

Abstract

Breast cancer is a leading cause of death among women, and according to the World Health Organisation (WHO) there will be a significant increase in the incidence of breast cancer in developing countries such as Nigeria by 2030. However, mammography screening can significantly reduce the mortality and morbidity of women as a result of breast cancer. Therefore, the aim of this review is to evaluate the mammography screening program in Nigeria, compare it with four developed countries and then draw inferences.

The Nigerian screening program was evaluated using the following factors: - mode of invitation, frequency of screening, age of the participants, image projections, imaging staff, quality assurance program, and availability.

Similarities exist between Nigeria and four developed countries (the United States of America, United Kingdom, Australia and Canada), for instance trained Radiographers do the imaging and the image projections obtained are the same. However, important differences exist, these include mode of invitation, financial model, quality assurance program and availability.

On comparison with the four developed countries, various issues have been identified within the Nigerian breast screening programmes. No one simple solution can be offered to address these as the challenges are multi-factorial.

Introduction

Breast cancer has been reported to be one of the leading causes of mortality among women worldwide; 508,000 women died as a result of breast cancer in 2011 ¹. Coleman et al. ² and Fregene and Newman ³ reported that the incidence of breast cancer amongst women in Western countries (including the United States of America, the United Kingdom, Canada and Australia) was significantly greater than that for women in African countries; the proportion of women that died as a result of the disease was higher amongst women in the African countries. This difference in mortality could be as a result of poor awareness of women about breast cancer, poor diagnostic facilities, poor treatment facilities, and high cost of the disease management ³. WHO suggests that there will be a 70% increase in the incidence of breast cancer by 2030 in developing countries such as Nigeria ⁴. Consequently, appropriate measures should be put in place to improve breast cancer detection and treatment.

Comparing previous records of breast cancer incidence rates among Nigerian women there was a significant increase of 200% since the earliest record from 1960-69 which was 13.7 cases per 100,000. The authors made an assumption that this increase could be as a result of increasing change in dietary and physical activity patterns, and alcohol use, as they did not have evidence to prove the causative factors ⁵. However, breast screening may be a factor

responsible for this apparent increase in Nigeria ⁶, with some communities (for example Lagos State Government) reporting the installation of more screening facilities for the early detection of breast cancer ⁷.

The stage at which breast cancer is detected determines prognosis⁸. Therefore, early detection is important for reducing the mortality rate of women ⁹.

Mammography screening is the most effective method for the early detection of breast cancers among asymptomatic women ¹. However, mammography screening has several disadvantages such as radiation risk, false positive results, and over diagnosis. Weighing the benefits and risks of screening, an organised mammography breast screening program is said to reduce the mortality rate of women as a result of breast cancer by 20% in the screening group compared to the non-screening group ¹.

Ethically, it is the obligation of a screening program to discuss both the merits and limitations of screening to the women, so that they can make an informed decision regarding participation in the screening program ¹⁰. Furthermore, the benefit to risk ratio of screening should be critically evaluated by clinicians before recommending the screening programs for the patients at higher risk of breast cancer ¹¹.

The aim of this review is to evaluate the mammography screening program in Nigeria, with critical comparison to four developed countries (United States of

America, Canada, United Kingdom, and Australia). This should give an insight as to how the current program is organised and utilised in Nigeria, and also how it might be improved.

Discussion

The screening program in Nigeria is largely unstructured regarding the mode of invitation, frequency of screening, and the age of the participants. For instance, only one Nigerian state out of the thirty-six reported organising a structured mammography screening program ⁷. Other non- government organisations and multinational cooperation organisations have also been involved in providing mammographic breast screening in Nigeria but it is haphazard. As there are several important elements involved in the four developed countries' screening programs, the program being evaluated will be discussed using these factors- mode of invitation, frequency of screening, age of the participants, image projections, imaging staff, quality assurance program, and availability (see table 1).

Mode of Invitation

The only available screening program found in Nigeria promotes public awareness campaigns to invite women to participate in its free screening program ⁷. However, recent evidence shows that the majority of eligible women within the population have not participated regularly in mammography screening ⁷. The use of public awareness may have been responsible for the small number of women participating in the free screening

program, as it was reported that only 12,692 women had participated in the mammography screening since 2006, when it began.

The United States of America (USA) and Canada also use public awareness campaigns, and the reason for their success could be because of the strength of their media^{12,13}. This is not the case in Nigeria, as the poor in the society have little or no access to information through print media (e.g. newspapers, magazines), watching television, listening to radio, or using the internet¹⁴. The USA uses a similar approach for inviting women for its mammography screening; however 99.9% of its population has access to information through the media that were mentioned earlier.

According to Azubuike and Okwuokei¹⁵, and Okobia et al.⁹, a moderate proportion of women (43- 56%) in Nigeria have a good knowledge of the early detection strategies of breast cancer (e.g. breast self-examination, clinical breast examination, and mammography). Therefore, more than half of the study participants had practiced at least one of the early detection strategies¹⁵.

The women with tertiary education and those that had previously been diagnosed with breast cancers had better knowledge of breast cancer, and they tend to practice early detection strategies¹⁵. Okobia et al.⁹ concluded that Nigerian women with a higher level of education were 3.6 times more likely to practice regular breast self-examination.

The results show that there is an increased knowledge of women about breast cancer risk factors, and breast cancer signs and symptoms compared to previous literature on a similar topic^{15, 9, 16}, with about 50% of the study participants identifying up to three risk factors, and about 65% of the participants identifying up to two signs and symptoms of breast cancer. Azubuike and Okwuokei¹⁵ suggest that the reason for this increase is as a result of increase in public awareness programs organised for women in the communities.

There was a direct relationship between knowledge levels and the practice of early breast cancer detection strategies. Also, there was a direct relationship between knowledge of breast cancer risk factors and practice of early breast cancer detection strategies¹⁵. Therefore, it is important that Nigerian women are educated about the key aspects of breast cancer and how to detect or prevent it.

In summation, there is an imbalance in the knowledge and practice of regular breast screening between groups of women with different education levels in Nigeria. However, for a screening program to be effective in Nigeria, education must be considered a priority to increase public awareness and screening rate. This has to be taken in to consideration as this might improve screening rate uptake, so that the desired benefit of screening can be achieved.

The approach used by the United Kingdom and Australia (a letter of invitation to attend) could be adopted by the Lagos State Ministry of Health (LSMH) screening program, as this has the ability to reach more of the women of interest in the population ^{17, 18}.

Bonfill, et al. ¹⁹ conducted a systematic review to evaluate different mammography invitation strategies and their effectiveness. They concluded that, interventions such as, invitation letter, making phone calls, mailing educational materials, and organising training activities with reminders for the women were effective at increasing the attendance rate of women invited to mammography screening programs. Furthermore, the combination of effective interventions such as, a letter invitation and phone calls have greater effect on the attendance rate among women within the lower socioeconomic group. It is possible that interventions such as these might increase the attendance rate for the LSMH screening program.

Frequency of Screening

In many of the screening programs around the world, women are encouraged to participate in breast screening once every two years. However, the screening program in the UK encourages women to participate in breast screening once every three years. The reason for the three years screening interval might be to minimise the cumulative radiation dose women are

exposed to during screening, and therefore the possibility of developing radiation induced cancer²⁰. The Breast Screening Frequency Trial Group²¹ gave evidence that the effectiveness of a screening program is not about the frequency of screening but the effectiveness of the process to detect breast cancer when it is present. The screening program in Nigeria has recently been encouraging asymptomatic women to screen biennially. However, before the recent change in frequency of breast screening, women were encouraged to participant in annual mammography screening, and there was no justification for this frequency. This indicates that the radiation dose Nigerian women were exposed to during screening was significantly increased, and that might increase the women's risk of radiation induced cancer. The cost of screening was also increased with the yearly screening programme, and this was not appropriate practice in a developing country like Nigeria, as it needs to receive financial support from health organisations outside the country. Only the screening program in the United States of America encourages women to participate annually, as it increases the chances of breast cancer early detection, because that seems to be the duration of time it takes for breast cancer to be detectable by mammography before symptoms develops¹². However, no evidence of experimental research was used to justify their choice.

Age of Participants

The screening program in Nigeria reported recruiting women from 40-70 years.

The justification for this is that a large percentage of breast cancers are seen in the younger age group in Nigeria compared to the advanced world⁵. Similarly, the American Cancer Society (ACS) also encourages women within 40-70 years to participate in their mammography screening program¹². This was due to the fact that there has been an increased incidence of breast cancer in younger women in the USA¹².

Evidence shows that mammography screening is of optimal benefit to women from 47 years to 73 years, as periodic screening within this age range reduces the women's chances of dying as a result of breast cancer²². More breast cancers were found in women within this age group, and the breast tissues are better visualised on mammograms, as it changes from being glandular to fatty tissue in older women¹. Currently, the United Kingdom invites women from 50-70 years of age to attend the program; but they are in the process of extending screening to women between 47 and 73 years by 2016, due to the potential benefits of screening at these ages¹⁷. The Australian screening program invites women within 50-74 years to participate in their mammography screening programs¹⁸, while Canada invites women within the age 50-69 years¹⁷. What is noticeable in these screening programs is that in all countries mentioned, except in Nigeria and the USA, women below the age of

47 years are not encouraged to participate in regular breast screening. This is due to the potential increase in the radiation dose they are exposed to, which may increase the chances of ionizing radiation-triggered breast cancer in their population ²⁰. Furthermore, the incidence of breast cancer below the age of 50 years is significantly lower compared to the incidence above the age of 50 years ²³. However, women who are at high risk of breast cancer (e.g. women with- BRCA I or II mutations, previous exposure to excess radiation dose) are being encouraged to participate in regular breast screening from 40 years, and are encouraged to use ultrasound and Magnetic resonance imaging for breast examination if available, as these do not pose any known harmful effects to patients ¹⁷.

Image projections

The mammography screening program in Nigeria, reported using two projections for each breast (cranio- caudal and medio-lateral oblique views). Similarly, the four other mammography screening programs also reported using similar projections. According to van Breest Smallenburg and colleagues ²⁴, in a study that evaluated inter-reader reliability in detecting breast cancer using one (medio-lateral oblique projection) and two projections mammograms - they found out that the two projections mammograms have a higher ability to detect breast cancer. Also, two projections mammograms are more cost effective than the single projection mammogram, as a significant

number of single projection mammograms were inconclusive thus requiring additional mammographic examinations. This re-enforces the need for two projections mammography; Nigeria is therefore in line with current evidence for the image projections obtained.

Imaging Staff

The use of properly trained staff in mammography screening programs helps reduce the repeat rate, which reduces the ionizing radiation dose participants are exposed to¹⁷. Within the Nigerian breast screening program, radiographers with additional mammogram-specific training are employed; this is similar to the four developed countries. However, the UK also uses trained assistant practitioners in its screening program. These radiographers are educated to be able to communicate effectively with the women before, during and after the mammography examination, as this has been shown to improve women's satisfaction with the screening process²⁵. Properly trained radiographers would have the ability to reassure the women, as they may be experiencing psychological distress¹⁷. This might improve the women's attitude towards rescreening in the future. Also, well trained Radiographers would be able to use evidence to improve their practice. For example, the use of practice-based evidence to minimize the pain and discomfort experienced by women during mammography screening, as this would improve the women's satisfaction with the service²⁶.

Quality Assurance

Regular quality assurance is necessary to safeguard high mammography screening standards. The effectiveness of the mammography equipment, accuracy of the image reader in detecting or excluding breast cancer, the reject or repeat rate analysis, and the patients' satisfaction with the service provided, need to be evaluated at regular intervals and compared to an approved standard¹⁷. In the case where audit standards are not met, interventions should be put in place to improve the mammography service¹⁸. No quality assurance program exists for the Nigerian breast screening program. However, the four other countries report carrying out regular quality assurance audits on their screening programs. Due to the benefits of having regular quality assurance assessments carried out, it would suggest that Nigeria should adopt an effective quality assurance program to monitor and improve the quality of the mammography screening program offered.

Cost

In Nigeria, 61% of the population could barely afford the essentials of living, and are living on less than one U.S Dollar per day (absolute poverty)²⁷. However, a mammography examination in Nigeria costs approximately seventy dollars (\$70). It is therefore not logical for these women with low incomes to show interest in mammography screening, even when they are aware of the benefits, assuming they have to pay for it. Interestingly, only one state out of

the thirty-six in Nigeria, organise a free mammography screening program for women ⁷. There is therefore an evident need for more government and private sector input into this, as cost could be a major limiting factor towards the early detection of breast cancer in the country. In three of the four developed countries (U.K, Canada and Australia) the mammography screening services are provided free to women, which helps to enhance the participation rate; and this directly reduces the mortality rate of women as a result of breast cancer within these countries ^{13,17,18}. In USA, patients are required to pay for their mammography screening ¹², but the poverty rate of this country is far different from that which exists in Nigeria.

Availability

In the screening program organised by the LSMH, four mammography units were reported to have been provided ⁷. However, the ratio of screening age women (40- 70years) was not provided by the LSMH, and therefore it cannot be said that the ratio of available units is sufficient. Insufficient mammography screening centres might lead to increased waiting times for screening. It can be assumed that a lack of imaging facilities and long waiting times may have contributed to the low participation of the women within the population towards mammography screening.

In the screening programs organised by the UK, Canada, Australia and USA, the ratio of mammography units to the number of women of interest within the population are, 21, 40, 63, and 89 units per million women respectively ²⁸.

Therefore, for the screening program in Lagos state to be effective in the early detection of breast cancer within its population, the number of women within the screening age in the population must be calculated and an adequate number of mammography screening units should be provided to cover the women of interest within the population.

Table 1: Table showing the comparison of the mammography screening programs in Australia, Canada, Nigeria, UK, and USA

Category	Australia	Canada	Nigeria	United Kingdom	United States of America
Mode of Invitation	Invitation letter	Public awareness	Public awareness	Invitation letter	Public awareness
Age of participants	50-74 years	50-69 years	40-70 years	50-70 years	40-70 years
Frequency	Biennial	Biennial	Biennial	Triennial	Annual
Image projection	2 views	2 views	2 views	2 views	2 views
Imaging staff	Trained Radiographer	Trained Radiographer	Trained Radiographer	Trained Radiographer	Trained Radiographer
Quality assurance	Frequently reported	Frequently reported	None	Frequently reported	Frequently reported
Availability	63 units per million	40 units per million	-	21 units per million	89 units per million
Cost	Free	Free	Mixed	Free (cost covered by the NHS)	Self-funded

Conclusion

The mammography screening program in Nigeria and specifically Lagos State (the only state out of the 36 in Nigeria that reported organising a free mammography screening program) when compared to the screening program organised in other countries (Australia, Canada, UK, and USA) appear to be lagging behind the four comparative developed countries in the areas of method of invitation, the age of the participants, quality assurance program, and availability of the mammography equipment. However, similarities exist with the other countries, regarding the frequency of screening, the image projections, and imaging staff it uses for the screening program. Nigeria has an extremely low participation rate amongst women for breast screening, and this low rate could be related in particular to cost, and to the mode of invitation used in its screening program. The biggest change would be to reduce or remove patient costs- this is likely to be the biggest barrier. The mode of invitation must reflect the population to which it applies, for example access to information, media, and literacy levels. Further work needs to be carried out on the factors associated with women's participation or non- participation in the Lagos state mammography screening program, as this can provide solutions on ways to improve the quality of the Nigerian screening program.

Reference list

1. World Health Organisation. (2014). Breast cancer: prevention and control. Retrieved 12th December, 2014 from; <http://www.who.int/cancer/detection/breastcancer/en/>
2. COLEMAN, M; QUARESMA, M; BERRINO, F; LUTZ, J; DE ANGELIS, R; CAPOCACCIA, R; BAILI, P; RACHET, B; GATTA, G; HAKULINEN, T; MICHELI, A; SANT, M; WEIR, HK; ELWOOD, JM; TSUKUMA, H; KOIFMAN, S; E SILVA, G; FRANCISCI, S; SANTAQUILANI, M; VERDECCHIA, A; STORM, H; YOUNG, J. (2008). Cancer survival in five continents: a worldwide population-based study (CONCORD). *Lancet Oncology*; **9**(8); 730–56.
3. FREGENE, A.; and NEWMAN, L. (2005). Breast cancer in sub-Saharan Africa: how does it relate to breast cancer in African-American women? *Cancer*; **103**(8); 1540-50.
4. BOYLE, P; LEVIN, B. (2008). World cancer report 2008. Lyon, France: International Agency for Research on Cancer.
5. JEDY-AGBA , E.; CURADO , M.; OGUNBIYI , O.; OGA , E.; FABOWALE , T.; IGBINOBA , F.; OSUBOR, G.; OTU, T.; KUMAI, H.; KOEHLIN, A.; OSINUBI, P.; DAKUM, P.; BLATTNER, W.; ADEBAMOWO, C. (2012). Cancer incidence in Nigeria: A report from population-based cancer registries. *Cancer Epidemiology*; **36**(5); 271 - 278.
6. BLEYER, A; and WELCH, H. (2012). Effect of three decades of screening mammography on breast- cancer incidence. *N Engl J Med*; 367; 1998-2005
7. LAGOS STATE MINISTRY OF HEALTH. (2010). Breast Cancer Screening And Awareness Programme. Retrieved 12th December, 2014 from, http://www.lagosstateministryofhealth.com/programme_info.php?programme_id=24
8. NIGERIA. SOCIETY OF ONCOLOGY AND CANCER RESEARCH OF NIGERIA (2014). Breast cancer information leaflet. Retrieved 12th December, 2014 from,

http://www.socron.net/socron/fileDump/Patients/Diseases/Cancer/leaflet_en.pdf

9. OKOBIA, M.; BUNKER, C.; OKONOFUA, F.; and OSIME, U. (2006). Knowledge, attitude and practice of Nigerian women towards breast cancer: A cross sectional study. *World Journal of Surgical Oncology*; **4**(2); 11.
10. BEREN, E; REDER, M; KOLIP, P; SPALLEK, J. (2014). A cross-sectional study on informed choice in the mammography screening programme in Germany (InEMa): a study protocol. *BMJ*; **4**(9); 1-6
11. United States Preventive Services Task Force. (2009) Screening for breast cancer: United States Preventive Services Task Force recommendation statement. *Ann Intern Med.*; **151**(10):716-26.
12. American Cancer Society. (2014). Breast Cancer Facts and Figures 2013- 2014. Retrieved 12th December, 2014 from, <http://www.cancer.org/acs/groups/content/@research/documents/document/acspc-042725.pdf>
13. Breast Cancer Society of Canada, (2014). Breast Screening Information for All Provinces and Territories. Retrieved 12th December, 2014 from, <http://www.bcsc.ca/p/48/l/102/t/Breast-Cancer-Society-of-Canada---Regional-Breast-Cancer-Screening>
14. OYEDIRAN, K.; FEYISETAN, O.; AKPAN, T. (2011). Predictors of condom-use among young never-married males in Nigeria. *J Health Popul Nutr.*; **29**(3):273-85.
15. AZUBUIKE, S.; and OKWUOKEI, S. (2013). Knowledge, attitude and practice of women towards breast cancer in Benin city Nigeria. *Annals of Medical and Health Science Research*; **3**(2); 155-160.
16. SALAUDEEN, A.; AKANDE, T.; and MUSA O. (2009) "Knowledge and attitudes to Breast Cancer and Breast Self Examination Among Female Undergraduates in a State in Nigeria". *European Journal of Social Sciences*; **7**(3); 157-165.

17. UNITED KINGDOM. NHS Cancer Screening Programme, (2014). NHS Breast Cancer Screening Programme. Retrieved 12th December, 2014 from;
<http://www.cancerscreening.nhs.uk/breastscreen/index.html>
18. Australian Government Department of Health, (2014). Breast Screen Australia Program. Retrieved 12th December, 2014 from,
<http://www.cancerscreening.gov.au/internet/screening/publishing.nsf/Content/breastscreen-about>
19. BONFILL, C; MARZO, C; PLADEVALL V; MARTI, J; EMPARANZA, J. (2009). Strategies for increasing the participation of women in community breast cancer screening (Review). *The Cochrane Library*; 1; 1- 30.
20. YAFFE, M.; and MAINPRIZE, J. (2011). Risk of Radiation-induced Breast Cancer from Mammographic Screening. *Radiology*; **258**(1); 98-105.
21. UNITED KINGDOM. The Breast Screening Frequency Trial Group (2002). The frequency of breast cancer screening: results from the UKCCCR Randomised Trial. *European Journal of Cancer*; **38** (1); 1458–1464.
22. MOSER, K; SELLARS, S; WHEATON, M; COOKE, J; DUNCAN, A; MAXWELL, A; MICHELL, M; WILSON, M; BERAL, V; PETO, R; RICHARDS, M; PATNICK, J. (2011). Extending the age range for breast screening in England: pilot study to assess the feasibility and acceptability of randomization. *Journal of Medical Screening*; **18**(2); 96-102
23. KERLIKOWSKE, K. (2012). Screening mammography in women less than age 50 years. *Current Opinion in Obstetrics and Gynecology*; **24**(1):38-43.
24. VAN BREEST SMALLENBURG, V; DUIJM, L; DEN HEETEN, G; GROENEWOUD, J; JANSEN, F; FRACHEBOUD, J; PLAISIER, M; VAN DOORNE-NAGTEGAAL, H; BROEDERS, M. (2012). Two-view versus single-view mammography at subsequent screening in a region of the Dutch breast screening programme. *European Journal of Radiology*; **81**(9); 2189–2194.

25. BAIRATI, I; TURCOTTE, S; DORAY, G; BELLEAU, F; GRÉGOIRE, L. (2014). Development and validation of an instrument assessing women's satisfaction with screening mammography in an organized breast cancer screening program. *BMC Health Services Research*; **14**(9); 1-7.
26. ROBINSON, L.; HOGG, P.; and NEWTON-HUGHES, A. (2013). The power and the pain: Mammographic compression research from the service-users' perspective. *Radiography*; **19**(3); 190 -195.
27. BRITISH BROADCASTING CORPORATION, (2012). Nigerians living in poverty rise to nearly 61%. Retrieved 26th December, 2014 from, <http://www.bbc.co.uk/news/world-africa-17015873>
28. AUTIER, P; and OUAKRIM, D. (2008). Determinants of the number of mammography units in 31 countries with significant mammography screening. *British Journal of Cancer*; **99**(7), 1185 – 1190.