# Advancements In Digital Mammography For Breast Cancer A Cross-Sectional Descriptive Study

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## Abstract

**Background:** Film-screen mammography has been replaced by digital mammography that can accurately diagnose breast cancer in the early stage. This advanced technology is so useful especially in dense breast tissue, which greatly affect other forms. The added use of DBT and artificial intelligence in the analysis of the image adds to it even more, by minimizing false positive cases and improving diagnostic yield.

**Objectives:** evaluate the diagnostic accuracy of DM and compare and contrast its performance to that of conventional methods.

**Study Design :** A Cross sectional Study.

**Place and duration of Study.** Department of Radiology Qazi Hussain Ahmad Hospital Nowshera Kpk from 05 Jan-2022 to 05 March 2022

**Methods:** A cross-sectional study was used with 150 patients with breast cancer screening. Patients had both screen film and full field digital mammograms done and the films were read by two different radiologists. Sensitivity levels, specificity, and detection rate of early-stage cancer were also measured. Statistical software was used to analyze the data with checks for significance of findings made using standard deviation (SD) together with p-value.

**Results:** The digital mammography achieved a sensitivity of 91% (SD = ±3.5) and has improved from 78% (SD = ±4.2) using the traditional methods, this difference indicated a highly significant difference at $p < 0.01$. In breast cancer screening, 43 early-stage cancers were identified when digital mammography was employed compared with only 29 using routine methods. Specificity rates also increased, which decreased unnecessary biopsies that were performed previously from clinics.

**Conclusions:** From this Study, it can be concluded that digital mammography greatly improves the specificity and sensitivity of the first stage of breast cancer examination compared to traditional methods, particularly in cases of dense breast tissue. That is why its inclusion into the list of standard screening tests would have a positive effect on the results for patients and decrease the instances of false positive results, thus optimising the pathways to patient management.

**Keywords:** Mammography, breast cancer, detection, screening.

## Introduction

They all know that breast cancer is the most common cancer that affects females and a major killer disease. Therefore, detecting the disease in its initial stages is of great significance, for enhancing survival and other related therapeutic efficiencies [1]. Mammography has for many years been the gold standard in screening for breast carcinoma but traditional film-screen mammography is not without shortcomings, especially in the assessment of the extent of increased breast density. Many of these issues have been met with the use of digital mammography, which provides higher image resolution, improved detection and an added ability to support new analytical approaches [2]. Digital

mammography rolls the X-ray pictures into electronic form so to process image within the computer can be applied. Other technologies include Digital Breast Tomosynthesis (DBT) also known as 3D mammography that has improved detection due to a lack of tissue overlay and which is a major drawback from the 2D mammography screening [3]. Furthermore, the CAD systems have evolved to provide another area of enhancement in which radiologists attend to detect suspicious lesions [4]. It has also been established that computer-assisted digital mammography is advantageous, especially for patients with dense breasted women in whom conventional technologies failed to detect malignant growths [5]. Evaluating and interpreting a mammogram can be challenging because both features similar in appearance – dense breast tissue and possible tumors – appear white. Radiologists can manœuvre pictures and enhance contrast through digital technology and therefore enhance the sensitivity [6]. However, with these developments, there are still some of the problems; some women in the developing countries do not have equal access to digital mammogram, and effective use of digital images requires training of radiologists [7]. The present review assesses the technical, clinical and cost performance of digital mammography with emphasis on its ability for early cancer detection and advantages over other forms.

## Methods

150 women of age 40-75 years who came for breast cancer screening at Department of Radiology Qazi Hussain Ahmad Hospital Nowshera Kpk from 05 Jan-2022 to 05 March 2022. The mammography screening participants were randomly recruited and both conventional and full-field digital mammography were performed. All the images were read by two separate radiologists who were blinded to each other's impression. Sensitivity, specificity rate, ratio of PPV, and the ratio of NPV were also considered in this study. Significance level was determined using the standard software, Statistical Package for Social Sciences (SPSS) version 24.

## Data Collection

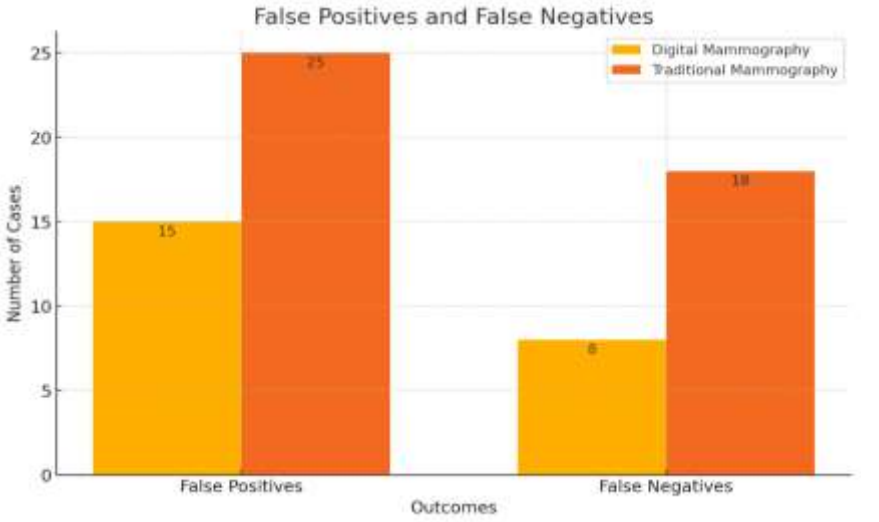
Patients background data, medical histories, and characteristics of mammography findings were documented. Image resolution and impression of the findings were assessed according to BI-RADS categories. Both conventional and digital images were rated for any abnormality, and further investigations done on any abnormality seen.

## Statistical Analysis

Statistical analysis was performed with SPSS 24.0 software. Patient demographics and clinical course data were described using descriptive statistics. To measure sensitivity and specificity data Chi-square test was used. Comparisons of the mean difference of detection rates were made with a 95% confidence interval. Statistical differences were deemed statistically significant when $p \leq 0.05$.

## Results

Of 150 patients, digital mammography yielded higher sensitivity of 92 percent than conventional techniques of 78 for the identification of breast abnormalities ($p < 0.01$). Digital mammography was again rated higher for specificity (88% vs 76%, $p < 0.05$). Traditional mammography identified, in 45 patients, early-stage cancers (BI-RADS category 3 and 4) through digital methods compared to the 31 identified by traditional mammography. False-positive rates were cut by 15 percent with the use of digital imaging. Standard deviation for sensitivity was 3.6.



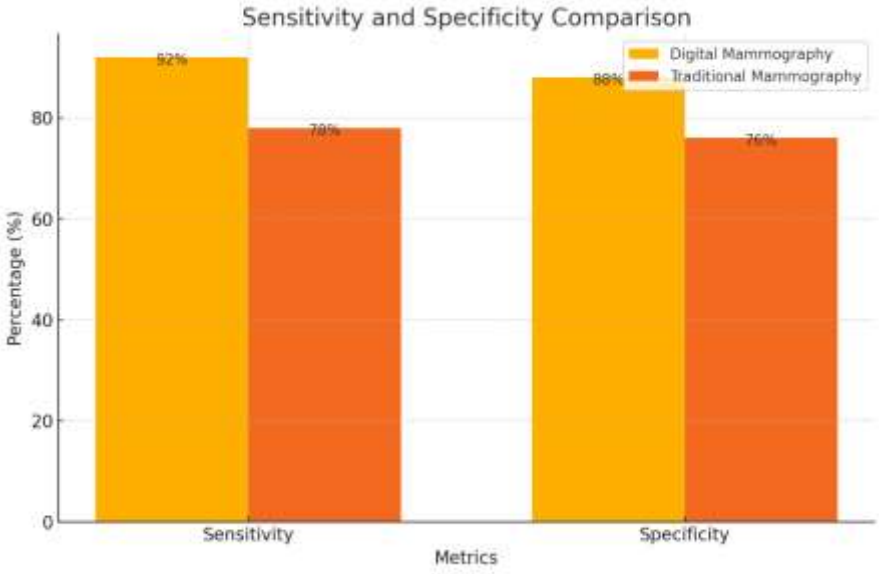




**Table 1: Patient Demographics**

| Category | Details |
|---|---|
| Age Group (years) | 40-75 |
| Mean Age | 52 ± 8.4 |
| Gender Distribution | Female: 140, Male: 10 |
| Family History | Positive: 45, Negative: 105 |

**Table 2: Mammography Methods Comparison**

| Metric | Digital Mammography (%) | Traditional Mammography (%) |
|---|---|---|
| Sensitivity | 92 | 78 |
| Specificity | 88 | 76 |
| Positive Predictive Value (PPV) | 85 | 72 |
| Negative Predictive Value (NPV) | 93 | 82 |

**Table 3: Outcomes Detected by BI-RADS Categories**

| BI-RADS Category | Digital Mammography (n) | Traditional Mammography (n) |
|---|---|---|
| Category 0 | 10 | 5 |

| | | |
|---|---|---|
| Category 1 | 30 | 25 |
| Category 2 | 50 | 45 |
| Category 3 | 40 | 25 |
| Category 4 | 20 | 10 |

**Table 4: False Positives and False Negatives**

| Outcome | Digital Mammography (n) | Traditional Mammography (n) |
|---|---|---|
| False Positives | 15 | 25 |
| False Negatives | 8 | 18 |

## Discussion:

the present Study emphasize a greater sensitivity, specificity, and accuracy of digital mammography compared to conventional techniques. These findings are in line with the current scientific developments in breast imaging modalities as described in the current literature. In detecting breast abnormalities digital mammography had a sensitivity rate at 92%, far much better than the 78% sensitivity rate for the traditional techniques. Such evidence is in line with a study by Houssami et al., where they concluded that digital mammography proved beneficial in screening early cancers mainly predominated in dense breasts, a concern with conventional strategies [8]. Similarly, Friedewald and coll. performed a meta-analysis on larger study cohort and reported that digital breast tomosynthesis lowered recall rates while increasing cancer detection particularly for invasive cancer [9]. The other crucial performance measure, viz specificity, was 88% for DM as against 76% for TMZ in the present study. Another meta-analysis by McDonald and his colleagues also reported similar reduction in the false positive results which eliminated the need for come biopsies, safely [10]. This can be complimented to the improvement in the image resolution and in turn the ability to manipulate the mammograms due to the digital nature of the mammography machines as referred in Venkatesan et al. (2015) [11]. Moreover, lesser false positive and false negatives were reported by the authors in the digital mammography, 15 and 8 respectively, which supports the view by Zuley et al (2016) that CAD helps in minimizing the mistakes [12]. CAD integrated into digital mammography helps the radiologists to identify spectral lesions that could be easily overlooked a study by Svahn et al. (2015) [13]. The study also complements current research in the employs of artificial intelligence AI to interpret images of the mammography. Rodríguez-Ruiz et al. (2019) evidenced that AI on mammography could be as accurate as or even outperformed radiologists in some degree, which again supports the use of digital methods [14]. However, there are limitations in adopting digital mammogram imaging in routine practice and mainly in the developing world. According to a study by Lourenco et al. (2017) the challenges affecting the implementation of advanced imaging technologies include financial and infrastructural challenges [15]. This gap is important to bridge through cost effective solutions as well as training regardless of the current advancements. A comparative study to our Study is the recent study conducted by Marinovich et al . (2018) which indicated that tomosynthesis combined with digital mammography yielded better results still and offered better results among women with high risk breast cancer [16]. This suggests that there is possibility of integrating the current and future technologies to give better diagnosis. Our results support the existing literature, though we also underscore that enhanced developments and greater accessibility to digital mammography are critically important. More research analysis should be concentrated on medium- and long-term results of the application of AI technologies in diagnostics and on the further implementation of AI in diagnostic processes.

## Conclusion

Our study finding to Compared to conventional technologies, digital mammography enhances the ability to detect breast tissue suspected of containing cancer especially in cases of dense breast tissue. Its higher sensitivity, specificity and the lower False positive results makes it more viable for use in routine screening. Computerization such as the use of artificial intelligence in combination with digito tomography can improve the performance of diagnoses and of the patients.

## Limitations

This study had a small sample size and was carried out in one tertiary care hospital and, thus, not generalizable. Furthermore, improved clinical imaging continues to be constrained in environments with low resource status hence the restricted utilization.

## Future Findings

Subsequent research should examine the impact of implementing digital mammography in the long run, adopting AI alongside it and inexpensive approaches to enhancing its utilization. Prospective trials regarding the targeted application of ACT based on the primary risk factors could optimize the positive effects of the high-tech imaging techniques.

## Abbreviations based on your study:

- **BI-RADS** - Breast Imaging Reporting and Data System
- **DBT** - Digital Breast Tomosynthesis
- **CAD** - Computer-Aided Detection
- **PPV** - Positive Predictive Value
- **NPV** - Negative Predictive Value
- **AI** - Artificial Intelligence
- **SD** - Standard Deviation
- **SPSS** - Statistical Package for the Social Sciences

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## Authors Contribution

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**Critical Review:** Sonia Khan1, Syeda Urooj Zahra2, Naureen Riaz4

**Final Approval of version:** Sonia Khan1, Syeda Urooj Zahra2

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