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Socio-demographic moderators of associations between psychological factors and Latinas' breast cancer screening behaviors

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Abstract

This study tested whether socio-demographic factors moderated associations between psychological factors and Latinas' breast cancer screening behaviors. 222 churchgoing Latinas (40–65 years) in San Diego, CA completed surveys assessing socio-demographics (e.g., income and acculturation), psychological factors (e.g., perceived barriers to screening), and cancer screening behaviors. Multilevel models examined associations of socio-demographic and psychological factors (and their interactions) with adherence to annual mammography or clinical breast exam (CBE) screening. Although no main effects were found, there were moderation effects. Acculturation moderated associations between perceived barriers to screening and both screening outcomes, with inverse associations only among the high-acculturation group. Education moderated the relationship between perceived barriers to screening and CBE screening, with an inverse association only among the low-education group. Marital status moderated the relationship between depressive symptoms and CBE screening, with an inverse association only among single/ non-partnered participants. Interventions are needed targeting psychological barriers to breast cancer screening among Latinas.

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Keywords

Breast cancer; cancer prevention and screening; depression; stress; Latino

Background

Breast cancer is the leading cause of cancer death among U.S. Latinas (1). Among Latinas nationally, breast cancer has the highest incidence (29%) and mortality (16%) rates than any other cancer (1). Cancer screening is an important behavior for reducing cancer incidence and diagnosing cancer at an early stage, thereby improving survival rates. However, less than half of Latinas meet the American Cancer Society's (ACS) recommendations for early detection of breast cancer (1).

Prior to the 2015 ACS cancer screening guidelines, women aged 40 years or older were recommended annual mammography and clinical breast exams (CBE) (2, 3). In 2013, the national prevalence of annual mammography screening was 46% among Latinas compared to 52% among non-Latina White women (1). Given the low screening rates and high risk for late-stage breast cancer diagnosis among Latinas, a better understanding is needed of the factors influencing Latinas' breast cancer screening behaviors.

According to ecological models of health behaviors, factors at multiple levels – such as individual (e.g., socio-demographic), psychological, social, and environmental – influence health behaviors (4). The most commonly cited correlates of cancer screening behaviors among Latinas are individual-level factors, including socio-demographic (e.g., income and acculturation), structural (e.g., access to health insurance), cognitive (e.g., cancer knowledge), and behavioral factors (e.g., adherence to other cancer screening tests) (5–11). Psychological factors are also important correlates of cancer screening behaviors but have been less studied. Factors such as perceived barriers to screening, stress, and depression have shown inconsistent associations with cancer screening behaviors across studies (12–16). One possible reason for the inconsistent results is that the relationships differ systematically by socio-demographic factors. This hypothesis is in line with ecological models. To our knowledge, no study has tested interactions between psychological and socio-demographic factors in relation to cancer screening behaviors.

The purpose of this study was to investigate associations of psychological factors – specifically, perceived barriers to screening, stress, and depressive symptoms – with Latinas' breast cancer screening behaviors and to assess whether socio-demographic factors moderated these associations. We hypothesized that the psychological factors would be inversely related to cancer screening only among Latinas of lower education, income, acculturation, and single/non-partnered women. These women were expected to have fewer resources to facilitate uptake of cancer screenings when perceived barriers to screening, stress, or depressive symptoms were high. Findings from our study can inform the development of cancer screening promotion interventions that target psychological barriers to cancer screening among Latinas.

Methods

Participants and data collection

This cross-sectional study used baseline data collected between May 2011 and September 2013 among churchgoing Latinas participating in an intervention to promote either physical activity (intervention arm) or cancer screening behaviors (attention-control arm) in San Diego, CA – *Fe en Acción* (Faith in Action). Details of the sampling, recruitment, and data collection efforts are described in the *Fe en Acción* protocol paper (17). The study recruited 16 Catholic churches followed by 436 participants (approximately 27 women/church). Churches were eligible if they reported having at least 200 Latino families and at least one Spanish-language mass. Women were recruited from the participating churches via fliers, word of mouth, and verbal and printed announcements. Participant inclusion criteria were: self-identifying as Latina, being 18–65 years of age, attending the church at least 4 times/ month, having reliable transportation, living within 15 minutes driving distance of the church, and reporting no health condition that could interfere with their ability to be physically active. Because the main trial's primary outcome was moderate-to-vigorous physical activity, the intervention arm activities included aerobics and fast walking groups. Such moderate-to-vigorous exercises were deemed more appropriate for women aged 18–65 years than older women who may have needed lower intensity exercises. Thus, women over 65 years of age were excluded from the main trial. In addition, the study recruited participants with low activity levels as assessed by self-report and accelerometer to include women who could benefit the most from a physical activity intervention. Trained research assistants (RA) obtained participant written informed consent.

For the present analyses, we used the ACS recommendations (3) only to identify participants who were age-eligible for both mammography and CBE screening at baseline, i.e., aged 40– 65 years (N=297). Only participants with complete data were included in the analyses (N= 222).

Measures

Participants completed a survey in their preferred language: Spanish (95.5%) or English (4.5%). Survey measures available only in English, including cancer screening, depressive symptoms, and perceived stress, were translated and back-translated by bilingual research staff.

Cancer screening outcomes—We used items from the 2010 BRFSS questionnaire (18) to assess whether the participant ever completed a mammogram or CBE (yes/no) and how long ago the test was performed if 'yes.' The ACS screening recommendations at the time of the study (3) were used to create binary variables (yes/no) for adherence to annual mammography and annual CBE screening.

Demographics—Age, marital status, monthly household income, and education were assessed using items from the 2005 BRFSS questionnaire (19). Questions about access to health care services and health insurance were developed by the study team and included in

the survey halfway through baseline measures. Thus, this information was only available for 110 of the 222 participants aged 40–65 years.

Acculturation—The Bidimensional Acculturation Scale (BAS) for Hispanics (20) provided an acculturation score for the Hispanic and non-Hispanic cultural domains (12 items each). The scale measures language use, linguistic proficiency, and electronic media use. Responses ranged from 1= "almost never/very poorly" to 4= "almost always/very well." Average scores for each domain were computed. Consistent with the authors proposed cut-offs (20), high acculturation was defined as adherence (score 2.5) to the non-Hispanic domain only or to both domains. Low acculturation was defined as adherence (score 2.5) to the Hispanic domain only. The sample Cronbach's alpha=0.83 for Hispanic domain and 0.94 for the non-Hispanic domain.

Perceived barriers to breast cancer screening—Nine items from the 1990 Tampa survey (21) were used to assess perceived barriers to breast cancer screening (e.g., "getting a mammogram is a frightening experience"). Responses ranged from 1= "strongly disagree" to 5= "strongly agree." Responses were averaged with higher mean scores indicating higher perceived barriers to screening. The sample Cronbach's alpha = 0.82.

Breast cancer knowledge—We used six breast cancer-related true/false items from the *Esperanza y Vida* Cancer Knowledge Questionnaire (22) to assess breast cancer knowledge (e.g., "a mammogram is a low-dose x-ray of the breast"). Participants were given an "I don't know" option. We scored responses as either "correct" or "incorrect," with "I don't know" responses coded as incorrect. We computed the percent of correct responses, with higher percentages corresponding to greater knowledge. The sample Cronbach's alpha = 0.63.

Depressive symptoms—We used the 10-item version of the Center for Epidemiologic Studies Depression scale (CES-D-10) to assess the frequency of experiencing depressive symptoms in the past week (e.g., "I was bothered by things that usually don't bother me") (23). Responses ranged from 1= "rarely or none of the time" to 4= "most or all of the time." We reverse coded positive statements and computed a sum score with higher scores indicating greater depressive symptoms. The sample Chronbach's alpha = 0.77.

Perceived stress—General perceived stress was assessed using the 4-item Perceived Stress Scale assessing the frequency of experiencing a series of feelings/thoughts in the last month (e.g., "felt that you were unable to control the important things in your life") (24). Responses ranged from 0= "never" to 4= "very often." We reverse coded positive statements and computed a mean score, with a higher score indicating greater perceived stress. The sample Chronbach's alpha = 0.61.

Analysis

For each of the breast cancer screening outcomes, we performed generalized linear mixed effects models with binary distributions (Logistic model) to obtain odds ratio's (OR) and 95% confidence intervals (CI), adjusted for clustering effects of the churches. We standardized the continuous variables to have a mean of 0 and standard deviation of 1.

Separate bivariate and multivariate models were performed to assess the associations of the socio-demographic factors, breast cancer knowledge scores, and psychological factors with each screening outcome. Although age and breast cancer knowledge were not significantly associated with either screening outcome in the bivariate models, we decided to include age as a covariate in the multivariate models given its' consistent relationship with breast cancer screening in other studies (6, 7).

To test for moderation effects, we added to the multivariate models interaction terms between each psychological factor and the four socio-demographic factors (marital status, income, education, and acculturation). We used a backwards-stepwise approach, with all 12 interaction terms tested simultaneously in one model for each outcome and the least significant terms removed one at a time until only those significant at $p < .05$ left in the models. Significant interaction terms were further probed to estimate the association between the psychological factor and breast cancer screening outcome at each level of the socio-demographic moderator. We also performed separate sub-analyses including the health insurance and access to care variables among those with available data (n=110).

Because no other study to our knowledge has examined the proposed interactions, we considered the analyses exploratory and thus, did not adjust for multiple hypothesis testing. Results should therefore be interpreted with caution. All statistical analyses were performed in SAS version 9.4 (SAS Institute Inc., Cary, North Carolina).

Ethical Considerations

The San Diego State University Institutional Review Board reviewed and approved this research.

Results

Sample characteristics

The majority of the sample was married/living as married, of low socio-economic status, and of low acculturation (Table 1). Just under half of the sample adhered to annual mammography or CBE screening recommendations (Table 1). Chi-square and student t-tests revealed that the 75 women excluded from analysis due to incomplete data did not differ significantly in demographics or the psychological factors from the 222 participants comprising the analytical sample.

Associations of the socio-demographic, cancer knowledge, and psychological factors with breast cancer screening behaviors

The bivariate associations showed that perceived barriers to screening was significantly related to lower adherence to CBE screening (OR=0.75, 95% CI: 0.57–0.99) (Table 2). In the multivariate models, none of the psychological factors were significantly related to either breast cancer screening outcome (Table 2).

Significant socio-demographic moderators of breast cancer screening behaviors

Acculturation, education, and marital status were significant moderators of the associations between the psychological factors and mammography or CBE screening (Tables 3 and 4). For mammography screening, only one out of the 12 interactions tested was significant, i.e., between perceived barriers to screening and acculturation (interaction p=0.01) (Table 3). Among participants with high acculturation levels, there was a significant negative association between perceived barriers to screening and mammography screening (OR=0.42, 95% CI: 0.24–0.75) (Table 4). In the sub-analyses controlling for health insurance and access to care data, the significant interactions with acculturation remained (data not shown).

For CBE screening, four out of 12 interactions were significant, i.e., between perceived barriers to screening and acculturation (interaction p=0.0005), perceived stress and education (interaction p=0.05), perceived barriers to screening and education (interaction p=0.03), and depressive symptoms and marital status (interaction p=0.02) (Table 3). Significant negative associations were found between perceived barriers to screening and CBE screening only among those with high acculturation levels (OR=0.21, 95% CI: 0.09–0.48) and those with less than a high school education (OR=0.33, 95% CI: 0.16–0.65). There was a positive relationship between perceived stress and CBE screening among those with less than a high school education and negative relationship among those with a high school education or higher; however, neither relationship was significant (Table 4). Participants with less than a high school education had a significant inverse association between perceived barriers to screening and CBE screening (OR=0.33, 95% CI: 0.16–0.65) (Table 4). Finally, among single/non-partnered participants, there was a significant inverse association between depressive symptoms and CBE screening (OR=0.25, 95% CI: 0.09–0.70) (Table 4). In the sub-analyses controlling for health insurance and access to care data, the two interactions with education became non-significant but those with acculturation and marital status remained (data not shown).

Discussion

Our study is one of the first to examine socio-demographic moderators of associations of psychological factors with breast cancer screening behaviors among a predominantly immigrant sample of Latinas living along the US-Mexico border. Although no main effects were found for any of the psychological factors with either breast cancer screening behavior, moderation effects were found by acculturation, education, and marital status. Overall, participants with higher acculturation or lower education levels, and single/non-partnered participants were less likely to be screened when perceived barriers to screening, stress, or depressive symptoms were high. Furthermore, breast cancer screening rates were low (just under 50%) among our sample but consistent with other studies involving Latinas (25).

The inconsistent evidence from studies examining the associations of perceived barriers to screening, stress, and depressive symptoms with cancer screening (12–16) and our null findings for main effects highlight the complexity of these associations. For perceived barriers to screening, it is possible that stronger associations would have been found with the individual barriers instead of the sum score as seen in other studies (13). However, the frequencies for most barriers in our sample were on the low end, thereby limiting our ability

to test each barrier separately. There is some evidence linking higher perceived stress with less healthful behaviors (e.g., less physical activity) (26) but we found no relationship. It is possible that among our sample, church attendance was protective against the expected negative effects of stress on cancer screening behaviors. Religious behaviors have been linked with better coping with stressful events (27). For depressive symptoms, one study found an inverse association between depressive symptoms and breast cancer screening (16) but another study reported no association (14). The lack of associations between depressive symptoms and breast cancer screening in our study may be due to the limited variability in depressive symptoms. The mean score, however, was in line with that among Mexican adults in the Hispanic Community Health Study/Study of Latinos (28).

Our results from the moderation analyses showed that the associations of the psychological factors with breast cancer screening varied by acculturation, education, and marital status. Due to the dearth of studies examining socio-demographic moderators of these associations, we could not compare our results to other studies but we offer some hypotheses to explain our findings.

Perceived barriers to breast cancer screening was inversely related to annual mammography and CBE screening only among Latinas of higher acculturation, contrary to our hypothesis that the inverse relationship would be found in the lower acculturation group. Participants with lower acculturation levels may have had lower incomes and lacked health insurance, making them eligible for programs that offered free breast cancer screenings, such as "Every Woman Counts" in San Diego. While the high acculturation group could have also lacked health insurance, they may have had higher incomes thereby making them ineligible for such programs. This hypothesis is also noted in another study (11) that found higher rates of mammography screening among Latinas of lower acculturation in San Diego. We tested whether our findings could be explained by access to care and health insurance but the interactions with acculturation remained even after controlling for these variables in the sub-analyses. In addition, other important cultural factors not measured in our study such as familism and *respeto* (respect for authorities) may have influenced the breast cancer screening behaviors (29). Traditional family attitudes may be a proxy for various forms of social support from family to encourage positive health behaviors.

Education was a significant moderator of the associations of perceived stress and barriers to breast cancer screening with CBE screening. Among participants with less than a high school education, CBE screening had a (non-significant) positive relationship with higher perceived stress but significant inverse relationship with higher perceived barriers to screening. However, when we controlled our models for health insurance and access to healthcare services in the sub-analyses, the moderation effects by education disappeared. These findings suggest that access to care may have a greater influence on CBE screening than the combined effects of perceived barriers to screening or perceived stress with education.

We found a significant negative relationship between depressive symptoms and annual CBE screening only among single/non-partnered participants. This finding may be explained by an expected lower amount of social support among single/non-partnered participants

compared to married/living as married participants to cope with stressful events that may promote depressive symptoms. Among Mexican American women, having spousal/partner social support has been linked with lower depressive symptoms (30).

Limitations and Strengths

Self-report of breast cancer screening may have led to over-reporting of adherence to screening recommendations. The late introduction of the health insurance and access to care items to the questionnaire limited our ability to control for these variables among the full sample. Given that to our knowledge no other study has examined the interactions tested in our study, our findings should be interpreted with caution, pending future verification. In addition, most of our interaction findings related to CBE screening and although this type of breast cancer screening is no longer recommended, it was recommended by ACS at the time the intervention was developed. The potentially increased access to preventive services in San Diego limits the external validity of our findings to Latinas living in other geographic regions of the US. The inclusion criteria for the main trial also limited the generalizability of our findings to non-churchgoing Latinas and those who were more physically active, possibly including women who engaged in more healthful behaviors. Finally, because the aim of the main trial was not on cancer screening but on physical activity promotion, the sample of women age-eligible for the screening outcomes was low thereby reducing statistical power to detect significant findings.

Strengths of our study include use of validated measures, which have shown acceptable reliability in other Latino samples (20, 21, 28). The focus of our analyses was on screening practices for the leading cancer affecting Latinas. Thus, our findings have important implications for the development of interventions to prevent breast cancer among Latinas.

Conclusions

Underutilization of important cancer screening tests among Latinas is a major public health challenge for early detection of cancer and prevention of cancer-related deaths. Our findings suggest that among Latinas, disparities to screening exist across acculturation, education, and marital status groups. The interactions between socio-demographic and psychological factors provide some support for ecological models for cancer screening behaviors. Interventions aimed at promoting breast cancer screening among Latinas should be comprehensive, with components targeting psychological factors alongside cancer screening behaviors.

Acknowledgments

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Table 1

Characteristics of Latinas age-eligible for breast cancer screening, 40–65 years of age (N=222). *Fe en Acción* (2011–2013) San Diego, CA.

Characteristic	*n*	Mean (SD) or %
Socio-demographic		
Mean age, years	222	49.6 (6.2)
Married/living as married, %	218	75.2
Household income < $2000/month, %	209	56.9
Less than high school completed, %	222	59.9
High levels of acculturation, % [a]	209	32.1
Mean breast cancer knowledge (% correct)	221	50.1 (20.9)
Screening		
Had mammogram in past year	222	46.0
Had CBE in past year	222	46.9
Had mammogram *and* CBE in past year	222	36.5
Psychological		
Mean perceived barriers to screening (range: 1–5)	222	1.9 (0.8)
Total perceived stress (range: 0–16)	222	9.0 (2.8)
Total depressive symptoms (range: 0–30)	222	5.4 (4.5)

CBE= Clinical breast exam

[a] Includes bicultural/assimilated women per scores on the Bidimensional Acculturation Scale for Hispanics.

Table 2

Associations of socio-demographic, cancer knowledge, and psychological factors with breast cancer screening behaviors among Latinas 40–65 years of age. *Fe en Acción* (2011–2013) San Diego, CA.

Factor	Annual mammogram				Annual clinical breast exam			
	Bivariate [a]		Multivariate [b]		Bivariate [a]		Multivariate [b]	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Socio-demographic								
Age	1.20	0.91–1.58	1.24	0.94–1.65	1.04	0.79–1.37	1.06	0.80–1.40
Married/living as married	1.04	0.55–1.95	-	-	0.78	0.41–1.47	-	-
Household income $2000/month	1.41	0.80–2.49	-	-	1.34	0.76–2.36	-	-
High school or higher completed	1.16	0.67–2.02	-	-	1.27	0.73–2.22	-	-
High levels of acculturation	1.04	0.57–1.90	-	-	1.17	0.63–2.16	-	-
Breast cancer knowledge	0.99	0.76–1.31	-	-	1.03	0.78–1.36	-	-
Psychological								
Perceived barriers to screening	0.79	0.60–1.04	0.76	0.57–1.01	0.75	0.57–0.99 *	0.77	0.57–1.02
Perceived stress	0.98	0.75–1.28	1.03	0.75–1.40	0.89	0.68–1.17	1.00	0.73–1.36
Depressive symptoms	0.95	0.72–1.25	1.02	0.74–1.39	0.82	0.62–1.08	0.86	0.63–1.40

*
$p < 0.05$

[a] Each bivariate model is adjusted only for clustering effects of the churches.

[b] Single model, adjusted for all other variables in the model. Socio-demographic variables, except age, and cancer knowledge were excluded due to non-significant associations with the screening outcome.

Table 3

Models with significant interactions between the psychological and socio-demographic factors in relation to breast cancer screening behaviors among Latinas 40–65 years of age. *Fe en Acción* (2011–2013) San Diego, CA.

Factor	Annual mammogram		Annual clinical breast exam	
	B (SE) [a]	p-value	B (SE) [a]	p-value
Perceived barriers to screening	0.03 (0.19)	0.86	−0.10 (0.23)	0.66
Perceived stress	0.04 (0.17)	0.82	0.38 (0.23)	0.10
Depressive symptoms	−0.09 (0.17)	0.61	−1.40 (0.53)	0.009
Age	0.24 (0.15)	0.11	0.004 (0.17)	0.98
Acculturation (ref: low acculturation)	0.19 (0.33)	0.56	−0.13 (0.43)	0.76
Education (ref: less than high school)	-	-	0.55 (0.39)	0.17
Marital status (ref: single/non-partnered)	-	-	−0.61 (0.41)	0.14
Perceived barriers to screening*acculturation	−0.91 (0.35)	0.01	−2.04 (0.57)	0.0005
Perceived stress*education	-	-	−0.70 (0.35)	0.05
Perceived barriers to screening*education	-	-	1.12 (0.51)	0.03
Depressive symptoms*marital status	-	-	1.24 (0.53)	0.02

[a] Adjusted for clustering effects of the churches.

Table 4

Significant socio-demographic moderators of the associations between psychological factors and breast cancer screening behaviors among Latinas aged 40–65 years. *Fe en Acción* (2011–2013) San Diego, CA.

Screening outcome and interaction	Level of moderator	OR [a]	95% CI	Interaction *p*-value
Annual mammogram				
Perceived barriers to screening × acculturation	Low acculturation	1.03	0.71–1.51	0.01
	High acculturation	**0.42**	**0.24–0.75**	
Annual clinical breast exam				
Perceived barriers to screening × acculturation	Low acculturation	1.58	0.93–2.69	0.0005
	High acculturation	**0.21**	**0.09–0.48**	
Perceived stress × education	Less than high school	1.47	0.93–2.30	0.05
	High school or higher	0.73	0.41–1.28	
Perceived barriers to screening × education	Less than high school	**0.33**	**0.16–0.65**	0.03
	High school or higher	0.99	0.54–1.83	
Depressive symptoms × marital status	Single/non-partnered	**0.25**	**0.09–0.70**	0.02
	Married/living as married	0.86	0.58–1.26	

Bolded values are statistically significant at .05.

[a]Adjusted for age and clustering effects of the churches.