EVALUATION OF SCREENING MAMMOGRAPHY RESULTS IN A COHORT OF FEMALE HEALTH CARE WORKERS AT THE FEDERAL MEDICAL CENTER, ABUJA, NIGERIA

Oiza T. Ahmadu[1], Uchechukwu E. Nwokwu[2], Olayinka B. Popoola[1], Adaugo C. Iheanacho[1], Lateef Lawal[1], Amarachi. N. Onyebuchi[1], Rahama Y. Tahir[1], Tolulope O. Oloyede[1], Saad A. Ahmed[3]

1- Federal Medical Centre Abuja, Nigeria
2- Federal Ministry of Health and Social Welfare
3- Ahmadu Bello University, Zaria, Nigeria

Corresponding author: Oiza T. Ahmadu, Federal Medical Centre, Abuja, Nigeria

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ABSTRACT

Background: Mammographic screening has significantly reduced breast cancer mortality in developed countries. However, data on screening outcomes in asymptomatic populations in Nigeria remain limited.
Objective: To determine the distribution of BI-RADS categories and breast density patterns among asymptomatic women undergoing screening mammography at Federal Medical Centre, Abuja, Nigeria.
Methods: A retrospective cross-sectional study was conducted among asymptomatic female staff aged 40 years and above who underwent routine screening mammography at the Federal Medical Centre, Abuja, in February 2024. Data were obtained from radiology records, categorised by age group, and analysed using descriptive and comparative statistical methods.
Results: Majority of the participants were aged 40–49-years, with a mean age of 47.14 ± 5.37 years. Regarding the breast density, BI-RADS category B (scattered fibroglandular density) was the most common, observed in 49% of participants. In terms of mammographic assessment, BI-RADS category 1 (normal) was the most frequently reported, accounting for 58% of cases. Inferential analysis revealed a significant association between age group and breast density ($\chi^2 = 5.545$, $p = 0.0185$), with higher-density breasts more common among younger women, while no significant association was observed between age group and BI-RADS category ($\chi^2 = 0.633$, $p = 0.426$).
Conclusion: Screening mammography in this population was predominantly utilised by women under 50 years of age, with normal or benign findings and scattered fibroglandular breast density being most common. The observed association between age and breast density highlights the importance of age-targeted screening strategies. These findings provide insight into breast health patterns and can inform resource-optimised, institution-based screening programs in resource-limited settings.

Keywords: Breast cancer, Mammography screening, BIRADS category, Breast density.

INTRODUCTION

Breast cancer is the most commonly diagnosed cancer and the leading cause of cancer mortality among women worldwide. In 2020, an estimated 2.3 million new cases and 685,000 deaths occurred globally, making

breast cancer the most frequently diagnosed malignancy overall.[1] While high-income countries have benefited from organised screening programmes and early detection strategies, the burden of breast cancer continues to grow in low- and middle-income countries (LMICs), where more than 60% of breast cancer deaths now occur.[2]

In sub-Saharan Africa, breast cancer poses a major public health challenge. Women typically present at advanced stages, often with node-positive or metastatic disease, which significantly reduces survival rates and increases the cost of care.[3] Nigeria mirrors this trend. It records the highest incidence and mortality rates from breast cancer in West Africa, yet organised screening services remain largely absent from the public health system. Barriers such as poor awareness, limited access to mammography, stigma, and out-of-pocket healthcare expenditures continue to hinder early detection efforts.[4]

The World Health Organisation (2021)[5] recommends population-based mammography screening for women aged 40 to 69 years in well-resourced settings, and endorses clinical breast examination and community health education as interim measures in low-resource environments. Similarly, the American Cancer Society advocates commencing breast cancer screening at about 30 years for women with a positive family history because Caucasians have a higher prevalence of positive family history when compared to their African counterparts.[1] In developed countries, mammographic screening annually or biennially has significantly decreased breast cancer mortality rates by at least 20%.[2] Mammography provides critical diagnostic information, and significant health milestones have been achieved through its use in detecting breast lesions, including cancer.[3,4]

Central to radiologic evaluation is the Breast Imaging Reporting and Data System (BI-RADS), developed by the American College of Radiology in 1993,[5] which standardises the interpretation of mammographic findings and is used in most countries.[5] BI-RADS categorises mammography results on a scale from 0 (incomplete) to 6 (biopsy-proven malignancy), with categories 3 to 5 representing increasing levels of suspicion for malignancy.[6] Additionally, BI-RADS classifies breast density into four types: A (almost entirely fatty), B (scattered fibroglandular densities), C (heterogeneously dense), and D (extremely dense), which are crucial because increased density is associated with both elevated cancer risk and reduced mammographic sensitivity.[7] The assessment of 250 anonymised mammograms reviewed by different UK and US radiologists using the BI-RADS categorisation yielded minimal subjective variations, further validating and standardising the reliability of the BI-RADS categorisation guidelines in different demographics.[6]

Prior to 2013, breast density was assessed using the 2003 4th edition of BI-RADS guideline[7,8] and was categorized thus: BIRADS 1 described less than 25% glandular tissue and reported it as fatty (low density), BIRADS 2, which referred to 25-50% of glandular tissue, was reported as scattered fibroglandular (average density), then BIRADS 3, corresponded to 51-75% of glandular tissue, reported as heterogeneously dense (high density) and finally BIRADS 4 with more than 75% of glandular tissue (very high density), reported as homogeneously

dense.[7,8] The sensitivity of mammography varies greatly from 98% in women with fatty breast tissue to 36% in those with dense breast composition.[8] The recent 5th edition of the BI-RADS guideline excluded the percentages of glandular tissue and rather buttressed the potential masking effect of mammographic breast density, which implies laying more emphasis on the densest region of the image than percentages of glandular tissue.[8] The final BI-RADS impression uses the ACR BIRADS 1-6 lexicon, which interprets and corresponds to normal, benign, probably benign, suspicious, highly suspicious and biopsy-proven malignant findings, respectively.[7] The predictability of benign or malignant outcome is clarified using the BIRADS.

Numerous Nigerian studies have applied BI-RADS to characterise mammographic findings, and together they provide a useful reference point for institutional analyses. Akande et al. reported BI-RADS 2 as the predominant category, with scattered fibroglandular patterns most common.[9] Akhigbe et al. found BI-RADS 1 to be the most frequent, with lymphadenopathy representing the commonest benign lesion.[10] Similar patterns have been observed across studies from Abuja, Sokoto, Port Harcourt, and Lagos, where BI-RADS 1 and 2 consistently account for most findings, and extremely dense breasts remain relatively uncommon. International evidence also underscores population differences: Oppong et al[11] demonstrated that dense breasts are most prevalent among Hispanic women, followed by Black and White women, with density influenced by age, parity, menopausal status, and obesity. Together, these studies highlight the importance of local breast density patterns in predicting screening performance and interpreting diagnostic outcomes.

Ironically, even healthcare workers in LMICs demonstrate poor engagement with breast cancer screening, despite the availability of screening tools and rising awareness of BI-RADS. Multiple Nigerian studies reveal that despite high levels of knowledge, female healthcare workers have low rates of clinical breast examination, mammography, and breast self-awareness practices.[8] Factors cited include time constraints, perceived low risk, discomfort with imaging procedures, and lack of institutional encouragement.[8]

To address these gaps in LMIC, a lot of sponsored screening programmes are organised to improve early detection. In February 2024, Federal Medical Centre (FMC) Abuja, in collaboration with the Federal Ministry of Health, the Inclusive Cancer Care Research Equity (iCCaRE) for Black Men Consortium and NNPC Foundation, conducted a two-phase sponsored breast cancer screening campaign. The initiative provided targeted health education, clinical breast examinations, mammography for women aged 40 years and above, and breast ultrasound for younger women. Female healthcare workers were included as a specific target group, given their dual role as service providers and influencers of patient behaviour.

This paper presents an analysis of the results to determine the distribution of BI-RADS categories, breast density patterns, and age-related mammographic findings among female healthcare workers undergoing screening mammography at the Federal

Medical Centre, Abuja, and to describe associated follow-up recommendations.

The primary outcomes of interest were BI-RADS categories, breast density distribution, and recommended follow-up actions among screened participants.

MATERIALS AND METHODS

Study Design and Setting

This was a descriptive cross-sectional study conducted as part of a hospital-based, staff breast cancer screening outreach held at Federal Medical Centre (FMC), Abuja. The outreach was designed as an institutional health programme for female employees of the hospital. The screening took place at the Mammography Suite of the radiology department within the hospital premises.[12,13]

Study Population

The study focused on apparently healthy female healthcare workers who were staff of Federal Medical Centre, Abuja, aged 40–65 years, who met the eligibility criteria for mammography. Women with a prior diagnosis of breast cancer or history of benign breast lesions were excluded.

All eligible participants were scheduled for mammogram after registration and appropriate instructions on the procedure.

Sampling and Recruitment

A convenience sampling approach was used. All eligible female staff members present during the outreach days and who consented were enrolled. Participation was voluntary, and information about the screening was disseminated through the hospital's public relations platforms and departmental notices.

Sample Size Consideration

The sample size for this study was determined by the number of eligible female staff who voluntarily participated in the hospital-based breast cancer screening outreach during the study period. As this was a staff-focused screening programme rather than a population -based survey, the sample size was inherently limited to the finite workforce of the institution and participation during the outreach days. No formal sample size calculation was performed, as the study aimed to describe mammographic findings among participating healthcare workers rather than to estimate population prevalence or establish causal associations.

Health Education and Consent

The participants received structured health education covering breast cancer risk factors, the importance of early detection, and the role of mammography as a screening tool for breast cancer. The education was delivered by facilitators from the oncology and radiology departments. Informed consent was obtained from all participants prior to mammographic examination. A post-screening health talk was organised to discuss the results of screening and to guide participants' subsequent actions based on recommendations.

Screening Procedure

Mammography was used for women aged 40 years and above. The screening was conducted by trained radiographers and interpreted by independent radiologists following standard imaging protocols. Mammographic findings were classified using the American College of Radiology Breast Imaging Reporting and Data System (BI-RADS) and breast density categories A–D.

Participants were triaged into three categories based on results:

- Normal
- Abnormal, requiring further testing to rule out malignancy
- Abnormal, with high suspicion of cancer requiring confirmatory tests.[14]

Data Collection

The results from the mammography screening were uploaded, and data for the study, which included age, breast density, BI-RADS category, and screening outcome, were sourced from the data storage system.[15] All records were anonymised and entered into a secure database.

Statistical Analysis

Screening breast imaging examinations were the unit of analysis. Data were extracted from the screening reports of the participants on an Excel sheet. Data cleaning was performed and subsequently input into the Statistical Package for Social Sciences (SPSS) version 27 for analysis. Continuous variables, such as age, were summarised using means and standard deviations, while categorical variables, including breast density, BI-RADS classification, and follow-up recommendations, were summarised as frequencies and percentages. Screening outcomes were compared across age groups. Associations between categorical variables were assessed using the chi-square (χ^2) test, with statistical significance set at $p < 0.05$. Specifically, analyses explored relationships between age group and breast density, as well as between age group and BI-RADS category.[16]

Ethical Considerations

Ethical approval for this study was obtained from the Federal Medical Centre, Abuja's Health Research Ethics Committee, with protocol number: FMCABJ/HREC/2025/217. Confidentiality was maintained throughout by anonymising data.

All participants provided informed consent and were counselled on result interpretation and recommended follow-up. Participants with abnormal results were referred for further evaluation according to the breast cancer screening protocol.

RESULTS

A total of 105 participants underwent mammography screening between February 4th and March 4th 2024. All were women aged 40 years and over, of whom more than two-thirds (71%) were between the ages of 40 and 49 years, with a median of 46.1 years. The most represented age group was 40-44 years, accounting for 39% of the participants. The mean age of study participants in years was 47.1 ± 5.6 years.

Table 1: Age Group of Female HCW for the Study (n= 105)

Age Group	Frequency	Percentage
40-44	41	39
45-49	34	32
50-54	19	18
55-59	9	9
60-64	1	1
65-69	1	1

Table 2: Breast Density Distribution with Age of Female HCWs

Age Group (years)	BI-RADS A	BI-RADS B	BI-RADS C	BI-RADS D
40-44	9	20	10	2
45-49	10	13	10	1
50-54	8	9	2	0
55-59	0	9	0	0
60-64	1	0	0	0
65-69	1	0	0	0
Total	**29**	**51**	**22**	**3**

Among the screening population, the most common breast density classification was BI-RADS B (51%), while the least common was BI-RADS D (3%).

The most frequently occurring BI-RADS classification overall was BI-RADS 1, observed in 58% (61) of participants.

Table 3: BI-RADS Category Distribution Pattern among HCWs

Age Group	BI-RADS 0	BI-RADS 1	BI-RADS 2	BI-RADS 3	BI-RADS 4	BI-RADS 5	BI-RADS 6	MIXED
40-44	4	24	11	0	0	0	0	2
45-49	4	21	5	2	2	0	0	0
50-54	0	13	6	0	0	0	0	0
55-59	0	2	5	0	2	0	0	0
60-64	0	1	0	0	0	0	0	0
65-69	0	0	0	1	0	0	0	0
Total	**8**	**61**	**27**	**3**	**4**	**0**	**0**	**2**

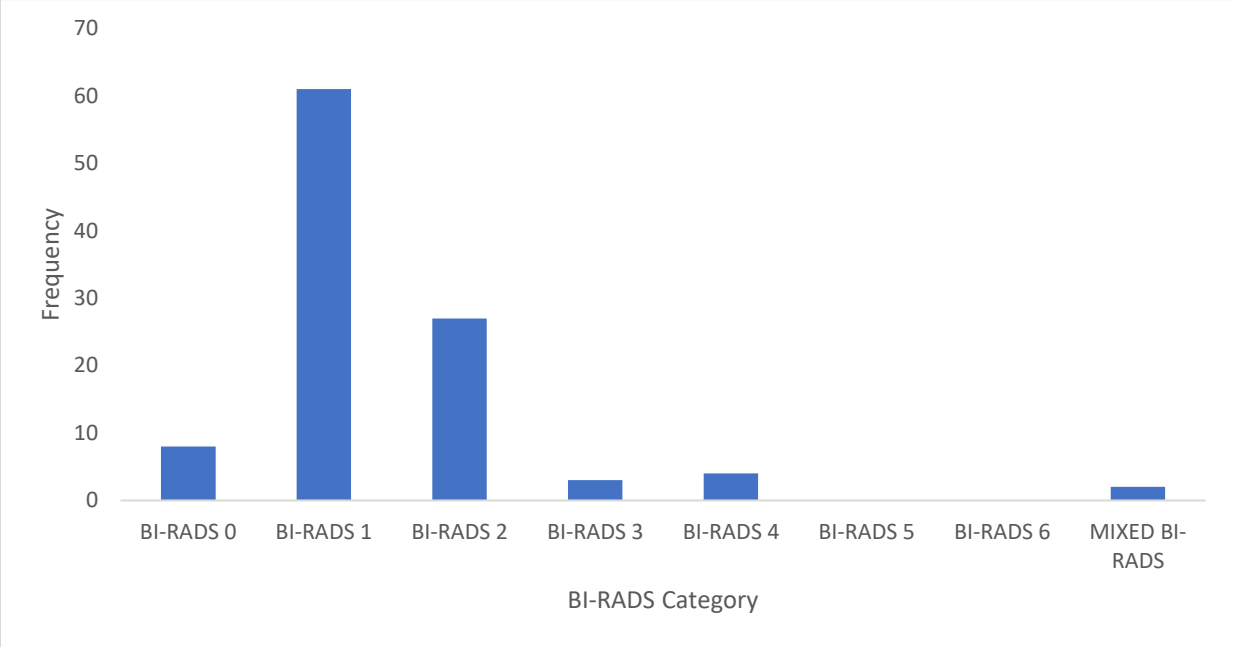

Figure 1: Distribution of Mammography Findings for Female HCWs

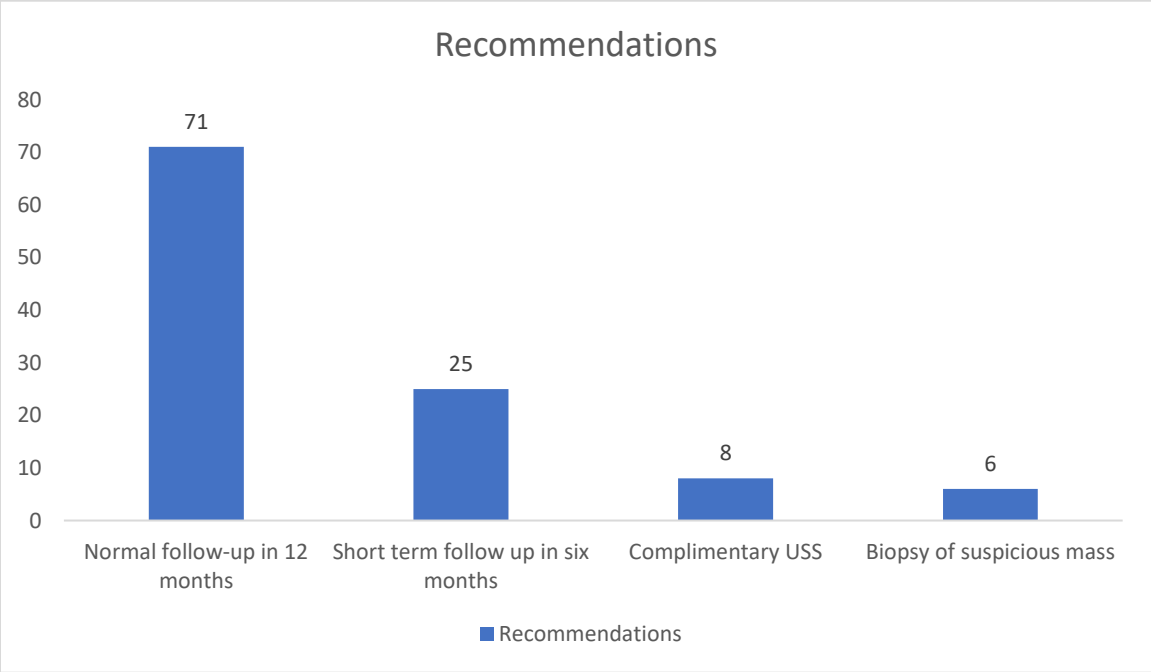

Figure 2: Distribution of Recommendations from Mammography Findings for female HCWs

A 12-month follow-up interval was the most frequent recommendation based on the results for 71 out of 105 participants (67.6%), while 6 of the 105 participants were recommended for biopsy of suspicious mass.

Association between Age, Breast Density, and BI-RADS Categories

Inferential analysis demonstrated a statistically significant association between age group and breast density ($\chi^2 = 5.545$, $p = 0.0185$), with higher breast density more frequently observed among women aged 40–49 years. No statistically significant association was found between age group and BI-RADS category ($\chi^2 = 0.633$, $p = 0.426$).

Due to sparse data across multiple BI-RADS and breast density categories, statistical assessment of the association between breast density and BI-RADS category, as well as between breast density and follow-up recommendations, could not be reliably performed.

Spearman correlation analysis showed a weak but statistically significant positive correlation between age and BI-RADS category ($\rho = 0.225$, $p = 0.022$), suggesting that higher age is modestly associated with higher BI-RADS scores.

DISCUSSION

In this study, the mean age of participants was 47.14 ± 5.37 years. This aligns with similar studies by Akhigbe et al (48.93+/- 8.0years) [10], and Akande et al (50.9+/- 8.1 years)[9] carried out in the Southwest and North central regions of Nigeria, respectively. However, the index mean age was at variance with Omidiji et al, who recorded 41.01± 6.01 years,[12] Ogolodom et al, with 44.5± 24.05 years,[13] Ebubedike et al with 49± 9.6 years[14] and Minouche et al, who recorded 43.7± 12.3 years.[15] The mean age in this study may be attributed to the small sample size of 105, as against Omidiji, Ogolodom and Minouche et al, with larger sample sizes of 300, 312 and 1738, respectively. The predominant BIRADS density in this study was BIRADS B (49%), while the least common was BI-RADS D (3%). This is in concordance with findings by Itanyi et al in Abuja,[16] Akhigbe et al (Benin & Lagos),[10] Akande et al (Ilorin)[9] and Galukande et al (Uganda).[17]

The distribution of breast density observed in this study revealed that younger participants, particularly those aged 40 to 49 years, were more likely to exhibit higher-density breast tissue classified as BI-RADS categories C and D. This pattern reflects global observations and reinforces evidence that breast tissue density decreases with increasing age.[18] These findings are also consistent with data reported by Obajimi et al. (2019)[1] in southwestern Nigeria, where higher breast density was associated with women aged below 50 years. In contrast to our findings, Obajimi et al. (2017)[1] recorded more fatty density (A), probably due to a higher number of older women in the study sample size,[12] which may also be attributed to age-related co-morbidities and other health concerns warranting better health-seeking behaviours in women of older ages. Akhigbe et al, in their study, however, concluded that the predominant BIRADS category was BIRADS with Lymphadenopathy as the commonest benign finding.[10] These overall findings may infer that Nigerian women predominantly have a lower breast density category (A and B) when compared to Hispanic women who have higher breast density.[11]

In terms of mammographic findings, the index study revealed the predominant BIRADS category pattern to be BIRADS 1 (58%), corresponding to normal/negative findings. This aligns with indigenous studies by Omidiji et al in Lagos,[12] Ogolodom et al in Port-Harcourt,[13] Akhigbe (Lagos & Benin)[10] and Itanyi et al, in Abuja.[16] The index study pattern was, however, in discordance with Ebubedike et al,[14] Akande et al,[9] Ehsanbakhsh[24] and Joshi et al,[25] with the latter two being non-indigenous studies.

Seven percent (7%) of participants were categorised as BI-RADS 3 or 4, indicating indeterminate or suspicious lesions requiring interval follow-up, complementary imaging or biopsy. This proportion aligns with previously reported rates in similar hospital-based screening cohorts.

The absence of BI-RADS 5 or 6 findings in this study may largely be due to the fact that our study was a screening exercise with asymptomatic participants as the subset of the target population, and the exclusion of women with known breast conditions.

Recommendations were also made based on imaging findings. Normal follow-up in 12 months was recommended for 71 participants (67.6%). This predominance of normal findings is consistent with other Nigerian screening studies targeting asymptomatic populations. For example, Akande et al. (2015)[9] reported that among women undergoing screening mammography in North Central Nigeria, 70% of findings were BI-RADS 1–2,[9] while Awosanya et al. (2008) observed 72.2% of asymptomatic women at a private hospital had normal mammograms.[4] Similarly, Abiodun et al. (2022) noted that 65% of female nurses screened in a tertiary hospital had BI-RADS 1–2 findings.[26] Compared with these studies, our 67.6% aligns closely with the expected benign-dominant pattern, supporting the notion that asymptomatic health-worker populations predominantly exhibit non-suspicious mammographic findings.

Short-term follow-up in 6 months was advised for 25 participants (23.8%). This proportion is higher than in other asymptomatic Nigerian cohorts, where it ranges between 8–15% (Akande et al., 2015[9] reported 12.4%; Awosanya et al., 2008[4] reported 10.5%). This may reflect the younger age profile of our cohort and a prevalence of denser breasts (BI-RADS C/D), both factors that can obscure lesions and necessitate cautious categorisation. These recommendations are in keeping with the American College of Radiology BI-RADS guidelines (ACR, 2013),[5] which advise short-interval imaging for probably benign lesions, balancing vigilance with avoidance of unnecessary biopsy.

Complementary ultrasound was indicated for 8 participants (7.6%), which could be explained by mostly dense breast patterns, suspicious lesions or indeterminate mammographic findings reflecting trends reported by Galukande et al,[22] who observed that 35–40% of women in sub-Saharan Africa present with BI-RADS C–D density. Use of adjunct ultrasound in screening populations enhances lesion detection, as supported by Alomaim et al,[6] who demonstrated improved diagnostic accuracy when ultrasound complemented mammography in ambiguous cases.

Biopsy was performed for 6 participants (5.7%), representing BI-RADS 4–5 lesions. This rate is comparable to other asymptomatic Nigerian populations, such as Rilwanu et al. (2024),[8] who reported a 4.6% biopsy rate among women undergoing screening in a tertiary facility. Performing biopsies for high-suspicion lesions aligns with BI-RADS guidance (ACR, 2013)[5] and ensures timely histologic confirmation for lesions with elevated malignancy risk.

Overall, the recommendations in this study, 67.6% normal follow-up in 12 months, 23.8% short-term follow-up in 6 months, 7.6% complementary ultrasound, and 5.7% biopsy, demonstrate a risk-stratified approach consistent with both Nigerian and international screening practices. Where recommendations for short term follow up exceeds prior Nigerian reports, this may be explained by participant age, breast density distribution, and the systematic use of adjunct imaging. These findings reinforce the importance of structured follow-up protocols, targeted use of ultrasound, and timely biopsy for suspicious lesions, ensuring early detection and optimised screening outcomes in asymptomatic Nigerian health workers.

When comparing our findings with global data, the majority of participants had normal or benign mammographic findings, with BI-RADS 1 comprising 58% and BI-RADS 2 comprising 25% of the cohort, together accounting for 83% of participants. This pattern is consistent with international screening data, where the majority of asymptomatic women typically present with BI-RADS 1–2 findings.[27,28] The proportion of participants with indeterminate or suspicious lesions (BI-RADS 3–4) was 7%, in line with global averages of 5–15% for screening populations.[5,23] No participants were categorised as BI-RADS 5 or 6, which aligns with expectations for an asymptomatic population undergoing screening rather than diagnostic evaluation.[6,7] Additionally, a small proportion (2%) presented with mixed BI-RADS categories, a phenomenon occasionally reported in both local and international studies due to heterogeneous breast tissue patterns.[11] Overall, these findings suggest that the screening outcomes in this Nigerian health-worker cohort reflect global trends for low-risk, asymptomatic populations, reinforcing the utility of mammography as a primary screening modality.[5,23]

Furthermore, the integration of a triage protocol, categorising participants into normal, abnormal requiring further testing, and abnormal with high suspicion of malignancy, further enhanced the screening model. These procedures reflect international recommendations for breast cancer screening programs in resource-constrained settings, which emphasise clear referral pathways, confidentiality, and immediate follow-up.[21] These operational strengths minimise loss to follow-up and reduce anxiety, thus fostering long-term trust in preventive health services.

The significant association between age and breast density observed in this study reinforces established evidence that breast density declines with advancing age. The absence of a statistically significant relationship between age and BI-RADS category likely reflects the asymptomatic nature of the screening population and the relatively low prevalence of suspicious lesions.

The weak positive correlation between age and BI-RADS suggests that as age increases, participants tend to have slightly higher BI-RADS categories, although the effect is modest. This complements the chi-square analysis, which did not find a significant association between age groups and BI-RADS categories, highlighting that a trend may exist at the individual level even if categorical comparisons are not significant.

Nevertheless, this study is limited by its single-centre design, convenience sampling, and the restricted population of healthcare workers aged 40-59 years, who are part of the active workforce, which may not reflect the screening behaviour or access challenges of the general female population.

Additionally, while the BI-RADS categorisation provides critical insight into breast imaging outcomes, pathological confirmation of abnormalities was beyond the scope of this report and remains a recommendation for future studies.

CONCLUSION

This study demonstrates the utmost importance of breast screening in the early detection of breast cancer, which assures improved management and cure.

It demonstrates that a facility-based breast cancer screening model incorporating health education, on-site mammography, and structured follow-up can achieve high participation rates and meaningful clinical findings among female healthcare workers. It also demonstrated a mean age of 47.14 ± 5.37 years, with the highest participation within the age group of 40 - 49 years, signifying the positive impact of ongoing breast cancer awareness in women above 40 years. The observed patterns of breast density and BI-RADS categories of normal findings (BI-RADS 1) align with existing evidence and support the feasibility of age-targeted screening programs in resource-poor settings. A significant association was observed between age group and breast density, with higher-density breasts more common among younger participants, while no significant association was found between age and BI-RADS category. These findings provide the baseline data that may inform age-focused screening strategies in resource-limited settings. It also provides insights into participation patterns and mammographic findings that may inform future facility-based screening initiatives.

Expanding screening programs within and outside the health workforce could improve early detection, normalise preventive screening behaviour, and indirectly influence the rate of breast screening uptake using mammography through informed healthcare providers. Integrating breast cancer screening into occupational health policies in hospitals and tertiary institutions represents a promising strategy for scaling early detection efforts in Nigeria. Future studies should include longitudinal follow-up, pathological verification, and economic evaluation to strengthen the evidence base for institutionalising screening as a public health priority.

DECLARATIONS

Conflicts of interest: We declare no conflict of interest.

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Data for this study is readily available, should there be any need for it to be made available.

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