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Breast Cancer Awareness and Screening in Africa: Identifying Challenges and Strategies for Improved Health Outcomes

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Abstract

Breast cancer (BC) is the most prevalent cancer among women globally, particularly in sub-Saharan Africa (SSA), where it is a leading cause of cancer-related deaths. This study explores the challenges and strategies for enhancing breast cancer awareness and screening in Africa. It highlights significant gaps in knowledge and education about BC, which adversely impact early detection efforts. Cultural stigmas and economic barriers further complicate access to screening services, leading to late-stage diagnoses. The study emphasizes the importance of tailored educational programs, collaborative efforts with community leaders, and the integration of breast cancer services with existing health initiatives to enhance awareness and accessibility. It advocates for affordable diagnostic options, mobile health clinics, and financial support programs to ensure that women from diverse socioeconomic backgrounds can access necessary screening services. Additionally, the need for educational outreach initiatives to dispel myths and foster open discussions about BC is underscored. By addressing these challenges through comprehensive strategies, the SSA countries aim to improve health outcomes for women and reduce the mortality associated with breast cancer. Ultimately, a concerted effort is required to create a supportive environment that encourages early detection and effective management of breast cancer in the region. In summary, enhancing breast cancer awareness and screening in Africa necessitates focused education, accessible screening, and addressing cultural stigmas, which can lead to earlier detection, improved treatment outcomes, and reduced mortality rates.

Keywords: Breast Cancer, Awareness**,** Screening, Healthcare Access**,** Cultural Barriers**,** Treatment

Introduction

Breast cancer (BC) is the most commonly diagnosed cancer among women and the primary cause of cancer-related deaths globally. In 2018, BC comprised 24.2% of the 8.6 million new global cancer cases, with 8.1% occurring in sub-Saharan Africa (SSA)[1]. Breast cancer is the most severe disease impacting women. It begins

with lesions that silently grow within normal breast tissue, ultimately leading to the formation of a cancerous lump[2]. BC was also responsible for nearly 15% of the 4.2 million cancer deaths globally, with SSA accounting for 11.8% of these fatalities[1]. BC is a prevalent cancer affecting women worldwide. In the United States of America, approximately 268,670 new patients were diagnosed in 2018. It is classified into three types based on molecular and histological characteristics based on its hormone receptor status (estrogen receptor-positive [ER+] or progesterone receptor-positive [PR+]), HER2 status (HER2-positive), or the absence of all three (triple-negative)[3].

BC is a major contributor to cancer-related mortality in women globally. In 2018, approximately 2.1 million new cancer cases and 600,000 deaths were attributed to breast cancer worldwide. The incidence of bilateral breast cancer ranges from 2.2% to 4.4%[4]. Breast cancer often presents as a painless lump, though 90% of breast masses are benign. Key signs include immobile lumps, breast or skin changes, and nipple alterations. Isolated breast pain is common but rarely indicative of malignancy without additional symptoms[5]. The study examined the global cancer burden in 2018, emphasizing geographic variations in occurrence and death rates. Breast cancer ranks with the leading diagnoses and causes of death, with disparities shaped by economic development and lifestyle factors[6]. Another study analyzed global cancer statistics for 2022, revealing nearly twenty million new cancer cases and nine point seven million deaths, with breast cancer among the most prevalent types. Geographic disparities in incidence and mortality underscore the need for targeted prevention strategies to combat rising cancer rates(**Table:2**)[6]. It is estimated that around 43,700 women will die from breast cancer[7]. Despite extensive research, breast cancer incidence continues to rise, affecting 1 in 20 women globally and 1 in 8 in high-income countries. Reducing incidence requires addressing modifiable risk factors and implementing precision prevention strategies for high-risk women[8]. Breast cancer is a prevalent form of cancer and a significant contributor to female mortality, with millions new cases reported globally in 2018. Although China has a lower incidence compared to other countries, rates have risen significantly since the 1990s, according to the data, BC disease is the sixth leading cause of death in Chinese women[9][4]. In Germany, mammography screening is recommended from age 50, but new guidelines suggest individual risk-based decisions for women under 50 and over 70. A study found that 39,000 women aged 40-49 with elevated breast cancer risk could benefit from earlier screening. For low-risk women aged 50-69, less frequent screening may reduce unnecessary diagnostic procedures and healthcare costs, supporting a more targeted, risk-adapted approach[10]. Breast cancer screening guidelines vary in the United States. The Preventive Services Task Force suggests mammograms every two years for women aged 50-74. In contrast, the American Cancer Society recommends annual mammograms beginning at age 45. The European Union recommends biennial screenings for women aged 50-69, but implementation varies by country, exemplified by Norway[11].

Recent advancements in breast cancer therapies highlight the disease's heterogeneity, shaped by genetic and environmental factors. Breast cancer stem cells are pivotal in the aggressive behavior of breast tumors and their resilience to treatment. Current treatment strategies include innovative approaches such as antibody-drug conjugates and nanoparticles, alongside prognostic biomarkers like Oncotype DX, Mammoprint, and uPA/PAI-1, which are important predictive indicators in

breast cancer management[3]. Breast cancer is a major public health concern in the European Union. While several nations have established population-based breast cancer screening initiatives, disparities in incidence and mortality rates highlight inequalities in healthcare access and screening effectiveness[12].

In 2020, the SSA reported approximately 801,392 new cancer cases and 520,158 cancer-related mortality, with breast cancer comprising 129,400 cases, making it the most prevalent cancer in 28 countries. The cumulative risk for women developing breast cancer by age 75 was 4.1%[13]. Breast cancer occurrence and death are rising in low- and middle-income nations, particularly in SSA, despite insufficient high-quality data (**Table:2**). Case fatality rates in LMICs are significantly higher than in developed countries, complicating the development of effective management and early detection strategies in resource-limited settings[14]. Breast cancer, with over 1 million new cases and 370,000 deaths annually, remains a major health concern. Despite rising incidence, mortality has reduced in developed nations because of improved education, early screening, and adjuvant treatments. Advances in breast cancer biology now reduce the need for radical mastectomies, aided by the expanding use of sentinel node techniques. Risk assessment incorporates nodal status, tumor characteristics, and emerging molecular factors. Endocrine therapy remains a key treatment for responsive tumors[12].

In sub-Saharan Africa, 77% of breast cancer patients are diagnosed at stages III/IV. However, some public-sector settings demonstrate improved stage profiles, indicating potential for progress despite challenges. Late-stage breast cancer is more prevalent among black Africans, but urban areas show lower rates of late-stage diagnoses. Studies suggest stage migration over time, with a notable decrease in stage III/IV cancers in South Africa[15]. The World Health Organization (WHO) defines a national cancer control program as a public health initiative focused on reducing the occurrence and mortality of cancer while improving the quality of life for individuals with cancer. This involves the organized and fair implementation of evidence-based approaches for prevention, early detection, diagnosis, treatment, and palliative care, making the most available resources[16]. The purpose of this study is to evaluate women's knowledge of breast cancer (BC) and its screening in Africa, focusing on the unique challenges faced in the region, such as limited access to healthcare, low awareness, cultural stigmas, and inadequate resources for early detection and treatment. This study will assess breast cancer risk and screening recommendations, highlighting the importance of informed decision-making for women regarding screening options based on personal values. Additionally, it aims to remind the needs of women at elevated risk and explore new therapies to improve breast cancer outcomes within African communities.

Characteristics of breast cancer stem cells (BCSCs)

BCSCs are critical drivers of tumor growth and recurrence due to their ability to self-renew and differentiate. These characteristics often result in treatment resistance and poor clinical outcomes. The development of BCSCs is affected by genetic alterations, cellular de-differentiation, and the epithelial-to-mesenchymal transition process. Additionally, the tumor microenvironment plays a pivotal role in preserving the stem-like properties of BCSCs[17]. BC can be categorized into different subtypes based on the expression of estrogen (ER), progesterone (PR), and HER2 receptors. The subtypes include luminal (70%, hormone receptor-positive), HER2-positive (15-20%),

and triple-negative (TNBC, 15%), and each subtype is associated with specific stem cell populations[18]. The biology of BC remains poorly understood. Although several factors have been correlated to prognosis, their prognostic value fades away due to internal correlations in multivariate analysis, providing limited information about the biology of the disease[19]. Cancer-associated fibroblasts (CAFs) interact with cancer cells, resulting in elevated collagen levels and aberrant expression of α-smooth muscle actin (αSMA), a process known as desmoplasia[20].

Characteristics of BC

BC is the second leading cause of cancer-related deaths in women. It develops when breast cells abnormally divide, affecting the milk ducts' inner lining and forming a lump or mass. These cells may metastasize to bones, brain, liver, or lungs[21]. Symptoms include nipple pain, changes in breast size, nipple discharge, and lymph node swelling. Breast cancer (BC) consists of various types, both invasive and non-invasive, including inflammatory breast cancer (IBC), invasive lobular carcinoma (ILC), ductal carcinoma in situ (DCIS), and lobular carcinoma in situ (LCIS). BC is categorized into five stages, from stage 0 to stage 4[21]. Patients diagnosed with breast cancer often encounter negative emotions such as anxiety and depression, stemming from their diagnosis, treatment, and changes in body image. Prolonged psychosocial issues can severely impact their overall quality of life[9]. Around 10-15 percent of breast cancer cases are considered familial, while around 90% are sporadic, linked to somatic mutations. However, genetic data in Sub-Saharan Africa is limited, as underscored by the African Genome Variation Project[14]. Breast cancer survival is tied to distant metastases. Liquid biopsy biomarkers, such as circulating tumor cells and cell-free DNA, offer non-invasive, repeatable tumor heterogeneity and treatment response monitoring, aiding personalized therapy and overcoming biopsy limitations in recurrent/metastatic cases[22].

Cancer Detection Rates Among Women: Age and Psychological Factors

Analysis of 428,560 women from the Ibaraki Health Service Association revealed significantly lower cancer detection rates in those under 40 (0.06%) compared to those over 40 (0.21%). The number needed to screen (NNS) was higher for younger women (1505 vs. 281–439), indicating fewer early-stage cancers, though this difference was not statistically significant[8]. In Switzerland, women with moderate to severe depressive symptoms exhibited greater adherence to mammography (51%) than those with no or mild symptoms (39.2%, $P = 0.005$). This adherence was significantly enhanced in regions with organized screening programs, yielding adjusted odds ratios of 2.7 and 4.21 for respective groups[23]. Although age-standardized BC occurrence rates are lower in poor countries than in developed countries, less developed regions reported 883,000 new BC cases in 2012, surpassing the 794,000 cases in more developed states (**Table:2**)[14].

Clinical features in Sub-Saharan Africa

Breast cancer therapy has advanced, focusing on avoiding over- and undertreatment. Neoadjuvant therapy is common in triple-negative and HER2-positive cases. Treatment decisions consider molecular subtype and tumor load. In metastatic cases, therapies aim to extend survival and maintain quality of life[24]. BC treatments vary according to the type and it stage, with current options including hormonal therapy, surgery, biological therapy, chemotherapy, and radiation therapy[24]. In SSA, approximately 80% of breast cancers are diagnosed at late stages (III or IV), compared to only 15% in high-income countries (HICs)[25]. In Sub-Saharan Africa,

late-stage BC diagnosis (stages III, and IV) is common due to low awareness, limited diagnostic facilities, and inadequate early detection programs (**Table:1**). Reports show 77-87.7% of patients present with advanced stages in Uganda, Rwanda, Angola, and Ghana. In Uganda, 34% have triple-negative breast cancer, with 68% being high-grade tumors, mostly invasive ductal carcinoma[14]. In SSA, women with BC tend to be diagnosed at a younger age compared to women in developed countries. Data shows that around seventy percent of women with breast cancer in sub-Saharan Africa are 50 years old or younger[26]. The diagnosis stage significantly influences breast cancer survival rates, with earlier stages linked to better outcomes. In Sub-Saharan Africa, a higher incidence of late-stage cancer is due to patient factors like low awareness and provider factors such as limited detection programs and diagnostic facilities[15]. Research on BC screening in rural Sub-Saharan Africa is limited, even though most women reside in these regions. Only a very small number of countries have national guidelines for early detection, making it difficult to reduce mortality rates. Downstaging is suggested as a suitable strategy, but context-specific understanding is crucial due to the lack of studies[27]. Rural women in Umuowa, Nigeria, particularly those with lower education levels, demonstrated limited knowledge about breast cancer. Additionally, a South African study noted a lack of health education on breast cancer, which adversely impacted early detection efforts (**Table:1**)[28]. In Zimbabwe, a separate study highlighted a significant lack of comprehensive knowledge about BC among women[27].

Historically, breast cancer (BC) incidence was higher in high-income countries. However, social and economic changes have reduced risk factor prevalence, resulting in rapidly increasing BC rates in non-developed countries, especially in SSA, where Malawi and Nigeria see annual increases of over 5%[29]. Breast cancer (BC) patients in low-income countries have worse prognoses compared to those in high-income countries, with nearly 60% of BC-related deaths occurring in developing nations[30]. Despite advancements in medical science, the absence of national breast cancer screening programs and weak health infrastructure in low-income countries, especially in sub-Saharan Africa, results in poor survival outcomes. For example, India's 5-year survival rate is 66.1% compared to 90.2% in the U.S. [31]. Early diagnosis and treatment could reduce breast cancer deaths by 28%–37% in sub-Saharan Africa, as the study suggests (**Table: 1**). Without new interventions, the burden of breast cancer will continue to increase, particularly in low- and middle-developed countries[32]. Breast cancer risk and outcomes vary by country and race. In BRICS-plus nations, infectious diseases overshadow non-communicable diseases like breast cancer, leading to neglect. Meanwhile, developed countries have improved survival rates through early diagnosis and timely, effective treatment[33].

Table 1: Challenges and proposed solutions concerning breast cancer awareness and screening in Africa

Challenges	Suggested Solutions
High mortality rates due to late-stage diagnosis	Develop community-based educational initiatives emphasizing the significance of early detection and routine screenings.
Limited access to screening in rural and underserved areas	Establish mobile health clinics to provide screening services directly in remote areas, ensuring accessibility for all women
Cultural	Collaborate with community

misconceptions and stigma surrounding breast cancer	leaders and opinion-makers to raise awareness campaigns that debunk misconceptions and foster transparent dialogues about breast cancer
Inadequate training and resources for healthcare providers	Implement comprehensive training programs for healthcare providers on breast cancer screening, diagnosis, and treatment approaches
Insufficient data on breast cancer prevalence and outcomes	Enhance cancer registry systems and improve data collection to better comprehend the burden of breast cancer in the region
Barriers faced by immigrant and marginalized populations	Develop culturally appropriate educational programs that address unique challenges and enhance access to screening for diverse populations

Advancements in Breast Imaging for Early Cancer Detection

Cancer's rising global impact makes accurate, timely diagnosis crucial for early intervention and prevention. Breast cancer, in particular, is on the rise, highlighting the need for swift detection and treatment to improve outcomes and save lives worldwide[34]. BC is the second leading cause of cancer-related deaths in women, following lung cancer (American Cancer Society, 2023)[35]. Breast imaging, including MRI, sonography, and mammography, is essential for cancer detection, providing structural and functional insights. Tests like PET scans, X-rays, CT, and ultrasound help detect cancer spread and are used when metastasis is suspected[21]. Previous studies indicated that breast ultrasound demonstrated greater sensitivity and accuracy than mammography in women aged thirty to sixty-five years who are at high risk for BC[36]. However, early BC diagnosis is challenging due to poor imaging features. Image processing helps by analyzing masses, calcifications, and breast density. The process involves image preprocessing (removing noise, background, pectoral muscle), finding regions of interest, and extracting features like texture and morphology. These features help distinguish between tumor and normal tissue for more accurate diagnosis[37].

Breast cancer survival rates depend on the type and stage at diagnosis (**Table:1**). Localized cancer has a 99% survival rate, regional cancer drops to 86%, and when the cancer has spread to distant areas, the survival rate falls to 30%[38]. The statistics underscore the vital importance of early detection in significantly improving survival rates. To identify breast cancer in its early stages, medical professionals increasingly rely on breast ultrasound (BUS) imaging due to its effectiveness, non-invasive nature, absence of radiation, cost-efficiency, and widespread availability[39]. Radiology experts face challenges in detecting and classifying breast lesions due to the extensive time required for mammogram analysis. To enhance accuracy, deep learning methodologies have been adopted as vital components of computer-aided diagnosis (CAD) systems, involving preprocessing, parameter initialization, and deep feature extraction from mammogram images[2]. Evaluating mammograms requires a significant number of dedicated radiologists, yet many countries face a shortage of qualified readers. Interval cancers often go undetected, and missed cancers lead to malpractice lawsuits. While digital breast tomosynthesis (DBT) improves cancer detection, it also doubles reading time, highlighting the need for enhanced evaluation assistance[40]. In Asia, studies of women have also demonstrated that ultrasound images are more sensitive and accurate than mammography. In the Japan,

Strategic Anti-Cancer Randomized Trial, ultrasound combined with mammography detected 184 breast cancers among 36,859 participants, with 41 detected solely by mammography and 67 solely by ultrasound, indicating a higher cancer detection rate for ultrasound[41].

Treatment of breast cancer

Surgery

In Switzerland, about 1,200 patients require axillary lymph node dissection (ALND), primarily for node-positive breast cancer identified through pre-operative or intraoperative evaluations[42]. Established in 1957, the National Surgical Adjuvant Breast and Bowel Project (NSABP) aimed to evaluate anticancer treatments alongside surgery, setting key clinical trial standards. In 1967, Bernard Fisher led protocol B-04, demonstrating that total mastectomy was as effective as the more extensive Halsted operation[43]. The transformation in breast cancer surgical management was similarly initiated in Europe by visionary surgeon Umberto Veronesi. His trials led to the endorsement of lumpectomy combined with radiation as the gold standard treatment whenever feasible[44]. Veronesi, in collaboration with Armando E. Giuliano in the U.S., pioneered the sentinel node biopsy (SNB) intervention, marking a significant advancement in breast cancer surgery. This method identifies the sentinel node in the axilla, offering essential staging information about axillary node status and sparing patients without nodal involvement from ALND[45]. A multicenter RCT involving patients with T1–2 BC and 1 to two metastatic sentinel lymph nodes (SLN) found that those treated with SNB alone achieved similar overall survival (98.7%) and recurrence-free survival (94.1%) rates compared to those undergoing ALND. To further validate the findings, enrollment was reopened as a single-arm study[46].

In 2024, breast cancer axillary surgery emphasizes personalized approaches over radical methods, as RCTs show the non-inferiority of omitting axillary dissection in certain patients. Ongoing trials investigate further applications, indicating a decreasing need for ALND[47]. The Optimal Treatment of the Axilla: Surgery or Radiotherapy trial determined that regional nodal irradiation (RNI) is equally effective as completion ALND in patients with early-stage breast cancer and sentinel lymph node metastasis[48]. In the initial analysis of the OTOASOR trial, researchers observed that, after an average follow-up of over 40 months, RNI was as effective as completion ALND in controlling axillary disease in patients with early-stage BC. Importantly, there were no differences in overall survival in the two groups[49]. The study assessed patient perceptions of lymphedema and precautionary behaviors after axillary surgery. Five years post-surgery, arm swelling was reported by 3% of patients after SLNB alone versus 27% after SLNB/ALND. Significant risk factors included body weight, infection, and injury, with notable discordance between measured and perceived lymphedema[50]. A review examines alternatives to axillary surgery in BC, showing that SLNB and axillary sampling yield similar survival rates to ALND while decreasing lymphoedema risk, indicating ALND may not be needed for clinically uninvolved axillae[51].

Metastatic breast cancer treatment options include hormone therapy, immunotherapy, and chemotherapy, selected based on the location of metastases and tumor characteristics. Despite advancements in targeted and personalized therapies, the effectiveness of first-line treatments has largely remained static over the past decade[52]. Primary hormone therapy has also been employed in the neoadjuvant systemic setting. Despite its low pCR rates, this therapy notably improves breast

conservation rates[53]. Neoadjuvant systemic therapy is essential for evaluating tumor response and studying the agent's mechanisms at the cellular level. However, some tumors exhibit primary resistance, where no response is observed, and the tumor continues to grow despite appropriate treatment, highlighting challenges in managing therapy-resistant cancers[53]. The analysis revealed no substantial difference in overall survival between early-stage BC patients who have undergone mastectomy or breast-conserving therapy, regardless of the follow-up duration. The decision should be made jointly, considering the patient's financial situation, the advantages of each option, and personal preferences, particularly in low-income settings[54].

Radiation therapy (RT)

RT is one of the prevalent potent cancer treatment techniques, with more than half of cancer patients needing it at some stage during their treatment process[55]. The projected number of BC cases in Africa is expected to increase from 168,690 in 2018 to more than 364,000 by 2040[56]. Most African countries face significant challenges in effectively managing breast cancer, largely due to limited access to radiation therapy services, which are essential for comprehensive treatment of the disease[57]. As of March 2020, data from the International Atomic Energy Agency indicates that only 28 out of 54 African countries have access to external beam RT, while 21 have access to brachytherapy. However, none of these countries possess sufficient radiation therapy resources to address the rising cancer incidence on the continent[58]. The forecast for new cancer cases continues to rise. The International Agency for Research on Cancer (IARC) has reported a substantial increase in new cancer cases in Africa, rising from 844,279 in 2012 to over 1.1 million in 2020. Projections suggest this number will continue to grow, exceeding 1.5 million by 2030[59]. Radiation therapy is a critical component of the BC treatment, from early to locally advanced stages. It is frequently employed to relieve symptoms in metastatic breast cancer, contributing significantly to managing disease progression and improving patients' quality of life[60].

Medical treatment

HER2-positive BC is a distinct subtype of BC that affects a specific group of patients who may benefit from anti-HER2 treatments. These treatments have significantly improved the prognosis for patients with this type of cancer. A roundtable discussion focused on the latest advancements in the diagnosis and treatment of HER2-positive BC, encompassing approved testing methods, available treatment options, and unresolved areas of debate[61]. The study used propensity score matching to examine the survival benefits of chemotherapy (CT) for estrogen receptor-positive (ER +) and HER2-negative BC patients. In a group of 895 women, the five-year recurrence-free survival (RFS) was significantly higher for those who received chemotherapy (CT) compared to those who did not (CT: 96.8% vs. non-CT: 82.7%, $p = 0.003$). Additionally, overall survival (OS) was markedly better in the CT group (CT: 100% vs. non-CT: 91.9%, $p < 0.001$). These findings underscore the substantial advantages of chemotherapy, particularly in women with node-negative/NG3 and 1-3 node-positive/NG2 BC[62].

A retrospective analysis of long-term outcomes in patients with breast cancer ≤2 cm following breast-conserving surgery was conducted, categorizing patients based on their immunohistochemistry (IHC)-defined subtypes[63]. Of the 282 patients included, the five- and ten-year local recurrence rates were 1.5% and 4%, respectively, while distant recurrence rates were 3% and 8%. Notably, patients with HER2-positive/nonluminal and luminal B-like/HER2-positive subtypes exhibited

poorer outcomes[63]. The study examined factors associated with response to neoadjuvant therapy in a group of 173 patients with HER2-positive breast cancer diagnosed between 2010 and 2016. The analysis revealed that several characteristics, including small tumor size, low estrogen receptor and progesterone receptor expression, HER2 immunohistochemistry 3+, high Ki-67, high HER2/CEP17 ratio, and high HER2 copy number, were significantly linked to a favorable response to neoadjuvant therapy in this patient population[64]. The study conducted by Mengqian Ni and colleagues demonstrated that the combination of eribulin and carboplatin was an effective and well-tolerated treatment option for patients with heavily pre-treated metastatic BC. The overall response rate achieved with this combination was 51.4%, and the cancer control rate was 81.1%, indicating promising clinical outcomes[65].

The multicenter, randomized study in patients with BC compared the efficacy and safety of F-627 (efbemalenograstim alfa) to filgrastim in reducing grade 3 or 4 neutropenia in patients who undergoing chemotherapy. F-627 demonstrated comparable effectiveness, with a single 20 mg dose being as safe and effective as daily filgrastim 5 µg/kg[66]. The study investigated receptor discordance between primary and locally recurrent breast tumors in 48 patients. It found 25%, 20.83%, and 4.16% discordance in estrogen receptor, progesterone receptor, and HER-2 status, respectively, with significant associations linked to invasive ductal carcinoma and higher disease stages[67]. Long non-coding RNAs, TERC and TERRA, are essential for telomere length maintenance in cancer cells. Their roles in telomere regulation present potential targets for anticancer therapies and precision oncology advancements[68].

Triple-negative breast cancer (TNBC) does not have targeted therapies. Immune checkpoint inhibitors (ICIs) combined with chemotherapy have shown promise in treating metastatic and early-stage TNBC, with ongoing clinical trials evaluating efficacy and side effects[69]. Triple-negative breast cancer (TNBC) may benefit from PD-1/PD-L1 inhibitors. They examined the regulation of PD-L1 expression, emphasizing the role of epithelial-mesenchymal transition (EMT) and metabolic pathways in TNBC treatment resistance[70]. In TNBC, expression of PD-L1 on immune cells is linked to the presence of tumor-infiltrating lymphocytes (TILs) and CD8+ T cell infiltration, suggesting its potential as a predictive marker for the response to immunotherapy[71]. Patients with TNBCs having low TILs and high-PD-L1 expression before preoperative systemic therapy (pre-PST) had a poor prognosis. This subset of TNBCs with Low-TILs and High-PD-L1 could be a potential target for immune checkpoint inhibitor therapy, according to the study by Nobumoto Tomioka et al[72].

Rising Incidence and Mortality Trends in Breast Cancer

The BC incidence continues to rise, contributing to overall increasing cancer rates. Despite advances in treatment reducing cancer death rates, breast cancer remains a significant concern, with persistent racial disparities in mortality. Ongoing efforts are needed to address this growing health challenge[73]. Breast cancer mortality in women peaked in 1989 but decreased by 42% by 2021, preventing over 490,000 deaths. This decline is due to earlier diagnosis through mammography, increased knowledge about BC, and improved treatments. Nonetheless, mortality declines have reduced recently, likely due to stable screening rates and rising incidence[74]. Cancer is largely preventable, with only 5–10% of cases due to genetics and 90–95%

linked to lifestyle and environmental factors. Smoking, poor diet, alcohol, sun exposure, and infections are major contributors[75]. Nearly 25–30 percent of cancer deaths are attributed to tobacco, 30–35 percent to diet, and 15–20 percent to infections. Preventive measures include quitting smoking, eating more fruits and vegetables, exercising, limiting alcohol, reducing sun exposure, and regular health check-ups[75]. Inflammation is identified as the key link between cancer-causing and cancer-preventing factors[75]. Factors that increase BC risk include age, family history, early menstruation, and late menopause. Modifiable factors include obesity, hormone use, alcohol consumption, and breastfeeding. Strategies to reduce risk include maintaining a healthy weight, regular exercise, limiting alcohol, extended breastfeeding, and considering medications like tamoxifen or raloxifene for high-risk women[76].

Burden of breast cancer

Annually, over 2 million breast cancer cases are diagnosed worldwide, accounting for one-third of women's cancer diagnoses and resulting in more than 600,000 deaths[42]. In 2015, the United States recorded 22.6 million mammograms performed as part of routine breast cancer screening efforts[77]. The 2013 Global Burden of Cancer report highlighted breast cancer as the top cause of DALYs, totaling 13.1 million[78]. BC was the most accurate cancer, affecting 2.4 million individuals, and 523,000 women died from this leading cause of cancer-related deaths, resulting in 15.1 million disability-adjusted life years (DALYs) (**Table: 3**)[79].

Cancer is an additional major health issue in the Gulf Cooperation Council (GCC) countries, with 42,475 new cases and 19,895 deaths in 2020. BC is among cancers accounting for 40% of cases. By 2040, the cancer burden is projected to rise significantly, with an estimated 104,000 new cases, driven by population growth[80]. Based on the Global Burden of Disease Study, a study evaluating the incidence and mortality of 29 cancer groups in 2017, along with trend examination from 1990 to 2017, revealed no BC cases in 15-year-olds. Women aged 50–69 bore a higher burden of breast cancer, accounting for approximately 40% of total cases and deaths [54]. The estimation of cancer deaths for 2023 was calculated using a joinpoint algorithm based on data from 2006 to 2020 (**Table: 3**). The Incidence estimated, using data through 2019, doesn't account for COVID-19's impact, while projected deaths reflect only the pandemic's first year. Basal and squamous cell skin cancers are excluded due to limited registry data[73].

Table 2: Breast Cancer Data: Age-Standardized Rates and Incidence Cases by East African Countries[78]

Location	Cause	Breast cancer rate per 100,000 people (95% uncertainty interval) from 1990 to 2013, percent change.			Cases in Thousands with 95% Uncertainty Interval, percent change		
		Incidence rate	DALY rate	Death rate	Incidence rate	DALY rate	Death rate
Democratic Republic of the Congo	Breast Cancer	48.78	33.33	26.92	200.00	161.54	100.00

Republic of Burundi	Breast Cancer	22.28	-12.11	-7.69	102.27	60.00	0.00
Republic of Kenya	Breast Cancer	10.11	-40.20	-3.51	139.36	19.66	100.00
Republic of Rwanda	Breast Cancer	13.98	-20.73	-14.44	109.09	46.43	0.00
Federal Republic of Somalia	Breast Cancer	15.12	-2.24	0.00	71.11	44.00	0.00
Republic of South Sudan	Breast Cancer	48.34	5.14	7.25	197.22	104.35	100.00
Republic of Uganda	Breast Cancer	48.19	-1.37	4.55	128.57	94.55	100.00
United Republic of Tanzania	Breast Cancer	24.99	5.39	0.00	140.00	89.19	150.00
Global	Breast Cancer	16.61	-20.56	-21.87	99.07	35.20,	40.12

This table presents the age-standardized BC rates and the number of incidence cases in East African countries. For each country, the breast cancer rates (per 100,000 people), the number of cases (in thousands), the disability-adjusted life years (DALY), and the mortality rates are provided, along with percentage variations. The data highlight the differences in incidence and mortality related to breast cancer in the region.

Table 3: Breast cancer trends: The Estimates of Incidence and Mortality according to GLOBOCAN and Regional

Cancer Site	Years	New Cases	Deaths	% of all sites	references
BC	2022	2,308,897	665,684	6.9	[6]
BC	2018	2,088,849	626,679	11.6	[1]
BC	2020	2,261,419	684,996	11.7%	[81]
BC	2019	700,660 (751,555–647,384)	2,002,354 (2,172,540–1,832,150)	35.7	[82]
BC	2017	Age-standardized per 100,000 (95% UI): 7.65 (8.01–7.37)	Age-standardized per 100,000 (95% UI): 24.19 (24.96–23.34)	-	[83]

This table summarizes the trends in BC in terms of new cases and deaths over different years, according to GLOBOCAN and regional studies. The data includes the number of new cases, deaths, and the proportion of these cases relative to BC cancer sites

Diagnosis

Breast cancer screening programs can reduce mortality by 15-40%, but also carry risks like overdiagnosis (5-54%), unnecessary treatments, and false negatives (6-46%). Women with family history should undergo genetic testing for BRCA1/2 mutations, enabling preventive measures including lifestyle, medical, and surgical options[33]. SLNB is the standard surgical procedure used to determine if cancer cells are present in the lymph nodes of BC patients[84]. The 8th edition BC staging incorporates biologic variables (grade, hormone receptor status, HER2, multigene panels) with TNM categories, providing more accurate survival stratification. This updated prognostic staging system enhances clinical relevance by integrating tumor biology and modern treatment protocols[85]. Tumor grade is a vital prognostic factor in BC, with current guidelines recommending the analysis of estrogen receptor (ER), progesterone receptor (PR), and HER2 status in all invasive cases. These markers are essential for oncologists to guide treatment decisions[86].

Breast cancer staging traditionally relies on tumor size (**Table 4**), lymph node involvement (LNI), and metastasis. The 8th American Joint Committee on Cancer (AJCC) edition includes biological markers, improving prognostic accuracy and providing better outcome predictions than anatomic staging alone, enhancing breast cancer classification and patient management[87]. Physicians require a straightforward and precise staging system to determine prognosis and standardize participants in clinical trials. Since 1959, the AJCC, in partnership with the International Union for Cancer Control, has developed cancer-specific staging systems. The breast cancer (BC) system utilizes the TNM model, which is based on TS, LNI, and metastasis[88]. The study analyzed 2890 breast cancer cases from Iran (2000-2021) to predict sentinel lymph node (SLN) involvement using TabNet, a deep learning model. TabNet achieved 75% accuracy, 81% precision, 70% specificity, 87% sensitivity, and 0.74 AUC, outperforming logistic regression (70% accuracy, 73% precision, 65% specificity, 79% sensitivity, 0.70 AUC). Key predictors included vascular invasion, tumor size (**Table 4**), and patient age[84]. The eighth edition outlines that only the largest tumor's maximum dimension should be measured, excluding minor microscopic satellite foci. The (m) modifier is used to record multiple primary cancers. When analyzing imaging studies, the largest tumor's size should include any microcalcifications or structural abnormalities, as these may influence the surgical approach[89].

Table 4: Breast Cancer Tumor Size Classifications (8th Edition) [89]

Category	Tumor Size
T1	Tumor ≤ 20 millimeters
T1mi	Tumor ≤ millimeter
T1a	Tumor > 1 millimeter but ≤ 5 millimeters
T1b	Tumor > 5 millimeter but ≤ 10 millimeter
T1c	Tumor > 10 millimeters but ≤ 20 millimeters
T2	Tumor > 20 millimeters but ≤ 50 millimeters
T3	Tumor > 50 millimeters

The T4 category denotes that BC cells have penetrated the chest wall or skin. T4a specifically designates

invasion into the ribs, intercostal muscles, and serratus anterior muscle, while invasion confined to the pectoral muscles does not meet the criteria for T4. Magnetic resonance imaging (MRI) offers a more accurate evaluation of chest wall extension in comparison to mammography or ultrasound[90]. The study analyzed 2,622 patients with stage I-III primary breast cancer, comparing the anatomical stage (aStage) with the pathological prognostic stage (ppStage) based on the AJCC 8th edition. The aStage distribution was as follows: IA (54.8 out of 100 patients), IB (1.1 out of 100), IIA (26.1 out of 100), IIB (9.2 out of 100), IIIA (5.6 out of 100), IIIB (0.1 out of 100), and IIIC (3.1 out of 100). For ppStage, the distribution was: IA (66.6 out of 100), IB (13.1 out of 100), IIA (11.1 out of 100), IIB (3.2 out of 100), IIIA (3.3 out of 100), IIIB (1.4 out of 100), and IIIC (1.2 out of 100). The ppStage remained the same in 65.2 out of 100 patients, was downgraded in 29.7 out of 100, and upgraded in 5.1 out of 100 cases. Both stages were significantly correlated with prognosis, but the ppStage demonstrated superior stratification of relapse-free survival (RFS), distant recurrence-free survival (DRFS), and overall survival[91]. The AJC on Cancer's pathological prognostic staging (PPS) demonstrates superior prognostication compared to anatomical staging (AS) in breast cancer, especially for estrogen receptor (ER)/progesterone receptor (PR)+ subtypes. However, outcomes may vary significantly among patients with the same PPS, highlighting the need for cautious interpretation in clinical practice[92].

BC Screening: Guidelines and Age-Related Risks

The US Preventive Services Task Force (USPSTF) recommends that women aged 40-74 receive a mammogram every two years. However, it gives an "I" recommendation for women 75 and older due to insufficient evidence, as clinical trials excluded this age group from screening studies[93]. Furthermore, the American Cancer Society (ACS) recommends annual mammograms for women aged 45-54 and biennial mammograms for women aged 55 and older who are expected to live for at least 10 years[94]. In 2015, around 231,840 women in the United States were diagnosed with BC. Although progress has been made in early detection and treatment, an estimated 40,290 women were expected to succumb to the disease that year, resulting in the loss of 783,000 potential years of life[94].

Breast cancer incidence and mortality rise with age, reaching their highest rates around age sixty, with a noticeable increase starting at age 40. However, in Latin America, twenty percent to thirty percent of breast cancer cases are diagnosed between the ages of twenty and forty-four, nearly double the proportion seen in the United States and Canada. In Asia and Africa, the peak age at diagnosis occurs between forty and fifty years[33]. BC is the most prevalent cancer in U.S. women. While mammography starting at age forty reduces mortality, it poses risks like false positives and overdiagnosis, leading to varying guidelines on when to begin, end, and how frequently to screen[95]. BC is the most prevalent life-threatening cancer diagnosed in women and holds the second position as a cause of cancer-related mortality among U.S. women. While women aged 70 and older constitute 31% of diagnoses, they represent a disproportionate 47% of breast cancer deaths[76].

Biomarkers and therapeutic

Hepatocellular carcinoma (HCC) incidence is rising, with poor long-term outcomes despite therapeutic advancements and early detection. Long noncoding RNAs (lncRNAs) and lipid metabolism are key in HCC development, where increased lipid synthesis drives tumor progression. LncRNAs regulate lipogenic enzyme expression, and lipid metabolism-related (LMR)-

lncRNAs accelerate HCC onset. These LMR-lncRNAs may serve as novel prognostic biomarkers and therapeutic targets(BTT)[96]. The study employed Mendelian randomization to identify novel BTT for BC. It discovered that reduced levels of CASP8, DDX58, CPNE1, ULK3, and PARK7, and elevated levels of TNFRSF9, TNXB, DNPH1, and TLR1 are associated with an increased risk of breast cancer. Among these, the CASP8 and DDX58 exhibited robust evidence, while ULK3 demonstrated potential as a prognostic biomarker and a promising therapeutic target[97].

Breast cancer heterogeneity leads to varied outcomes. Mast cells play a crucial role in tumor development and prognosis across subtypes. Mast cells promote tumor-initiating properties of cancer cells, enhancing stem-like features through heparanase activity and heparan sulfate stimulation. Mast cells further enhance estrogen receptor expression, particularly in HER2-negative cells, promoting mammosphere formation, stem-related gene expression, and tamoxifen resistance. This reveals a novel mechanism by which mast cells contribute to breast cancer aggressiveness, with subtype-specific effects[98]. The study found that the combination of TGF-β and TNF-α significantly upregulated MMP-9 expression more than either agent alone, suggesting a synergistic effect in promoting cancer invasion and metastasis. This upregulation was mediated through the TGF-βRI/Smad3 pathway and histone methylation[99]. Hypoxia, or low oxygen levels, drives tumor growth and spread by activating HIF-mediated gene expression, which alters tumor metabolism, migration, invasion, and the tumor microenvironment. Brief periods of hypoxia create a "hypoxic memory" that persistently suppresses IFN signaling and antigen presentation pathways, further promoting tumor progression. However, the histone deacetylase inhibitor entinostat can reverse this effect, providing a potential strategy to combat tumor advancement[100].

Recent research on breast cancer identified LGALS2 as a key marker in tertiary lymphoid structures (TLSs), promoting immune responses via TLS-associated dendritic cells. Elevated LGALS2 expression is linked to improved survival and robust anti-tumor activity, suggesting its potential in TLS-targeted immunotherapy and personalized treatment strategies[101]. Around 70% of breast cancer cases are classified as ERα positive and are managed with hormonal therapies. Cancers that overexpress HER2 are found in 25-30% of cases and are often treated with Trastuzumab. Triple-negative breast cancer (TNBC) accounts for 15-20% of cases and does not have specific targeted therapies, leaving traditional chemotherapy as the primary treatment. Resistance, whether intrinsic or developed over time, leads to treatment failures across all these breast cancer subtypes[102]. Breast cancer diagnosis in Rwanda costs US$ 138.29 per patient, with biomarker analysis making up 48.7% of the expense. Using STRAT4 reduces diagnosis costs by US$ 7.33 (10.9%) and pathologist time by 20 minutes (60.6%). Cost savings are limited in labs with high antibody efficiency, but HER2 testing is increasing[103].

Breast Cancer: A Formidable Challenge

In Africa, BC claimed 74,072 lives in 2018, with an estimated 168,690 new cases. The age-standardized incidence rate ranged from 6.9/100,000 in the Gambia to 69.6/100,000 in Mauritius, with an overall rate of 37.9/100,000. The age-standardized mortality rate varied from 4/100,000 in the Gambia to 29.1/100,000 in Somalia, with an overall rate of 17.2/100,000. The study found that Nigeria had the highest burden of breast cancer, with 26,310 cases and 11,564 deaths, followed by Egypt with 23,081 new cases and 9,254 deaths. The

mortality-to-incidence ratio for Africa was 0.44, ranging from 0.24 in Libya to 0.68 in the Central African Republic[104]. BC arises from the epithelial tissue of mammary glands, utilizing an amoeboid mechanism for translocation. Cancer cells undergo a process known as epithelial-mesenchymal transition (EMT), which allows them to acquire migratory and invasive properties. Subsequently, these cells may undergo a mesenchymal-epithelial transition (MET), enabling them to metastasize to lymph nodes and distant organs, such as bones, liver, and the brain[105]. The capacity of BC cells to spread and form new tumors in other parts of the body is the main reason for unsuccessful treatment and death. The metabolic characteristics of BC cells are shaped by inherent factors like MYC, PIK3CA, and TP53, as well as external factors such as low oxygen levels, oxidative stress, and acidic conditions[106]. BC is the most prevalent malignant tumor worldwide, and metabolic reprogramming is a defining characteristic of cancer, supporting the unrelenting growth and metastasis of tumor cells. BC cells reprogram their metabolism through diverse mechanisms, and altered metabolism contributes to therapeutic resistance. Comprehending the metabolic adaptability underlying breast cancer progression and devising metabolic interventions are pivotal for developing innovative therapeutic approaches[107].

Metabolism challenges in breast cancer

The study examined how obesity, telomere shortening, and breast cancer progression are related, focusing on estrogen receptor-positive (ERα+) postmenopausal cases. It highlights leptin's role in activating telomerase, estrogen receptors' impact on cancer growth, and potential therapies targeting telomerase and estrogen pathways[108]. Altered metabolism is a promising yet challenging therapeutic vulnerability. Tumor cells can adapt their metabolism based on their stage of progression, location, and treatment. External factors like nutrient levels, oxygen availability, and acidity can also influence their metabolic processes. Cancer cells reshape their surrounding environment to support their metabolic changes and proliferation. Effective metabolic therapy requires precision medicine integrating genomics, proteomics, and metabolomics to stratify patients[102]. ERα plays a key role in controlling adipose tissue metabolism, which is vital for breast cancer research. The interaction between adipocytes and mammary epithelial cells can lead to important metabolic changes. 17β-estradiol (E2) enhances insulin receptor expression while decreasing the lipogenic function of lipoprotein lipase in adipose tissue[109]. The processes by which dysfunctional adipocytes linked to obesity contribute to breast cancer stemness remain poorly defined. Research by Gao et al. revealed that the transcription factor TAZ in adipocytes significantly elevated the secretion of cytokines, while the knockdown or absence of TAZ reduced the tumor-enhancing properties of cancer-associated adipocytes (CAAs)[110].

Liu et al. identified cellular adaptation as the main factor driving obesity-related tumor growth, as opposed to preexisting clone expansion. Their research revealed that palmitic acid, derived from cancer-associated adipocytes, stimulated breast cancer cell initiation via a C/EBPB-dependent pathway[111]. CAAs enhance breast cancer stem cell (BCSC) activity through metabolic reprogramming, specifically by activating the FAO-AMPK-YAP pathway. Within this pathway, YAP is critical in maintaining mitochondrial redox balance and supporting BCSC stemness[112]. A reciprocal relationship exists between endothelial cells and cancer stem cells (CSCs), mediated by LPA/PKD-1 signaling. Breast cancer stem cells (BCSCs) tend to cluster near

blood vessels, utilizing the vasculature to support their migration and access essential nutrients[113].

Breast Cancer in East Africa: Incidence, Treatment, and Knowledge Gaps

As reported in the 2018 GLOBOCAN statistics, the most commonly diagnosed cancers in Africa included breast, cervical, prostate, liver, and colorectal cancers. The primary contributors to cancer mortality were cervical, breast, prostate, liver, and colorectal cancers. However, only breast, colorectal, liver, and ovarian cancers were adequately represented in studies focusing on cancer genetics and genomics[37]. However, reports highlight a significant shortage of published studies on RT for BC in Africa, coupled with lower overall survival rates than those in high-income countries. To enhance BC survivorship, governments and healthcare planners must allocate more resources for RT and establish training initiatives for healthcare personnel[114]. According to the study, in Sub-Saharan African countries, 60% of breast cancer patients underwent only surgical treatment, 52 percent received RT after surgery, and 19percent received chemotherapy[115]. The treatment options for breast cancer patients vary across different regions, depending on factors such as the stage of cancer at diagnosis, availability of medical resources, patient age, and the cost of treatment[116].

BC is the most prevalent cancer in Burundi, with 802 new cases reported. It is also the leading cause of cancer-related deaths, accounting for 468 fatalities. As the top cancer in the country in terms of both incidence and mortality, breast cancer poses a significant health concern, underscoring the need for enhanced screening and treatment initiatives[117]. Available data estimates the number of new cancer cases in Burundi at 6,743 in 2012, 8,682 in 2018, and 7,929 in 2020. These figures, however, are approximations derived from neighboring countries' data, as Burundi lacks a formal cancer incidence registry[118].

BC mortality rates are highest among women of African descent in the U.S., who are also more likely to develop aggressive forms of the disease. Whole-exome sequencing of tumors from African American, European American, and Kenyan patients revealed distinct mutational profiles, particularly in TP53 and ARID1A, suggesting genetic differences that could impact treatment and outcomes across these populations[119]. BC is the most common type of cancer affecting women in Kenya, comprising 23% of all cancer cases among the female population[120]. In Kenya, 70-80% of cancer cases, particularly breast cancer, are diagnosed at late stages, leading to high mortality among women[121]. According to reports, 86% of women in Western Kenya had not undergone any breast cancer screening previously[122]. Women living in rural areas and the North Eastern Province of Kenya have lower odds of being screened for breast cancer. Additionally, women who are less educated, poorer, and uninsured are less likely to have been screened[120]

In Rwanda, BC accounts for 15.8% of all cancer cases, and new diagnoses are rising as more people undergo screening. However, early detection of BC can lead to effective treatment and extended lifespan, and palliative care is available [56]. A study conducted in Uganda found that despite receiving education about breast cancer, some women still do not participate in downstaging. However, education and using cell phone messaging by healthcare providers were found to increase engagement in downstaging efforts(**Table:1**)[27]. A cross-sectional study conducted in Kinshasa revealed that only 22.09% of participants had a strong understanding of BC, while a substantial 77.91% lacked adequate knowledge about it. Although 65.85%

recognized breast self-examination (BSE) as valuable, only 27.81% learned how to perform it, and 44.17% practiced it. Higher education and prior screening were key to better knowledge[123]. Additionally, in another study of 4,315 women, 1,113 radiological breast examinations revealed 101 malignant lesions. Among the breast cancer cases, 56% were under 50 years old, with 75% classified as stage III tumors. A genetic alteration in the BRCA gene was identified in a family with a substantial history of BC[16].

The breast cancer awareness campaign reached 4,315 women, of whom 497 had a palpable mass. 133 women consulted the radiology department, where BIRADS 3, 4, and 5 lesions were identified. The campaign led to an increase in breast examinations at the hospital, from 312 in 2010 to 416 by 2012, with 1,113 mammographies performed and 167 suspicious lesions biopsied[16]. A collaborative cervical and breast cancer education program was customized for Somali women in Nebraska, covering reproductive health, cancer knowledge, and screening. The 2-day sessions, led by trained lay health workers, reached 52 women and showed potential for African refugee populations[124]. Somali immigrant women encounter obstacles in accessing breast and cervical cancer screening, such as limited knowledge, cultural barriers, and healthcare system challenges. Recommendations involve providing culturally appropriate education, enhancing community engagement, and training healthcare providers to increase screening rates and support this underserved population[125].

This retrospective study of 237 breast cancer patients in Sudan's largest cancer center found that nearly half had incomplete diagnostic work-ups, regardless of ethnicity or geography. Additionally, a notable proportion of patients with hormone receptor-negative tumors or undocumented subtypes received inappropriate hormone therapy, indicating substantial gaps in the delivery of care[126]. This study compared 114 Sudanese and 138 Italian breast cancer cases. Sudanese patients were younger, with larger, more advanced-stage tumors and more frequent nodal metastases. ER expression differed significantly, but no differences were found for PR, Her-2/neu, CK5/6, CK17, or subtypes. Differences in Sudanese and Italian breast cancer cases reflect diagnosis stages, underscoring the importance of early detection and treatment strategies in Africa[127].

The patient-specific data from Tanzania reveal substantial limitations in the management of breast cancer, including inadequate axillary staging, lack of formal diagnosis, limited biomarker testing, and low rates of completing adjuvant therapy. These challenges underscore the critical need for interventions aimed at improving adherence to clinical guidelines and enhancing the overall quality of patient care[128]. The study conducted at Bugando Medical Centre in Tanzania found that the triple assessment method for breast cancer diagnosis had 100% sensitivity and specificity, indicating its accuracy and ability to provide quick results, making it a viable alternative to traditional open biopsy[129]. A community survey in Tanzania involving 1,129 women aged 30 and older showed that while 73% were aware of cancer, only 10% had received education on breast health, and 14% knew the signs of breast cancer. Despite a willingness to seek care for changes, significant gaps in knowledge about risk factors emphasize the need for targeted awareness campaigns[130]. The hospital-based cross-sectional study conducted in Mwanza Tanzania enrolled 354 patients (1 male: 32 females), finding 134 (37.9%) with malignant lesions and 220 (62.1%) with benign lesions. Conventional FNAC showed a diagnostic

accuracy of 92.0%, while ultrasound-guided FNAC achieved 100% accuracy with no error margin[131].

Recommendations

An analysis of 23 BC screening guidelines issued between 2010 and 2021 across 11 countries revealed discrepancies in quality. The majority advocated for annual or biennial mammography for women aged 40 to 74 while emphasizing earlier screenings for those at higher risk. Notably, most guidelines originated from developed nations, highlighting the need for localized adaptations in low- and middle-income countries (LMICs)[132]. BC in adolescents and young adults has a greater likelihood of recurrence. Conservative surgery combined with radiation therapy is the recommended approach. Adjuvant systemic treatments, such as chemotherapy and endocrine therapy, are frequently required. Early detection through screening can enhance treatment outcomes[133]. In the United States, 1 in 196 cases under forty years old is diagnosed with BC, frequently exhibiting aggressive subtypes. Adolescents and young adults necessitate comprehensive staging, genetic testing, and multidisciplinary care addressing fertility, genetics, rehabilitation, and psychosocial needs. Clinical trials are strongly recommended[134]. In 1999, California saw around 19,000 breast cancer diagnoses, resulting in 4,600 deaths. Early detection, education, and effective treatment were crucial during this time. Focus groups with 42 low-income women revealed significant barriers to accessing early detection services, highlighting the need for targeted solutions. These challenges are also seen in low-income nations, particularly in SSA, where limited healthcare access, lack of awareness, cultural stigmas, and inadequate resources for screening and treatment remain persistent issues(**Table:1**)[135]. However, Low- and middle-income countries should adopt evidence-based guidelines with higher AGREE II scores[132]. We suggest 6 main recommendations for Strengthening Breast Cancer Prevention and Care in Sub-Saharan African countries:

1. Empowering Communities through Education

- Grassroots Initiatives: Launch local campaigns designed to enhance awareness of breast cancer, focusing on risk factors, early detection techniques, and the critical importance of timely medical intervention.
- Tailored Educational Programs: Offer a variety of workshops, seminars, and mobile health services aimed at delivering essential information to women from diverse backgrounds, ensuring that language and cultural differences are addressed.
- Collaborative Efforts: Work alongside community leaders, healthcare practitioners, and advocacy groups to create a nurturing environment that supports women navigating breast cancer challenges.

2. Increasing Access to Screening Services

- Affordable Diagnostic Options: Make mammograms and clinical breast examinations financially accessible to women across all socioeconomic backgrounds.
- Mobile Health Clinics: Utilize mobile units to bring screening services directly to underserved regions, ensuring convenience and accessibility for women in those communities.
- Financial Support Programs: Develop initiatives to provide financial assistance for women in need, covering the expenses associated with screening and treatment.

3. Overcoming Cultural and Social Obstacles

- Educational Outreach Initiatives: Conduct campaigns aimed at dispelling cultural myths and stigma related to breast cancer, fostering an environment that

encourages open discussions and reduces the anxiety associated with diagnosis and treatment.

- Community Leadership Involvement: Engage local leaders and influential figures to advocate for breast cancer awareness and motivate women to pursue early medical evaluations.
- Support Networks: Establish groups and networks to offer emotional and practical support to women diagnosed with breast cancer.

4. Integrating Health Services

- Collaborative Health Programs: Align breast cancer prevention and care strategies with existing health initiatives, such as those focused on maternal and child health, to create a cohesive approach to women's health.
- Utilizing Existing Healthcare Resources: Capitalize on the current healthcare framework and resources to facilitate easier access to breast cancer-related services.
- Comprehensive Health Services: Ensure that women receive an all-encompassing suite of healthcare services that address prevention, diagnosis, treatment, and post-treatment care.

5. Enhancing Access to Genetic Counseling and Testing

- Improved Access to Genetic Services: Increase access to genetic counseling and testing for women at higher risk of developing breast cancer.
- Tailored Healthcare Guidance: Offer personalized recommendations based on genetic predispositions, empowering women to make informed health decisions.
- Support for Preventive Options: Assist women in considering preventive measures, including risk-reduction surgeries or pharmacological options.

6. Implementing a Multidisciplinary Care Framework

- Comprehensive Support Systems: Create a structured approach to multidisciplinary care that caters to the physical, emotional, and social dimensions of women with breast cancer.
- Coordinated Care Efforts: Integrate the skills of healthcare providers, mental health professionals, and social workers to deliver holistic support.
- Patient-Centered Care Philosophy: Center the treatment experience around the patient's preferences and requirements throughout their healthcare journey.

Conclusion

Addressing the complex challenges surrounding breast cancer awareness and screening in Africa is crucial. Introducing targeted educational programs, expanding access to affordable screening options, and confronting cultural stigmas can improve early detection and treatment, enhancing health outcomes and reducing mortality rates for women in the region.

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