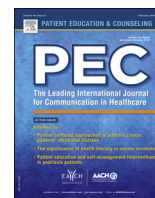




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Between-race differences in the effects of breast density information and information about new imaging technology on breast-health decision-making

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ABSTRACT

Objectives: Some US states have mandated that women be informed when they have dense breasts; however, little is known about how general knowledge about breast density (BD) affects related health decision-making. We examined the effects of BD information and imaging technology information on 138 African–American (AA) and European–American (EA) women's intentions to discuss breast cancer screening with their physicians.

Methods: Women were randomly assigned to receive BD information and/or imaging technology information via 2 by 2 factorial design, and completed planned behavior measures (e.g., attitudes, intentions) related to BC screening.

Results: Attitudes mediated the effects of BD information, and the mediation was stronger for AA women compared to EA women. Effects were more robust for BD information compared to imaging technology information. Results of moderator analyses revealed suppressor effects of injunctive norms that were moderated by imaging technology information.

Conclusion: Information about BD favorably influences women's intentions to engage in relevant breast health behaviors. Stronger attitude mediated-effects for AA women suggest greater scrutiny of BD information.

Practice implications: Since BD information may influence women's intentions to discuss BC screening, strategies to effectively present BD information to AA women should be investigated given the likelihood of their increased scrutiny of BD information.

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1. Introduction

Women with more dense breasts (i.e., larger ratio of fibroglandular to fatty breast tissue) are at higher risk for breast cancer (BC) [1–5]. Some US states now mandate that, following revelation via mammogram, women with dense breasts be notified of their breast density (BD) and associated BC risk [6,7]. Consequently, and in light of women's generally inaccurate knowledge about what BD is [8], we must clarify how generally educating women about BD and the associated BC risk influences their decision-making related to breast health behaviors (e.g., decisions about BC screening). Given that dense breasts mask tumors on mammograms [9], it is also worthwhile to simultaneously examine how learning about new breast imaging modalities that may be better suited for

imaging dense breasts (i.e., ultrasound tomography [UST]) affects women's behavioral decision-making. We used the theory of planned behavior (TPB) [10,11] as a model to examine effects of BD and UST information on BC screening decision-making.

The TPB is a well-validated cognitive-process model which has been used successfully in the prediction of health behaviors [12,13] and which theorizes a specific role for information. In the TPB, behavioral intentions directly predict behavioral engagement, and are themselves directly predicted by attitude towards the behavior, perceptions of descriptive norms (what you see others doing) and injunctive norms (what you think others want you to do), and perceptions of behavioral control (PBC). In turn, attitudes, norms and PBC are influenced respectively by beliefs about behavioral outcomes, motivations to comply with and pay attention to relevant others and beliefs about behavioral impediments. The TPB proposes that knowledge and information are background factors that (a) influence attitudes, norms and PBC indirectly by making related beliefs more salient and (b) influence the magnitude of the relation between attitudes, norms and PBC and subsequent

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behavioral intentions [14,15]. For example, BD risk information may make beliefs that “breast cancer screening saves lives” more salient, both engendering more favorable attitudes towards BC screening and increasing reliance on those attitudes for the formation of BC screening intentions. Thus, the mediational role of attitudes underscores their importance for cognitive integration of health information, and the moderating role of health information underscores the important role that information plays in anchoring decision-making to relevant beliefs and attitudes.

The influence of relevant information may be different for African American (AA) and European American (EA) women. We generally expect the effect of BD information to be greater for EA women compared to AA women since BD information may not be as effectively received by AA women in the absence of culturally targeted dissemination [e.g.,16–18]. This suggests that for AA women we may find a weaker effect of BD information on intentions and attitudes, a weaker mediated effect of BD information on intentions, and a weaker moderating effect of BD information on the relation between attitudes and intentions.

Data show that breast ultrasound identifies additional breast cancers that have been missed by mammograms among women with dense breasts [19–23], and the application of automated whole breast ultrasound imaging [24–26] makes it feasible that this modality may one day be introduced as a screening tool for women with dense breasts. Consequently, it is worthwhile to understand how making women aware of this technology will influence their decision-making. Compared to BD information, information about new medical technology is more saliently related to medical institutions. Given extant evidence of medical mistrust among AAs [27–29], information about new medical technology may also make some unfavorable beliefs more salient; so much so that they may attenuate any positive effects of new technology information on attitudes and intentions for AA women. Hence, we expect new technology information to lead to stronger intentions, for that effect to be more strongly mediated, and for technology information to be a stronger moderator for EA women compared to AA women.

1.1. Current study

Guided by the TPB, we tested hypotheses that information about BD and information about new imaging technology (breast UST via Softvue™) [24] would increase women’s intentions to talk to physicians about BC screening. We expected information to most strongly affect attitudes; thus, attitudes should most strongly mediate the effects of, and be moderated by, information as it influences intentions. We expected our hypothesized effects to be weaker for AA women compared to EA women.

2. Methods

2.1. Participants and procedure

Two hundred and two AA or EA women older than 40 were recruited via SurveyMonkey to participate in our study online examining how BD information affects anxiety related to learning one’s BD. Information on how respondents are recruited to and compensated by SurveyMonkey is available here: www.surveymonkey.com/mp/audience. Since our current analyses examined the effects of BD information on decision-making processes related to discussing screening behaviors with physicians, and since women who already knew their BD may have separate but related beliefs that influence their screening decisions, we restricted our analysis to those women ($N=138$) who reported that they did not know their own BD. We used a 2 (BD Information) by 2 (UST Information) between-subjects factorial design. Upon consenting

to participate, women provided demographic information and responded to items assessing BD knowledge (including whether they knew their own BD). They were then randomly assigned to one of four information conditions: no information, BD information, UST information or both information types. Following exposure to information, they completed planned behavior items related to talking to their doctors about BC screening. They also completed other cancer-related perceptions items (e.g., BC risk knowledge, cancer history, etc.) not reported here. Our study protocol was approved by our institutional review board.

2.2. Information conditions

Participants in the BD information condition viewed a title slide (“Breast Density”) and three slides of information related to breast density (Fig. 1a). Participants in the UST information condition viewed a title slide (“Advances in Breast Imaging Technology”) and three slides of information related to Softvue™ (Fig. 1b). Participants in the both information condition viewed a title slide (“Breast Density and Advances in Breast Imaging Technology”) followed by the three BD information slides and the three UST information slides. Participants in the no information condition did not receive any information.

2.3. Measures

Theory of Planned Behavior Items. Our target behavior was discussing BC screening with one’s doctor (i.e., “. . . talking to my doctor [i.e., primary care, ob/gyn, etc.] at my next available appointment about being screened for breast cancer”). All responses were on a scale from 1 to 7, with some responses reverse coded to address response bias. There was missing data for some scale items due to skipped responses. We established scale reliabilities with raw item scores and imputed missing data for the aggregated scale scores (imputation methods described below). Participants indicated intentions with responses to two items (e.g., “I intend to talk to my doctor . . .”, and “I have decided that I will talk to my doctor . . .”). Item correlation was acceptable ($r=.81$, $n=134$, $p<.001$) and the mean was used to assess intentions. Attitudes were assessed with the mean of participants’ responses to 5 items regarding attitudes (e.g., Extremely pleasant/extremely unpleasant, beneficial/harmful) towards discussing BC Screening ($\alpha=.84$, $n=130$). Injunctive norms (i.e., “Most people I care about would expect me to talk to my doctor . . .”) descriptive norms (i.e., “Most women who I care about would talk to their doctor . . .”) and PBC were each assessed with one item (e.g., “For me to talk to my doctor . . . is <extremely easy to extremely difficult>”).

2.4. Statistical analyses

To address missing data, we used SPSS v. 20 to impute 5 sets of complete data using Markov Chain Monte Carlo algorithms with linear regression models for the estimation of continuous variables, and used the mean across the imputed data for analyses.

We used a 2 (BD information) by 2 (UST information) by 2 (Race) full-factorial MANOVA to examine experimental effects and between-race differences in experimental effects on intentions and on the predictors of intentions.

To examine our mediation and moderation hypotheses, we fit multi-group path models, with race as the grouping factor, using lavaan [30] implemented with R software v 3.1.2 [31]. The mediation model (Fig. 2) was specified such that intentions, attitudes, injunctive and descriptive norms, and PBC were endogenous variables, each predicted by two effects-coded variables to identify receipt of UST or BD information (coded as .5 for Yes, –.5 for No), and their interaction. Covariances were

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