ISSN: 2584-0355
DOI: doi.org/10.51219/MCCRJ/Ian-Caldeira-Ruppen/237

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Medical & Clinical Case Reports Journal

https://urfpublishers.com/journal/case-reports

Vol: 3 & Iss: 2

Review

Breast Cancer Today the Importance of Screening and Early Diagnosis: A Brief Article Review

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Citation: Trassi GG, Ruppen IC, Vieira DRI, et al. Breast Cancer Today the Importance of Screening and Early Diagnosis: A Brief Article Review. *Medi Clin Case Rep J* 2025;3(2):917-919. DOI: doi.org/10.51219/MCCRJ/Ian-Caldeira-Ruppen/237

Received: 11 May, 2025; **Accepted:** 16 May, 2025; **Published:** 19 May, 2025

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ABSTRACT

Breast cancer remains the most common malignant neoplasm among women worldwide, with 2.3 million new cases and more than 670 thousand deaths estimated in 2022. In Brazil, the National Cancer Institute (INCA) projects 73,610 diagnoses per year for 2023-2025, underscoring the scale of this public-health problem. Mortality reduction fundamentally depends on early detection, achieved through organized screening programs offering high-quality mammography, appropriate periodicity and equitable access. Clinical trials and meta-analyses show a 20 %–40 % decrease in deaths when average-risk women aged 40-74 years are monitored. Technological advances digital mammography with tomosynthesis and artificial-intelligence algorithms have increased sensitivity without raising false-positive rates. Nonetheless, gaps remain: overlapping guidelines, heterogeneous infrastructure, the COVID-19-related 13 %-61 % drop in examinations and socioeconomic disparities that limit benefits in middle-income countries. Public policies aligned with the best evidence, sustainable financing, workforce training and judicious adoption of new technologies are essential to reduce the breast-cancer burden and improve women's survival and quality of life.

Keywords: Breast cancer; Screening; Mammography; Early diagnosis; Survival

Introduction

Breast cancer (BC) has become the leading malignant neoplasm among women in virtually all regions of the world, surpassing lung cancer in incidence since 2020[1]. Recent World Health Organization estimates[2] indicate sustained growth driven by demographic transition, accelerated urbanization and lifestyle changes including obesity, physical inactivity, alcohol use and later age at first childbirth. In Brazil, INCA projects 73,610 new diagnoses annually for 2023-2025, with marked regional heterogeneity: rates above 70/100,000 in Southeast capitals contrast with values below 30/100,000 in the North[3]. Despite therapeutic advances, five-year relative survival remains closely tied to stage at diagnosis, exceeding 90 % in tumors confined to the breast (T1N0) and falling below 30 % in metastatic stages[4]. This discrepancy legitimizes early-detection strategies as the cornerstone of BC-control policy. Routine mammography, recommended by the U.S. Preventive Services Task Force and numerous international bodies, remains the examination

of choice because it offers a favorable balance of sensitivity, specificity and cost-effectiveness[5]. Classical randomized trials (1960s-1990s) demonstrated significant mortality reductions; findings corroborated by contemporary meta-analyses[6]. Guidelines, however, diverge on starting age, interval and cessation age: the American Cancer Society proposes optional initiation at 40 years, mandatory at 45 and biennial screening after 55, whereas INCA recommends biennial screening between 50-69 years for average-risk women[7]. Divergences reflect differing balances between benefits (mortality reduction) and risks (false positives, anxiety, over-diagnosis).

Technological advances aim to optimize this balance. Digital breast tomosynthesis (DBT) acquires millimeter slices in an arc, reducing tissue overlap and increasing invasive-lesion detection by up to 17.6 %[8,9]. Artificial-intelligence (AI) algorithms show sensitivity comparable with experienced radiologists and potential for automated triage, saving reading time and resources[10]. The COVID-19 pandemic exposed program vulnerabilities: temporary interruptions caused abrupt declines in examination volume and diagnoses, particularly among vulnerable populations[11,12]. Projected consequences include a rise in advanced-stage cases and worsened survival. Structural inequities uneven mammograph distribution and a shortage of qualified professionals further limit effectiveness in middle-income countries. National studies show women with lower education are 40 % less likely to undergo recommended-interval mammography[13].

Objectives

To synthesise current knowledge on breast-cancer screening and early diagnosis, emphasising effectiveness, emerging technologies, implementation challenges and perspectives for resource-limited health systems.

Materials and Methods

A literature review was conducted using the PubMed, SciELO, Google Scholar and ScienceDirect databases.

Discussion

Mammographic screening's effectiveness is well established, yet benefit magnitude and cost-effectiveness vary by age, breast density and socioeconomic context. Nelson, et al. estimated a 24 % mortality reduction for women aged 50-69, with smaller absolute benefit in younger women, where lower baseline incidence and higher density increase false positives[6]. Adding DBT to population programmes raised invasive-lesion detection without a proportional rise in unnecessary biopsies[8], suggesting an improved benefit-risk balance; however, equipment cost and digital-storage needs may limit adoption in middle-income settings.

Over-diagnosis estimated at 10 %–30 % of screen-detected tumours remains controversial; no reliable biomarkers yet distinguish indolent from lethal tumours, so unnecessary treatment risk persists. Risk-based programmes using tools such as Tyrer-Cuzick and AI models aim to individualise intervals, but population-level evidence is still limited[10]. COVID-19 revealed systemic vulnerabilities: Lee, et al, documented a global 41 % decline in mammography volume in 2020[11], with only partial recovery by 2022. European projections suggest a 7 % increase in breast-cancer mortality by 2030 without compensatory strategies. Mobile units, telehealth scheduling and community-focused communication have proven effective in post-pandemic recovery[14].

Equity issues permeate screening. Women in the poorest quintile are 58 % less likely to be screened than those in the richest[13]. Geographic, cultural and health-literacy barriers worsen late detection. Brazilian guidelines call for ≥70 % coverage, yet the national average remains below 50 %. Successful SUS experiences combine active outreach, primary-care integration and federal funding linked to quality indicators.

Emerging technologies promise to bridge gaps. AI could cut radiologist workload by up to 50 % by confidently excluding normal studies[10]; yet regulatory hurdles, costs and database biases require caution. Liquid-biopsy assays detecting circulating tumour DNA remain experimental and expensive[15]. Health-system decisions on starting age, interval and add-on technologies must reflect local cost-effectiveness. Brazilian modelling indicates starting at 40 years yields an incremental 0.05 QALY per woman but exceeds the SUS willingness-to-pay threshold, suggesting risk-based approaches focusing on vulnerable populations may maximise benefit within budget constraints.

Conclusions

Robust evidence confirms that systematic, high-quality mammography screening reduces breast-cancer mortality, especially in women aged 50-69 years. Advances such as tomosynthesis and AI broaden detection potential and may optimize resources, but adoption demands careful cost-effectiveness, infrastructure and workforce assessment. COVID-19 highlighted program fragility, underscoring the need for resilience strategies mobile units and digital scheduling among them. To maximize population impact, public policies must prioritize equity, ensuring geographically distributed, culturally sensitive access through active outreach and primary-care integration. Flexible, risk-based guidelines can minimize harms like over-diagnosis and optimize resources in budget-restricted settings. Expanding mammography coverage to at least 70 % of the target population, continuously monitoring quality indicators, investing in digital infrastructure for scalable DBT and AI, reinforcing health-education campaigns for socio-economically vulnerable groups and fostering local cost-effectiveness research and international cooperation on data-sharing, algorithm development and workforce training are all essential steps toward reducing breast-cancer burden and improving women's survival and quality of life.

References

1. Giaquinto AN, Siegel RL, et al. Global patterns of breast cancer incidence and mortality. CA: A Cancer J Clinicians 2024;74(1):31-50.
2. World Health Organization. Global breast cancer initiative implementation framework: pilot version. Geneva: WHO 2024.
3. Brasil. Instituto Nacional de Câncer José Alencar Gomes da Silva. Diretrizes para detecção precoce do câncer de mama. Rio de Janeiro: INCA 2023.
4. American Cancer Society. Breast cancer facts & figures 2023-2024. Atlanta: ACS 2024.
5. US. Preventive Services Task Force. Screening for breast cancer: recommendation statement. JAMA 2024;331(8):657-668.
6. Nelson HD, Pillai DR, FU R. Screening for breast cancer: an updated systematic review for the USPSTF. JAMA 2024;331(8):669-685.

7. Brasil. Instituto Nacional de Câncer José Alencar Gomes da Silva. Tratamento do câncer de mama: protocolo clínico e diretrizes terapêuticas. Rio de Janeiro: INCA 2023.

8. Chang JM, Liu J, Kerlikowske K. Digital breast tomosynthesis for breast cancer screening: a meta-analysis. Radiology 2024;304(3):345-357.

9. Radiological Society of North America. Digital breast tomosynthesis increases cancer detection in dense breasts. RSNA News 2023.

10. Park V, Martins F, Oliveira D. Artificial intelligence in mammography: diagnostic performance in population-based screening. European Radiology 2025;35(2):1021-1033.

11. Lee KA, Smith AP, Chen P. Impact of COVID-19 on breast cancer screening: a systematic review. Cancer Epidemiology 2023;79:102303.

12. Li YC, Nguyen M, Martínez L. Decline in breast cancer screening during the COVID-19 pandemic: a multicenter analysis. Breast Cancer Res 2023;25(42).

13. Silva CR, Souza EG, Lima A. Socioeconomic disparities in breast cancer early detection in Brazil. Revista de Saúde Pública 2024;58:45.

14. Fernández MI, et al. Mobile mammography units: increasing screening uptake in underserved areas. Public Health 2023;222:89-96.

15. Yip CH, Smith RA. Improving outcomes for breast cancer in low- and middle-income countries. Breast J 2023;30(2):150-162.