Breast density awareness and knowledge in a predominantly Hispanic sample

**Title:** Breast density awareness and knowledge in a mammography screening cohort of predominantly Hispanic women: Does breast density notification matter?

**Authors:** Jessica D. Austin,1,2 Mariangela Agovino,1 Carmen B. Rodriguez,1 Mary Beth Terry,1,3 Rachel C. Shelton,2,3 Ying Wei,4 Elise Desperito,5 Karen M. Schmitt,3,6 Rita Kukafka,2,3,7 Parisa Tehranifar1,3

**Affiliations:**

1 Department of Epidemiology, Columbia University Mailman School of Public Health, New York, NY
2 Department of Sociomedical Sciences, Columbia University Mailman School of Public Health, New York, NY
3 Herbert Irving Comprehensive Cancer Center, Columbia University Medical Center, New York, NY
4 Department of Biostatistics, Columbia University Mailman School of Public Health, New York, NY
5 Department of Radiology, Columbia University Medical Center, New York, NY
6 Division of Academics, Columbia University School of Nursing, New York, NY
7 Department of Biomedical Informatics, Vagelos College of Physicians and Surgeons, Columbia University, New York, NY, USA.

**Corresponding Author:**
Parisa Tehranifar, DrPH
Columbia University Mailman School of Public Health
722 West 168th St,
New York, NY 10032
Email: pt140@columbia.edu

**Funding:** This work was supported by grants from the National Institutes on Minority Health and Health Disparities (1R01MD011506) and Columbia Herbert Irving Comprehensive Cancer Center, Avon Foundation for Women (01-2015-069).

**Manuscript Word Count:** 2868/4000

**Tables:** 2

**Figures:** 2

**Conflicts of Interest:** The authors declare no conflicts of interest.
Breast density awareness and knowledge in a predominantly Hispanic sample

**ABSTRACT**

**Background:** New York State law mandates that women with dense breasts receive a written notification of their breast density (BD) and its implications but data on the impact of dense breast notification (DBN) on BD awareness and knowledge in diverse populations remains limited.

**Methods:** Between 2016 and 2018, we collected survey and mammographic data from 666 women undergoing screening mammography in New York City (ages 40-60, 80% Hispanic, 69% Spanish-speaking) to examine the impact of prior DBN on BD awareness by sociodemographic and breast cancer risk factors, and describe BD knowledge by sources of information.

**Results:** Only 24.8% of the overall sample and 34.9% of women with DBN had BD awareness. In multivariable models adjusting for DBN, awareness was significantly lower in women who were Spanish-speaking (OR 0.16; 95% CI 0.09-0.30 vs. English speakers), foreign-born (OR 0.31; 95% CI 0.16-0.58 vs. U.S.-born), and had lower educational attainment (e.g., high school degree or less OR 0.14; 95% CI 0.08-0.26 vs college or higher degree). Women with DBN were more likely to be aware of BD (OR 2.61; 95% CI 1.59-4.27) but not more knowledgeable about the impact of BD on breast cancer risk and detection. However, women reporting additional communication about their BD showed greater knowledge in these areas.

**Conclusions:** DBN increases BD awareness disproportionately across sociodemographic groups.

**Impact:** Efforts to improve communication of DBN must focus on addressing barriers in lower socioeconomic and racially and ethnically diverse women, including educational and language barriers.
INTRODUCTION

Between 40 and 50% of U.S. women receiving a mammogram are estimated to have mammographically dense breasts, using the Breast Imaging Reporting and Data System (BI-RADS) for breast composition classification.\(^1\)\(^-\)\(^3\) Increased breast density (BD) is associated with both false-negative\(^4\)\(^-\)\(^6\) and false-positive mammogram results\(^7\), and is a strong, independent predictor of breast cancer risk.\(^8\)\(^-\)\(^10\) Breast health advocates have championed for the enactment of legislation that mandate mammography facilities to provide women with information about their BD following mammography screening. Connecticut became the first state to pass such legislation in 2009; over 35 states have since implemented similar mandates, with some variation in the extent and type of information provided to women and whether both women with mammographically dense and non-dense breasts receive information.

A major impetus for notifying women about their BD is to empower women to become more involved in decisions about breast cancer screening by increasing their awareness of BD and its implications for breast cancer screening. Rhodes et al. conducted two of the largest cross-sectional national surveys assessing BD awareness and two aspects of knowledge relevant to screening decisions – knowledge of lower sensitivity of mammography for detecting breast tumors in the presence of dense breast tissue and knowledge of increased breast cancer risk from dense breasts.\(^11\),\(^12\) The first survey, conducted in 2012, found that over half of women had heard of BD, but this awareness of BD and knowledge of its implications for detection and risk were lower among Hispanic and Black women, as well as among women with lower income and educational attainment.\(^12\) Comparison of these results to a similar survey conducted in 2017 revealed increased BD awareness and knowledge of breast cancer risk over this time period, yet racial/ethnic and socioeconomic disparities persisted.\(^11\)
Breast density awareness and knowledge in a predominantly Hispanic sample

A recent review of 19 mostly cross-sectional studies revealed that general and personal awareness of BD varied substantially depending on the study population, and highlighted the need for additional research using prospective data.\textsuperscript{13} Importantly, few studies have collected mammographic data in general screening populations to determine the groups of women who would receive notification of their BD as per legislation. As a result, the majority of studies cannot distinguish whether BD awareness and knowledge are due to women’s receipt of and understanding of notification of personal BD information or reflect awareness from other sources of information including media, internet, friends, or healthcare providers. Further, few studies have examined BD awareness and knowledge in study populations with sufficient representation of lower socioeconomic or diverse racial and ethnic minority women who tend to experience greater personal and structural barriers to access and use of screening and follow-up care.\textsuperscript{14}

To address these gaps, we collected clinical and survey data from a cohort of predominantly Hispanic, Spanish-speaking, immigrant women undergoing screening mammography in New York City. The New York State legislation, enacted in 2013, requires that only women found to have dense breasts, as defined by BI-RADS breast composition categories of heterogeneously or extremely dense breasts, receive written notification of their BD status and its implications.\textsuperscript{15} This dense breast notification (DBN) must also inform women about the lower detection and higher risk of breast cancer from having dense breasts, and encourages women to discuss their BD and personal breast cancer risk and screening options with their healthcare providers.\textsuperscript{16} We used women’s clinical BD from mammograms obtained prior to survey implementation to prospectively ascertain DBN in relation to BD awareness and examine differences by women’s sociodemographic and breast cancer risk factors. We further described patterns of BD knowledge of breast cancer detection and risk by sources of information.
METHODS

Study Population and Data Collection

Between 2016 and 2018, trained bilingual research staff recruited 812 women, ages 40-60 years, at a mammography screening clinic in New York City, regardless of their history of breast cancer screening or breast density. Women completed an interviewer-administered in-person survey in English or Spanish during their screening mammography appointment. For this analysis, we excluded women with a personal history of breast cancer (n=4) as their knowledge and screening experiences may differ from average-risk screening populations, as well as women for whom no prior mammogram report was available (n=142), leaving a final sample of 666 women. This study was approved by the Columbia University Medical Center institutional review board and all women provided written informed consent prior to data collection.

The survey questionnaire collected data on sociodemographic, breast cancer risk factors, and mammography screening history. The questionnaire also included items that aligned with the New York State DBN elements - informing women with mammographically dense breasts of their clinical BD, the detection effect of dense breast, and the increased risk of breast cancer from having dense breast. Finally, we extracted clinical mammography reports since January 2013 (the implementation date of New York State legislation) from electronic medical records to ascertain women’s clinical BD, as a proxy for DBN.

Main Exposure - Dense Breast Notification. New York State legislation mandates that mammography facilities provide written notification to all women categorized as having dense breasts based on the clinical radiologists’ assessment using the BI-RADS density classification. The recruiting facility provides mammography results to women in both English and Spanish,
Breast density awareness and knowledge in a predominantly Hispanic sample

including the state-mandated DBN text as an additional paragraph for reports provided to women with dense breasts. Our primary measure of DBN was based on women’s clinical reports from the mammogram that followed the implementation of DBN legislation in 2013 and immediately preceded the study interview when women reported BD awareness and knowledge. Women with dense breasts (BI-RADS categories C/heterogeneously dense or D/extremely dense) were categorized as receiving DBN and women with non-dense breasts (BI-RADS categories A/almost entirely fatty or B/scattered fibro glandular densities) were categorized as not receiving DBN. As an additional measure, we considered the number of times each women had a mammogram with dense BI-RADS categories since 2013 (0, 1, ≥2 dense breast mammograms).

**Outcomes - BD Awareness and Knowledge.** Consistent with prior studies, we assessed general BD awareness by asking the following survey question, “Do you know about something called breast density or dense breasts?” Women who responded affirmatively to this question were categorized as having general BD awareness while women who responded ‘no’, ‘don’t know’, or ‘unsure’ were categorized as not having a general BD awareness. Women who reported BD awareness also completed knowledge questions about how BD impacted breast cancer risk and detection. Correct knowledge of breast cancer detection was categorized as the response ‘make detection more difficult’ to the following question: “How does dense breasts impact the results of mammogram?”. Correct knowledge of breast cancer risk was categorized as the response ‘increases her chances of getting breast cancer’ to the following question: “How does having dense breasts impact a woman’s chances of getting breast cancer?”. All other responses indicated incorrect (e.g., ‘make detection easier’) or lack of knowledge (e.g., ‘don’t know’ responses) and were combined into a single category. In addition, we asked women with general BD awareness if they were directly told that they had dense breasts — referred hereinafter
Breast density awareness and knowledge in a predominantly Hispanic sample

as personal BD awareness - and if so, to report if they were told by a health care professional (provider, radiologist, technician), a letter with mammogram results, or any other sources; women could have selected multiple information sources.

**Covariates:** We considered the following factors in our analysis: educational attainment, race, ethnicity, place of birth (nativity), primary language, age at menarche, parity and age at first pregnancy, family history of breast cancer in female first-degree relatives, prior breast biopsies, and health literacy using a validated three-item scale. We included the frequency of times a woman reported having ever received a call back for additional tests after a routine mammogram. We also considered proxies for acculturation including age at migration to the U.S., length of time in the U.S. and linguistic acculturation but these measures were excluded from our final analysis as all observed differences in DBN and BD awareness were limited to nativity (foreign- vs U.S.-born) and primary language (Spanish vs English interview language). Finally, in addition to including individual breast cancer risk factors, we used the Gail Model to develop a composite predicted risk and identify women at high risk for breast cancer using the established threshold of $\geq 1.67\%$ for 5-year risk.

**Analysis**

We examined differences in sociodemographic, breast cancer risk factors, and screening related variables by general BD awareness (aware vs. unaware). We performed multivariable logistic regression using stepwise selection to identify a parsimonious set of predictors of general BD awareness, specifying a p-value of 0.2 for entry into the model and a p-value of 0.1 for a variable to remain in the final model. We report adjusted odds ratios (OR) and 95% confidence intervals (CI) from the resulting models. We did not include the race/ethnicity variable in multivariable models since it overlapped greatly with dominant language, nativity, and
Breast density awareness and knowledge in a predominantly Hispanic sample

educational attainment (86.2% of Spanish speakers, 91% of foreign born, and 55% of women
with high school or less education were of Hispanic ethnicity). To examine whether
sociodemographic differences in general BD awareness varied by DBN, we tested for the
presence of multiplicative interaction between women with dense and non-dense breasts using
the statistical significance of the cross-product term (at $\alpha <0.05$) and model fit statistics and
performed stratified analysis by DBN for each of the following variables: race/ethnicity,
educational attainment, health literacy, language dominance and nativity. We further examined
the distribution of correct knowledge of the impact of BD on detection and risk of breast cancer,
as well as sources of BD information in the subset of women with general BD awareness. We
performed all analyses as two-sided tests using SAS 9.4, using 0.05 as significance level (SAS
Institute, Gary, NC).

RESULTS

The majority of women identified as Hispanic (80.3%), Spanish-speaking (69.2%),
foreign-born (79.3%), and half reported having ever received a call back for further follow-up
and diagnostic services after screening mammograms. In addition, data from the electronic
medical record identified that 37.4% of women in this study had mammographically dense
breasts, and thus would have received a written DBN per New York State’s legislative mandate.
DBN was more prevalent among non-Hispanic white women (44%) than non-Hispanic black
(34%) and Hispanic (37%) women.

General Breast Density Awareness

Only 24.8% of women in the entire sample had general BD awareness. Women who
received DBN reported higher awareness (34.9%) than women who did not receive DBN
Breast density awareness and knowledge in a predominantly Hispanic sample

(18.7%). Significant differences in general BD awareness were observed by race/ethnicity, education, health literacy, primary language, nativity, family history of breast cancer, receiving a mammography callback, and DBN (Table 1).

Table 2 presents the results of the multivariable models that included all the variables that met the model selection criteria, described above. In the fully adjusted models, Spanish-speaking (OR 0.16; 95% CI 0.09-0.30 vs. English-speaking), foreign-born (OR 0.31; 95% CI 0.16-0.58 vs. U.S-born) and lower educated women were significantly less likely to have general BD awareness (e.g., high school degree or less OR 0.14; 95% CI 0.08-0.26 vs college or higher degree). In the same model, women who had ever received one or more callbacks after screening mammogram were significantly more likely to have general BD awareness (e.g., OR 2.0; 95% CI: 1.19, 3.37 for one callback vs. none), as were women receiving DBN (OR 2.61, 95% CI 1.59, 4.27). The addition of women’s DBN in the model did not alter the estimates of the associations for sociodemographic and breast cancer risk factors, and only slightly increased the model fit (c-statistic of 0.882 and 0.891 for model without and with DBN respectively), suggesting a relatively small contribution to explaining observed associations of sociodemographic and breast cancer risk factors with BD awareness or to outcome prediction beyond these factors. We additionally examined whether the number of times women had mammograms triggering DBN affected BD awareness, and observed a higher likelihood of BD awareness for women receiving multiple DBN (2 or more mammograms with dense BI-RADS categories) than for women receiving a single DBN (OR 1.79, 95% CI 0.97, 3.34 and OR 2.29, 95% CI 1.31, 4.00, respectively, both relative to women who never received DBN in the final multivariable model; p for trend <0.003).
Breast density awareness and knowledge in a predominantly Hispanic sample

We did not find support for differential associations of DBN with general BD awareness across sociodemographic groups through statistical tests (all p values ≥ 0.05 for multiplicative statistical interaction terms). DBN-stratified analysis confirmed these results with the exception of family history of breast cancer, which was only significantly associated with higher general BD awareness in women without DBN (Supplemental Table). Corroborating the independent effects of DBN and sociodemographic factors, Figure 1 shows consistently higher proportion of general BD awareness among women receiving DBN compared to women not receiving DBN across groups characterized by race/ethnicity, educational attainment, health literacy, language preference and nativity. However, general BD awareness was significantly lower among Black, Hispanic, lower educated, and foreign-born women regardless of DBN.

Knowledge of Breast Density Impact on Breast Cancer Detection and Risk

Among women with general BD awareness (n=165), over 80% were knowledgeable of the breast cancer detection effect of dense breasts, while only 50.9% of women were knowledgeable of the impact of dense breasts on breast cancer risk. Further, 53% of women had personal BD awareness – that is, reported being told that they have dense breasts - including 67% of women with DBN. The vast majority of women with personal BD awareness reported being told about their BD by a healthcare provider (85.1%). Of those told by a healthcare provider, 79% indicated that the healthcare provider initiated the discussion while 21% brought up the topic of BD themselves. Only 15% of women reported having been informed about their BD through a letter containing their mammography results. Finally, there were no significant differences in knowledge of breast cancer detection or risk by DBN (Figure 2, Panel A); however, women who reported being informed directly of their personal BD status were
Breast density awareness and knowledge in a predominantly Hispanic sample

significantly more knowledgeable about the impact of BD on breast cancer risk and on detection (Figure 2, Panel B).

DISCUSSION

This is one of the first studies to use mammogram reports to assess the impact of prior personal DBN on BD awareness and knowledge in a sample of predominantly Hispanic, Spanish-speaking, immigrant women in New York City. We found that only a quarter of women undergoing screening had general BD awareness, with a significantly lower proportion of awareness seen among Hispanic, immigrant, Spanish-speaking, lower educated, and low health literate women. As our findings show, compared to women who had non-dense breasts, women with dense breasts who would have received DBN were significantly more likely to have general BD awareness, with some evidence for greater awareness with increasing number of DBNs. However, these women were not more likely to be knowledgeable about the impact of BD on detection and risk of breast cancer, and knowledge of these effects was only significantly greater in women who reported being directly informed of their BD, primarily by a healthcare provider, compared to women who did not report such communication. Overall, our findings add to the growing evidence supporting that DBN may increase general BD awareness, but pervasive disparities in awareness remains. In addition, DBN alone is unlikely to increase knowledge of the implications of BD on breast cancer risk unless reinforced by direct communication of this information.

Our findings are consistent with prior studies showing lower BD awareness and knowledge observed among non-English speaking, lower-literacy, and certain racial/ethnic minority populations. For instance, comparable to our findings, in the largest study of women of screening age, only 23% of Hispanic women had heard of BD compared to 65% of
Breast density awareness and knowledge in a predominantly Hispanic sample non-Hispanic white women. While a recent online survey of a diverse sample of women residing in New York State found that nearly 70% had heard about BD, the majority of the sample was educated, born in the US, and it’s unclear how many were Spanish-speaking or had dense breasts. Racial/ethnic disparities in BD awareness in states such as New York where only women with dense breasts receive notification may be partly attributed to decreased prevalence of BI-RADS ascertained dense breast in these population groups and therefore lower likelihood of receiving DBN. Yet, racial and ethnic differences in the proportion of women with BI-RADS ascertained dense breasts was not large in our study. Further, by accessing clinical data to ascertain personal DBN, we found that disparities in BD knowledge and awareness remained after accounting for DBN, thus reducing the possibility of differential prevalence of DBN as an explanation. Rather, our results likely reflect women’s limited understanding of DBN information, which in most states is written at reading levels difficult for many women to understand. Prior studies also show that Hispanic women with limited English proficiency prefer to receive health information directly from their healthcare provider. Thus, amending DBN content to improve readability level combined with efforts to facilitate patient-provider communication could help to improve the reach and effectiveness of DBN, particularly for women with lower literacy levels and ethnically diverse populations.

The low level of BD awareness and knowledge among women receiving DBN in our study suggests somewhat limited benefit of DBN for improving quality and informed decision-making about breast cancer screening. However, the public discourse around BD presents an opportune time for healthcare providers, researchers, and public health experts to broadly increase informed decision making as well as risk- and preference-based breast cancer screening. Importantly, we found that women’s history of follow-up and diagnostic evaluation after...
Breast density awareness and knowledge in a predominantly Hispanic sample screening mammography and their family history of breast cancer were associated with awareness of BD, independent of DBN and sociodemographic characteristics. Notably, having been called for follow-up after mammography screening was a strong predictor of BD awareness, conferring over two to four fold higher likelihood of BD awareness with increasing frequency of this experience. These findings are consistent with several prior studies\textsuperscript{11,12,33}, and lend further support for the possibility that healthcare encounters in the context of women’s breast cancer risk or screening may offer opportunities for communicating BD information to women, and serve as important avenues for increasing BD awareness and knowledge. Specifically, educating women beyond a single risk factor and incorporating other important risk factors for breast cancer (i.e., age, family history, genetic mutations, or prior breast biopsy) can help broaden women’s understanding of their personal risk and options for breast cancer screening and prevention.\textsuperscript{34} This, along with increased clinical risk assessment can also more appropriately direct the provision of supplemental breast imaging tests (e.g., Breast ultrasound or MRI), as suggested in most DBN legislation, and address concerns around the uncertainty of benefits and harms balance of supplemental imaging to mammography in women with dense breasts, who are otherwise not at increased breast cancer risk remain unknown.\textsuperscript{34,35} Ultimately, optimizing the potential effects of DBN to improve informed screening and reduce disparities should explore integrating DBN within a larger multi-level effort that includes a strong structural component to support equitable communication of personalized breast cancer screening.\textsuperscript{36-41}

This study addresses critical gaps in the literature but it is not without limitations. We recruited women from a large screening clinic in New York City which may limit the generalizability of findings to populations in other states, non-urban geographic settings, or smaller healthcare systems. However, this ensured that uniform DBN procedures were applied to
Breast density awareness and knowledge in a predominantly Hispanic sample

all screened women, reducing system variability and potential confounding of results by practice or system level factors. We cannot rule out that women received mammograms outside of the recruiting facilities during the study period. Variability in BI-RADS density classification across radiologists is also well-documented\(^42\) and BD may change over time, mainly declining with age.\(^43\) Thus, it is possible that women receive different information about their BD depending on differing radiologist interpretation and/or breast tissue changes. Yet, in our study, more than two thirds of women with multiple mammograms had the same DBN categorization (i.e., all non-dense or all dense mammograms) during the study period. Since the New York State DBN does not provide BD information to women with non-dense breasts, it is unlikely that women receive conflicting BD information and the most likely effect of inconsistent BD classification would be that some women more consistently receive DBN while others receive DBN on fewer occasions. Another limitation is that we did not assess awareness prior to the 2013 New York State mandate; thus, we cannot verify that awareness increased due to DBN or prior experience with dense breast screening. The use of BI-RADS breast composition directly from mammography reports as a proxy of DBN is a notable strength of this study; however, we were unable to confirm using self-report or other methods (e.g., postal records) if women with dense breast actually received a DBN. Another strength of our study is the use of a measure of health literacy\(^19\) that was strongly correlated with primary language in our sample of largely monolingual Spanish speaking women, potentially reducing the ability to distinguish the contribution of different dimensions of health literacy to BD awareness and knowledge. Despite having a large overall sample, we only provide bivariate analyses for knowledge and sources of information because only a small subset of women were aware of BD and could respond to
Breast density awareness and knowledge in a predominantly Hispanic sample

knowledge questions. However, the diversity of this subset in terms of race/ethnicity, language, and literacy represents a significant strength in light of prior gaps in the literature.

In conclusion, DBN can increase awareness of BD with potential to ultimately improve breast cancer screening and informed decision making, but these benefits are currently distributed disproportionately across sociodemographic groups. To this end, there is a need for innovative strategies to address the underlying concerns initially raised by breast cancer advocates for facilitating informed decision-making around BD and breast cancer screening that is equitable and responsive to the needs, values, and preferences of women. Potential strategies may include clarifying and improving the readability level of DBN, developing tools to promote communication between providers and patients, and reducing structural barriers to clinical risk assessment and supplemental screening if appropriate.

Acknowledgements: This work was supported by the National Institute of Minority Health and Health Disparities R01 MD011506 (principal investigator: P. Tehranifar). We would like to thank the study participants for contributing data and Rossy Sandoval and Melissa Rodriguez for data collection.
REFERENCES


Breast density awareness and knowledge in a predominantly Hispanic sample


Breast density awareness and knowledge in a predominantly Hispanic sample


Breast density awareness and knowledge in a predominantly Hispanic sample

Table 1. Overall sample characteristics and general breast density (BD) awareness

<table>
<thead>
<tr>
<th></th>
<th>Total sample N=666</th>
<th>Aware of BD N=165</th>
<th>Unaware of BD N=501</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (year)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-49</td>
<td>211 (31.7)</td>
<td>61 (37.0)</td>
<td>150 (29.9)</td>
</tr>
<tr>
<td>50-60</td>
<td>455 (68.3)</td>
<td>104 (63.0)</td>
<td>351 (70.1)</td>
</tr>
<tr>
<td><strong>Race/ethnicity</strong>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic White</td>
<td>47 (7.1)</td>
<td>40 (24.2)</td>
<td>7 (1.4)</td>
</tr>
<tr>
<td>Non-Hispanic Black</td>
<td>69 (10.4)</td>
<td>43 (26.1)</td>
<td>26 (5.2)</td>
</tr>
<tr>
<td>Non-Hispanic Mixed/ Other</td>
<td>15 (2.2)</td>
<td>9 (5.5)</td>
<td>6 (1.2)</td>
</tr>
<tr>
<td>Hispanic White</td>
<td>168 (25.2)</td>
<td>28 (16.9)</td>
<td>140 (27.9)</td>
</tr>
<tr>
<td>Hispanic Black</td>
<td>147 (22.1)</td>
<td>19 (11.5)</td>
<td>128 (25.6)</td>
</tr>
<tr>
<td>Hispanic Mixed/ Other</td>
<td>220 (33.0)</td>
<td>26 (15.8)</td>
<td>194 (38.7)</td>
</tr>
<tr>
<td><strong>Educational Attainment</strong>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High School degree or less</td>
<td>317 (47.7)</td>
<td>22 (13.3)</td>
<td>295 (59.0)</td>
</tr>
<tr>
<td>Some College or Trade School</td>
<td>148 (22.3)</td>
<td>41 (24.8)</td>
<td>107 (21.4)</td>
</tr>
<tr>
<td>College degree or higher</td>
<td>200 (30.1)</td>
<td>102 (61.8)</td>
<td>98 (19.6)</td>
</tr>
<tr>
<td><strong>Health Literacy</strong>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adequate</td>
<td>328 (49.3)</td>
<td>130 (78.8)</td>
<td>198 (39.5)</td>
</tr>
<tr>
<td>Marginal</td>
<td>173 (25.9)</td>
<td>26 (15.8)</td>
<td>147 (29.3)</td>
</tr>
<tr>
<td>Inadequate</td>
<td>161 (24.2)</td>
<td>7 (4.2)</td>
<td>154 (30.7)</td>
</tr>
<tr>
<td><strong>Primary Language</strong>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>English</td>
<td>205 (30.8)</td>
<td>123 (74.5)</td>
<td>82 (16.4)</td>
</tr>
<tr>
<td>Spanish</td>
<td>461 (69.2)</td>
<td>42 (25.5)</td>
<td>419 (83.6)</td>
</tr>
<tr>
<td><strong>Nativity</strong>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US Born</td>
<td>138 (20.7)</td>
<td>90 (54.5)</td>
<td>48 (9.6)</td>
</tr>
<tr>
<td>Foreign-Born</td>
<td>528 (79.3)</td>
<td>75 (45.5)</td>
<td>453 (90.4)</td>
</tr>
<tr>
<td><strong>Age at menarche (years)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 12</td>
<td>166 (24.9)</td>
<td>41 (24.8)</td>
<td>125 (25.0)</td>
</tr>
<tr>
<td>12</td>
<td>110 (16.5)</td>
<td>30 (18.2)</td>
<td>80 (16.0)</td>
</tr>
<tr>
<td>13 -14</td>
<td>275 (41.3)</td>
<td>70 (42.4)</td>
<td>205 (41.0)</td>
</tr>
<tr>
<td>≥15</td>
<td>113 (17.0)</td>
<td>24 (14.5)</td>
<td>89 (17.8)</td>
</tr>
<tr>
<td><strong>Family history of breast cancer</strong>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>579 (86.9)</td>
<td>135 (81.8)</td>
<td>444 (89)</td>
</tr>
<tr>
<td>Yes</td>
<td>84 (12.6)</td>
<td>29 (17.6)</td>
<td>55 (11)</td>
</tr>
<tr>
<td><strong>History of breast Biopsy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>530 (79.6)</td>
<td>125 (75.8)</td>
<td>405 (80.8)</td>
</tr>
<tr>
<td>Yes</td>
<td>136 (20.4)</td>
<td>40 (24.2)</td>
<td>96 (19.2)</td>
</tr>
<tr>
<td><strong>Mammography Callback</strong>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>333 (50.0)</td>
<td>66 (40.0)</td>
<td>267 (53.3)</td>
</tr>
<tr>
<td>Once</td>
<td>273 (41.0)</td>
<td>75 (45.5)</td>
<td>198 (39.5)</td>
</tr>
<tr>
<td>More than once</td>
<td>60 (9.0)</td>
<td>24 (14.5)</td>
<td>36 (7.2)</td>
</tr>
<tr>
<td><strong>5-year Gail model risk score</strong>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High risk (≥1.67%)</td>
<td>84 (12.6)</td>
<td>35 (21.2)</td>
<td>49 (9.8)</td>
</tr>
<tr>
<td>Average risk (&lt;1.67%)</td>
<td>582 (87.4%)</td>
<td>130 (78.8)</td>
<td>452 (90.2)</td>
</tr>
<tr>
<td><strong>Dense Breast Notification (DBN)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (dense)</td>
<td>249 (37.4)</td>
<td>87 (52.7)</td>
<td>162 (32.3)</td>
</tr>
<tr>
<td>No (non-dense)</td>
<td>417 (62.6)</td>
<td>78 (47.3)</td>
<td>339 (67.7)</td>
</tr>
</tbody>
</table>

† Percentage of participants indicating “yes” to the question: “Have you ever heard of something called breast density?”
* p-values <0.05 for comparison between women with and without breast density awareness
Breast density awareness and knowledge in a predominantly Hispanic sample

Table 2. Multivariable logistic regression models of predictors of general breast density awareness.

<table>
<thead>
<tr>
<th></th>
<th>OR (95% CI) Multivariable model without adjustment for DBN</th>
<th>OR (95% CI) Multivariable models, with adjustment for DBN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Education Attainment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High School degree or less</td>
<td>0.13 (0.07, 0.23)</td>
<td>0.14 (0.08, 0.26)</td>
</tr>
<tr>
<td>Some college or trade school</td>
<td>0.41 (0.24, 0.72)</td>
<td>0.44 (0.25, 0.77)</td>
</tr>
<tr>
<td>College degree or higher</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Primary Language</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>English</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Spanish</td>
<td>0.18 (0.10, 0.32)</td>
<td>0.16 (0.09, 0.30)</td>
</tr>
<tr>
<td><strong>Nativity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.S. Born</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Foreign-Born</td>
<td>0.33 (0.18, 0.62)</td>
<td>0.31 (0.16, 0.58)</td>
</tr>
<tr>
<td><strong>Family history of breast cancer</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Yes</td>
<td>1.85 (0.94, 3.63)</td>
<td>1.93 (0.97, 3.83)</td>
</tr>
<tr>
<td><strong># of mammography callback</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Once</td>
<td>2.27 (1.36, 3.78)</td>
<td>2.0 (1.19, 3.37)</td>
</tr>
<tr>
<td>More than once</td>
<td>4.67 (2.07, 10.50)</td>
<td>4.23 (1.85, 9.69)</td>
</tr>
<tr>
<td><strong>DBN</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (non-dense)</td>
<td>--</td>
<td>1.0</td>
</tr>
<tr>
<td>Yes (dense)</td>
<td>--</td>
<td>2.61 (1.59, 4.27)</td>
</tr>
</tbody>
</table>

Abbreviation: DBN, Dense Breast Notification. OR, odds ratio. CI, confidence interval.
Breast density awareness and knowledge in a predominantly Hispanic sample

**Figure 1.** General breast density awareness by dense breast notification (DBN) across sociodemographic groups.

Legend:

- % aware of breast density in women receiving DBN (dense breasts)
- % aware of breast density in women not receiving DBN (non-dense breasts)
Figure 2. Percent correct knowledge of breast cancer risk and detection among women with general breast density awareness (n=165) by dense breast notification (Panel A) and by personal breast density (BD) awareness (Panel B). * p<0.05

Legends
Panel A
■ Yes  □ No
Dense Breast Notification

Panel B
■ Yes  □ No
Personal BD awareness
Figure 1.
Figure 2.
Breast density awareness and knowledge in a mammography screening cohort of predominantly Hispanic women: Does breast density notification matter?

Jessica D Austin, Mariangela Agovino, Carmen B. Rodriguez, et al.

Cancer Epidemiol Biomarkers Prev Published OnlineFirst August 4, 2021.

Updated version
Access the most recent version of this article at:
doi:10.1158/1055-9965.EPI-21-0172

Author Manuscript
Author manuscripts have been peer reviewed and accepted for publication but have not yet been edited.

E-mail alerts
Sign up to receive free email-alerts related to this article or journal.

Reprints and Subscriptions
To order reprints of this article or to subscribe to the journal, contact the AACR Publications Department at pubs@aacr.org.

Permissions
To request permission to re-use all or part of this article, use this link http://cebp.aacrjournals.org/content/early/2021/08/04/1055-9965.EPI-21-0172. Click on "Request Permissions" which will take you to the Copyright Clearance Center's (CCC) Rightslink site.

Downloaded from cebp.aacrjournals.org on August 23, 2021. © 2021 American Association for Cancer Research.