

Original Research

Staff Perceptions of the BI-RADS Ultrasound Characterization of Breast Masses at Mulago National Referral Hospital in Uganda

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Article information

Accepted: February 17th, 2025; Published: February 28th, 2025

Cite this article

Onono A, Mubuuke AG. Staff perceptions of the BI-RADS ultrasound characterization of breast masses at Mulago National Referral Hospital in Uganda. *Radiol Open J.* 2025; 9(1): 1-6.

ABSTRACT

Introduction

The Breast Imaging-Reporting and Data System (BI-RADS) is a classification system aimed at standardizing risk assessment during breast ultrasound to ensure patient safety. BI-RADS is currently used in Uganda so as to standardize breast ultrasound reporting and enhance patient management.

Objective

This study aimed at exploring staff perceptions towards the use of the BI-RADS ultrasound characterization of breast masses.

Methodology

It was an exploratory qualitative study that involved staff who perform breast ultrasound at Mulago Hospital in Uganda. Focus group discussions and individual interviews were conducted.

Findings

All staff used the BI-RADS system, however, some of them had a negative attitude towards BI-RADS. The three major themes that emerged were: standardization of breast ultrasound reporting for patient safety; need for more Continuous Professional Development (CPD) and challenges with the BI-RADS system.

Conclusion

The study demonstrated that the staff generally had positive perceptions and attitude of the BI-RADS system and felt that it was an efficient system for ensuring patient safety and further reduce mortality from breast cancer.

Keywords

Breast imaging-reporting and data system (BI-RADS); Breast; Ultrasound; Staff perceptions.

INTRODUCTION

Breast cancer is the third commonest cancer in women in Uganda after Kaposi's sarcoma and cervical cancer.¹⁻³ Five year survival rate is 56%.¹ Several studies have reported that breast cancer is the most common cancer that compromises patient safety and resulting in cancer deaths in women thus remaining a world concern.⁴⁻¹⁰ For example in Brazil, breast cancer is the leading cause of cancer deaths among women.¹¹ Among Turkish women, breast cancer represents 24.1% of all cancers and is the second prime cause of cancer-related deaths.

It has been reported that by 2020, 70% of the 15 million new annual cancer cases will be in developing countries.¹² In South Africa breast cancer is the most common cancer in women. The lifetime risk of developing breast cancer is 1 in 26-women across all population groups. Annually more than 3000-women die from breast cancer in South Africa. More than 60% of women present with locally advanced breast cancer. It has been speculated that the lack of an early cancer detection program is responsible for the majority of women presenting at a late, symptomatic stage when cure is impossible.¹²

Primary randomized controlled trials have shown the significance of mammography in the early diagnosis of breast cancer in asymptomatic women and it has been effective in decreasing mortality especially in women aged 50-69-years with reductions of 20% to 35%.^{13,14} However, for the women who know about mammography, the costs involved are still very high which prevents them from going for it.¹⁵ Besides the economic issues, other difficulties of mammography include the fear of irradiation that can potentially compromise patient safety due to harmful effects of radiation.¹⁶ There is a wealth of literature reporting women's adherence to mammography including their knowledge, behavior and beliefs about breast cancer, knowledge of risk factors, attitudes and mammography.⁴ There have been some improvements in the encouragement of women to have mammograms. Nevertheless, mammography remains underutilized by women although it can be effective in early detection of breast cancer.

The primary factors that increase the risk of breast cancer in women include family the history of breast cancer, certain inherited genetic mutations and biopsy-confirmed hyperplasia.¹⁷ Other factors that increase breast cancer risks include a long menstrual history, obesity after menopause, recent use of oral contraceptives, postmenopausal hormone therapy, nulliparity or having the first child after the age of 30, ethnicity characteristics, exposure to radiation, or consumption of one or more alcoholic beverages per day.¹ Factors that decrease breast cancer risks include breast-feeding, physical activity, and the maintenance of healthy body weight.¹⁸ Unfortunately, many women lack access to all this information. Mammography, clinical breast examination (CBE) and breast self-examination (BSE) are the secondary preventive methods used for investigation in the early detection of breast cancer.¹⁹ Cancer detection investigations, therefore, play a pivotal role in reducing breast cancer related mortalities.

The American Cancer Society (ACS) recommends CBE and mammography in the early detection of breast cancer.²⁰ According to ACS recommendations, women should know how their breasts normally feel and report any breast changes promptly to their health care providers. BSE is an option for women starting from the early 20 s.²⁰ ACS no longer recommends BSE as there is reliable data that breast cancer detection through BSE does not increase the survival rate.²⁰ However, in a developing and resource-constrained country like Uganda, BSE is an important viable optional substitute, where access to CBE and most importantly mammography is extremely difficult and might still detect breast cancer early enough for treatment which can be offered to prolong women's lives and reduce suffering. Women in their 20 s and 30 s should have a CBE as part of a periodic health examination by health professionals preferably every 3-years. After the age of 40, women should have a CBE and a mammogram every year, as recommended by the ACS.²¹ Annual mammography is considered the most valuable tool for detecting breast cancer in the earliest possible stages, before cancer has metastasized and when interventions are most effective, least invasive and debilitating. The decline in breast cancer mortality has been largely attributed to regular mammography investigations.²¹

Since mammography, which is the gold standard imaging modality for screening and diagnosis is expensive and inaccessible to most women especially in developing countries, the use of breast ultrasound and breast imaging reporting and data system (BI-RADS) classification has been widely advocated for. The BI-RADS system is an internationally recognized system of characterizing and classifying breast masses as seen at ultrasound, mammography and magnetic resonance imaging (MRI),²²⁻²⁴ and it is used by imaging professionals to standardizing their reporting and ease communication of imaging findings to the referring clinicians. However, this study focused on BI-RADS use in breast ultrasound. The BI-RADS system of characterizing breast masses at ultrasound investigations is comprised of seven categories namely: BI-RADS 0, 1, 2, 3, 4, 5 and 6. These are summarized in Table 1.

Table 1. BI-RADS Breast Ultrasound Categories

BI-RADS Category	Summary Description
BI-RADS 0	Needs additional imaging
BI-RADS 1	Normal
BI-RADS 2	Benign
BI-RADS 3	Probably benign
BI-RADS 4	Suspicious
BI-RADS 5	Highly suspicious
BI-RADS 6	Known breast malignancy

The BI-RADS system has been reported to be very useful in the prompt management of women with breast masses.²⁵ In the absence of routine mammography screening services, breast ultrasound using BI-RADS classification can be an effective way of evaluating palpable breast masses and an appropriate management recommendation formulated early enough when treatment is still possible.²¹ The BI-RADS classification is also useful in standardizing the communication of breast ultrasound findings.¹⁸

In Uganda, the BI-RADS system of characterizing breast masses at ultrasound have been adopted in practice. However, the perceptions of staff towards this standardized system of reporting breast ultrasound findings have not been previously explored in Uganda, hence this study aimed at exploring perceptions of radiology staff regarding the use of the BI-RADS ultrasound system.

MATERIALS AND METHODS

Study Design

This was an exploratory qualitative study conducted among staff that performs breast ultrasound in the radiology department of Mulago National Referral Hospital in Uganda.

Participants and Sampling

Purposeful consecutive sampling was used to select 4 radiologists and 18 sonographers who had received training in the use of BI-RADS system of categorizing breast masses.

Data Collection and Analysis

Data was collected using both focus group discussions and individual interviews. Three focus group discussions were conducted with the sonographers, each group having 6 participants and 4 individual interviews were conducted with the radiologists. The participant responses were audio-recorded and later transcribed. Thematic analysis was employed to generate codes, categories and the eventual themes that finally emerged from the study.

Ethical considerations

The study received approval from the Mulago Hospital Research and Ethics Committee (Protocol No: MHREC 1545). Informed consent was obtained from all the participants prior to conducting the focus groups and interviews. The participants were also assured of the anonymity and confidentiality of their responses and no names were to be tagged to any response. Participants were also informed that they were free to withdraw from the study at any one time.

FINDINGS

Four (4) radiologists, eighteen (18) sonographers participated in the study. Eight of the participants were female and the rest were male. All these staffs that participated are currently working in the ultrasound units of the radiology department in Mulago hospital had received some training in the use of the BI-RADS breast ultrasound reporting system. The study resulted in three major themes namely: Standardization of breast ultrasound reporting: a precursor for patient safety; Need for more continuous professional development (CPD) and Challenges with the BI-RADS system.

Standardization of Breast Ultrasound Reporting: A Precursor for Patient Safety

All the staff reported that the BI-RADS breast ultrasound system facilitates the classification of breast masses according to international standards and ensures that all staff use similar guidelines and characteristics to assess breast masses. This, in turn, ensures the timely intervention of management procedures for women with especially a suspicious breast mass when therapeutic options are still possible. Consequently, the BI-RADS system ensures patient safety. The following responses illustrate this theme as reported by the participants.

"Previously some women with breast masses would succumb to breast cancer simply because they were not prioritized as urgent cases requiring timely intervention, however with the BI-RADS system, many of these urgent cases can now be identified after scanning and attended to quickly which ensures their safety.....many of them have survived death because the BI-RADS ultrasound report helped Clinicians to give them priority."

"With this BI-RADS classification, I have realized how patient safety is now important. Previously, we just used to write presence of breast masses, however with BI-RADS, one can prioritize so that the safety of those women with highly suspicious breast masses is ensured first.....even if they are

to die eventually, their lives are prolonged and quality added".

The above two responses generally reflect what all the participants alluded to that the BI-RADS system has facilitated the prioritization of women with highly suspicious breast lesions to ensure their safety and improve their quality of life.

Need for more Continuous Professional Development

The second theme spoke to the need for CPD regarding the BI-RADS breast ultrasound reporting system. This was a common thread throughout all the responses. The staff were pointing to the fact that despite using BI-RADS and its obvious benefits in maximizing patient safety, there was still a need to re-train staff periodically about this system. This argument can be seen through the following representative quotations from the participants:

"The BI-RADS system has useful benefits especially in as far as prioritizing women that need urgent management attention to ensure their safety. However, we still need continued training with this system because I have realized that different people are still mixing up the BI-RADS categories which sometimes causes anxiety and unnecessary worry among patients and clinicians.....more continuous training is thus needed so that we all speak the same language."

"Much as BI-RADS was meant to standardize the reporting of breast masses, there are still variations in how we write our reports. For example, some people still view ultrasound features differently and ignore some of them. The solution is to have periodic sessions where we remind ourselves of the key features for each BI-RADS category and this will ensure that the safety of women that need urgent attention is maximized."

From the above responses, one can observe that despite BI-RADS being aimed at standardizing breast ultrasound reporting, there are still variations in how staff categorizes the breast masses, which would compromise on patient safety as well, hence the need for continuous training.

However, the CPD should not only be limited to the side of the breast imaging experts. There is a need to sensitize other clinicians about the importance of BI-RADS as a system for standardizing breast ultrasound reporting and ensuring patient safety. Ignorance of the BI-RADS system by other professionals that might compromise patient safety can be seen to resonate through the response below:

"Some physicians send back breast ultrasound reports just because they haven't understood what it means by BI-RADS 1, 2, 3, etc."...just concluding with a BI-RADS classification does not make the physicians know how the mass really is.....therefore BI-RADS seems to be only a well understood language by radiology professionals only"

Challenges with the BI-RADS System

The last dominant theme that resonated through the responses related to challenges faced with using the BI-RADS breast ultrasound reporting system. Most of these responses were in relation

to a negative attitude by some of the imaging staff towards this system because this standardized way limits their descriptive reporting that was previously used. This can be observed in the following response:

"This BI-RADS system though good, limits my ability to present to the doctor what exactly I have seen. Previously, we had liberty to write as much as we wanted to include everything we had seen.....but now we are limited. At least the reporting templates should have space for us to still write some notes."

The other challenge observed through the responses was the fact that the BI-RADS standardized system is not used all the time within the department. This results into situations where some reports are structured according to the BI-RADS system while others are not, which might also compromise quality and thus affect the safety of women with breast masses. The following response was common:

"Sometimes we are overwhelmed by the big number of women to scan and going through the BI-RADS template consumes more time.....so for me I simply write a short descriptive report to the referring doctor."

DISCUSSION

The purpose of this study was to explore staff perceptions regarding the use of the BI-RADS system in reporting breast masses on ultrasound as a way of ensuring patient safety among women. Findings from the study generally demonstrated positive perceptions of the staff towards the BI-RADS system of reporting breast masses. There seemed to be a general agreement that the BI-RADS system facilitates the standardization of reporting features of breast masses which eventually facilitates timely patient management. This finding is in resonance with previous studies which also report that the BI-RADS system of reporting breast ultrasound scans provides a more standardized way of ensuring that women with suspicious breast masses are prioritized and attended to first.⁵ However, this study presents an alternative angle of thought in terms of patient safety. By categorizing breast masses according to the BI-RADS system, the health workers are basically bringing to the fore the safety of patients, in this context the women with highly suspicious breast masses, who would then be managed first to prevent a possible spread of a cancer or at least to improve the quality of life of these patients. This notion of relating the BI-RADS system to the concept of patient safety resonated through the participant responses. Without the BI-RADS system, many women with potential cancerous breast masses would probably not be prioritized, thus compromising their safety. Therefore, the concept of standardizing the breast ultrasound reporting should be viewed as a way of optimizing patient safety in which the most at risk women are attended to first. This is particularly important in this era of increasing mortality due to breast cancer.¹⁶

Despite the fact that participants in this study generally had positive perceptions of the BI-RADS system, the need for CPD specifically focusing on BI-RADS was evident, a finding that

is in agreement with previous studies.¹⁴ The fact that participants in this study had previous training in the BI-RADS system, but still recognized the need for periodic CPD sessions should not be ignored. It has been reported that despite there being specific features of breast masses at ultrasound within the various BI-RADS categories, many imaging professionals still find challenges characterizing these masses.¹¹⁻¹⁶ Findings from this study alluded to this reported literature as well. Breast ultrasound is a real-time examination and the interpretation of the features of breast masses solely depends on the individual doing the breast scanning at that particular time. As a result, well defined breast masses can be interpreted as ill-defined masses simply due to a poor visualization of the mass or poor technique on the side of the imaging professional. This can result into unnecessary anxiety to patients and unnecessary biopsies of benign masses, while delaying the management of potential cancerous masses at the same time. This therefore compromises patient safety, especially those women with missed suspicious breast lesions. Therefore, the need to continually train staff in the key characteristic feature of the various BI-RADS categories needs to be carried out.

In relation to CPD sessions, the idea that clinicians who refer these women for ultrasound should also be included in the CPD package is very important. From this study, clinicians seemed to send back several BI-RADS reports simply because they could not understand this reporting system. Subsequently, patient management gets delayed which further compromises patient safety. Therefore, even other health workers that manage women with breast symptoms need to be included within the CPD package. It is recommended that the radiology departments organize tailored CPD sessions for clinicians within the other departments so that they are educated about the BI-RADS breast ultrasound reporting system. It is only through this way that this system will receive maximum operationalization within the hospitals dealing with breast cancer management.

Although the BI-RADS breast ultrasound reporting system was generally perceived as being good in terms of standardization and ensuring patient safety, the staff who participated in this study sometimes did not follow this system mainly due to its limitation in terms of description as well as large patient numbers. The observation that this structured way of reporting breast ultrasound scans was perceived by staff as limiting the description of the breast report has been reported elsewhere.¹³ This is perhaps attributable to the fact that every professional would like to describe as much as possible the ultrasound findings so that the referring clinician can get a true picture of the findings. However, this is perhaps where the challenge lies. Descriptive ultrasound reports with no structure may often lead to non-standardized reporting without a clear management pathway for the patient, which ultimately compromises patient safety. The BI-RADS structured way of reporting ensures that all professionals communicate the same language and clearly alerts the clinician to the next management plan because each BI-RADS category dictates a management plan. We think that perhaps more training in using the BI-RADS system can change this attitude. Similarly, the notion that the BI-RADS structured

reporting may not be applicable due to large patient volumes in this setting is surprising. One would think that writing descriptive reports without following the BI-RADS system would actually be more cumbersome and not applicable in settings with large patient volumes. However, findings from this study are on the contrary to this. The plausible reason as to why participants viewed BI-RADS ultrasound reporting as not applicable due to large patient numbers is not clear-cut. However, we think this could be an attitudinal mind-set because BI-RADS reporting is relatively new in this context. However, more research is needed to explore this observation in more depth. The fact that this was a qualitative study carried out in only a particular setting has its own limitations. This combined with the small participant numbers limits the generalizability of these findings. However, the findings still provide insights that can guide future larger studies across different settings. The fact that participants perceived the BI-RADS breast ultrasound system as an aspect of ensuring patient safety is a strength of this study. We do recommend sustained CPD sessions regarding the BI-RADS system involving not only staff within radiology departments, but also other clinicians that handle breast-related cases.

CONCLUSION

This study has demonstrated that the staff who perform the breast ultrasound scans at Mulago National Referral Hospital generally had good perceptions of the BI-RADS system and actually used it most of the time. This was seen as an aspect of ensuring patient safety, especially those women with suspicious breast masses. The idea of periodic CPD sessions focusing on BI-RADS for both radiology staff as well as other clinicians needs to be put into place.

ACKNOWLEDGMENTS

This work was supported by Grant Number D43TW010132 supported by Office of The Director, National Institutes Of Health (OD), National Institute Of Dental & Craniofacial Research (NIDCR), National Institute Of Neurological Disorders And Stroke (NINDS), National Heart, Lung, And Blood Institute (NHLBI), Fogarty International Centre (FIC), National Institute On Minority Health And Health Disparities (NIMHD). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the supporting offices. Special thanks also go to the radiographers who participated in the study.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

REFERENCES

- Galukande M, Mirembe F, Wabinga H. Patient delay in accessing breast cancer care in a sub Saharan African country: Uganda. *Br J Med Med Res*. 2014; 4: 2599-2610. doi: [10.9734/BJMMR/2014/7293#sthash.PglzE4b6.dpuf](https://doi.org/10.9734/BJMMR/2014/7293#sthash.PglzE4b6.dpuf)
- Gakwaya A, Kigula-Mugambe JB, Kavuma A, et al. Cancer of the breast: 5 year survival in a tertiary Hospital in Uganda. *Br J Cancer*. 2008; 8: 99(1): 63-67. doi: [10.1038/sj.bjc.6604435](https://doi.org/10.1038/sj.bjc.6604435)
- Okello J, Kisembo H, Bugeza S, Galukande M. Breast cancer detection using sonography in women with mammographically dense breasts. *BMC Med Imaging*. 2014; 14: 41. doi: [10.1186/s12880-014-0041-0](https://doi.org/10.1186/s12880-014-0041-0)
- DeSantis CE, Bray F, Ferlay J, et al. International variation in female breast cancer incidence and mortality rates. *Cancer Epidemiol Biomarkers Prev*. 2015; 24: 1495-1506. doi: [10.1158/1055-9965.EPI-15-0535](https://doi.org/10.1158/1055-9965.EPI-15-0535)
- Odusanya OO, Tayo OO. Breast cancer knowledge, attitudes and practice among nurses in Lagos, Nigeria. *Acta Oncol*. 2001; 40: 844-848. doi: [10.1080/02841860152703472](https://doi.org/10.1080/02841860152703472)
- Sadler GR, Dhanjal SK, Shah NB. Asian Indian women: Knowledge, attitudes and behaviour toward breast cancer early detection. *Public Health Nurs*. 2001; 18: 357-363. doi: [10.1046/j.1525-1446.2001.00357.x](https://doi.org/10.1046/j.1525-1446.2001.00357.x)
- Sadler GR, Ryujin LT, Ko CM. Korean women: Breast cancer knowledge, attitudes and behaviours. *BMC Public Health*. 2001; 1: 7. doi: [10.1186/1471-2458-1-7](https://doi.org/10.1186/1471-2458-1-7)
- Maxwell CJ, Bancej CM, Snider J. Predictors of mammography use among Canadian women aged 50-69: Findings from the 1996/1997 national population health survey. *CMAJ*. 2001; 164: 329-334.
- Dibble SL, Vanoni JM, Miaskowski C. Women's attitudes toward breast cancer screening procedures: Differences by ethnicity. *Women's Health Issues*. 1997; 7(1): 47-54. doi: [10.1016/S1049-3867\(96\)00048-5](https://doi.org/10.1016/S1049-3867(96)00048-5)
- Ferro S, Caroli A, Nanni O, Biggeri A, Gambi A. A cross-sectional survey on breast self-examination practice, utilization of breast professional examination, mammography and associated factors in Romagna, Italy. *Tumori*. 1992; 78: 98-105. doi: [10.1177/030089169207800207](https://doi.org/10.1177/030089169207800207)
- Blanchard K, Colbert JA, Puri D, et al. Mammographic screening: Patterns of use and estimated impact on breast carcinoma survival. *Cancer*. 2004; 101(3): 495-507. doi: [10.1002/cncr.20392](https://doi.org/10.1002/cncr.20392)
- Sankaranarayanan R. Strategies for implementation of screening programs in low-and medium-resource settings. Paper presented at: UICC World Cancer Congress; 2006; Washington, DC, USA.
- Elmore JG, Armstrong K, Lehman CD, Fletcher SW. Screening for breast cancer. *JAMA*. 2005; 293(10): 1245-1256. doi: [10.1001/jama.293.10.1245](https://doi.org/10.1001/jama.293.10.1245)
- Nyström L, Andersson I, Bjurstam N, Frisell J, Nordenskjöld B, Rutqvist LE. Long-term effects of mammography screening: Updated overview of the Swedish randomized trials. *Lancet*. 2002; 359(9310): 909-919. doi: [10.1016/S0140-6736\(02\)08020-0](https://doi.org/10.1016/S0140-6736(02)08020-0)

15. Lee EO, Ahn SH, You C, et al. Determining the main risk factors and high-risk groups of breast cancer using a predictive model for breast cancer risk assessment in South Korea. *Cancer Nurs.* 2004; 27(5): 400-406.
16. Lubish L, Greenberg S, Friger M. Breast cancer screening in two multicultural family practice teaching clinics. *Isr Med Assoc J.* 2001; 3: 579-583.
17. Kailash S, Tariq A, Ghanshyam DG. The accuracy of ultrasound in diagnosis of palpable breast lumps. *JK Science.* 2008; 10: 186-188.
18. Scheel JR, Nealey EM, Orem J, et al. ACR BI-RADS use in low-income countries: An analysis of diagnostic breast ultrasound practice in Uganda. *J Am Coll Radiol.* 2016; 13: 163-169. doi: [10.1016/j.jacr.2015.07.035](https://doi.org/10.1016/j.jacr.2015.07.035)
19. Umanah IN, Akhiwu W, Ojo OS. Breast tumours of adolescents in an African population. *Afr J Paediatr Surg.* 2010; 7: 78-80. doi: [10.4103/0189-6725.62849](https://doi.org/10.4103/0189-6725.62849)
20. American College of Radiology (ACR). *ACR BI-RADS-Ultrasound*. Reston, VA, USA: American College of Radiology; 2003.
21. Yip CH, Smith RA, Anderson BO, et al. Guideline implementation for breast healthcare in low- and middle-income countries: Early detection resource allocation. *Cancer.* 2009; 113: 2244-2256. doi: [10.1002/cncr.23842](https://doi.org/10.1002/cncr.23842)
22. Lee HJ, Kim EK, Kim MJ, et al. Observer variability of breast imaging reporting and data system (BI-RADS) for breast ultrasound. *Eur J Radiol.* 2008; 65: 293-298. doi: [10.1016/j.ejrad.2007.04.008](https://doi.org/10.1016/j.ejrad.2007.04.008)
23. Lazarus E, Mainiero MB, Schepps B, et al. BI-RADS lexicon for US and mammography: Interobserver variability and positive predictive value. *Radiology.* 2006; 239: 385-391. doi: [10.1148/radiol.2392042127](https://doi.org/10.1148/radiol.2392042127)
24. Hong AS1, Rosen EL, Soo MS, Baker JA. BI-RADS for sonography: Positive and negative predictive values of sonographic features. *AJR Am J Roentgenol.* 2005; 184: 1260-1265. doi: [10.2214/ajr.184.4.01841260](https://doi.org/10.2214/ajr.184.4.01841260)
25. Burnside ES, Sickles EA, Bassett LW, et al. The ACR BI-RADS experience: Learning from history. *J Am Coll Radiol.* 2009; 6: 851-860. doi: [10.1016/j.jacr.2009.07.023](https://doi.org/10.1016/j.jacr.2009.07.023)