a barrier; however, Utah women are more likely to pursue breast augmentation procedures than U.S. women in general [31]. Therefore, researchers should continue to explore whether this pattern holds in other populations. If it does, then public health practitioners might pursue health campaigns and interventions through plastic surgery offices or organizations.

The present study had several limitations. First, Utah women may hold different attitudes and perceptions compared to U.S. women in general. For instance, it is possible that concerns about faith and breast implants will prove to be more or less pronounced in this population. Second, participants were recruited from the four most populated counties in Utah which means that the current sample likely under-represents the rural population within the state. Third, some of the participants were recruited from conventions, and the response rate was relatively low, both of which could limit the generalizability of the sample. Fourth, the outcome was intention rather than actual behavior, and it was assessed with a single item measure. Relatedly, all of the women in this study were screening nonparticipants; that is, they had never screened before or they were behind on their screening. A survey that had included both screening participants and nonparticipants may have yielded different insights. Fifth, the new barriers were measured using single items. This is consistent with the original Champion scale; however, past research has demonstrated that the underlying constructs that these items might stem from—such as spirituality—are multidimensional [32]. Finally, the study was cross section, and thus causality cannot be determined.

Whether women pursue mammography is strongly related to their perceived barriers. The present study examined whether the oft-used Champion perceived barrier scale would benefit from additional items. The results are consistent with the notion that the existing scale could benefit from additional items including those capturing perceptions of faith, breast implants, and perceived recommendations. But we also caution that it is not possible to determine—with this sample—whether the four new items should be combined with the original scale for other populations. We developed the new items to address suspected barriers that could be unique to our population (implants, faith), though, of course, it is possible that those same barriers will explain variance in other groups. If the results do replicate to other groups, then this could be the first step toward an expanded barriers scale.

Acknowledgments Jakob D. Jensen is an Associate Professor in the Department of Communication and the Huntsman Cancer Institute at the University of Utah. Chelsea Ratcliff, Jeremy Weaver, William Payton, and Sherrie Loewen are graduate students in the Department of Communication at the University of Utah. Melinda Krakow is a post-doctoral fellow at the National Cancer Institute. This research was funded by a grant from the Utah Department of Health.

Compliance with ethical standards

Conflict of Interest The authors have no conflicts of interest to report. No author has a financial conflict or incentive related to or influenced by this research.

Appendix

See Table 4.

Table 4 Champion's 11 perceived barrier items

For each question below, place an "X" in the box that best represents your opinion.	Strongly Disagree				Strongly Agree
(Find) I am afraid to have breast cancer screening because I might find out something is wrong.	❑	❑	❑	❑	❑
(Understand) I am afraid to have breast cancer screening because I don't understand what will be done.	❑	❑	❑	❑	❑
(Know) I don't know how to go about getting screened for breast cancer.	❑	❑	❑	❑	❑
(Embarrassed) Getting screened for breast cancer is too embarrassing.	❑	❑	❑	❑	❑
(Time) Getting screened for breast cancer takes too much time.	❑	❑	❑	❑	❑
(Rude) People doing breast cancer screenings are rude to women	❑	❑	❑	❑	❑
(Radiation) Getting screened for breast cancer exposes me to unnecessary radiation.	❑	❑	❑	❑	❑
(Remember) I cannot remember to schedule a breast cancer screening.	❑	❑	❑	❑	❑
(Other Problems) I have other problems more important than getting screened for breast cancer.	❑	❑	❑	❑	❑
(Old) I am too old to need a routine breast cancer screening.	❑	❑	❑	❑	❑
(Painful) Getting screened for breast cancer is too painful.	❑	❑	❑	❑	❑

4 New Items

For each question below, place an "X" in the box that best represents your opinion.	Strongly Disagree				Strongly Agree
(Implants) I'm concerned about having a mammogram because I have breast implants.	❑	❑	❑	❑	❑
(Faith) Having a mammogram would require me to do things inconsistent with my faith.	❑	❑	❑	❑	❑
(News) I've seen news stories that make me skeptical about mammograms.	❑	❑	❑	❑	❑
(Recommend) I don't think the American Cancer Society recommends having a mammogram anymore.	❑	❑	❑	❑	❑

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