**Breast cancer in Africa:**

**Screening, diagnosis and treatment**

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**Abbreviations:**

CBE Clinical breast exam

CHW Community health workers

LMC Low and middle income countries

HDI Human development index

FNA Fine needle aspiration

BIRADS Breast Imaging Reporting and Data System

BHGI Breast Health Global Initiative

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Table of Contents

[Introduction 3](#_Toc436648267)

[Statistics 4](#_Toc436648268)

[Late stage diagnosis 5](#_Toc436648269)

[Infrastructure 7](#_Toc436648270)

[Policy: Cancer control plans 8](#_Toc436648271)

[Pathology 10](#_Toc436648272)

[Cancer Registries 11](#_Toc436648273)

[Access to treatment 13](#_Toc436648274)

[Information, awareness and education 16](#_Toc436648275)

[Breast Cancer Early Detection 18](#_Toc436648276)

[Screening practices and behaviors in Africa 23](#_Toc436648277)

[Conclusions 24](#_Toc436648278)

[References 26](#_Toc436648279)

Introduction

The continent of Africa is made up of 55 states, the majority of which are classified as Low- and Middle-Income Countries (LMICs).(The World Bank, 2015) Forty-eight are categorized as sub-Saharan, and the remaining seven are in North Africa. These countries are linguistically, culturally, demographically and ethnically diverse. Unfortunately, one area of commonality shared by African women regardless of their nationality is poor outcomes from breast cancer with associated high mortality rates. The recent CONCORD-2 study of 5 year breast cancer survival rates from 1995-2009 based on the analysis of individual data from 279 population-based registries in 67 countries, reported that in High Income Countries (HICs) age-standardized net-survival rates were in excess of 85%.(Allemani et al., 2015) One country in Africa, Mauritius, a HIC island nation off the coast of Madagascar, had similar 5-year survival rates of 87.4 (78.1–96.7) and North African countries had more favorable outcomes including 59.8 (48.6–71.1) in Algeria; 76.6 (55.5–97.7) in Libya (Benghazi registry); and 68.4 (64.5–72.2) in Tunisia. By contrast, data are available from only 2 sub-Saharan African countries: South Africa, 53.4 (35.5–71.3); and Mali, 13.6 (0.0–30.1) both of which are significantly inferior to other regions around the world.(Allemani et al., 2015)

The reasons for these disparities are varied. Cancer remains a low priority for much of the population in Africa, with many barriers impeding women’s access to affordable effective breast health care, including gaps in the receipt of accurate, culturally appropriate information on breast health including signs and symptoms of breast cancer; access to breast cancer early detection and to appropriate and timely diagnosis and treatment. These barriers can be cross-cultural such as endemic poverty, a lack of infrastructure, inadequate training and expertise, inequitable distribution of services in urban vs. rural areas, and poverty.(Harford, 2015) Barriers, which are rarely encountered in HICs such as major transportation deficits, are common in Africa. A study in the republic of South Africa reported that increasing residential distance from hospitals was associated with risk of late stage diagnosis (Dickens et al., 2014), and a study in Cameroon reported that 23% of patients seen over 2 months in 2010, travelled for >7 hours to reach the hospital to receive treatment for cancer.(Price et al., 2012) Unfortunately, many countries in the region also have a history of military conflict and political instability which contribute to fragmented health infrastructure, and often disrupt established health care practices.(Spiegel et al., 2014). Finally, other more culturally specific barriers also limit women's ability to seek care even where it is available and include such as sociocultural influences as use of traditional medicines, discrimination, stigma, and cultural taboos, along with fears mastectomy and of abandonment after a diagnosis of breast cancer. (Daher, 2012; Nour, 2003) For example, a Nigerian study of 2154 breast cancer patients where 87% presented with stage III or IV disease reported that the most common reasons for delay in seeking treatment were preference for prayer houses or spiritual healing homes (13.5% of patients); a belief that the lesion was due to inflammation (8.5%); preference for native doctors or herbalists (23.1%) and economic reasons (10.2%).(Ajekigbe, 1991) A Rwandan report of 144 breast cancer patients seen at rural hospitals, reported that seeing a traditional healer first were significantly associated with a longer delay in seeking treatment, a risk factor for late stage diagnosis.(Pace et al., 2015)

Investment in healthcare overall in the region is limited. Total expenditure on health per capita (US$) in 2013 in counties classified by the World Bank as low income averaged US$36, compared to $277 in middle-income countries, and $4,687 in HIC (Table 1).(The World Bank, 2015). Competing burdens of communicable diseases, and high child and maternal mortality rates, make it difficult for many countries to prioritize health spending on cancer, especially as rates of cancer have historically been lower than in HICs.(Galukande and Kiguli-Malwadde, 2010) Despite the increase in breast cancer incidence and the concomitant increase in breast-cancer related mortality, spending on all cancers averaged only 5% of the total expenditure on health.(Farmer et al., 2010). In addition, the lack of cancer registries and access to appropriate statistics on incidence and mortality rates in many African countries, may contribute to a lack of awareness about the magnitude of the current and future cancer burden among policy makers and the general public.

Statistics

Breast cancer is the second most common cancer worldwide, and the most common cancer in women (1.7 million cases, 11.9% of total cases); incidence rates vary nearly fourfold across the world regions, with rates ranging from 27 per 100,000 in Middle Africa to 96 in Western Europe. (Ferlay et al., 2015) However, it is the most frequent cause of cancer death in women in LMICs (324,000 deaths, 14.3% of total deaths).

While breast cancer incidence is lower in LMICs, its incidence is increasing rapidly compared with HIC, where rates have been stable or have declined since the early 2000s. Between 1990 and 2013, age-standardized incidence rates (ASIR) per 100 000 have increased by 17% globally (44.36 to 51.73), by 46% in developing countries (27.74 to 40.40) and by 8% in developed countries (69.75 to 74.98).(Fitzmaurice et al., 2015) For breast cancer in 2012, Globocan reported that more cases occurred in less developed (883,000 cases) than more developed regions (794,000).(Ferlay et al., 2015) In addition, the burden of breast cancer is greater in LMICs: breast cancer caused 13.1 million disability-adjusted life-years (DALYs) s in 2013; 63% occurred in developing countries and 37% in developed countries.(Fitzmaurice et al., 2015)

Similar to other countries with previously low incidence rates of breast cancer, incidence rates of, and mortality from breast cancer are rapidly increasing in the Arab countries in North Africa (Libya, Tunisia, Morocco, Algeria and Mauritania). Breast cancer in Arab women is often diagnosed at a younger age and at a more advanced stage (El Saghir et al., 2006; El Saghir et al., 2002; Ezzat et al., 1999; Salhia et al., 2011) compared to other populations. The ASIR of breast cancer in North Africa for example is currently 2-4 times lower than in western countries (Corbex et al., 2014) but is expected to double in the next 15 years as risk factor exposure increases (including that related to population aging).

In sub-Saharan Africa, the proportion of the disease burden attributable to cancer is rising, and the region is projected to have more than an 85% increase in cancer incidence by 2030, solely based on demographic changes (i.e., a larger and older population than exists presently).(Morhason-Bello et al., 2013) Unfortunately, the overall case fatality from breast cancer, as estimated by the ratio of mortality to incidence (MIR) in a given region or country, is consistently higher in LMICs (Table 2).(Ferlay et al., 2015; Ferlay et al., 2013) Overall cancer mortality in sub-Saharan Africa is high because of poor infrastructure, insufficient numbers of health-care workers, advanced stage at presentation, reliance on traditional therapies, few treatment choices, and poor compliance with treatment regimens.(Kingham et al., 2013)

Late stage diagnosis

Late stage diagnosis is a principal barrier to improving outcomes in women with breast cancer in LMICs. Down staging of disease is one of the more important strategies in areas where limited treatment will have the most chance of success. However the women in this region with symptoms of breast cancer do not seek medical attention, leading to late stage presentation, and poor prognosis. Barriers to reducing stage at diagnosis include lack of screening and early detection services, poverty, limited awareness of early signs and symptoms of cancer among both the public and health care providers, reliance on traditional beliefs and treatments, and stigma associated with a diagnosis of cancer.(Daher, 2012; Keusch et al., 2006)

Delayed presentation is common: for example one study reported a mean delay of 11.2 months between the onset of symptoms and presentation in Nigerian women diagnosed between 1996 and 2003, (Adesunkanmi et al., 2006) and a second study found that 65% of women waited more than 3 months after symptoms appeared before seeking treatment.(Adisa et al., 2011) A study of 66 Ghanaian patients with breast cancer found that while 14 (21.2%) of the breast cancers were discovered through breast education and clinical breast examination (CBE) as offered through outreach programs, women commonly waited between 6 weeks to 2 years before seeking formal diagnosis and treatment.(Clegg-Lamptey et al., 2009) Two Cameroonian studies found significant delays in seeking care: one study examined 531 women seen over a 10 year period, and found that the mean delay before presentation at hospital was 10.4 months, and 54.9% had used traditional medicine before medical evaluation. Metastasis and locally advanced breast cancer at diagnosis were present in 8.1% and 62.8%, respectively.(J.D. Kemfang Ngowa et al., 2011) A second study reported that 35% percent of patients waited >6 months to speak to a health care provider after the first sign of their cancer.(Price et al., 2012) A report of 200 Libyan women diagnosed with breast cancer between 2008 and 2009 found that 56% were diagnosed within a period more than 6 months after presentation of symptoms.(Ermiah et al., 2012) One hundred and forty-four breast cancer patients in 2 rural hospital in Rwanda had a median total delay between symptom presentation and treatment of 15 months, resulting from a combination of both patient delays in seeking treatment, and health system delays (both a median of 5 months); patient and system delays of ≥6 months were significantly associated with diagnosis at more advanced-stages.(Pace et al., 2015) Finally, an Eritrean study of 82 newly diagnosed breast cancer patients, reported that more than 60% presented after >2 years following onset of symptoms, and 66% of patients had late stage disease.(Tesfamariam et al., 2013) These delays in seeking care result in diagnosis at a more advanced stage compared to other populations.

The African Cancer Registry Network (AFCRN) encourages registries to record stage at diagnosis, although a recent review found that less than half were recording TNM status.(Gakunga and Parkin, 2015) Thus, the majority of reports at the present come from retrospective reviews of breast diagnoses at individual cancer hospitals or treatment centers. Nonetheless, the reported stage of diagnosis from a variety of studies is broadly consistent, with the majority of women presenting with late stage disease: approximately 70-80% of tumors were diagnosed as stage III or IV. A review of 225 breast cancer cases diagnosed at the Angolan Institute of Cancer Control in 2009, reported 176 (77.8%) were classified as stages III or IV.(Lopes et al., 2015) Data on tumor size and stage of breast cancer from a random sample of women diagnosed with breast cancer between 2008-2009 from population-based cancer registries in Abidjan (Côte d'Ivoire; 141 cases) and Brazzaville (Republic of Congo; 139 cases) reported that in the Côte d'Ivoire, 68% of tumors were ≥5cm in diameter and 74% were stage III or IV; in the Republic of Congo, 63% were ≥5cm and 81% were stage III or IV.(Islami et al., 2015) More than half of all histologically confirmed breast cancer patients (N=385) seen between 1991 and 2005 at the Obafemi Awolowo University Teaching Hospital in Nigeria had metastatic disease and more than two-thirds had more than one secondary site on initial evaluation. The 1-year survival rate was 27%.(Adisa et al., 2011) Of 297 patients with breast cancer seen at a hospital in Uganda between 1996 -2000, 77% presented with stage III or IV disease (Gakwaya et al., 2008b), and 85.2% of 330 Ghanaian breast cancer patients had stage III or IV tumors.(Ohene-Yeboah and Adjei, 2012) Similar results were found in a review of characteristics of women with breast cancer in several countries in Western Africa.(Sighoko et al., 2013)

Infrastructure

Cancer care in any country is a costly, complex and multi-step endeavor, particularly for breast cancer, a heterogeneous disease, where effective treatment is dependent on early detection and diagnosis. Given that the majority of African countries spend less than 6% of their GNP on all healthcare, which also must cover communicable diseases, the scale of the problem can be overwhelming.(Strother et al., 2013)

While some middle income African countries, such as South Africa and Ghana have several cancer centers, others have none.(Stefan et al., 2013; Stulac et al., 2015) Among existing facilities, there are a lack of trained personnel and technology. For example, a 2013 review of teletherapy units in Africa found that the average number of units was 0.22 per million people in sub-Saharan Africa, with the majority being located in urban referral hospitals. Many African countries have no radiotherapy machines at all.(Abdel-Wahab et al., 2013)

With a history of profound lack of investment in breast health care, the question of ‘where to start’ is difficult to answer. However a number of African countries in partnership with international agencies are making significant strides in improving components of breast health care. In addition, tools such as the Breast Health Global Initiative’s (BHGI) ‘evidence-based, economically feasible, and culturally appropriate’ guidelines for breast health care can allow countries to implement programs that are most appropriate to their resource level. These guidelines were developed according to a 4-tiered system, depending on the availability of resources, and classified as ‘basic’, ‘limited’, ‘enhanced’ and ‘maximal’ level services. For example, for early detection programs, basic level services are appropriate where mammography services are unlikely to be available, and encompass breast health awareness campaigns emphasize obtaining a history of symptoms suggestive of breast cancer and CBE in women who seek medical care. Limited level services are intended for areas with resources for diagnostic imaging, such as ultrasound and mammography, but not for mammographic screening.(Anderson et al., 2011; Anderson et al., 2008; Smith et al., 2006)

The International Atomic Energy Agency (IAEA) Program for Action for Cancer Therapy (PACT) carries out comprehensive cancer control capacity and needs assessments, known as ‘imPACT’ review missions, and in 2014 completed reviews in 10 countries, including Mozambique, and Rwanda. In Mozambique, key challenges identified were (i) human resource needs for different disciplines related to cancer care and control; (ii) capacity requirements in infrastructure, equipment and workforce at the tertiary level to ensure access to timely and efficient treatment for early detection programs; and, (iii) lack of radiotherapy services. A National Strategic Plan (July 2014 – June 2019), addresses cancer policies, including a national plan to allocate resources to all cancer care components (including radiation therapy) at eleven provincial hospitals and one center of excellence.(IAEA, 2015c)

A critical barrier to providing cancer care in LMICs is the profound shortage of health professionals. According to WHO, 57 countries worldwide including 36 in sub-Saharan Africa, are experiencing a critical shortage of health professionals including surgeons, radiologists, nurses and oncologists.(IAEA, 2015c; Kingham et al., 2013; Stulac et al., 2015) In order to achieve sustainable breast cancer control capacity in developing countries, and in Africa in particular, a large increase in professionals trained locally or regionally is needed. IAEA-PACT has called for measures to strengthen local recruitment and ensure retention of graduates from national training programs, and is currently supporting Virtual University for Cancer Control network (VUCCnet) and the Regional African Cancer Training network (RACT): A training program on-site at several cancer centres in sub-Saharan Africa, in collaboration with WHO, IARC, the Union for International Cancer Control (UICC), the US National Cancer Institute (US NCI), the African Organization for Research and Training in Cancer (AORTIC), and with private sector funding from Roche.(IAEA, 2015c) VUCCnet and RACT are part of *the EDUCARE (EDUcation for Cancer in African REgions) Initative.* Ghana, Uganda, United Republic of Tanzania and Zambia comprise the initial intervention countries with South Africa and Egypt acting as mentor countries.(IAEA, 2015c) In 2010 PACT and BHGI developed an initiative in Ghana to implement a learning lab with a focus on breast cancer control, using the VUCCnet platform.(IAEA, 2015b)

Policy: Cancer control plans

The World Health Organization developed guidelines for regional and national cancer control programs stratified by national economic development. The WHO recommends cancer control programs in Africa begin in a stepwise approach by implementing one or two key priorities in a demonstration project. The WHO stated that ‘projects could be sustainable only when African countries take the initiative and make the political commitment to invest in the programs with a dedicated budget and required staff.’(World Health Organization, 2005) A 2013 WHO survey assessing non-communicable disease (NCD) capacity found that of 55 African countries, only 16 had an operational policy/strategy/action plan for cancer.(World Health Organization, 2015a) While some countries lack specific policy program or plan for the prevention or control of breast cancer (WHO: African Health Observatory, 2014), some are attempting to implement a variety of interventions including free health care initiatives, and some have described specific programs from breast cancer control. Country specific examples of breast cancer early detection status include the following:

* In Kenya, a report by the Kenyan Ministry of Health called for enhanced health promotion and education, and to improve early detection of cancer by introducing or expanding screening programs, and by developing guidelines for screening and early detecting of cancer (Ministry of Public Health and Sanitation and the Ministry of Medical Services, 2012). However, many of these have yet to be implemented.(Matheka, 2014) No formal guidelines for breast screening for the country are currently available.
* In Malawi, mammographic screening is available in only one private hospital (Msyamboza et al., 2012) and there are no governmental guidelines on breast cancer screening.
* The Republic of Mauritius developed a National Cancer Control Program for 2010-2014, and recommended that breast health awareness campaigns encouraging BSE and yearly CBE to women >40 years . Population based screening mammography was not thought to be advisable, given the relatively high proportion of cancers in women younger than 45 years.(Republic of Mauritius, 2014)
* There are no formal screening guidelines in Zimbabwe, but a number of non-profit organizations such as the Cancer Association of Zimbabwe and Breast Cancer Alleviation of Zimbabwe recommend breast health awareness and regular BSE.(The Cancer Assocaiton of Zimbabwe, 2014) A recent report by the Zimbabwean Ministry of Health on a strategy setting out national goals for cancer prevention and control from 2014-2018 identified a series of barriers to breast and other cancers screening. These included lack of access to early detection; inadequate resources, equipment and technology, lack of education and awareness of the importance of regular cancer screening, prohibitive costs of screening services, and lack of referral of patients. The goals of this strategy included a reduction of late stage breast cancer presentation from 80% to 50% by 2018.(Ministry of Health and Child Care of Zimbabwe, 2013)
* Since 2011, Rwanda has been proactive in developing a national cancer program.(Stulac et al., 2015) The national cancer plan was developed by a technical working group of clinicians, civil society representatives, NGOs and international partners to create a program integrating components of the WHO National Cancer Control Plan framework while incorporating experiences of partners from South Africa, the U.S. and Europe. The first national cancer control protocols were first endorsed in 2012 and provide guiding principles on cancer diagnosis and treatment at the Butaro Cancer Center of Excellence (BCCOE), which is the first rural cancer center to deliver comprehensive cancer services in the country through a decentralized health system that prioritizes equitable access to all levels of care. BCCOE was created and is supported through a unique twinning partnership between the Rwandan Ministry of Health (MOH), the NGO Partners in Health and Harvard Medical School. While no breast screening program has yet been instituted, the MOH has supported education of community health workers in supportive care and provided information to women to support breast health awareness. The feasibility screening with the use of CBE at initial point of contact has been evaluated as a national initiative at the request of the MOH,(Abdalla et al., 2013) (but the program has not yet been implemented.
* In Egypt, cancer has become a national priority with the publication of the 2014–20 national cancer plan (Hamdi Cherif et al., 2014), but it is unclear whether any progress has been made. No data on breast screening policies or practices are published.

Pathology

Accurate diagnosis is a cornerstone of effective breast cancer control. BHGI guidelines emphasized the importance of a pathologic diagnosis before initiation of treatment.(Shyyan et al., 2006; Shyyan et al., 2008) However, the process is complex and requires specialized training correct tissue preparation and consensus diagnoses. The capacity and infrastructure necessary to perform adequate pathological assessment of breast cancers is lacking in the majority of African countries. A recent informal survey which aimed to capture the number of pathologists working in African countries reported that, with the exceptions of Botswana and South Africa, all countries in the region have fewer than one pathologist (including all practice sub disciplines) for every 500,000 people, with many having fewer than one per million. One country (Somalia) did not have any active pathologists (Table 1). (Adesina et al., 2013; Awadelkarim et al., 2010) Adesina et al recommended 3 necessary components to ensure provision of effective pathological services including meeting system needs, quality assurance needs and workforce needs.(Adesina et al., 2013; Adeyi, 2011)

A major limitation to breast cancer care in sub-Saharan Africa is the shortage of pathologists, resources and infrastructure. BHGI guidelines stratified diagnostic and pathology methods into basic, limited, enhanced, and maximal. Minimal requirements at the basic level include obtaining a medical history from patients, performing a CBE, a tissue diagnosis, and maintaining high quality medical records. The latter is not an insignificant issue: a Cameroonian retrospective study of 531 patients with breast cancer reported that 33% of medical files were incomplete, or missing, and stated that the ‘problem of medical records is a big concern in developing countries, and it represents a major handicap for medical statistics and research in this setting.’(J.D. Kemfang Ngowa et al., 2011)

At the limited level, with increasing availability of resources, several approaches are proposed for improving breast pathology, including training pathologists, establishing pathology services in centralized facilities, and organizing international pathology services.(Shyyan et al., 2006) The importance of the development of optimal breast pathology services has been identified by the BHGI as a fundamental requirement for the delivery of quality breast healthcare with an emphasis on patient outcome.(Masood et al., 2008) Immunohistochemical marker assessment is necessary to determine estrogen receptor (ER) status, but the resources needed are beyond the scope of available resources in some situations.(Anderson et al., 2003) While the 2005 BHGI guidelines included assessment of HER-2/neu oncogene status and IHC detection of metastases in axillary lymph nodes including sentinel lymph nodes, it was classified as appropriate for high level resource settings where trastuzumab is available for treatment of HER-2/*neu* positive cancers.

Several promising international collaborations to improve diagnostic pathology services are in place. One between the Ghanaian Komfo Anokye Teaching Hospital (KATH), and University Hospital of North Norway (UNN), resulted in development of a 5-year plan to re-establish surgical pathology at KATH, where hematoxylin and eosin (H & E) stained slides have been sent to UNN for review and Ghanaian pathologists received training at UNN. (Stalsberg et al., 2008) Since that collaboration, KATH has improved cancer surgical pathology diagnosis from 35% in 2004 to >80% in 2010; and pathology services were extended to cover Regional and District Hospitals in northern Ghana.(Awuah, 2012)

A collaboration between the Malawi Ministry of Health, Kamuzu Central Hospital, and the University of North Carolina at Chapel Hill in the United States (U.S.), resulted in the opening of the first diagnostic pathology laboratory in Lilongwe in 2011. The authors cited virtual microscopy or ‘telepathology’ as an important aspect in building a collaborative relationship between pathologists and clinicians in Malawi and the U.S., allowing exchange of ideas, and professional development activities. Over the first two years of operation, the laboratory described an increasing workload, a transition away from reliance on telepathology, and the return of a number of Malawian pathologists to the laboratory from other countries. (Gopal et al., 2013) Similar collaborations to develop capacity have been described in Uganda (Stulac et al., 2015) Finally a variety of volunteer organizations have coordinated the efforts of volunteer pathologists to improve and provide affordable pathology services to underserved patients in LMICs, by establishing pathology laboratories, providing diagnostic pathology services, and training local physicians as pathologists. As of 2011 projects have been completed or are currently active in Kenya, Eritrea, Madagascar, and Ghana. (Hoenecke et al., 2011)

Cancer Registries

Over 70% of the burden of the increasing incidence of breast cancer will fall on LMICs who are ill-equipped to deal with this burden. The availability of high-quality population-based cancer registration system is a vital component for any evidence-based cancer control program, since it provides direct evidence of changes in outcome following policy changes and interventions. Adequate data on breast cancer incidence and mortality and associated demographics is essential for assessing the burden of cancer, prioritizing health spending, and evaluating the effectiveness of cancer prevention and control programs. In the recent CONCORD-2 analysis, the authors commented that the absence of civil registration and cancer registry systems in participating countries in Africa made the assessment of recent survival trends from available data almost impossible (Allemani et al., 2015)

In an attempt to address the dearth of cancer registries across the continent, The African Cancer Registry Network (AFCRN) was inaugurated on 1st March, 2012, has 22 members, and aims to improve the effectiveness of cancer surveillance in sub Saharan Africa. (African Cancer Registry Network (AFCRN), 2015) ACRN partners with IARC within the framework of its *Global Initiative for Cancer Registry Development (GICR) in LMICs* to provide a network Regional Hub for cancer registration in Sub-Saharan Africa.(World Health Organization, 2015b) ACRFN provides technical and scientific support to countries seeking to establish population based cancer registries, advocating for cancer registration in this region, and coordinating research projects and disseminating findings and guidelines. Based on past knowledge and existing opportunities, an initial set of starter countries has been selected for each region. The ACRN and GIRC aim to have initiated work on registry-related activities in 20 low- and middle-income countries by 2020 and a further 30 by 2025.(World Health Organization, 2015b)

While the Cancer Incidence in 5 continents (C15, Volume IX) utilized data from only 6 registries which had data of sufficient quality for its estimates; Volume X utilized 8: Algeria (Sétif), Egypt (Gharbiah), Libya (Benghazi), Tunisia, Malawi (Blantyre), South Africa, (PROMEC), Uganda, (Kyadondo County), and Zimbabwe, (Harare) (Forman et al., 2013). A recent paper describing the results of a survey of 23 of the 25 active registries in Africa 2014 (Gakunga and Parkin, 2015) pointed out that while few African registries have meet the high standards of completeness and validity required for inclusion in these analyses, many are functioning well to agreed ACRN standards, and can be used for national cancer control planning. This survey found that the 23 registries who responded had catchment populations ranging from 87,000 (Seychelles) to 48,235,000 (South Africa), with a corresponding range in numbers of cases registered (164–52,706 per year). The majority of data collection was active, and the timeliness of the registries was comparable to that of registries in Europe. (Gakunga and Parkin, 2015) Despite these promising changes, however, 19 countries in Sub-Saharan Africa (23% of the population) have no available information on cancer incidence or mortality. (Ferlay et al., 2015)

Two relevant recent publications include a case study which described the barriers and facilitators to the implementation of a system for representative nation-wide cancer registration in Nigeria (Jedy-Agba et al., 2015), and a report on the current status of cancer surveillance activities including a pilot project in South Africa and use of the GICR framework to propose the development of four population-based cancer registries, (Singh et al., 2015a). The Kumasi Cancer Registry in Ghana, in collaboration with AFCRN, successfully transitioned from a hospital-based cancer registry (initiated in 2004) into a population-based cancer registry in 2012 providing data on cancers in the Ashanti Region.(Laryea et al., 2014) Within the past 10 years a number of other countries have either reestablished or scaled up cancer registries. For example in 2011, South Africa's Department of Health instituted compulsory cancer registration. While the National Cancer Registry was established in 1986, it had become almost inactive after 2004 because of a lack of resources. (National Cancer Registry of South Africa, 2015; Singh et al., 2015b; Stefan et al., 2013) In Egypt, a National Cancer Registry Program of Egypt was established in 2007, and now has a network of population-based registries that contribute data to the national cancer registry. (Ibrahim et al., 2014; National Cancer Registry Program of Egypt; Stefan et al., 2013)

Access to treatment

As discussed earlier, many women do not seek appropriate care when breast cancer symptoms arise, resulting in late stage diagnoses. When women do seek care, treatment is often unavailable due to lack of access to trained personnel, lack of available treatments and economic barriers. For example, a study in Yaoundé General Hospital (YGH), the only hospital in Cameroon where cancer patients can receive chemotherapy from trained medical oncologists, interviewed 79 consecutive patients with a diagnosis of breast cancer, Kaposi sarcoma, or lymphoma in 2010. The delay between first consultation with a health care provider and receipt of a cancer diagnosis was >3 months for 47% of patients. The total delay from the first sign of cancer to receipt of the correct diagnosis was >6 months for 63% of patients. 40% of patients interviewed spent >$200 on a single round of chemotherapy.(Price et al., 2012) The latter highlights a significant barrier to receiving treatment in many African countries: the prohibitive cost.(Kingham et al., 2013) A Ghanaian retrospective study reported that 79.4% of patients with advanced breast cancer cited economic barriers to treatment.(Scherber et al., 2014)

Appropriate treatment for breast cancer includes surgery, radiotherapy and systemic therapy. Systemic therapy for breast cancer can include chemotherapy, hormonal therapy and targeted agents and can be administered pre-operatively (neoadjuvant therapy), as a treatment of locally advanced breast cancer, or post-operatively (adjuvant therapy) for metastatic disease. A retrospective study from 2007-2010 identified the majority of cancer treatments in Malawi as palliative in nature.(Kendig et al., 2013)

##### Radiotherapy

Radiation therapy is an important component of breast cancer treatment programs. Nigerian women with breast cancer diagnosed between 2005 and 2008 and who received a combination of receiving surgery/chemotherapy/radiotherapy had a significant increase in survival outcome compared to those receiving surgery/chemotherapy alone.(Makanjuola et al., 2014) However like many other breast cancer services associated with improved outcome, many African countries are at a significant disadvantage with respect to availability of radiotherapy resources. The IAEA Program for Action for Cancer Therapy (PACT) estimates that there is a lack of at least 5,000 radiotherapy machines in developing countries, and that up to 70% of patients in these countries who may benefit from radiation medicine do not receive it.(IAEA, 2015a) The African Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA) agreement, in cooperation with the International Atomic Energy Agency (IAEA) which funds approximately 75% of AFRA’s budget, provides a framework for its 39 African Member States to collaborate on programs and projects focused on their specific shared needs. AFRA described significant barriers to improving access to nuclear science and technology including lack of adequately skilled and trained personnel and lack of basic nuclear infrastructure in some member states. However, AFRA did identify a number of positive points such as local and international collaborations; implementing AFRA best practices in the region; and African stakeholders focusing on enlarging the scope and sustainability of a number of nuclear programs.(AFRA, 2013)

A recent review of the status of radiotherapy in Africa examined the Directory of Radiotherapy Centers (DIRAC), a database by the IAEA, which is estimated to include 90% of existing radiotherapy facilities worldwide, and contains information about external beam radiotherapy, brachytherapy, dosimetry, ancillary equipment, and trained personnel. The review was a longitudinal assessment of the state of radiation oncology resources in from 2002-2012, and found a direct correlation between gross national income per capita, and average number of teletherapy machines per million population: 8.6/106 population for high-income countries; 1.6 for upper-middle-income countries, 0.71 for lower-middle-income countries; and 0.21 for low-income countries. The 160 radiotherapy centers in Africa have 277 radiotherapy machines (88 cobalt60 units and 189 linear accelerators). However the majority of the machines were located in South Africa (33%) and Egypt (27%), and approx. 20% of the African population live in one of the 29 countries that do not have any teletherapy facilities (Table 1). (Abdel-Wahab et al., 2013; Grover et al., 2015)

A 2011 paper arising from the International Conference on Advances in Radiation Oncology (Salminen et al., 2011) discussed new and existing technologies that may be suitable for LMICs, and identified barriers to establishing basic radiation therapy services in LMICs, including a global shortage of skilled professionals and lack of education and training programs. It also cited recommended that a series of conditions be met before advanced technologies are introduced into a target country, including identifying that a need for advanced technology exists (i.e. patients with curative potential); experience with 3D conformal radiation therapy and advanced treatment planning; adequate imaging services are available; personnel have adequate training in planning, implementation, and QA in advanced technology; continuous medical education system is in place; and that an adequate QA/QC program has been established. Finally it recommended that clinical studies should be undertaken to demonstrate clinical and cost-effective benefits to the advanced technologies.(Salminen et al., 2011)

It should be noted that, where radiation therapy services do exist, patients may chose or be prevented from attending radiotherapy clinics. A Nigerian study of 385 women diagnosed with histologically confirmed breast cancer, where over 50% had metastatic disease, found that only 30% of women referred to a local center for radiotherapy attended their first appointment.(Adisa et al., 2011)

##### Chemotherapy

Access to treatment for breast cancer in LMICs is limited.(Kingham et al., 2013) A recent report which reviewed national essential medicines lists based on the WHO 2013 list, from LMICs found significant variation in available treatments for different types of early breast cancer in their National Essential Medicines Lists (NEML): over 80% of the American countries included all therapy components for all types of early breast cancer (except for HER2 overexpressed tumors). In comparison, over 40% of the countries in Africa did not have all treatment components for any subtype, and guideline-recommended treatments were less frequently included in the NEMLs of low-income countries than in middle income countries. Treatments for late stages were more frequently selected as essential medicines in LMICs compared to early stages,(Bazargani et al., 2015) reflecting the presentation at late stage of disease by the majority of women in these countries.

As part of Target nine of the Global Action Plan, the WHO aims to have an 80% availability of the affordable basic technologies and essential medicines, including generics, required to treat major non-communicable diseases in both public and private facilities. It provides tools to implement this action plan include guidelines on pricings, storage distribution of drugs. (World Health Organization, 2015c) The 2015 WHO essential medicine list now includes five chemotherapy medications commonly used to treat breast cancer.(World Health Organization, 2015d) However, a commentary on the essential medicines list pointed out that labeling a medicine as essential does not guarantee patient access, especially in LMICs, and should be regarded as a first step in the policy process towards assuring access to these medicines, as part of broader global health and sustainable development goals.(Gray et al., 2015)

The BHGI guidelines stratified by disease stage and resources level recommend classic cyclophosphamide, methotrexate, and 5-fluorouracil (CMF), doxorubicin and cyclophosphamide (AC), epirubicin and cyclophosphamide (EC) and 5-fluorouracil, doxorubicin, and cyclophosphamides (FAC) for adjuvant chemotherapy for stage II breast cancer, and pre-operative chemotherapy with AC, EC FAC or CMP for stage III. In limited resource settings, additional stage I adjuvant therapy with classic CMF, AC, EC or FAC, and classic CMF and anthracycline monotherapy or combination treatment for Stage IV metastatic and recurrent breast cancer treatment, are added to the model. Finally, in enhanced settings taxanes for stages I-III, and sequential single agent or combination treatments with Trastuzumab and Lapatinib for stage IV breast cancer are recommended.(Eniu et al., 2008)

In Ghana a retrospective study of medical records for 597 breast cancer patients seen in 2008-2011 examined patient management and treatment patterns. Late stage at diagnosis was common, treatment plans of the study hospital were relatively standardized according to disease severity, and defaulting/interrupting treatment in the records was also common. Patients diagnosed with late stage cancer who received adjuvant therapy and patients with known hormone status evaluation were more likely to have complied with treatment guidelines and continued oncotherapy compared to those who never had hormone status requested or reported.(Scherber et al., 2014) A small Sudanese study of 98 breast cancer patients with locally advanced disease (Stage IIIa-c) observed with locally advanced breast cancer and treated with neoadjuvant chemotherapy using therapies appropriate for basic level resources, observed a good clinical response rate with 11.2% with a complete clinical remission and 72.4% had a partial remission.(Alawad, 2014)

However financial barriers to completing chemotherapy regimens where they are available have been reported. A small Nigerian study found that number of patients on neoadjuvant chemotherapy declined to 46% by the last cycle during a six-course treatment regimen, principally due to financial reasons as treatment was an out-of-pocket expense.(Anyanwu et al., 2010) In Eritrea, a resource-poor country, a small study of 82 breast cancer patients where over 66% were diagnosed with late-stage disease between 2007 and 2008, only 1 patient received chemotherapy; the remainder were managed by surgery only. In comparison a cross-sectional study from the Egyptian Gharbiah population-based cancer registry, located in a middle-income country, identified 5348 cases of breast cancer: 78.1% received radiotherapy; 92.8% adjuvant chemotherapy and 56.9% hormonal therapy. (Zeeneldin et al., 2013)

Information, awareness and education

In the absence of breast early detection or screening programs, culturally appropriate education and awareness campaigns have been widely supported as a method to improve awareness of breast cancer symptoms among women in LMICs, and to encourage them to seek early diagnosis and treatment.(Anderson et al., 2008) While education and awareness campaigns are of vital importance in LMICs, there are a variety of unanticipated barriers to implementing them. These include lack of awareness, knowledge and poor health literacy. For example, while there have been some efforts to provide education to women on the importance of breast health in Sierra Leone (Shepherd and McInerney, 2006), a study of 3,645 women identified minimal education, poverty and reliance on traditional healers as barriers for women with breast masses.(Ntirenganya et al., 2014) A Nigerian study identified a number of economic and cultural barriers to implementing education about basic screening programs including lack of both specialized health personnel and breast cancer screening facilities, the absence of biomedical terminology in local languages, gender inequality and the prevailing influence of traditional health practitioners.(Asobayire and Barley, 2014)

A lack of knowledge of the importance of breast health awareness and of the importance of breast cancer early detection leads to a lack of screening practices, even at the basic level. In an Egyptian study in 2000, only 10.4% of 565 newly diagnosed breast-cancer patients, had practiced BSE, and 2.7% reported monthly BSE.(Abdel-Fattah et al., 2000) In Morocco, a study of 136 female doctors found that while 75% of study participants practiced BSE once a month, only 15% ever had a mammogram.(Ghanem et al., 2011) A cross-sectional study in Tunisia of 900 women reported poor knowledge of specific risk factors for breast cancer and of breast screening modalities, with only 14% of women performing any type of breast screening.(El Mhamdi et al., 2013)

Non-governmental organizations (NGOs) are important resources for many countries in this region, as they partner with governments with a goal of reducing cancer mortality in this region, often by promoting early detection, diagnosis and treatment and reducing the stigma that often surrounds a cancer diagnosis.(Oluwole and Kraemer, 2013) A number of pilot projects by governmental and non-governmental organizations have attempted to increase breast cancer awareness in urban and rural areas across Africa, with a variety of success. For example, in North Africa the Algerian government, in partnership with Roche and a patient advocacy group El Amel (Hope) launched a mobile mammography unit in 2013, which brings trained nurses, and other healthcare workers to remote regions within Algeria, with a goal of combining breast cancer education with screening facilities. Other countries such as Tunisia are focusing on prevention and early detection of cancer as part of their national strategy in the fight against cancer (2010-2014).

In the absence of formal guidelines in many West African countries, a number of awareness and educational campaigns have been initiated. In Ghana, a cross-sectional survey assessed the impact of an education program on knowledge, attitudes and practices toward breast cancer and breast cancer prevention among women from rural communities, and found that knowledge about breast cancer symptoms improved, and the number of women who reported beginning BSE increased.(Mena et al., 2014) There have been multiple studies of awareness, attitude and practice of breast examination in Nigerian women. Knowledge and practice of BSE and CBE vary widely, but women who have received a tertiary education are consistently more likely to be aware of and the conduct BSE. The Free Breast Cancer Awareness and Screening program launched in Nigeria in 2006 in collaboration with the Ministry of Women Affairs and Poverty Alleviation educates women about BSE,(Lagos State Ministry of Health, 2011) and performs free counselling and referral services. While there are no governmental guidelines on breast screening in Cameroon, there are periodic mass campaigns for breast health awareness and CBE organized by the Ministry of Health.(J.D. Kemfang Ngowa et al., 2011) A number of cross-sectional surveys in African women found that knowledge of preventive measures and risk factors was poor in women in Cameroon.(Suh et al., 2012) An NGO, SOCHIMIO (Solidarite Chimiotherapie) is a Cameroonian NGO affiliated with the UICC, based in Yaoundé that has initiated several cancer research projects in Cameroon. While these are primarily aimed at providing therapeutic care to cancer patients, they have also implemented educational outreach programs.(Solidarite Chimiotherapie (SOCHIMIO), 2014)

In South Africa, the government and a variety of NGOs provide community outreach and educational materials to increase awareness of breast cancer signs and symptoms. These include mobile breast check units which travel to semi urban and urban areas offering free CBE, education in BSE and other awareness campaigns.(Cancer Association of South Africa, 2014) In Swaziland, the SBCN’s educational programs aim to increase awareness on aspects of breast cancer including the promotion of BSE annual medical examinations and the importance of early diagnosis and treatment.(Swaziland Breast Cancer Network, 2008)

In an Ethiopian study designed to improve health workers’ knowledge and awareness using an abbreviated training intervention reported that initial knowledge and practice skills related to CBE were low, but improved significantly post-intervention.(Mutebi et al., 2013) A number of NGOs in Kenya such as Cancer Free Women support a variety of awareness and education campaigns including g teaching BSE and symptoms of breast cancer to Kenyan women.(Cancer Free Women, 2013) In Madagascar a variety of NGOs provide preventive care initiatives, and education and awareness campaigns.(4aWoman, 2014) In Rwanda, an NGO Breast Cancer Initiative East Africa (BCIEA) launched a month-long campaign in Kigali, Rwanda, to provide free CBE for women and to persuade both women and their partners of the importance of cancer awareness.(Kigali, 2014) Finally, NGOs in Zimbabwe perform a variety of awareness programs to inform women about cancer prevention strategies and cancer screening procedures.(The Cancer Assocaiton of Zimbabwe, 2014)

Breast Cancer Early Detection

Successfully down staging breast cancer in populations is dependent on successful early detection programs. Unfortunately, many African countries have limited resources to allocate to early breast-cancer detection resulting in late diagnosis, which is more difficult to treat effectively, and is associated with increased morbidity and mortality.(Coleman et al., 2008) Even if breast cancer awareness increases among African women, access to mammography is limited to wealthier women living in large urban areas. Hence, current early detection efforts focus on promoting BSE, teaching women to recognize the early symptoms of breast cancer, and encouraging them to present for early medical evaluation when necessary. Most women presenting with breast symptoms receive a CBE; those with positive findings are referred to larger hospitals for diagnostic interventions such as fine needle aspirations and biopsies. The effectiveness of CBE depends on the examiner’s training and experience and is potentially limited by a high false positive rate, in some cases up to 85%.(McDonald et al., 2004; Trapp et al., 1999) Nevertheless, CBE is currently used as the primary method for breast cancer detection in most regions of Africa because of its availability and low cost. Therefore, efforts to downstage breast cancer should include improving provider CBE training with the aim of reducing the number of false positive CBEs which require referral and expensive diagnostic interventions.

Ultrasound is available in many facilities, even those located outside large urban areas, and it is less expensive than mammography. The capacity already exists among midlevel providers (sonographers and midwives) at these facilities to use this equipment to diagnose common medical problems, such as identifying potential complications related to pregnancy.(McClure et al., 2014) With appropriate additional training, ultrasound use could expand to include evaluating women with positive CBEs to reduce the number of women requiring referral and diagnostic interventions. Efforts to improve breast ultrasound training and use in Africa are currently in progress.(Scheel et al., 2015)

###### **North Africa**

A number of countries in North Africa have developed recommendations for breast cancer screening, and serval are making strides in scaling up successful pilot projects. WHO EMRO published guidelines on breast cancer screening in 2006, and in line with the BHGI, suggested that screening could be implemented in centralized cancer facilities where breast cancer treatments are available.(Khatib, 2006) While these programs will only provide screening to a limited proportion of the population, they could act as pilot programs with the ultimate aim of expanding them to cover the entire population as more resources become available. Recommendations for screening frequency vary considerably in this region. A report by the Algerian National Institute of Public Health in 2003 identified a variety of issues in the prevention and diagnosis of late stage breast tumors including a delay between presentation and diagnosis, and lack of observance of screening and treatment protocols. (Hammouda et al., 2003) While cancer has become a national priority with the publication of the 2014–20 national cancer plan,(Hamdi Cherif et al., 2014) it is unclear whether any progress has been made. No data on breast screening policies or practices were found. Some opportunistic pilot projects are in place such as a partnership between the Algerian government, Roche and a patient advocacy group El Amel (Hope), which launched a mobile mammography unit in 2013.

Similar to other countries in the area, women in Egypt present with advanced breast cancer.(Omar et al., 2003; Salhia et al., 2011) The Women’s Health Outreach Program recommends monthly BSE starting at age 20, and offers free annual breast screening for all Egyptian women above the age of 45 years.(Salem et al., 2008; Women's Health Outreach Program, 2014) The program was made up of 5 phases with a 1-year pilot phase (2007-2008) to identify barriers in implementation. Each implementation phase will address a number of governorates. The target of the 5-year implementation plan is to provide coverage for the entire population. Screening is delivered in an opportunistic fashion through mobile units equipped with digital mammography units which serve rural and less affluent regions. Asymptomatic women are invited to return in a years’ time for a repeat mammogram.(Women's Health Outreach Program, 2014) However the program was criticized as being both expensive and ineffective and not the most effective use of resources: fewer than 90 true cases of cancer were found as a result of 20,000 mammograms.(Harford, 2011; Stefan et al., 2013) More effective alternative methods of breast screening have also been explored, including training women resident in a Cairene slum in breast health awareness and BSE.(Kharboush et al., 2011) Another study which randomized 14,807 women to CBE vs. a control arm demonstrated high acceptance, with 85–91% of the women targeted enrolling in the study. Initial results demonstrated that stage distribution was significantly better in the intervention arm compared to the control arm.(Miller, 2008) The Egyptian national screening program, the Women’s Health Outreach Program (WHOP), was launched 2007: prior to this, a study conducted by United States Agency for International Development reported that only 1.7% women aged 40 and above had had a mammogram within the past 12 months.(Corbex, 2009; El-Zanaty and Way, 2009)

Morocco set up a National Cancer Prevention and Control Plan (NCPCP), comprising a coordinated breast cancer awareness campaign and a program aimed at developing breast cancer screening was in 2010, aimed at targeting half-a-million women. A new breast and uterine cancer screening and early detection center was opened in 2013 in Mohammedia, which provides screening facilities for more than 40,000 eligible women. Mobile mammography units travel to remote areas to provide opportunistic screening to those without access to centralized screening facilities. The NCPCP in Morocco has developed a 3-tiered system for increasing screening overage. Level 1, health care clinics with general practitioners and nurses who provide breast health education and CBE to women; Level 2, specific reproductive health clinics who receive referrals from Level 1 clinics and preform diagnostic ultrasound and mammography; and Level 3, oncology centers. Breast cancer screening is recommended for women between the ages of 45-69.(The Foundation Lalla Salma, 2014) The Tunisian Ministry of Health has stated goals of focusing on prevention and early detection of cancer as part of their national strategy in the fight against cancer (2010-2014), and currently recommends annual CBE for women aged 40-69 years, with mammography reserved for high-risk women and those referred after primary screening via CBE. The state has implemented a number of pilot programs examining the efficacy and feasibility of mammographic screening in the general population. Based on the results of these programs the Tunisian government will consider moving toward population-based mammographic screening.(Association Tunisienne pour la Recherche et les Etudes en Pharmacie, 2014) One of the first pilot studies in 2003 was a large scale population-based mammographic screening in urban areas, but participation rates have tended to be low.(Bouchlaka et al., 2009; Zaanouni et al., 2009) The most recent evaluated three rounds of mammography screening as part of a pilot program, carried out between 2004-2010 in Sfax, Tunisia. Biennial screening was offered to women aged >45 years, and 17.4% of the target population underwent screening, resulting in 12,657 mammograms.(Frikha et al., 2013)

###### **Sub-Saharan Africa**

A number of countries lack either guidelines and/or data on screening guidelines or practices including: Libya, and Mauritania, in North Africa; Angola, Cameroon, Central African Republic, Chad, Democratic Republic of Congo, Republic of Congo, Equatorial Guinea, and Gabon in central Africa; Republic of Benin, Burkina Faso, Gambia, Guinea, Ghana, Guinea-Bissau, Liberia, Mali Mauritania, Namibia, Nigeria or Senegal, or Togo in western Africa; Eritrea, Ethiopia, Kenya, Malawi, and Zimbabwe and in Eastern Africa. Where mammography does exist in these countries it is often limited to private hospitals,(Msyamboza et al., 2012) and are centralized in major urban centers.(Ly et al., 2012). For example, the Lagos State Ministry of Health reported there are only 4 functional mammography units in Lagos, utilization of mammography is rare and most women are unaware of its use as a screening tool.(Lagos, 2014) However, many countries in the region are developing innovative low-cost early detection methods that can be used effectively in low resource settings. While Sudan lacks guidelines on age at which cancer screening should begin, (Abuidris et al., 2013b) it established a National Cancer Control Program in 1982, which focuses on prevention, early detection and screening. Unfortunately, a lack of resources has hampered implementation of breast cancer screening and the majority of efforts have been focused on public awareness campaigns and education of medical professionals.(Hamad, 2006) However, a Sudanese study trained female volunteers to detect breast abnormalities while visiting households in 56 villages in an intervention county, while the control county received no intervention. The volunteers screened women >18 years for breast abnormalities, and referred those with suspected breast cancer for medical diagnosis and, if necessary, treatment at a district hospital. From 2010-2012, 10 309 (70%) of 14 788 women in the intervention county were screened; 138 women were identified as having breast abnormalities and were referred for diagnosis and treatment; of the 118 women attended the hospital, 101 were diagnosed with benign lesions, 8 with carcinoma in situ, and 9 with malignant disease. In the control villages, only four women attended the hospital for diagnosis: one was diagnosed with a benign lesion and three with advanced disease.(Abuidris et al., 2013a)

In recognition of the need to develop formal guidelines, a report by the Kenyan Ministry of Health called for enhanced health promotion and education, and improved early detection by introducing or expanding screening programs, and by developing guidelines for screening and early cancer detection (Ministry of Public Health and Sanitation and the Ministry of Medical Services, 2012). However, many of these have yet to be implemented.(Matheka, 2014) Health workers have been proposed as a link between the general population and access to care, especially in rural areas.(Mutebi et al., 2013)

There are no formal screening guidelines in Zimbabwe, but a number of non-profit organizations such as the Cancer Association of Zimbabwe and Breast Cancer Alleviation of Zimbabwe recommend breast health awareness and regular BSE for women aged 18 and older.(The Cancer Assocaiton of Zimbabwe, 2014) A recent report by the Zimbabwean Ministry of Health on a strategy setting out national goals for cancer prevention and control from 2014-2018 identified a series of barriers to breast and other cancer screening. These included lack of access to early detection; inadequate resources, equipment and technology, lack of education and awareness of the importance of regular cancer screening, prohibitive costs of screening services, and lack of referral of patients. The goals of this strategy included a reduction of late stage breast cancer presentation from 80% to 50% by 2018.(Ministry of Health and Child Care of Zimbabwe, 2013)

Breast cancer incidence rates have increased over the last 20 years in Uganda.(Wabinga et al., 2014) The average age in Uganda is low (Uganda Bureau of Statistics (UBOS), 2002), with a peak age at diagnosis of between 40 and 50 years. The limited health care budget and resources in Uganda are directed towards fighting communicable diseases.(Galukande and Kiguli-Malwadde, 2010) In 2012, there were 4 mammography units in Uganda, (2 in government and 2 in private health units) and 42 radiologists.(Monu et al., 2012) Galukande and Kiguli-Malwadde commented on the greater availability and lower cost of ultrasound as a potential breast cancer screening tool in Uganda. Although there is some government subsidized healthcare, the majority of the population has to self-fund care. Consequently, in the Breast Cancer Guidelines for Uganda (written by a team of oncologists, surgeons and radiologists from Kampala) BSE is recommended for its practicability and affordability.(Gakwaya et al., 2008a)*.*

No data were found on breast screening policies or practices for countries in Southern Africa, with the exception of the Republic of South Africa. The public-sector health service emphasizes community level healthcare complimented by a hierarchical referral system through district hospitals: breast cancer symptoms are usually detected by cancer patients rather than via screening, who then attend primary health care clinics. They are then referred to secondary and tertiary level clinics and hospitals for diagnosis and treatment. The NGO Cancer Association of South Africa (CANSA) recommends monthly BSE for all women and regular CBE. Yearly mammograms are recommended for women over the age of 40, however these are not free.(Cancer Association of South Africa, 2014). CANSA provides education about the importance of early detection and performs opportunistic screening via CBE through mobile health clinics and CANSA care clinics throughout South Africa.(Cancer Association of South Africa, 2014) Mammograms are offered though public hospital breast clinics.

In 2010, the Swaziland Breast Cancer Network (SBCN) operated three breast cancer clinics, which offer free consultations, examinations, diagnosis and referrals. SBCN recommends monthly BSE, and annual CBE by a trained provider, and has developed a referral tool for further diagnostic work for patients who report suspicious findings. It is unclear whether the SCBN is affiliated with the Swazi Ministry of Health: no formal guidelines on breast screening were found on the Ministry of Health’s website While the SBCN recommends that all women over 40 should undergo mammography, it recognizes that mammography is used only very occasionally by those who can afford this service.(Swaziland Breast Cancer Network, 2008)

Finally unlike many countries in the region, Mauritius is a HIC with a 5-year survival rate from breast cancer that similar to other HICs.(Allemani et al., 2015) The republic developed a National Cancer Control Program for 2010-2014, and recommended that breast health awareness campaigns encouraging BSE and yearly CBE to women >40 years. Population based screening mammography was not thought to be advisable, given the relatively high proportion of cancers in women younger than 45 years.(Republic of Mauritius, 2014) Diagnostic procedures such as MRI and CAT scans are available as is radiotherapy and chemotherapy.(Mauritius, 2015) The Republic of Mauritius is one of the few countries in the region with formal guidelines on breast cancer screening.

Screening practices and behaviors in Africa

In Ghana, the majority of women are diagnosed between the ages of 40-49.(Wiredu and Armah, 2006) In a small cross-sectional study, the rates of breast screening practices was poor, with the self-reported BSE rate of 32%, CBE 12% and mammography, 2%, with higher levels of education strongly associated with screening behaviors.(Opoku et al., 2012). A Senegalese cross-sectional study in 2006 interviewed 300 patients attending 5 hospitals in Dakar for a medical or surgical consultation for breast-health related issues, on knowledge and practice of BSE. Study participants were young, with an average age of 34 years, uneducated and living in poverty. Participants were aware of BSE (42.7%) and 29% regularly practiced BSE. Practice of BSE was associated with income and educational attainment.(Gueye et al., 2009)

In Cameroon, a 2011 retrospective study examined the medical records of 531 breast cancer patients diagnosed at Yaoundé Medical Hospital between 1989 and 2009: self-detection was the mode of detection in 95.3% of patients, and only 2.9% of patients were diagnosed via mammography or CBE. 71.1% of patients presented at late stage.(J.D. Kemfang Ngowa et al., 2011) A study interviewing women appearing at Yaoundé General Hospital with Stage IV cancer, found that the main reasons for delay in seeking medical care was inability to pay; inadequate diagnosis by general doctors; beliefs, fears, cultural factors including a fatalistic attitude after a diagnosis of cancer, and lack of knowledge about breast cancer.(Ekortarl et al., 2007) A cross-sectional survey in Cameroon of 120 women in 2012 reported that while 74.2% of women had heard of BSE, 40% had never performed it. In Nigeria, a study of 221 undergraduate students reported that 85·1% were aware of BSE; 37.3% were knowledgeable about BSE; but only 11.8% aware of the ideal age to start BSE.(Gwarzo et al., 2009) A second Nigerian study of 393 students reported that 67.9% of those who had heard of breast cancer knew that there were screening methods available; of these 91.6% were aware of BSE, 93.2% were aware of CBE and 32.8% were aware of mammography as a screening method. However only 50% of respondents who were aware of breast cancer practiced BSE, and only 7.6% of respondents had ever undergone any form of clinic-based screening. (Olugbenga-Bello et al., 2011)

A national population-based cross-sectional study of 2202 women in the Republic of South Africa, found that only 15.5% ever reported having a mammogram; screening was associated with White or Indian/Asian population group, greater wealth, and having health insurance.(Peltzer and Phaswana-Mafuya, 2014) In an analysis of performance data of screening mammography at a breast center in South Africa, of 10 000 women screened, 55 cancers were detected. In women aged 40-49 years the detection rate was 3.8/1000 exams, and in women 50-69 years 9.7/1000.(Apffelstaedt et al., 2008)

A 2012 study of 390 health workers in northwest Ethiopia found that 37% of respondents had ever practiced BSE and 14.4% practiced it regularly. The main reasons for not performing regular BSE were not having problems with breasts (53.2%), not knowing the technique (30.6%), and not knowing its importance (21.4%); having knowledge of the importance of BSE was a predictor of BSE practice.(Azage et al., 2013)

Qualitative studies of women in this region report a variety of barriers to seeking early diagnosis, or participating in screening. Data from 69 Ethiopian breast cancer patients found that even among women who are aware of breast cancer, early signs/symptoms are frequently ignored, traditional healers are preferred, and study participants indicated that stigmatization and social isolation complicate discussion and action around breast cancer.(De Ver Dye et al., 2011) A qualitative study of Kenyan women reported differences between rural and urban women with respect to knowledge of symptoms and the importance of breast screening. The majority of women was fatalistic about the disease and assumed it to be incurable.(Muthoni and Miller, 2010)

Despite the lack of governmental guidelines on breast cancer early diagnosis, and low levels of awareness about the importance of breast self-awareness, a number of countries are implementing pilot studies in an attempt to reach underserved populations. A recent paper from the Democratic Republic of Congo reported use of BHGI guidelines in implementing a breast cancer awareness campaign in Kinshasa from 2010-2012, based on BSE and CBE by trained healthcare workers.(Luyeye Mvila et al., 2014) Participating women underwent CBE and in the case of suspicious findings, received a mammography and ultrasound, and where necessary FNA. A total of 4,315 women were screened, of whom 1,113 underwent mammography screening. A pilot screening program using a mobile mammography unit in the Western Cape province in the republic of South Africa in women aged 40 years and older between 2011-2012, performed 2,172 screening mammograms, with a 9.6% recall rate.(Apffelstaedt et al., 2014) The authors reported multiple problems, both technical (such as poor quality images) and administrative (e.g., images not reaching the referral center) and a low cancer detection rate, concluding commencement of a screening program using this model was not justified in this setting.

Conclusions

While the situation in many African countries paints a bleak picture for breast cancer care, due to over-burdened or non-existent health care infrastructures, poverty and increasing rates of breast cancer, which are commonly diagnosed at late stages, the outlook on some fronts calls for optimism. Some African nations are working to create national and international networks to improve aspects of breast cancer care. Governmental initiatives through cancer control planning, public/private partnerships, institutional twinning, and the use of available tools such as the BHGI resource-stratified guidelines can allow local stakeholders to develop novel and innovative methods for improving breast health care. The use of awareness education and distributed models of care to facilitate breast cancer down-staging is essential for most of Africa in order to decrease the number of patients who are unrealistic or inappropriate candidates for curative treatment and instead should be the focus of palliative efforts. Diagnostic services based on tissue sampling is essential, both for making cancer diagnoses, but also for determining proper treatment planning. The prolonged time from initial diagnosis to instigation of treatment is so lengthy as to be a measurable aspect of worsened breast cancer outcome. In addition, healthcare systems in Africa need to be expanded and supported such that patients who begin a treatment regimen are likely to complete it. Through this type of systematic approach to breast cancer care delivery in Africa, we can realistically anticipate seeing improvements in breast cancer outcomes given resources for organizational restructuring and time for realistic implementation.

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