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Perceived risk for breast cancer and its relationship to mammography in Blacks, Hispanics, and Whites

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Abstract

A challenge for health behavior science is to develop theory and best practices that take cultural diversity into account. Using data from Black, Hispanic, and White respondents to the 2003 Health Information National Trends Survey, we examined racial/ethnic differences in: (1) breast cancer risk perceptions/worry; (2) the associations between perceived risk/worry and ever having received a mammogram; and (3) perceived risk/worry and having had at least 2 mammograms over a 4-year period (consecutive mammography). Compared to White race/ethnicity, Black race/ethnicity was associated with lower perceived absolute risk and comparative risk for developing cancer. For the sample as a whole, higher perceived risk (both absolute risk and comparative risk) and worry predicted greater odds of mammography use; however, this was not true for Hispanics. In stratified analyses, perceived risk and worry were not associated with mammography use for either Hispanics or Blacks whereas they were for Whites; however, this interaction effect was significant only for Hispanics vs. Whites. Results support the need for formative research to identify determinants of health behavior prior to cancer prevention message planning for diverse audiences in order to accommodate racial/ethnic differences not only in the level of perceived risk, but also the association between risk perception to behavior change in that community.

Keywords

Race; Hispanic; African American; Mammography; Breast neoplasms; Perceived risk

Introduction

Health education theory and practice recognize that intervention efforts should be designed to be acceptable and meaningful within the context of an audience's beliefs and values; however there remains considerable question about how to do this (Resnicow et al., 1999). Inquiries into the cross-cultural relevance of constructs long considered central to health behavior theory such as perceived susceptibility or perceived risk can inform these efforts (Joseph et al., 2009). Characterizing racial/ethnic variation in central constructs such as perceived risk and whether these constructs differentially predict protective behavior for different racial/ethnic groups will aid decision-making about the use of these key constructs in messaging and intervention efforts.

This work will also advance health behavior theory. For example, perceived risk is theorized to be a key motivator of preventive action (Janz & Becker, 1984; Leventhal et al., 2003; Vernon, 1999; Weinstein, 1988), with many cancer prevention efforts designed to change health behavior by increasing perceived risk. Although empirical data indicate that perceived risk can motivate health protective behavior (Katapodi et al., 2004; Vernon, 1999), the literature is mixed with respect to the generalizability, magnitude and direction of the relationship between perceived risk and health behavior (Calvocoressi et al., 2004). Research is still needed to illuminate this relationship, including identifying boundary conditions that demarcate when perceived risk does and does not influence behavior. Although the effects would be temporally and culturally bound, race/ethnicity is potentially one such condition.

In the present study we examined racial/ethnic variability in level of perceived risk. Previous investigations of racial/ethnic differences in perceived risk for breast cancer, primarily employing clinic and convenience samples, have yielded mixed results. Some studies have found no differences (Facione, 2002), others have found that Black women have higher perceived breast cancer risk than White women (Miller & Champion, 1997; Vernon et al., 1993), and others, that Black or non-White women report lower perceived breast cancer risk than White women (Donovan & Tucker, 2000; Glanz et al., 1996; Skinner et al., 1998). If perceived risk is lower among Black and Hispanic women, this may reflect issues with access to appropriate and acceptable cancer risk and prevention messages (Salant & Gehlert, 2008; Wailoo, 2011).

In addition, it has also been hypothesized that risk perception may be a less important determinant of health behavior in Black and Hispanic women than in White women because the concept may lack cultural resonance for these groups (Ashing-Giwa, 1999; Hughes et al., 1996; Joseph et al., 2009), or because socioeconomic and other barriers emerge as more important determinants in these groups (Joseph et al., 2009; Salant & Gehlert, 2008; Shelton et al., 2011). However, to our knowledge the hypothesis that the utility of perceived risk as a predictor of health behavior varies as a function of race/ethnicity has not been directly tested.

We tested whether perceived risk was less predictive of mammography among Hispanic and Black, compared to White respondents to the 2003 Health Information National Trends Survey (HINTS). Data on mammography use are useful for studying mechanisms underlying health behavior, especially in the years prior to the 2009 change in US Preventive Services Task Force recommendations that now recommend biannual mammography between the ages of 50 and 74 for women at average risk (US Preventive Services Task Force (USPSTF), 2009). Mammography use has been widely encouraged through the medical, community, and mass communication channels and has been well documented, although gaps with respect to understanding the determinants of the behavior

remain. Perceived risk, including both cognitive and affective components (e.g., worry), has been associated with mammography in predominantly White samples (Katapodi et al., 2004; McCaul et al., 1996; Vernon, 1999), and in the 2003 HINTS data (Moser et al., 2007; Rakowski et al., 2006) used in the present study, but these studies did not examine racial/ethnic variation in the relationship between perceived breast cancer risk and mammography.

Finally, the present work was also an opportunity to inquire into behavioral correlates of “don’t know” responding to risk perception items. It has been suggested that people respond “don’t know” to survey items for multiple reasons, including, not only lack of knowledge, but also lack of willingness to share their knowledge due to embarrassment, lack of trust in the confidentiality of their responses, or simply not spending the effort to do so (Beatty et al., 1998). Participants who respond “don’t know” to risk perception items are often dropped from analyses; however, these responses may merit further study. Evidence indicates that higher odds of responding “don’t know” to cancer risk perception items is associated with black race and immigrant status (Waters et al., 2011), lower screening knowledge, and health information-seeking (Orom et al., 2012). It is not known, however, whether “don’t know” responding to perceived cancer risk items is associated with lower rates of primary or secondary prevention behaviors, including mammography use.

In sum, in the present study we tested whether (1) Blacks and Hispanics report lower perceptions of breast cancer risk than Whites do; (2) “Don’t know” responding to perceived risk items is higher among Blacks and Hispanics than Whites; (3) Perceived risk is associated with mammography use among Whites but not among Blacks and Hispanics; and (4) “Don’t know” responding to perceived risk items is associated with mammography use. The analytic strategies employed in the current study will provide evidence as to whether perceived risk for breast cancer is a promising target for intervention for Black and Hispanic women as well as for White women.

Method

Dataset

Data for the study were obtained from the 2003 HINTS, a computer assisted random digit dial (RDD) probability-based survey conducted by the National Cancer Institute to study cancer health information seeking, cancer knowledge and health behavior (National Cancer Institute, 2005). Although there are more recent HINTS datasets, the 2003 data set was the only one that contained items on breast cancer risk perception. As the focus of the paper is on characterizing generalizable mechanisms underlying health behavior, the 2003 dataset has utility for addressing the current research question, despite the length of time since collection.

Blacks and Hispanics were oversampled and the total sample was weighted to be nationally representative. Response rates for the screener and full interviews were 55.01 % and 62.8 %, respectively. The response rate is comparable to other RDD surveys conducted during the same time period (Curtin et al., 2005). Participants were excluded if they were male, did not self-classify as non-Hispanic White, non-Hispanic Black or Hispanic, had a personal history of breast cancer, or had missing data on control variables [marital status, education, age, health care coverage status, having a usual source of health care, and language preference (Spanish vs. English)]. Asian women were excluded due to very low representation in the sample ($n = 59$). Forty-three participants were lost due to missing values on one or more of the control variables, yielding 3,361 participants in the overall sample. In addition to performing analyses on this sample, analyses were performed on smaller subsets of participants when analyses were restricted to women either 40 years or greater or 45 years or

greater ($n_s = 3,342-1,551$). Perceived risk and worry were examined both in all eligible respondents and, separately, in respondents aged 40 years and older.

Variables

Demographic characteristics—Participants self-identified as Non-Hispanic White, Non-Hispanic Black/African American or Hispanic. The groups are hereafter referred to as White, Black, and Hispanic. Age, marital status (married or living with a partner vs. divorced, widowed, separated, or never been married), education (<high school, high school, some college, college or greater), health care coverage status (some form of coverage vs. no coverage), and availability of usual source of health care were assessed via self-report. Participants could choose whether to complete the interview in English or Spanish. The language in which the survey was completed was used as a proxy for language preference.

Perceived breast cancer risk and worry—Perceived absolute breast cancer risk was assessed with the item, “How likely do you think it is that you will develop breast cancer in the future? Would you say your chance of getting breast cancer is very low/somewhat low/moderate/somewhat high/very high/don’t know?” Responses were converted to a 5-point response format, with higher scores indicating greater perceived risk. An additional variable, “don’t know responding,” was created by dichotomizing responses from those who indicated their level of risk and those who responded “don’t know.” A similar approach was used to assess level of perceived comparative breast cancer risk and “don’t know” responding using the item, “Compared to the average woman your age, would you say that you are more likely to get breast cancer, less likely, or about as likely?” Perceived worry about developing breast cancer was assessed by asking, “How often do you worry about getting breast cancer?” (rarely or never/sometimes/often/all the time). Responses were converted to a 4-point response format with higher scores indicating greater worry.

Mammography—Ever having had a mammogram was only examined in women 40 years and older because in 2003, most major guidelines advised women at average risk for breast cancer to begin receiving mammograms every one or one to two years starting at age 40 (Smith et al., 2003; United States Preventive Services Task Force, 2002). We coded ever having had a mammogram by categorizing women, aged 40 or older, according to whether they had received at least one mammogram in their lifetimes or had never had a mammogram. We coded consecutive mammography by categorizing women, 45 years or older who had received at least one mammogram, according to whether they had received at least one mammogram within each of the two 2-year periods prior to participating in the survey. Age 45 was chosen as the cutoff to allow for the fact that it might have taken women up to one year to have their first mammogram.

Data analysis

All analyses employed data that were weighted to produce nationally representative estimates. Bivariate analyses of sample characteristics as a function of race/ethnicity were performed with Chi-square tests and independent-sample *t* tests. Adjusted associations between race and absolute risk and worry about developing breast cancer (continuous outcomes) were examined using linear regression. Associations with comparative risk (categorical outcome) were examined with multinomial logistic regression. For the latter, relative risk of perceiving oneself at lower compared to average risk and higher compared to average risk were examined. Odds of responding “don’t know” to the perceived risk items were analyzed apart from the main analyses. Associations between race/ethnicity and reporting not knowing one’s risk (binary outcome) were examined using logistic regression. All multivariate models were adjusted for marital status, education, age, health care

coverage status, having a usual source of health care as control variables, and language preference (Spanish vs. English) when Hispanics were examined.

Results

Characteristics of the overall sample

Demographic characteristics of the overall sample and each racial/ethnic sub-sample are presented in Table 1. Compared to the average White respondent, Hispanic and Black respondents were younger, had lower educational attainment, and were less likely to have health care coverage. Blacks were less likely than Whites to be married.

Hypothesis 1 Compared to White Women, Black and Hispanic Women Will Report Lower Perceptions of Breast Cancer Risk and Lower Worry about Breast Cancer.

Unadjusted means and proportions for risk perception and worry for the overall sample and as a function of race (all ages) are presented in Table 1. Unadjusted means and proportions for risk perception and worry for women age 40 or over are presented in Table 2. In the overall sample, Blacks had a pattern of lower perceived comparative risk with respect to Whites. Blacks were the most likely to report having lower than average risk and this was the most commonly used category among Blacks (43.25 % compared to 34.88 % for Whites and 29.78 % for Hispanics; see Table 1). In the overall and 40 samples, they were also more likely than Whites to say that they did not know their perceived absolute or comparative risk. Among women 40, Hispanics were less likely to have received a mammogram than Whites and had higher perceived worry about getting breast cancer than Whites.

Perceived absolute risk—Results for the multivariate models of perceived absolute risk for women of all ages and women age 40 and over are presented in Table 3. After adjusting for education and marital status, age, health care coverage status, and usual source of health care, in the overall sample, Black race was associated with lower perceived absolute risk of developing breast cancer ($B = -0.17$, 95 % CI $-0.33, -0.01$). The effect for Hispanic ethnicity was in the same direction but was not significant ($B = -0.14$, 95 % CI $-0.31, 0.03$). In the subset of respondents 40 years and older, the pattern of results was similar to that for the entire sample (see Table 3).

Perceived comparative risk—The multinomial models (Table 4) revealed that after adjusting for covariates, in women of all ages, Blacks had a greater relative risk than Whites of perceiving that they were at lower compared to average risk for breast cancer ($RRR = 1.54$, 95 % CI 1.13, 2.11). However, it should be noted that Blacks used both end-points of the comparative risk response format more often than Whites. The relative risk of reporting higher than average breast cancer risk compared to average breast cancer risk was in the direction of being higher in Blacks than Whites, but the effect was not significant ($RRR = 1.39$, 95 % CI 0.94, 2.08). Hispanics also used both end-points of the comparative risk response format more often than Whites. Hispanics, compared to Whites, had a greater relative risk of perceiving their breast cancer risk as both lower rather than average ($RRR = 1.55$, 95 % CI 1.08, 2.21) and higher rather than average ($RRR = 1.76$, 95 % CI 1.10, 2.82). In the sub-sample of respondents 40 years and older, there were no significant racial/ethnic differences in comparative breast cancer risk ($p > 0.08$).

Worry about developing breast cancer—Neither Black nor Hispanic race/ethnicity predicted worry about developing breast cancer ($B = -0.02$, 95 % CI $-0.12, 0.09$ and $B = 0.10$, 95 % CI $-0.02, 0.22$, respectively). Older age was associated with less worry ($B = -0.08$, 95 % CI $-0.01, -0.01$). Having a usual source of care ($B = 0.13$, 95 % CI 0.06, 0.20),

and preferring Spanish ($B = 0.45$, 95 % CI 0.24, 0.67) were associated with greater worry about developing cancer. Results were similar for the subset of respondents 40 years and older.

Hypothesis 2 “Don’t know” Responding to Perceived Risk Items Will Be Higher Among Blacks and Hispanics than Whites.

In the analyses including women of all ages, Blacks had greater adjusted odds than Whites of responding “don’t know” when asked to judge their perceived absolute risk (OR = 4.22, 95 % CI 2.30, 7.74), but Hispanics did not (OR = 0.92, 95 % CI 0.36, 2.33). Blacks also had significantly greater adjusted odds than Whites of responding “don’t know” when asked to judge their perceived comparative risk (OR = 4.36, 95 % CI 2.39, 7.93). Hispanics did not (OR = 1.51, 95 % CI 0.60, 3.78). The results were identical for the analyses including only the subset of women who were 40 years and older.

Hypothesis 3 Perceived Risk Will Be Less Predictive of Mammography Use among Blacks and Hispanics than Whites.

Unadjusted rates of mammography use as a function of race—Table 2 contains unadjusted proportions of respondents, 40 years and older, who reported having had at least one mammogram, and respondents, 45 years and older, who reported consecutive mammograms during each of two 2-year periods prior to the survey. There were no Black-White differences for either. Hispanics were significantly less likely to have ever received a mammogram than Whites ($\chi^2 = 12.28$, $p = 0.003$), a difference that was primarily attributable to mammography receipt among Hispanics with a Spanish language preference. A significantly lower proportion of Hispanics who preferred Spanish (78.01 %, 95 % CI 67.79 %, 88.22 %) had received a mammogram than Whites (89.79 %, 95 % CI 88.03 %, 91.54 %; $\chi^2 = 11.41$, $p = 0.003$); whereas the difference between Whites and Hispanics who preferred English (84.00 %, 95 % CI 75.35 %, 92.65 %) was not significant ($\chi^2 = 3.27$, $p = 0.13$). Similarly, the only difference in consecutive mammography was between Hispanics who preferred Spanish (63.24 %, 95 % CI 49.35 %, 77.13 %) and Whites (79.80 %, 95 % CI 77.23 %, 82.38 %; $\chi^2 = 9.80$, $p = 0.007$).

Factors associated with mammography use—In women 40 years and older, greater perceived absolute risk (OR = 1.27, 95 % CI 1.09, 1.48), and worry about developing cancer (OR = 1.45, 95 % CI 1.10, 1.91) were significantly associated with greater odds of ever having had a mammogram in multivariate models. Perceiving one’s risk to be lower than average was associated with lower odds of ever having had a mammogram OR = 0.68, 95 % CI 0.47, 0.98). In women 45 years and older, greater absolute risk (OR = 1.24, 95 % CI 1.07, 1.43), and worry (OR = 1.58, 95 % CI 1.24, 2.02) were also significantly associated with greater odds of consecutive mammography. Lower than average comparative risk was associated with lower odds of consecutive mammography (OR = 0.68, 95 % CI 0.49, 0.94).

Role of risk perception in mammography use by race/ethnicity—The main effects of perceived absolute risk and worry on the odds of ever having had a mammogram in women 40 years and older were qualified by an interaction with race/ethnicity. There were significant interactions between race/ethnicity (Hispanics vs. Whites) and absolute risk (OR = 0.64, 95 % CI 0.42, 0.95) and worry (OR = 0.47, 95 % CI 0.26, 0.84). Stratifying by race revealed that the interaction effects were attributable to a positive association between absolute risk/worry and having ever had a mammogram for Whites, but no associations between absolute risk or worry and having ever had a mammogram for Hispanics (Table 5). The interactions between race/ethnicity (Black vs. White) and the risk and worry constructs

were not significant ($ps > 0.12$). There were also no interactions between race/ethnicity and perceived risk or worry that predicted consecutive mammography.

Hypothesis 4 “Don’t Know” Responding to Perceived Risk Items Will Be Associated with Mammography Use.

Reporting that one did not know one’s absolute or comparative risk did not predict mammography use ($0.69 < ORs > 1.25$, $ps > 0.32$).

Discussion

Black race/ethnicity was associated with lower perceived absolute and comparative breast cancer risk compared to White race/ethnicity in multivariate models that adjusted for age, marital status, education, and access to care. The effect of Hispanic ethnicity (compared to White race/ethnicity) on perceived absolute risk was in a similar direction, but was not significant. These results are consistent with our previous report that in the 2007 HINTS sample, Black, Hispanic and Asian race/ethnicities were associated with lower perceived risk for cancer in general compared to Whites (Orom et al., 2010). We have argued that lower perceived risk among racial/ethnic minorities may be due to unequal access to, including acceptability of public health messaging about cancer, greater presence of competing risks, cultural differences in communication about and salience of cancer, and different risk attributions (Orom et al., 2010). For example, there have been a growing number of studies in which family history and the underlying genetic transmission of risk has been found to be an important attribution for cancer risk among Whites (e.g., Hay et al., 2011), but has less influence on perceived risk and screening behavior among Blacks and Hispanics (Orom et al., 2010; Ponce et al., 2011).

In the present study we were able to examine multiple perceived cancer risk constructs. Black race/ethnicity was associated with lower perceived absolute risk and to a lesser degree with perceived comparative risk, but not associated with worry. One possibility is that people take breast cancer base rates for their race/ethnicity into account when making judgments about absolute risk, resulting in lower perceived absolute risk among non-Whites than Whites. These perceived base rates may be derived not only from scientific knowledge of breast cancer incidence rates across racial/ethnic groups (lower among minorities), but also the presence, or lack thereof, of salient exemplars in their network (Katapodi et al., 2010), or lay perceptions that breast cancer is a White woman’s disease (Moore, 2001). In contrast, although race/ethnicity was not specified in the comparative risk item (“Compared to the average woman your age...”), when people conceive of the ‘average’ person with whom they are being asked to compare themselves, they may assign this exemplar characteristics of their own social identity. Under these circumstances, people should not factor in racial/ethnic differences in cancer rates and race or ethnicity should not be systematically associated with perceived risk. Identifying determinants such as race/ethnicity that discriminate between dimensions of risk is helpful for underscoring and potentially understanding the differences between these constructs. In addition, to truly understand the phenomenology of perceived risk we may also need to use formative procedures (Han et al., 2009) to study additional facets of risk perception, including those that may be culture-specific (Joseph et al., 2009).

As expected, perceived absolute and comparative risk and worry were associated with mammography use for the sample as a whole and among Whites, but not among Blacks and Hispanics. Interactions between Hispanic vs. White race/ethnicity and perceived absolute risk and worry predicted ever having had a mammogram. Greater perceived absolute risk and worry were not associated with greater odds of ever having had a mammogram among

Hispanics as they were among the sample as a whole and among Whites. Although a similar pattern was found for Black versus White race/ethnicity in the race stratified analyses, the interaction terms did not reach statistical significance.

One possibility is that perceived risk for disease, as it has been conceptualized by prevention science, fails to capture cognitive-affective determinants of health behavior that are phenomenologically important to many Hispanics. These may include competing meta-narratives of personal control over health, such a belief in God's will, lack of confidence in receiving quality health care, and/or expectations of being discriminated against by health care providers (Austin et al., 2002; Joseph et al., 2009). A second possibility is that reduced importance of cognitive-affective factors, including perceived risk or worry, may reflect relative greater importance of other factors such as barriers to health care. Many of these barriers could be what Kiviniemi and colleagues identify as "system-level factors": accessibility and accommodation issues such as lack of convenient and reliable transportation, appropriate hours of service, or culturally competent care (Kiviniemi et al., 2009). Hispanics, in particular those who function primarily in Spanish, face numerous barriers to care, including lack of health care coverage (Centers for Disease Control and Prevention [CDC], 2004), language and literacy barriers, lower likelihood of receiving a recommendation for mammography, and experiences of discrimination within the health care system (Austin et al., 2002; Joseph et al., 2009). For Hispanics, barriers to mammography utilization may overwhelm the motivational impact of perceiving oneself to be at risk for breast cancer. Although we attempted to control for differences in access by including health care coverage, having a source of usual care, and education in all of our analyses, these constructs and, or the way that they were measured may not fully capture the many sources of deficits in access to quality health care. It is also possible that, given considerable heterogeneity among Hispanics, risk could be differentially related to mammography use across Hispanic subgroups.

Blacks, but not Hispanics, were more likely than Whites to respond "don't know" to the risk perception items. We had reasoned that greater likelihood of responding "don't know" among Black respondents might stem from lower availability, applicability, and salience of cancer risk information in predominantly Black, compared to predominantly White communities (Salant & Gehlert, 2008). "Don't know" responding was not associated with mammography use. Additional research is needed to clarify the meaning of Black-White differences in responding "don't know" and whether it meaningfully relates to primary or secondary prevention, including mammography use in samples that reflect racial/ethnic differences in consecutive or regular mammography.

Strengths, limitations and future directions

Research on whether racial/ethnic differences in perceived cancer risk are causally related to racial/ethnic disparities in regular mammography receipt is needed. This question could not be addressed in this study because in the HINTS 2003 sample there were no statistically significant racial/ethnic differences in consecutive mammography. At the level of the US population as a whole, the Centers for Disease Control and Prevention report small Hispanic-White disparities and equal rates for Blacks and Whites for recent mammography (at least one mammogram in previous 2 years) among women ages 50–74 (Centers for Disease Control and Prevention, 2012). However, Hispanics and Blacks may be less likely than Whites to consistently receive biannual mammography, a disparity that appears to account for some of the Black-White difference in breast cancer mortality (Smith-Bindman et al., 2006). Recent evidence also indicates that self-report data overestimate mammography use compared to documented use (e.g., medical and billing records) and that the gap is larger for Blacks than Whites, potentially masking additional disparities (Njai et al., 2011). In the present study self-reported mammography use and timing was not verified

(e.g., by chart review), and may have been inflated by recall bias or misunderstanding the mammography use questions.

Finally, even for Whites, the associations between perceived breast cancer risk and worry about developing breast cancer and mammography use were relatively small, a common trend in the literature on perceived risk (Katapodi et al., 2004; McCaul et al., 1996; Yarbrough & Braden, 2001). However, the real life relationship between perceived risk and behavior may be stronger than is apparent from research on the topic. On one hand, intermediaries such as barriers or self-regulatory failure likely reduce the association between risk perception and behavior in women who feel at risk. On the other hand, many women who do not feel particularly at risk may get mammograms because they are recommended by a health care provider (Leventhal et al., 1999). Although either possibility would reduce the *measured* association between perceived risk and mammography use, neither explanation undermines the importance of perceived risk as a significant (although perhaps not sufficient) (Vernon, 1999; Weinstein, 1988) cause of behavior.

Effects may be artifactually reduced in cohort data because the majority of women will have had normal mammograms and this may result in these women perceiving themselves to be at lower risk for developing breast cancer or being less worried about developing the disease because they feel 'in the clear', so to speak. Correlation data assessed at a single time point present a number of difficulties for detecting a relationship between perceived risk and protective behavior (Brewer et al., 2004). People may report lower perceived risk when they anticipate engaging in health protective behaviors, resulting in finding no or a negative correlation between beliefs and behavior (Brewer et al., 2004). Furthermore, if women (and messaging) conflate the risk of getting and dying from breast cancer, it is plausible that women who anticipate or receive regular mammograms downgrade their perceived risk for getting the disease. Given tendencies for people to attribute cancer risk to characteristics of individuals, including genetic predisposition and personal history of health behaviors (Gerend et al., 2004; Katapodi et al., 2005), the experience of having normal mammograms may increase some women's confidence in a belief that they are not the kind of woman likely to get breast cancer. Although downgrading perceived risk after engaging in secondary preventive behaviors such as mammography is not rational, strictly speaking, it may be common (Aiken et al., 1995). Furthermore, recent research indicates that the relationship between perceived risk and behavior may be important but may not only be causal; perceived risk may function as a moderator, strengthening or weakening the effects other psycho-social constructs on behavior (McQueen et al., 2010).

The present study extends previous research with a novel quantitative examination of cross-cultural variability in the applicability of risk perception constructs. It also adds to the literature on racial/ethnic differences in perceived risk for developing breast cancer that is relatively sparse and has often employed convenience samples. The present study is significant in that it alerts us to the fact that the barriers to health behaviors such as mammography may vary considerably across individuals and communities and efforts are needed to understand those that apply broadly as well as those that are unique to groups of particular interest. Specifically, the results of this study indicate that, when planning messaging or intervention to increase cancer prevention behavior in Hispanic communities, investing in formative research on determinants of behavior in the target audience could be a prudent investment given that standard approaches that nearly always emphasize increasing perceived susceptibility for breast cancer may lack cultural applicability. Targeted interventions to promote health behaviors could then be informed by research that has identified the most important behavioral determinants in a given community. With respect to interventions targeted to Black communities, implications of the data are more complex. Low perceived risk for cancer may be a barrier to protective behavior in this population;

however, it is also possible that perceived cancer risk may not be as strong a motivator of behavior in Black as White communities. Again, results indicate the importance of formative research to identify barriers to behavior prior to message and intervention planning. This would provide a basis for optimal matching of evidence-based intervention strategies to community characteristics. Furthermore, the process of conducting formative research and evaluating the success of programs targeted to minority communities will help build a missing evidence base on intervention development and implementation in minority communities. Concurrently exploring the implications of this research for health behavior theory will help address limitations regarding the applicability of current health behavior theory to diverse populations.

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Table 1

Weighted mean characteristics/proportions (95 % CI) for the entire sample and by race

Demographic characteristic	Overall sample <i>N</i> = 3,361 ^a	White <i>n</i> = 2,454	Black <i>n</i> = 453	Hispanic <i>n</i> = 454
Mean age	45.93 (45.21, 46.65)	47.35 (46.52, 48.18)	43.56 (41.45, 45.68) **	39.22 (37.45, 40.99) ***
% Married/living with partner	61.62 (59.64, 63.60)	65.68 (63.46, 67.90)	34.87 (29.20, 40.53) ***	62.25 (56.81, 67.69)
Education				
<High school	15.77 (14.11, 17.42)	10.82 (9.09, 12.56)	21.19 (15.68, 26.71)	41.97 (36.41, 47.53)
High school	33.09 (31.15, 35.04)	33.41 (31.16, 35.65)	34.72 (28.74, 40.71)	29.47 (24.48, 34.45)
Some college	28.00 (26.17, 29.82)	29.06 (26.92, 31.20)	29.88 (24.75, 35.01)	19.34 (14.63, 24.05)
College	23.15 (21.62, 24.67)	26.71 (24.83, 28.59)	14.20 (11.00, 17.40) ^b	9.22 (6.72, 11.73) ^b
Has health care coverage	87.88 (86.47, 89.29)	91.93 (90.53, 93.32)	83.80 (79.18, 88.42) ***	66.09 (60.63, 71.55) ***
Usual source of care	71.06 (69.15, 72.98)	75.60 (73.49, 77.70)	60.57 (54.52, 66.63) ***	52.51 (46.90, 58.16) ***
Prefers Spanish	5.37 (4.47, 6.26)	–	–	45.08 (39.49, 50.66)
Mean perceived absolute risk	2.48 (2.43, 2.52)	2.49 (2.44, 2.54)	2.37 (2.21, 2.53)	2.49 (2.36, 2.62)
% “don’t know” absolute risk	2.88 (2.22, 3.55)	1.84 (1.29, 2.39)	7.91 (4.29, 11.53) ***	4.60 (2.32, 6.88)
Comparative risk				
% less likely	35.19 (33.21, 37.18)	34.88 (32.61, 37.14)	43.25 (37.00, 49.50)	29.78 (24.47, 35.09)
% as likely	51.26 (33.21, 37.18)	52.08 (49.68, 54.47)	41.93 (35.71, 48.16)	54.65 (48.96, 60.33)
% more likely	13.55 (12.10, 15.00)	13.05 (11.39, 14.71)	14.81 (10.60, 19.03) ^c	15.57 (11.47, 19.68)
% “don’t know” comparative risk	3.72 (2.94, 4.50)	2.97 (2.19, 3.76)	9.28 (5.46, 13.11) ***	2.98 (1.36, 4.60)
Mean worry (out of 4)	1.58 (1.55, 1.62)	1.56 (1.53, 1.60)	1.56 (1.47, 1.65)	1.73 (1.63, 1.83) ***

Means and proportions for Blacks and Hispanics were compared to those for Whites. Significant differences are denoted by asterisks (** $p < 0.01$, *** $p < 0.001$)

^aThe *n* for perceived absolute and comparative risk and worry are based on slightly fewer participants due to data missing on these variables

^bBlacks and Whites ($\chi^2 = 51.17, p < 0.001$), and Hispanics and Whites ($\chi^2 = 275.39, p < 0.001$) differed with respect to level of education

^cPerceived comparative risk differed significantly between Blacks and Whites, $\chi^2 = 12.91, p < 0.001$ (don’t know responses were analyzed separately)

Table 2

Unadjusted, weighted means and proportions (95 % CI) for perceived risk, worry, and mammography use in women 40

Variable	Overall sample	White	Black	Hispanic
Mean perceived absolute risk	2.40 (2.35, 2.46)	2.42 (2.36, 2.48)	2.25 (2.07, 2.43)	2.44 (2.25, 2.63)
% “don’t know” absolute risk	4.10 (3.05, 5.16)	2.64 (1.81, 3.46)	12.50 (6.39, 18.60)***	7.14 (2.49, 11.79)
Comparative risk				
% less likely	38.09 (35.61, 40.57)	38.37 (35.60, 41.15)	39.78 (31.91, 47.65)	33.45 (25.74, 41.15)
% as likely	47.67 (45.11, 50.24)	48.42 (45.56, 51.27)	42.18 (33.81, 50.55)	47.03 (38.90, 55.16)
% more likely	14.24 (12.39, 16.09)	13.21 (11.20, 15.23)	18.04 (12.26, 23.82)	19.52 (12.40, 26.64)
% “don’t know” comparative risk	5.09 (3.93, 6.26)	4.05 (2.92, 5.18)	13.57 (7.60, 19.54)***	4.03 (1.27, 6.80)
Mean worry (out of 4)	1.54 (1.51, 1.58)	1.52 (1.48, 1.56)	1.52 (1.41, 1.64)	1.82 (1.66, 1.97)***
% 1 mammogram in lifetime	90.98 (89.44, 92.51)	89.79 (88.03, 91.54)	91.192 (87.43, 94.81)	81.22 (74.59, 87.85)**
	45 years	45 years	45 years	45 years
% repeat mammography	78.89 (76.52, 81.27)	79.80 (77.23, 82.38)	75.97 (67.74, 84.45)	73.12 (64.72, 81.52)

Means and proportions for Blacks and Hispanics were compared to those for Whites. Significant differences are denoted by asterisks (* $p < 0.01$, *** $p < 0.001$). Results are for women 40 years with the exception of repeat mammography which is presented for women 45 years. We used all available data and the sample size varied by variable. Corresponding sample sizes can be found in Table 5

Table 3

Results for linear regression models predicting perceived absolute breast cancer risk in the total sample and in women 40 years

Variable	Absolute perceived risk <i>B</i> (95 % CI)	
	Overall sample (<i>n</i> = 3,226)	40 years (<i>n</i> = 2,069)
Race		
White	Ref	Ref
Black	-0.17 (-0.33, -0.01) *	-0.20 (-0.39, -0.02) *
Hispanic	-0.14 (-0.31, 0.03)	-0.14 (-0.39, 0.11)
Education		
<High school	Ref	Ref
High school	-0.13 (-0.29, 0.02)	-0.18 (-0.38, 0.01)
Some college	-0.17 (-0.33, -0.009) *	-0.26 (-0.46, -0.06) *
College or greater	-0.23 (-0.38, -0.07) **	-0.34 (-0.54, -0.14) **
Married or living with partner	-0.03 (-0.12, 0.06)	0.03 (-0.91, 0.14)
Age	-0.01 (-0.012, -0.007) ***	-0.01 (-0.02, -0.008) ***
Has health care coverage	-0.18 (-0.34, 0.03) *	-0.08 (-0.29, 0.13)
Usual source of care	0.21 (0.11, 0.31) ***	0.24 (0.10, 0.38) **
Prefers Spanish	0.01 (-0.26, 0.29)	0.12 (-0.27, 0.51)

* $p < 0.05$,

** $p < 0.01$,

*** $p < 0.001$

Table 4

Results for multinomial logistic regression models predicting relative risk of perceiving breast cancer risk in the total sample and in women 40 years

Variable	Comparative risk relative risk ratio (RRR) (95 % CI)			
	Total sample (n = 3,206)		40 years (n = 2,048)	
	“Less likely” compared to “as likely”	“More likely” compared to “as likely”	“Less likely” compared to “as likely”	“More likely” compared to “as likely”
Race				
White	Ref	Ref	Ref	Ref
Black	1.54 (1.13, 2.11)**	1.39 (0.94, 2.08)	1.10 (0.73, 1.66)	1.26 (0.77, 2.05)
Hispanic	1.55 (1.08, 2.21)*	1.76 (1.10, 2.82)*	1.52 (0.95, 2.44)	1.71 (0.84, 3.49)
Education				
<High school	Ref	Ref	Ref	Ref
High school	1.09 (0.77, 1.54)	0.81 (0.52, 1.26)	0.91 (0.60, 1.36)	0.57 (0.33, 0.97)*
Some college	1.19 (0.83, 1.71)	0.93 (0.59, 1.47)	0.97 (0.64, 1.48)	0.64 (0.37, 1.12)
College or greater	1.07 (0.75, 1.53)	0.72 (0.46, 1.14)	0.88 (0.58, 1.35)	0.40 (0.22, 0.70)**
Married or living with partner	0.80 (0.66, 0.97)*	0.97 (0.75, 1.26)	0.70 (0.55, 0.88)**	0.79 (0.57, 1.10)
Age	1.02 (1.01, 1.03)***	1.00 (1.00, 1.01)	1.02 (1.01, 1.03)***	0.98 (0.97, 0.99)**
Has health care coverage	0.99 (0.71, 1.38)	0.82 (0.52, 1.26)	0.99 (0.64, 1.55)	0.92 (0.50, 1.67)
Usual source of care	0.81 (0.65, 1.01)	1.18 (0.86, 1.63)	0.93 (0.69, 1.24)	1.20 (0.76, 1.86)
Prefers Spanish	0.28 (0.16, 0.52)***	0.34 (0.17, 0.68)**	0.30 (0.14, 0.66)**	0.42 (0.16, 1.10)

* $p < 0.05$,

** $p < 0.01$,

*** $p < 0.001$

Table 5

Results for logistic regression models predicting ever having had a mammogram as a function of perceived absolute risk, comparative risk, or worry in women 40, stratified by race

Odds ratio (95 % CI)					
Model	Risk construct	Total sample (n = 2,067)	White (n = 1,625)	Black (n = 238)	Hispanic (n = 204)
1	Absolute risk		1.41 (1.17, 1.71)***	0.83 (0.52, 1.31)	0.93 (0.65, 1.34)
	Comparative risk		0.68 (0.47, 0.98)*	1.07 (0.33, 3.44)	0.67 (0.22, 2.07)
2	More likely		1.71 (0.81, 3.60)	0.94 (0.23, 3.95)	0.93 (0.25, 3.55)
	Less likely		1.45 (1.10, 1.91)**	1.20 (0.60, 2.37)	0.82 (0.52, 1.31)
3	Worry				

Models contained either absolute risk, comparative risk, or worry and controlled for education, marital status, age, health care coverage status, usual source of care and analyses performed on Hispanic participants controlled for language preference (Spanish vs. English). In the comparative risk model, the referent group for comparative risk was participants responding “about as likely” to get breast cancer compared to the average woman. Absolute perceived risk and worry were entered as continuous predictors

Statistically significant effects are denoted by asterisks (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$)