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Breast density in multiethnic women presenting for screening mammography

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Abstract

Data on ethnic variations in breast density are limited and often not inclusive of underrepresented minorities. As breast density is associated with elevated breast cancer risk, investigating racial and ethnic difference may elucidate the observed differences in breast cancer risk among different populations. We reviewed breast density from initial screening of women from the Capital Breast Care Center and Georgetown University Hospital from 2010 to 2014. Patient demographics including race, age at screening, education, menopausal status, and body mass index were abstracted. We recorded the BI-RADS density categories: (1) “fatty,” (2) “scattered fibroglandular densities,” (3) “heterogeneously dense,” and (4) “extremely dense.” Multivariable unconditional logistic regression was used to identify predictors of breast density. Density categorization was recorded for 2146 women over the 5-year period, comprising Blacks (n = 940), Hispanics (n = 893), and Whites (n = 314). Analysis of subject characteristics by breast density showed that high category is observed in younger, Hispanic, nulliparous, premenopausal, and nonobese women (*t*-test or chi-square test, *P*-values <.0001). Obese women are 70% less likely to have high density. Being Hispanic, premenopausal, and nonobese were predictive of high density on logistic regression. In this analysis of density distribution in a diverse sample, Hispanic women have the highest breast density, followed by Blacks and Whites. Unique in our findings is women who identify as Hispanic have the highest breast density and lower rates of obesity. Further investigation of the impact of obesity on breast density, especially in the understudied Hispanic group is needed.

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Keywords

BI-RADS; Blacks; Hispanics; mammographic density

1 | BACKGROUND

Breast density impacts the visualization of mammography and is one of the strongest and most consistent risk factors for breast cancer.^{1,2} Breast density is categorized by the percent of the breast composed of glandular and connective tissue relative to fatty tissue.² However, there are different breast density classification schemes including Wolfe's parenchymal patterns,^{3,4} Tabar's classification scheme,⁵ the American College of Radiology's Breast Imaging Reporting and Data System (BI-RADS),⁶ and quantitative methods that estimate the percentage of dense area. Several studies have demonstrated that mammographic density is associated with breast cancer risk regardless of the method used to measure breast density.^{7,8} Women with the highest mammographic density (>75%) are at a 4- to 6-fold increased risk of developing breast cancer compared with women with the least dense tissue.^{7,9–12}

The vast majority of the studies assessing breast density and cancer risk have been conducted among White women, with limited inclusion of minority populations.^{13–15} The data on Hispanic women are more limited.^{16,17} Results are conflicting.^{15,16,18,19} Razzaghi et al.¹² found that White cases and controls had a greater percentage of "extremely dense" and "heterogeneously dense" breasts compared with African-American cases and controls. Furthermore, the BI-RADS density category with greatest prevalence among African-Americans was "scattered fibroglandular densities."¹²

In the present study, we examined the distributions of breast density as reported according to the BI-RADS density classification. To investigate racial differences, we compared White women with 2 understudied minority populations—African-American and Hispanic women. We also examined associations between breast density and selected breast cancer risk factors.

2 | METHODS

The study population is derived from data merged from 2 separate studies of women presenting for breast cancer screening at Capital Breast Care Center (CBCC) and MedStar Georgetown University Hospital (GUH) from January 2010 to December 2014 and approved by the Institutional Review Board of Georgetown University.

2.1 | Capital Breast Care Center

Capital Breast Care Center serves as a safety net for under and uninsured and medically underserved women residing in DC, Maryland and Virginia.²⁰ All women presenting for screening have their information prospectively collected and entered into the Electronic Medical Record system (EMR). Variables collected include demographic data (including age, race, ethnicity, education level, and reproductive history) and insurance status. Age at screening, education, and menopausal status were abstracted in addition to body mass index (BMI), calculated based on reported height in inches and weight in pounds. Imaging during

the study period was performed using computer-assisted design assisted, full field digital mammography with visual calculations of breast density based on BI-RADS assessment categories.⁶ The results of the screening studies are entered including the breast density. We abstracted the density description recorded at the first screening mammogram for each woman.

2.2 | Georgetown University Hospital

Female participants were recruited from 2010 to 2014 after a normal mammogram examination at the Ourisman Center for Breast Health at Georgetown University Medical Center. Eligibility criteria included being aged 35–50, English speaking, with no history of previous cancer or abnormality, including ductal or lobular carcinoma in situ or atypical ductal hyperplasia. Eligible women received a mailed survey, written consent and HIPAA documents, a letter of invitation from the study principal investigator and the medical director of Ourisman, and a self-addressed stamped envelope to return study documents. We also included a self-addressed stamped postcard by which participants could decline the study. A total of 822 packets were sent to eligible patients. Of these, 453 (55%) refused participation (113 active and 340 passive refusals). Twenty-five women were determined ineligible upon return of their survey. Our final sample of 344 women who completed questionnaires and consents represents 43% of the eligible sample. Our respondents did not differ from nonrespondents on age (45.7 vs 45.2; $t_{1/4} 1.84$; $p_{1/4} .07$). Participants received a \$20 gift card to thank them for their time. All participants provided written, informed consent.²¹

2.3 | Measures

2.3.1 | Sociodemographic and medical variables—We assessed age, race, ethnicity, marital status, education, and income, as well as known breast cancer risk factors, such as number of affected first-degree relatives and the number of breast biopsies.

2.3.2 | Breast density classification—We used the American College of Radiology BI-RADS to classify density. BI-RADS classification consists of 4 categories: (1) almost entirely fat, (2) scattered fibroglandular densities, (3) heterogeneously dense, and (4) extremely dense. The most recent mammogram available in the electronic medical record maintained by MedStar Health, the health system to which the Ourisman Center and GUMC belong, was used. Two board-certified radiologists (E.M. and E.P.) independently classified each participant. For the CBCC subset, the recorded density on the mammography report was used (no independent review of imaging).

For this analysis, breast density was categorized into low (categories 1 and 2) and high (categories 3 and 4). Figure 1 depicts mammographic images of a fatty or low density breast (A) compared to a dense breast (B).²²

2.4 | Statistical analysis

The distribution of participant characteristics was presented using frequencies and percentages for categorical data, and means and standard deviations for numerical data. Differences between low and high breast density on selected characteristics including were

tested by Pearson's chi-square test if they were categorical variables and by *t*-test if they were continuous variables. Multivariable logistic regression was used to obtain odds ratios (ORs) and the corresponding 95% confidence intervals (CIs) for the association between the selected variables and breast density. *P*-values less than .05 were considered significant.

3 | RESULTS

From 2010 to 2014, mammographic density was recorded for 2146 women presenting for screening. Race and ethnicity were self-reported. About 940 (43.8%) identified as Black, 893 (41.6%) Hispanic, and 314 (14.6%) White. After combining the data from the 2 screening sites (CBCC and GUH), subjects were analyzed by mammographic density with low density (BI-RADS categories 1 and 2) and high mammographic density (BI-RADS categories 3 and 4). Sample characteristics by mammographic density level are shown in Table 1. The average age at screening was 53.33 in the low density group compared to 48.44 in the high group (*P*-value <.0001). High density was associated with race (*P*-value <.0001) and premenopausal status (*P*-value <.0001).

Selected breast cancer risk factors significantly associated with high density (categories 3 and 4) are age at screening, Hispanic race/ ethnicity, parity, menopausal status, age of menarche, family history of breast, and BMI (chi-square, *P* < .05). Young women, Hispanic, nulliparous, premenopausal status and nonobese women were more likely to have high mammographic density.

Associations of selected breast cancer risk factors with high mammographic density on logistic regression analysis are represented in Table 2. The factors associated with low mammographic density include increasing age (OR = 0.94, 95% CI: 0.93, 0.96), Black (OR = 0.47, 95% CI: 0.38, 0.59) and White (OR = 0.38, 95% CI: 0.28, 0.53) compared to Hispanic race/ethnicity, postmenopausal status (OR = 0.72, 95% CI: 0.56, 0.93), and obesity (OR = 0.29, 95% CI: 0.23, 0.37).

4 | CONCLUSIONS

In this study, comparing the mammographic densities of Black, White and Hispanic women presenting for breast cancer screening, Hispanic women had the highest density followed by Black women after adjusting for factors including age and BMI. Additionally increasing age, obesity, higher parity, and postmenopausal status were negatively correlated with mammographic density. Over the last 3 decades, important determinants of mammographic density have been revealed, including genetic and lifestyle and societal/environmental influences such as reproductive factors, alcohol intake, smoking, and measures of growth and body size.^{10,11,15} Of these risk factors, age, BMI, and parity have both been strongly inversely related to density.¹⁸ The inverse association of age and BMI with mammographic density in this study is similar to prior reports. However, results in our screening population suggest that Hispanic women had higher breast density compared to White women, even after adjusting for obesity and age at screening.

The study had a few limitations that warrant attention. The screening studies for the CBCC participants were read in 1 facility (MedStar Washington Hospital Center) by different

radiologists. This introduces inherent variations on density categories. Two board-certified radiologists independently classified the density for each participant from (GUH). Neither site quantified the percent breast density which is more accurate but not utilized in standard mammography reporting. Nonetheless, given the paucity of reporting on mammographic density in minority women, these data presented are valuable. Especially advantageous is our diverse patient population that facilitated a comparison between Black, Hispanic, and White women.

As more information on the breast density and cancer interplay emerges, it is becoming a crucial element in the investigation of racial and ethnic disparities in breast cancer outcomes. Additional research is needed to further study the awareness of breast density in minority women and how obesity impacts the increased risk associated with higher density. Efforts are especially needed to increase inclusion in such research, particularly among Hispanic women as they may have higher breast density than previously reported and are even less likely than Blacks to be studied. At CBCC, the largest immigrant groups are from Latin America. This is representative of the nation's population that is projected to change as the Hispanic population increases at a rapid rate. All in all, minorities, now 37% of the U.S. population, are projected to comprise 57% of the population in 2060.²³

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FIGURE 1.
Mammogram showing normal (A) fatty vs (B) dense breast tissue

TABLE 1

Sample characteristics by mammographic density

Characteristics	Low density (n = 935)	High density (n = 1,211)	P*
Age at screening (years), mean $\pm$ SD	53.33 $\pm$ 8.51	48.44 $\pm$ 7.89	<.01
Race, n (%)			
Hispanic	296 (33.1)	597 (66.9)	<.01
White	122 (38.9)	192 (61.1)	
Black	517 (55.1)	422 (44.9)	
Education, n (%)			
High school or less	449 (45.3)	543 (54.7)	.12
Some college	180 (45.6)	215 (54.4)	
College or more	224 (39.4)	344 (60.6)	
Missing	82 (42.9)	109 (57.1)	
Reproductive Parity, n (%)			
Nulliparous	44 (35.2)	81 (64.8)	<.01
1 or 2	389 (40.6)	568 (59.4)	
3+	420 (48.2)	452 (51.8)	
Missing	82 (42.7)	110 (57.3)	
Menopausal status, n (%)			
Premenopausal	459 (34.7)	865 (65.3)	<.01
Postmenopausal	458 (58.0)	331 (42.0)	
Missing	18 (54.5)	15 (45.5)	
Age of menarche (years), mean $\pm$ SD	12.98 $\pm$ 1.91	13.19 $\pm$ 1.70	<.01
Family history, n (%)			
No	725 (43.1)	958 (56.9)	.53
Yes	209 (45.5)	250 (54.5)	
Missing	1 (25.0)	3 (75.0)	
BMI (kg/m ²), n (%)			
Nonobese (BMI <30 kg/m ²)	263 (30.4)	602 (69.6)	<.01
Obese (BMI $\geq$ 30 kg/m ²)	451 (60.7)	292 (39.3)	
Missing	221 (41.1)	317 (58.9)	

BMI, body mass index; SD, standard deviation.

*P represents the P-value for testing the association between each variable and breast density (chi-square test for categorical predictors and t-test for continuous predictors).

TABLE 2

Odd ratios (OR) and 95% confidence intervals (95% CI) for the association between selected variables and mammographic density based on logistic regression

Variables	Adjusted OR* (95% CI)
<i>Age</i>	0.94 (0.93, 0.96)
Race	
Hispanic	1.00
Black	0.47 (0.38, 0.59)
White	0.38 (0.28, 0.53)
Reproductive parity	
Nulliparous	1.00
1 or 2	0.83 (0.54, 1.28)
3+	0.62 (0.40, 0.96)
Menopausal status	
Premenopausal	1.00
Postmenopausal	0.72 (0.56, 0.93)
Age of menarche	1.05 (1.00, 1.11)
Family history of breast cancer	
No	1.00
Yes	1.02 (0.80, 1.30)
BMI (kg/m ²)	
Nonobese (BMI <30 kg/m ²)	1.00
Obese (BMI ≥ 30 kg/m ²)	0.29 (0.23, 0.37)

OR, odds ratio; CI, confidence intervals; BMI, body mass index.

* OR = odds ratio for each variable is adjusted for the other variables.