Breast Cancer in Low- and Middle-Income Countries (LMICs): A Call for Contextualized Strategies to Improve Women's Health

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DOI: https://doi.org/10.51244/IJRSI.2025.120500174

Received: 26 April 2025; Revised: 12 May 2025; Accepted: 16 May 2025; Published: 21 June 2025

ABSTRACT

Breast cancer continues to be the most common malignancy and a primary cause of cancer-related death worldwide among women, with an increasing burden in Low- and Middle-Income Countries (LMICs). Despite the recent progress in diagnosis and treatment, inequalities in healthcare infrastructure and access persist, aggravating breast cancer survival rates in LMICs. In this paper, we explore the factors accounting for the high prevalence of breast cancer in LMICs. We implore governments and key health players in LMICs to collaborate and support the provision of comprehensive technological innovations such as AI-based diagnostics and mobile screening units, to facilitate early detection, and raise public awareness campaigns to promote healthy lifestyles.

Keywords: Breast Cancer, Low-Middle-Income Countries, Women

INTRODUCTION

Disease statistics

Breast cancer, a condition characterised by the uncontrolled proliferation of abnormal breast cells, is a significant global health concern and the most prevalent cancer in women globally (Wilkinson & Gathani, 2022; World Health Organisation, 2025). In 2020, the age-standardized incidence rate (ASIR) of breast cancer was 4.7 per 100,000 women (Reeder-Hayes & Anderson, 2017). By 2022, approximately 2.3 million new cases were reported globally, with 670,000 deaths, the majority of which affected females (Wilkinson & Gathani, 2022; (Francies et al., 2020). The global prevalence of breast cancer is projected to increase by 38% by 2050, while the annual mortality rate is expected to rise by 68% (Francies et al., 2020). Despite low breast cancer incidence rates in low- and middle-income countries (LMICs), these regions experience disproportionately high mortality rates up to 30 per 100,000, highlighting a critical public health concern (Francies et al., 2020; Reeder-Hayes & Anderson, 2017).

There are several effective interventions for breast cancer, including surgery (lumpectomy or mastectomy), specific therapy, chemotherapy, endocrine therapy, and immunotherapy. (Wang & Wu, 2023). Yet, in LMICs, limited infrastructure for early detection, and healthcare access, unsafe industrial practices, and exposure to endocrine-disrupting chemicals, including Bisphenol A (BPA), Phthalates, and low socioeconomic status (Wheeler et al., 2013; Wilkerson et al., 2024; Wilson & Sule, 2025) continue to reduce the overall patient quality of life. AI-based mammography tools remain underutilized due to limited infrastructure and training among

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue V May 2025

radiologists in these settings, especially in India (Adapa et al., 2025; Taylor et al., 2023).

Risk factors

Lifestyle-related factors significantly influence the risk of breast cancer, especially in LMICs, where urbanization and sedentary lifestyles contribute to rising obesity rates, a major risk factor, particularly among postmenopausal women (Bouras et al., 2023; Pashayan et al., 2020). Obesity, linked to elevated estrogen levels, promotes the growth of hormone receptor-positive breast cancers (Olopade et al., 2008). In LMICs, alcohol consumption increases the risk by 7 to 10%, while smoking, especially when initiated early or sustained over time, further heightens the risk (Calaf & Ponce-Cusi, 2020; Brophy et al., 2012; Lei et al., 2021). Though less common in LMICs, regular physical activity helps regulate hormone levels, reduce inflammation, and maintain a healthy weight, lowering the risk (Daly et al., 2017). Additionally, excessive sitting, a common consequence of sedentary lifestyles, is linked to higher risks of breast cancer, obesity, type 2 diabetes, and coronary heart disease, all of which are pressing concerns with limited healthcare resources (Harper et al., 2009; Betancourt & Mobley, 2010; Villeneuve et al., 2011). Therefore, adopting healthier lifestyles such as increased physical activity and reducing alcohol and tobacco consumption can significantly lower the risk of breast cancer in LMICs (Hashemi et al., 2014).

Healthcare access disparities, particularly in screening and treatment services, exacerbate breast cancer outcomes in low- and middle-income countries (LMICs) (de Souza et al., 2016). Women in these resource-limited settings often face financial, cultural, and geographical barriers that delay diagnosis and limit treatment options. Research indicates that women from lower socioeconomic backgrounds are more likely to be diagnosed later, when treatment resources are scarcer and less effective (Bourgeois et al., 2024). Additionally, genetic factors, such as mutations in the BRCA1 and BRCA2 genes, account for 5% to 10% of all breast cancer cases in LMICs (Mehrgou & Akouchekian, 2016). Hereditary breast and ovarian cancer syndrome (HBOC), caused by BRCA mutations, represents approximately half of genetically linked breast cancer cases in these regions (Bouras et al., 2023). Advances in genetic predisposition recognition, risk assessment, and testing have improved early identification and prevention strategies (Pashayan et al., 2020). For BRCA1 and BRCA2 mutation carriers, management may include individualized approaches, such as enhanced surveillance and preventive strategies, including prophylactic mastectomy in high-risk populations (Mainor & Isaacs, 2020). These genetic mutations significantly increase the risk of hereditary breast cancer, underscoring the importance of genetic testing and personalized care (Olopade et al., 2008).

Environmental factors play a significant role in the risk of breast cancer in LMICs (Francies et al., 2020). BPA, a common pollutant found in plastic materials, can alter protein expression in developing mammary tissue, and women in LMICs are particularly vulnerable due to widespread exposure (Calaf et al., 2020). The carcinogenic potential of these chemicals is largely due to their estrogen-mimicking properties, which disrupt hormonal balance and increase cancer risk (Soto & Sonnenschein, 2010). Additionally, occupational exposure to hazardous chemicals in industries such as textile processing, agriculture, and plastics manufacturing has been associated with higher breast cancer rates in LMICs, further highlighting the impact of environmental factors on the disease's prevalence in these regions (Brophy et al., 2012).

RECOMMENDATIONS

To effectively address the burden of breast cancer in LMICs, a coordinated, multisectoral approach based on evidence and equity is essential.

Strengthening Epidemiological Surveillance and Data System for Breast Cancer

In collaboration with international health organizations, governments should prioritize developing and managing robust national cancer registries. These systems will ensure the timely collection, analysis, and dissemination of disaggregated data on breast cancer incidence, mortality, risk factors, and treatment outcomes. Accurate data will enable policymakers to allocate resources effectively and assess the impact of intervention programs (Barrios, 2022; Lei et al., 2021; Wilkinson & Gathani, 2022). Strengthening national cancer registries and comprehensive data systems is essential for informed planning (Lei et al., 2021).

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue V May 2025

Deploying Digital Health and Artificial Intelligence (AI) Technology

Governments, in partnership with academic institutions and private sector innovators, should invest in digital infrastructure to support the integration of AI-assisted diagnostic tools and telemedicine services into routine cancer care. Mobile health platforms can bridge the gap between urban cancer centres and rural communities, enabling early detection, remote consultations, and referral systems in LMICs (Barrios, 2022; Wang & Wu, 2023).

Expanding Early Detection and Community-Based Health Education

Ministries of health and community health stakeholders should implement screening programs using cost-effective approaches such as clinical breast examinations and a mobile mammography unit. Community health workers, non-governmental organizations NGOs, and local women's groups should be engaged to raise awareness, dispel myths, and reduce cultural stigma surrounding breast cancer. The campaigns should be tailored to target populations' linguistic, educational, and cultural backgrounds to enhance their effectiveness (Wheeler et al., 2013; Wilkerson et al., 2024; Wilson & Sule, 2025). Policies must prioritise universal health coverage, equitable service delivery, and legislative support for environmental and occupational health protection (Betancourt et al., 2010; Harper et al., 2009; Villeneuve et al., 2011).

Promoting Interdisciplinary and Collaborative Research

Research institutions and universities in LMICs should be empowered through national funding bodies and international research partnerships to investigate risk factors, including genetic predisposition, environmental factors, and transitions. Governments can facilitate this by investing in infrastructure and creating platforms for international knowledge exchange (Colditz & Bohlke, 2014; Daly et al., 2017; Valencia et al., 2017). Given the role of BRCA1/2 mutations and other hereditary cancer syndromes, genetic services should become part of national cancer strategies. Health ministries, with support from geneticists, oncology societies, and global health donors, should ensure that training in genetic counselling and cost-subsidized testing are accessible, particularly for high-risk families (Daly et al., 2017; Valencia et al., 2017).

CONCLUSION

Breast Cancer in LMICs presents unique challenges driven by multiple factors. Effective control strategies should emphasise early detection through community-based awareness initiatives and the implementation of cost-efficient technologies, including AI-driven diagnostics and mobile screening units. Access to equitable healthcare, targeted policy reform implementation, and environmental regulation establishment are essential. Genetic services integration and improved health literacy are crucial for reducing late-stage diagnoses and enhancing survival outcomes.

Ethical Consideration

No ethical approval or informed consent was required as we used published papers.

Conflict of Interest

No source of financial support

Data Availability

No data available

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