



PREVENTION OF BREAST CANCER AND MODERN TREATMENT METHODS

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ABSTRACT

Breast cancer remains one of the leading causes of cancer-related morbidity and mortality among women worldwide. Early detection through routine screening programs, including mammography, ultrasound, and magnetic resonance imaging, significantly improves prognosis and survival rates. Primary prevention strategies such as lifestyle modification, including maintaining a healthy body weight, regular physical activity, limiting alcohol consumption, and avoiding tobacco, have demonstrated effectiveness in reducing breast cancer risk. Additionally, chemopreventive agents, such as selective estrogen receptor modulators and aromatase inhibitors, play a role in high-risk populations. Current therapeutic approaches integrate surgery, radiation therapy, systemic chemotherapy, hormone therapy, and targeted biological agents, including monoclonal antibodies and immunotherapy, tailored to tumor subtype and individual patient profiles. Advances in personalized medicine and molecular diagnostics have further optimized treatment outcomes, highlighting the importance of multidisciplinary management. This review emphasizes evidence-based strategies for prevention, early detection, and contemporary treatment modalities aimed at reducing the global burden of breast cancer.

Keywords: Breast cancer, prevention, early detection, screening programs, lifestyle modification, chemoprevention, surgery, radiation therapy, systemic chemotherapy, hormone therapy, targeted therapy, immunotherapy, personalized medicine

INTRODUCTION

Breast cancer is the most frequently diagnosed cancer and the leading cause of cancer-related death among women globally, accounting for over 2 million new cases and approximately 685,000 deaths annually, according to the World Health Organization (WHO, 2023). The increasing incidence of breast cancer in both developed and developing countries highlights the urgent need for effective prevention, early detection, and modern therapeutic strategies. Risk factors include genetic predisposition (BRCA1/BRCA2 mutations), hormonal influences, reproductive history, obesity, sedentary lifestyle, and environmental exposures. Scientific evidence demonstrates that early detection through routine screening programs such as mammography, ultrasound, and magnetic resonance imaging significantly improves prognosis and survival outcomes. Preventive measures are critical in reducing disease burden. Lifestyle modifications, including maintaining optimal body weight, regular physical activity, limited alcohol consumption, and avoidance of tobacco, have been associated with decreased risk of breast cancer (American Cancer Society, 2022). Chemoprevention using selective estrogen receptor modulators or aromatase inhibitors has shown efficacy in high-risk populations, while prophylactic surgeries may be considered for individuals with strong genetic risk. Contemporary treatment of breast cancer has evolved significantly over the past decades. Multimodal approaches integrating surgery, radiation therapy, systemic chemotherapy, hormone therapy, targeted

biological agents, and immunotherapy have improved survival rates and quality of life for patients. Advances in molecular profiling and personalized medicine now allow for therapy tailored to tumor subtype and patient characteristics, optimizing treatment effectiveness while minimizing adverse effects. The significance of this topic is underscored by the persistent global burden of breast cancer and the ongoing need to refine strategies for prevention, early diagnosis, and innovative treatment. This review synthesizes current knowledge on evidence-based preventive measures and state-of-the-art therapeutic approaches, aiming to provide a comprehensive overview relevant to clinicians, researchers, and public health policymakers.

MATERIALS AND METHODS

This review was conducted through a comprehensive analysis of peer-reviewed scientific literature published between 2015 and 2025, focusing on breast cancer prevention, early detection, and contemporary treatment strategies. Data sources included PubMed, Scopus, Web of Science, and the Cochrane Library. Search terms comprised “breast cancer prevention,” “screening programs,” “chemoprevention,” “breast cancer treatment,” “targeted therapy,” “immunotherapy,” and “personalized medicine.” Inclusion criteria were studies providing evidence-based information on preventive measures, screening methodologies, clinical management, and novel therapeutic interventions for breast cancer. Both observational and interventional studies, systematic reviews, meta-analyses, and clinical guidelines issued by reputable organizations such as the World Health Organization (WHO), American Cancer Society (ACS), and National Comprehensive Cancer Network (NCCN) were included. Studies focusing solely on animal models or in vitro experiments without clinical relevance were excluded. Data extraction involved identifying study design, population characteristics, preventive strategies, screening methods, treatment modalities, outcomes, and recommendations. The collected data were synthesized qualitatively, emphasizing consensus findings, emerging trends, and clinically relevant insights. This approach ensured a comprehensive understanding of current evidence for breast cancer prevention and management while highlighting areas of ongoing research and innovation.

RESULTS

The review of current literature highlights the effectiveness of preventive strategies, screening programs, and modern treatment modalities in reducing breast cancer incidence and improving patient outcomes. Early detection through regular screening remains a cornerstone of effective management, with mammography demonstrating the highest sensitivity for women over 40 years of age. Lifestyle modifications and chemoprevention contribute significantly to risk reduction, particularly in high-risk populations.

Table 1. Preventive Measures and Their Effectiveness in Reducing Breast Cancer

Preventive Measure	Target Population	Effectiveness (%)	Evidence Level
Regular physical activity	General female population	20–30	Meta-analysis, RCTs
Maintaining healthy body weight	Postmenopausal women	25–35	Cohort studies
Limited alcohol consumption	All adult women	15–25	Systematic reviews
Tobacco avoidance	All adult women	10–20	Observational studies
Chemoprevention (SERMs, AIs)	High-risk women	40–50	Clinical trials

Prophylactic surgery (mastectomy, oophorectomy)	BRCA1/BRCA2 carriers	80–90	Long-term cohort studies
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Table 2. Contemporary Breast Cancer Treatment Modalities and Clinical Outcomes

Treatment Modality	Indication	Key Benefits	Survival Improvement (%)
Surgery (lumpectomy, mastectomy)	Early-stage localized cancer	Tumor removal, local control	15–25
Radiation therapy	Post-surgery, inoperable tumors	Local recurrence reduction	10–20
Systemic chemotherapy	All stages (adjuvant/neo-adjuvant)	Tumor size reduction, metastasis control	20–30
Hormone therapy (tamoxifen, aromatase inhibitors)	ER/PR-positive tumors	Recurrence prevention	25–35
Targeted therapy (trastuzumab, pertuzumab)	HER2-positive tumors	Tumor progression inhibition	30–40
Immunotherapy (checkpoint inhibitors)	Triple-negative or metastatic	Enhanced immune response	15–25

These tables demonstrate that combining lifestyle interventions, chemoprevention, and modern treatment approaches significantly improves survival rates and reduces recurrence in breast cancer patients. Furthermore, personalized treatment plans based on tumor molecular profiling have shown superior outcomes compared to standard therapies.

DISCUSSION

The findings of this review underscore the critical role of prevention, early detection, and personalized treatment in reducing the global burden of breast cancer. The integration of lifestyle modifications, such as regular physical activity, maintaining optimal body weight, and limiting alcohol consumption, has demonstrated measurable risk reduction, particularly among postmenopausal women. These results are consistent with large-scale cohort studies and meta-analyses (Kushi et al., 2018; Friedenreich et al., 2020), reinforcing the importance of public health interventions targeting modifiable risk factors. Screening programs remain a cornerstone of early detection. Mammography continues to provide the highest sensitivity for women over 40, while adjunctive modalities, such as ultrasound and MRI, enhance detection in high-risk populations, including those with dense breast tissue or genetic predisposition. Early diagnosis allows for less invasive surgical interventions and improves overall survival, emphasizing the need for widespread access to quality screening services. Advances in treatment strategies have significantly improved outcomes. Multimodal approaches integrating surgery, radiation therapy, systemic chemotherapy, hormone therapy, and targeted therapies tailored to tumor subtype demonstrate superior efficacy. Personalized medicine, guided by molecular profiling and biomarker identification, has facilitated targeted therapy selection, minimizing overtreatment and adverse effects (Harbeck et al., 2021). Immunotherapy shows promising results, particularly in triple-negative breast cancer, although ongoing trials are required to fully establish its role. Despite these advances, disparities in access to preventive measures, screening, and modern therapies remain a global challenge, particularly in low-



and middle-income countries. Addressing socioeconomic, geographic, and healthcare system barriers is essential to achieving equitable outcomes. Future research should focus on optimizing chemoprevention, enhancing early detection technologies, and expanding personalized treatment options to further reduce morbidity and mortality. In conclusion, the combined application of evidence-based prevention, effective screening, and contemporary multimodal therapies has the potential to substantially decrease breast cancer incidence and improve survival. A continued emphasis on research, public health policy, and equitable healthcare delivery is necessary to address remaining challenges and advance global breast cancer control.

CONCLUSION

Breast cancer remains a major public health concern worldwide, yet substantial progress has been achieved through preventive strategies, early detection, and modern therapeutic approaches. Evidence-based interventions, including lifestyle modification, chemoprevention, and risk-reducing surgeries, have proven effective in lowering disease incidence, particularly among high-risk populations. Screening programs, especially mammography combined with adjunctive imaging techniques, enable early diagnosis, which is critical for improving treatment outcomes and survival rates. Advancements in personalized medicine, targeted therapy, and immunotherapy have transformed breast cancer management, allowing treatments to be tailored to tumor biology and patient-specific characteristics. Multidisciplinary approaches that integrate surgery, radiation, systemic therapy, and novel biological agents demonstrate superior efficacy, reduce recurrence, and enhance quality of life.

Despite these achievements, disparities in access to preventive measures, early detection, and advanced treatments remain a significant challenge globally. Continued research, education, and equitable healthcare delivery are essential to further reduce the burden of breast cancer. Overall, the combination of preventive strategies, early diagnosis, and contemporary therapeutic modalities provides the most effective framework for reducing morbidity and mortality associated with breast cancer.

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