






The evolving epidemic of breast cancer in sub-Saharan Africa: Results from the African Cancer Registry Network

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Abstract

Breast cancer (BC) is the leading cause of cancer in sub-Saharan Africa (SSA) with rapidly increasing incidence rates reported in Uganda and Zimbabwe. However, the magnitude of these rising trends in premenopausal and postmenopausal women is unknown in most African countries. We used data from the African Cancer Registry Network on incident breast cancers in women from 11 population-based cancer registries in 10 countries representing each of the four SSA regions. We explored incidence changes among women before and after age 50 by calendar period and, where possible, generational effects in this unique sub-Saharan African cohort. Temporal trends revealed increasing incidence rates in all registries during the study period, except in Nairobi where rates stabilised during 2010 to 2014 after rapidly increasing from 2003 to 2010 (APC = 8.5 95%, CI: 3.0-14.2). The cumulative risk

Abbreviations: AAPC, average annual percentage change; ACRN, African Cancer Registry Network; APC, annual percentage change; ASIR, age-standardised incidence rate; BC, breast cancer; BMI, body mass index; BRCA, breast cancer gene; CI, confidence interval; CI5, cancer incidence in five continents; DCO, death certificate only; DDT, dichlorodiphenyltrichloroethane; DHS, demographic and health surveys; ER+, oestrogen-receptor positive; IARC, International Agency for Research on Cancer; ICD10, International Classification of Diseases 10th Revision; ICD-O, International Classification of Diseases for Oncology; MV, morphologically verified; PMA, performance monitoring and accountability surveys; SEER, Surveillance, Epidemiology and End Results Program; SSA, sub-Saharan Africa.

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varied between and within regions, with the highest risks observed in Nairobi-Kenya, Mauritius and the Seychelles. There were similar or more rapidly increasing incidence rates in women aged 50+ compared to women <50 years in all registries except The Gambia. Birth cohort analyses revealed increases in the incidence rates in successive generations of women aged 45 and over in Harare-Zimbabwe and Kampala-Uganda. In conclusion, the incidence of BC is increasing rapidly in many parts of Africa; however, the magnitude of these changes differs. These results highlight the need for urgent actions across the cancer continuum from in-depth risk factor studies to provision of adequate therapy as well as the necessity of supporting the maintenance of good quality population-based cancer registration in Africa.

KEYWORDS

Africa, breast cancer, incidence, population-based cancer registry, trends

1 | INTRODUCTION

Breast cancer incidence rates in Africa are increasing. The average annual percentage change (AAPC) in the breast cancer incidence rate was estimated at 4.5% between 1991 and 2006 in Kampala, Uganda,¹ and at 4.9% between 1991 and 2010 in Harare, Zimbabwe.² In a recent study describing cancer trends in people aged 60 and above in sub-Saharan Africa, breast cancer incidence was estimated to be increasing at an annual rate of 5% in Harare and Kampala, while slower rates of increase were observed in women under the age of 60.³ Conversely, an earlier study in Western Africa (Bamako [Mali] and The Gambia) had described a more rapid breast cancer incidence rate among women aged 55 and below.⁴ In contrast, the U.S. Surveillance, Epidemiology and End Results Program (SEER) in the period 1992 to 2011 observed stabilising rates among White non-Hispanic women with an estimated AAPC at −0.4%, while incidence rates among black and Asian/Pacific women were still moderately increasing, at 0.2% and 0.6%, respectively.⁵

The rapid rate of increase in breast cancer incidence in sub-Saharan Africa in recent years has been attributed to a “westernisation” of lifestyles, that encompasses the effects of changing reproductive patterns—delayed age at first birth, fewer children and reduced breastfeeding duration—as well as changes in diet, alcohol intake and body weight, among other factors.⁶ Other determinants unique to women of African origin have been suggested, such as the use of skin lighteners and increased exposures to hormone modulators in skincare and hair products, as often used by women of African descent.^{7–9}

Although this changing risk is common across populations, the incidence of breast cancer in sub-Saharan Africa varies across countries and regions. GLOBOCAN 2018¹⁰ estimated the age standardised breast cancer incidence at 29.9 per 10⁵ person-years in Eastern Africa, 27.9 in Middle Africa, 46.2 in Southern Africa and 37.3 in Western Africa. The International Agency for Research on Cancer (IARC) publications “Cancer Incidence in Five Continents” (C15) have reported on the incidence of cancer at a population level worldwide since the 1960s. Out of these 46 SSA countries, 11 have appeared in these publications, although only 2 (Kampala-Uganda and Harare-Zimbabwe) have appeared in four successive volumes.⁶ Thus, little is published on long-term cancer trends from

What's new?

Breast cancer is the leading cause of cancer in sub-Saharan Africa (SSA), and may be on the rise. In this study, the authors examined registries from ten SSA countries, and found that this is indeed the case, especially in older women. Changing risk-factor profiles may account for these trends. These results indicate an urgent need for strengthening the healthcare systems of SSA, including improved public health programs such as screening programs for breast cancer, in-depth risk-factor analysis, etc., as well as planning for adequate therapy for an increasing number of patients.

other SSA countries. Clearly more studies are needed to understand breast cancer incidence trends in the countries of the continent, separating out the contributing effects of ageing of the population, the aetiological effects on successive generations, and changes that simultaneously affect all studied age groups in a particular time period, that may represent changes in diagnostic capacity or completeness of cancer registration.

In this article, we describe the temporal trends observed in breast cancer incidence rates, using data generated by member registries of the African Cancer Registry Network (AFCRN). We explore in greater depth incidence changes among women before and after age 50 and examine period and, where possible, cohort effects in 11 population-based cancer registries from 10 countries representing each of the four sub-Saharan African regions.

2 | METHODS

2.1 | Data sources

Completely anonymised data were obtained on incident cases of breast cancer (International Classification of Diseases, ICD-10 C50) from the database of the AFCRN (<http://afcrn.org>). This is a network

of sub-Saharan African population-based registries that facilitates homogenisation of registration activities, collaboration, advocacy and research. For a population-based cancer registry to obtain membership into the AFCRN, they must have attained at least 50% coverage of their target population on admission and at least 70% coverage by its third year.¹¹ There are currently 32 population-based member registries within the network, although for this incidence trend analyses, we included only those with at least 10 years of continuous data on breast cancer incidence. We grouped them according to the United Nations geoscheme for Africa.¹²

From the Eastern African region, we included data from Blantyre, Malawi (1994-2011), Bulawayo, Zimbabwe (1963-1972 and 2011-2015), Harare, Zimbabwe (1990-2014), Kampala (Kyadondo County), Uganda (1990-2014), Mauritius (2001-2014), Nairobi, Kenya (2003-2014) and Seychelles (2004-2015). From the Middle African region, we included data from Brazzaville, Congo (1996-2017). From the Southern African region, we included data from Eastern Cape, South Africa (1998-2014). Finally, from the Western African region, we included data from The Gambia (1986-2012) and from Ibadan, Nigeria (1991-2010). The population-based registries of The Gambia, Mauritius and Seychelles cover the national territory, while all the others cover urban areas, except for the Eastern Cape registry of South Africa, which covers a rural population.

These registries use active methods for case detection, and the data are entered electronically into the CanReg5 software, developed by the International Agency for Research on Cancer. This software helps identify duplicate cases and applies internal quality checks. The International Classification of Diseases for Oncology (ICD-O) topography and morphology coding¹³ are used by all the registries. We included data on invasive primary tumours of the breast occurring in black African females aged 15 and above.

Country-specific population censuses were obtained from their respective National Statistics Office reports. To obtain the population-at-risk for each year, intercensal interpolations were made

by sex, and within 5-year age groups assuming a constant logarithmic increase. Postcensal projections were made assuming a linear rate of increase at the rates observed between the preceding censuses.

2.2 | Statistical analyses

For each registry, the proportion of cases registered based only on a death certificate—death certificate only (DCO)—and of morphologically verified (MV) cases were estimated. These proportions are used as indicators of the data quality for each registry.¹⁴

We estimated age-specific (5-year age groups) and crude incidence rates per 100 000 women by registry for the entire period and by 5-year periods. Age standardisation was performed by the direct method, using the World Standard population.¹⁵ We also estimated the cumulative risk for each 5-year period. The cumulative risk expresses the overall risk of developing breast cancer before age 75, in the absence of competing risks of death.¹⁶

Temporal trends in the age-standardised incidence rate were examined using joinpoint regression,³⁸ with a maximum of three joinpoints and with the changes in the trend expressed as annual percent change (APC). Joinpoint regression involves fitting a straight line to the log-transformed age-standardised incidence rates. It fits the simplest model first with the smallest number of join points, and tests for the necessity of adding more joinpoints to the model using a Monte Carlo Permutation Method,¹⁷ with a significance level set at 0.05. From these, we obtained the average annual percentage change (AAPC), which is a weighted average of the changing trends in each segment of the model. This weighting is based on the number of years represented by each segment. We estimated the AAPC by registry for all women, and among older (50-74) and younger women (15-49).

For two of the registries, Kampala-Uganda and Harare-Zimbabwe, which have contributed to four successive volumes of CI5, we did an

TABLE 1 Description of included registries for time trend analyses

UN Region	Country	National population, 2010	Registry catchment area	Catchment population, 2010	Percentage of country covered, 2010	Time Period	Basis of diagnosis		
							MV (%)	Clinical (%)	DCO (%)
Eastern Africa	Kenya	42 030 676	Nairobi	3 237 000	7.7	2003-2014	82.9	14.1	3
	Malawi	14 539 612	Blantyre	701 000	4.8	1994-2011	60.7	38.8	0.5
	Mauritius	1 250 400	Mauritius	1 250 400	100	2001-2015	98.1	1.7	0.2
	Seychelles	89 770	Seychelles	89 770	100	2004-2015	97.3	2.3	0.4
	Uganda	32 428 167	Kampala	1 594 000	4.9	1990-2014	58.2	39.9	1.9
	Zimbabwe	12 697 723	Bulawayo	658 000	5.2	1963-1972	90.3	9.7	0
			Bulawayo			2011-2015	79	21.1	0
Middle Africa	Republic of Congo	4 273 731	Harare	1 475 000	11.6	1990-2014	80.1	11.6	8.3
			Brazzaville	1 574 000	36.8	1996-2017	69.7	33.8	0
Western Africa	Gambia	1 793 196	The Gambia	1 793 196	100	1986-2012	61.4	38.4	0
	Nigeria	158 503 197	Ibadan	2 814 000	1.8	1991-2010	75	21.2	0.4
Southern Africa	South African Republic	51 216 964	Eastern Cape - Transkei region	1 072 800	2.1	1998-2016	86.8	13.2	0

TABLE 2 Breast cancer crude incidence rates, age-standardised rates and cumulative risk by registry area and calendar period

Registry catchment area	Time period	Number of cases	Crude rate (per 100 000)	ASR per 100 000	Cumulative risk (0-74) %
Eastern Africa					
Kenya, Nairobi	2003-2004 ^a	339	14.2	44	5.1
	2005-2009	1277	18.2	54.3	6.3
	2010-2014	2007	22.7	63.2	7.3
Malawi, Blantyre	1995-1999	78	4.1	9.3	1.0
	2000-2004	132	6.1	13.2	1.4
	2005-2009	186	7.5	15.3	1.5
	2010-2011 ^a	140	13	28.9	3.3
Mauritius	2001-2004 ^a	1069	44	40.2	4.3
	2005-2009	1606	51.6	43.5	4.7
	2010-2014	1069	69.8	53	5.7
Seychelles	2005-2009	89	37.2	33.6	3.5
	2010-2014	128	56.4	48.5	5.7
Uganda, Kampala	1990-1994	198	6.9	18.3	2.1
	1995-1999	301	8.7	23.9	2.5
	2000-2004	384	8.8	27.2	3.0
	2005-2009	521	9.9	29.3	3.2
	2010-2014	739	11.5	30.7	3.4
Zimbabwe, Bulawayo	1963-1972	31	4.2	12.6	1.4
	2011-2015	399	23.2	39.4	4.5
Zimbabwe, Harare	1990-1994	215	8.0	20.9	2.1
	1995-1999	274	9.0	25.9	2.8
	2000-2004	354	10.3	27.2	3.0
	2005-2009	561	15.5	36.9	4.0
	2010-2014	781	20.8	44.6	5.1
Middle Africa					
Congo, Brazzaville	1996-1999 ^a	223	10.3	12.8	1.1
	2000-2004	313	10.4	15	1.6
	2005-2009	556	16.0	28.1	3.1
	2010-2014	515	12.7	22.6	2.4
	2015-2017 ^a	343	12.5	23.9	2.6
Western Africa					
The Gambia	1986-1989 ^a	28	1.4	3.0	0.3
	1990-1994	66	2.7	6.0	0.5
	1995-1999	100	3.5	7.3	0.5
	2000-2004	112	3.4	6.4	0.5
	2005-2009	157	4.0	7.9	0.5
	2010-2012 ^a	127	4.8	7.9	0.7
Nigeria, Ibadan	1991-1994 ^a	188	4.9	7.7	0.8
	1995-1999	321	6.1	9.9	1.1
	2000-2004	675	11.5	17.5	1.9
	2005-2009	847	12.9	19.7	2.1
Southern Africa					
South Africa, Eastern Cape	1998-1999 ^a	77	6.7	9.2	1
	2000-2004	165	5.7	7.5	0.8
	2005-2009	274	9.5	11.5	1.2
	2010-2014	296	10.1	11.8	1.3
	2015-2016 ^a	147	12.3	13.8	1.4

^aLess than 5-year period.

exploratory analysis of the age-specific breast cancer incidence rates by birth cohort and by period of diagnosis for the age range 25 to 74. We used 5-year time periods between 1990 and 2014, subtracting the central age for each 5-year age group from the mid-year of the period of diagnosis to obtain 10-year overlapping and synthetic birth cohorts. For Kampala, incidence rates for 1990 and 2014 were incomplete, as were those for Harare in 2007 to 2009 (due to problems with the medical services during the economic crisis in those years).² We used a modification of the method proposed by Schiffers et al,¹⁸ fitting a fourth degree polynomial rather than cubic splines to interpolate values for the missing years, based on the observations in adjacent periods. This graphical analysis is critical to understanding and interpreting what is observed in the summary age-standardised rates, as sometimes summary rates cannot adequately represent time trends in the presence of influential cohort effects.¹⁹

3 | RESULTS

3.1 | Registry and patient characteristics

Table 1 presents an overview of the 11 registries included, grouped by geographical region. Registry coverage ranged from 1.8% of the national population in Ibadan, Nigeria to 100% (national coverage) in

Seychelles, Mauritius and The Gambia. The Eastern Cape registry was the only subnational PBCR covering a rural population, the rest covered urban areas. The percentage of microscopically verified (MV%) cases ranged from 58.2% in Kampala, Uganda to 98.1% in Mauritius. The percentage of cases diagnosed based on a death certificate (DCO %) was less than 10% for all registries.

3.2 | Time trends in age-standardised incidence rates, cumulative risks and Joinpoint analyses

Table 2 shows numbers of cases, and incidence rates (crude, age standardised and cumulative) by 5-year time period. During the 2005 to 2009 time period (for which data are available for all registries except Bulawayo), the age-standardised incidence rate (ASIR) ranged between 7.9 per 100 000 women in The Gambia to 54.3 per 100 000 women in Nairobi-Kenya (Table 2). Like the ASIR, the breast cancer cumulative risk varied between and within regions, with the highest values in the most recent time period observed in Nairobi-Kenya at 7.3% (approximately 1 in 14 women will develop breast cancer by age 74 with no other competing causes of death), followed by Mauritius and Seychelles at 5.7%. Lower cumulative risks were observed in Middle, Southern and Western Africa. The

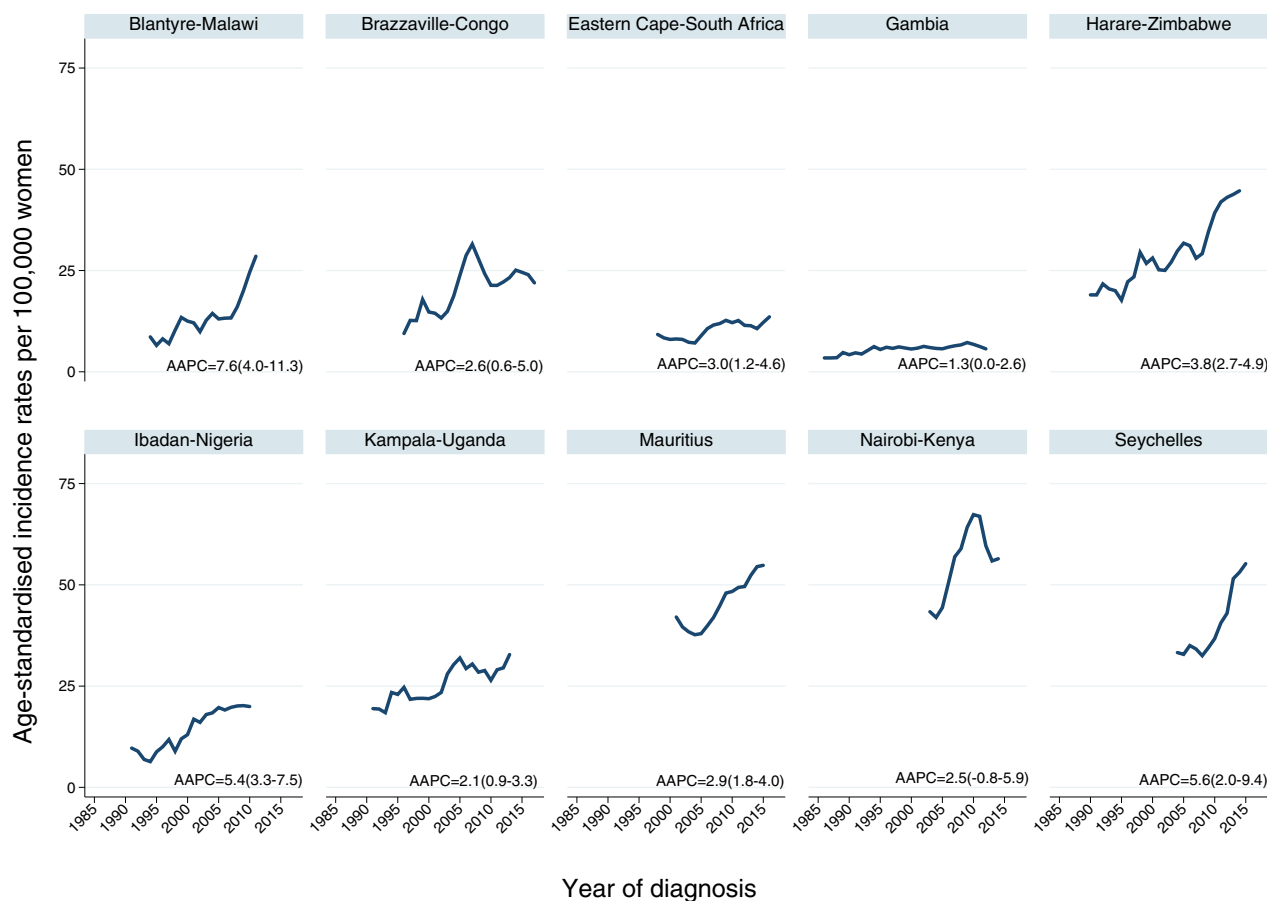


FIGURE 1 Breast cancer age-standardised incidence rates plotted as three-year moving averages and the average annual percentage change by registry area [Color figure can be viewed at wileyonlinelibrary.com]



FIGURE 2 Breast cancer age-standardised incidence rates plotted as three-year moving averages, in women <50 and women 50+ by year of diagnosis and by registry area [Color figure can be viewed at wileyonlinelibrary.com]

lowest cumulative risk was observed in The Gambia, which did not exceed 1% in any time period. For Bulawayo-Zimbabwe, we included historic data from the 1963 to 1972 period as well as the most recently available data from the 2011 to 2015, observing a more than threefold increase in the age-standardised incidence rates, from 12.6 to 39.4 per 100 000 women, with a corresponding tripling in the cumulative risk (Table 2).

Figure 1 shows the age-standardised incidence trends for all registries by calendar year, presented as 3-year moving averages, as well as the AAPC for all years of available data. Temporal trends in incidence rates continued to increase during the study period in all registries, except in Nairobi where rates stabilised during 2010 to 2014 after rapidly increasing from 2003 to 2010 (APC = 8.5 95% CI: 3.0-14.2).

Figure 2 shows the time trends in age-standardised incidence rates for women aged <50 and ≥50 years, presented as 3-year moving averages. Incidence rates are higher in women aged ≥50 for all registries, although in The Gambia there was a progressive convergence of rates in these two age-groups. Table S1 presents the Joinpoint regression analyses for all the years of available data for women <50 and ≥50 years. In The Gambia, the AAPC showed a significant increase in incidence rates among women <50 compared to women aged 50+. In Malawi-Blantyre and Eastern Cape-South

Africa, the AAPC is higher for women less than 50 compared to women aged 50 and above, although with overlapping confidence intervals. In Mauritius, the AAPC shows similar rates of increase in both groups. For the other registries, the AAPC indicates a more rapid rate of increase in breast cancer incidence rates among women diagnosed at age 50 and above.

3.3 | Time trends in age-specific incidence rates

Figure 3 shows the age-specific rates by registry in successive time periods. We observe rapid increases in incidence with advancing age in premenopausal women, followed by a decline in the gradient of the curves after age 45. In Brazzaville and Seychelles, this decline in the gradient of the curves is seen after age 55. There are fluctuations in age-specific rates in the earlier time periods in The Gambia. Overall, these trends point towards a gradual increase in age-specific incidence rates in successive time periods for most registry areas, with the relative difference in age-specific rates over time being greater for women aged 45 and above.

Trends by birth cohort in Harare-Zimbabwe and Kampala-Uganda are shown in Figure 4. We observe an increase in the breast cancer

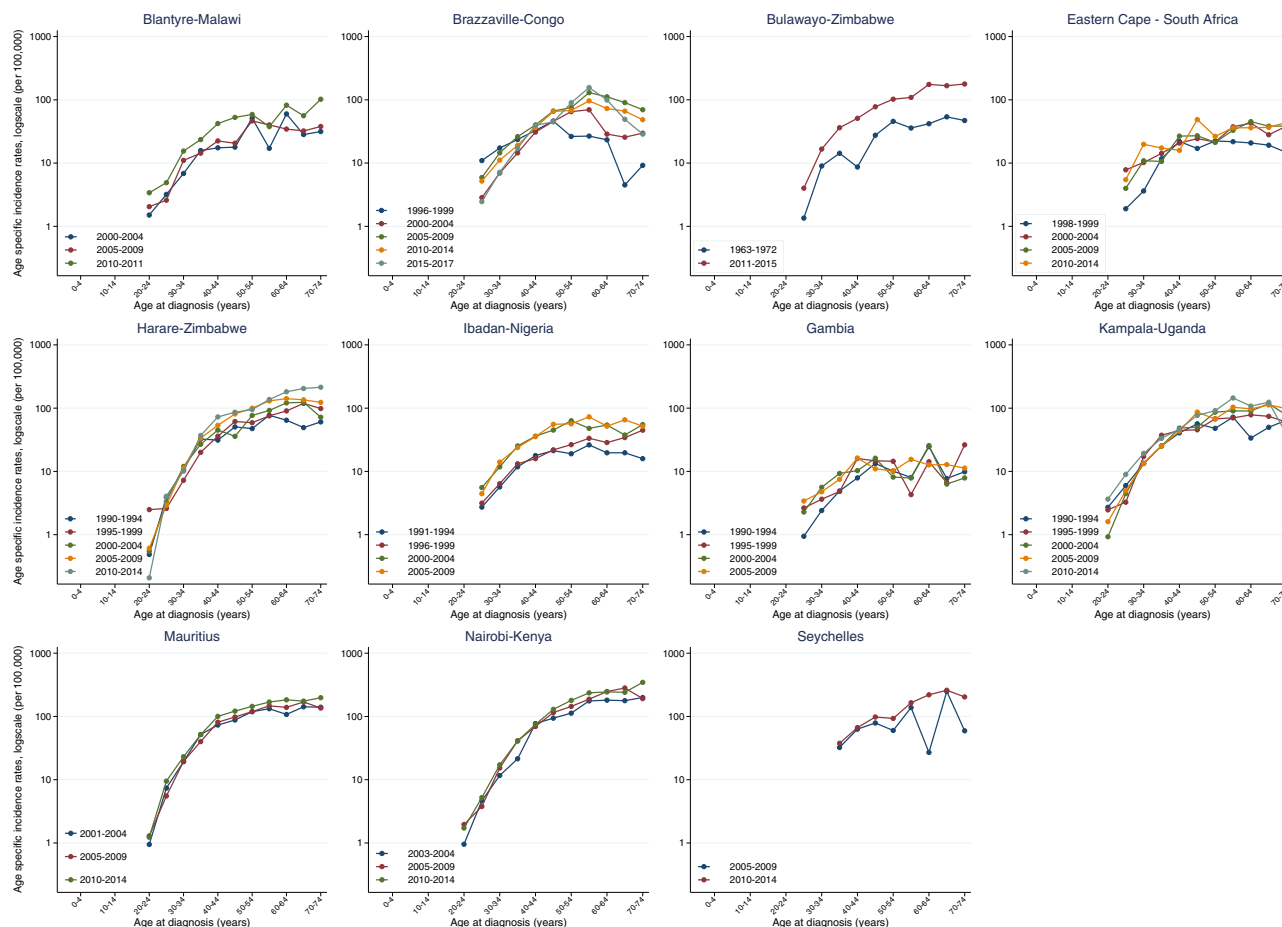


FIGURE 3 Breast cancer age-specific incidence rates by time period and registry area [Color figure can be viewed at [wileyonlinelibrary.com](#)]

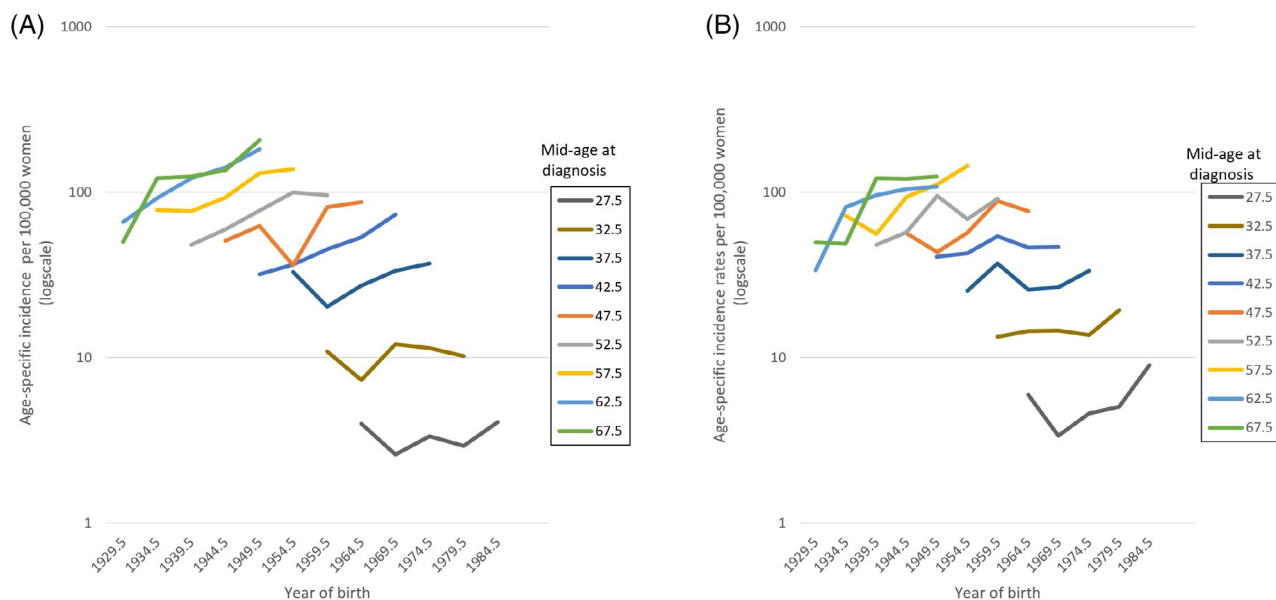


FIGURE 4 Breast cancer age-specific incidence rates by birth cohort in A. Harare, Zimbabwe and B. Uganda, Kampala [Color figure can be viewed at [wileyonlinelibrary.com](#)]

age-specific incidence rates in successive generations (period of birth), for women aged 40 to 45 (with mid-age 42.5) and older at time of diagnosis. In Uganda, we observe this progressive increase in incidence rates for successive generations of women aged 45 to 50 (mid-age 47.5) and older. Fluctuations in incidence rates are observed among younger women in both countries.

4 | DISCUSSION

This article presents breast cancer incidence trends in the populations covered by 11 population-based registries of sub Saharan Africa. Although these registries vary in their coverage and completeness, they provide important insights on the variability in the burden and incidence trends that exists within Africa.

Breast cancer incidence rates are increasing in all of these populations, from all four regions of sub Saharan Africa, in both rural (Eastern Cape, South Africa) and urban populations. The highest rates, however, are observed in urban, more affluent areas like Nairobi-Kenya, Mauritius and Seychelles. Although age-specific and age-standardised rates are higher in older women (≥ 50 years) compared to younger women (< 50 years), the younger demographic construct of African populations means that most breast cancer cases are diagnosed in women aged under 50, an observation made in many clinic-based studies.^{20–22} It does not however imply a higher risk in younger women compared to older women, as has been noted previously.²³ Similarly, the relatively small increase in incidence with age in older women, evident in Figure 3 (compared to that observed in western populations) represents a cohort effect, with progressively higher incidence rates in more recent generations²³—an effect visible in Figure 4—most clearly for Harare. As a result, at any period of observation, older women will appear to have relatively lower rates, and there may even be an apparent *decrease* in risk with age (as in some of the curves in Figure 3).

For areas for which we have data as far back as the 1960s, we observe a more than threefold increase in the risk of breast cancer over four decades. In CI5 Volume 1,²⁴ Uganda, Kampala had an ASIR in the period 1954 to 1960 of 8.8 per 100 000 women, compared to 29.2 in 2005 to 2009. In Maputo, Mozambique, during the period 1956 to 1961, the breast cancer ASIR was 3.2 per 100 000 women^{24,25} while by the period 2015 to 2017 it had reached 15.7 per 100 000 women.²⁶ These trends point towards rapidly increasing breast cancer rates across many sub-Saharan African countries. Despite the increasing rates, observed particularly in postmenopausal women, they are lower than rates observed in more developed countries. In Table S2, we use data from GLOBOCAN 2018 to compare the ratio of the cumulative risk and ASIR of post-menopausal (ages 50+) to premenopausal (ages < 50) using national level estimates for different African regions, Europe and North America. Rates of postmenopausal breast cancer are much higher than premenopausal in all world regions; although the ratios are lower in Africa, where increases in incidence (generation-specific) appear to be continuing. This is partly due to the birth cohort effects seen in Figure 4, whereby rates

increase within each age group among successive generations of women. However, the higher differential among post-menopausal women in developed countries in part reflects the effects of population-level screening, with increases in recorded rates in women in screened age groups (eg, ages 50–74) resulting from lead-time and overdiagnosis effects. In the prescreening era in Denmark the cumulative risk of developing breast cancer was estimated at 8%,²⁷ and in 2018 the cumulative risk was estimated at 9.5%.²⁸ In our study, the cumulative risk of developing breast cancer before age 75 ranges from less than 1% in The Gambia to 7.3% in Nairobi-Kenya. The lifetime risk of developing breast cancer in the U.S. for all ethnics in 2010 to 2012 was estimated at 12.3% (1 in 8 women).²⁹

The influence of oestrogens on breast cancer pathogenesis is probably similar across regions of the world,³⁰ so that the variability in the magnitude of recorded incidence is related to transitioning risk factor profiles in different SSA countries. Older age at first birth, reduced duration of breastfeeding and lower parity are all associated with increasing breast cancer risks, as are low physical activity (increased sedentarism) and increasing obesity. The Demographic and Health Surveys (DHS),³¹ provide insights on the prevalence and changes in some of these risk factors over time in Africa. The DHS estimates that the prevalence of women with a body mass index (BMI) > 25 kg/m² has increased from 23% in 1994 in Zimbabwe, to 34.9% in 2015, and from 8.4% in 1995 to 18.8% in 2011 in Uganda. Fertility rates are declining across sub-Saharan Africa; for example, the average number of live births per woman from the 1980s to 2015 decreased from 7.4 to 5.7 in Zimbabwe, and from 5.4 to 4.0 in Uganda. A greater proportion of African women are entering tertiary education, with corresponding delays in age of marriage and first birth,³⁶ while greater numbers of women returning to work after maternity may limit the average duration of breastfeeding; breast cancer risk is reduced by 4% to 7%^{37,38} for every year of breastfeeding.

The increased risk conferred by these risk factors is more marked in older women. Obesity is associated with an increase in postmenopausal breast cancer.³² Among African-American women, obesity is associated with an increased risk of oestrogen-receptor positive (ER+) breast cancer (which is more common in older women), and a decrease in the risk of triple-negative breast cancer.³³ In Ghana, Figueroa et al showed that increased parity (≥ 3 births) was associated with a reduced risk of both ER+ and ER– breast cancer among women aged 50+ but was associated with an increased risk of early onset ER– tumours. Extended breastfeeding was also associated with a protective effect for both ER+ and ER– breast cancer, although the protective effect was stronger for ER+ tumours.³⁴ In a small Ugandan hospital-based study, no differences in distribution of reproductive risk factors by ER status were found among breast cancer cases.³⁵

Use of oral contraceptives has been shown to increase breast cancer risk in current and recent users. The use of modern contraceptives, among which are exogenous hormones, varies by sub-Saharan African region with the lowest use in Middle and Western Africa and the highest use in Southern Africa³⁹; there is a greater uptake of contraceptive use among women of higher socioeconomic status.⁴⁰ The use of injectables and implants have increased among sexually active

women over time in SSA according to data from the DHS and the Performance Monitoring and Accountability Surveys 2020 (PMA 2020).³⁹ The use of injectable and/or oral contraceptives in South Africa was associated with significantly increased breast cancer risk, and this increased risk persists for about 5 to 10 years after cessation.⁴¹ Reduced physical activity has been associated with increased breast cancer risk in SSA,⁴² and physical activity during leisure in many SSA countries is relatively low.⁴³ There are also ongoing changes in diet with “westernisation” characterised by an increased consumption of diets richer in calories and poorer in fruits and fibre. The increased use over time of animal over plant-based products in sub-Saharan Africa correlates with increased breast cancer incidence rates.⁴⁴ Consumption of diets rich in fruits and cruciferous vegetables has been associated with a decreased breast cancer incidence rates in South Africa, while diets rich in calories and which are nutrient poor conferred higher incidence rates.⁴⁵

These changing risk factor patterns across Africa surely account for much of the increase in breast cancer incidence rates, the larger increases observed in older (postmenopausal) women, as well as probably explaining disparities in the magnitude of the breast cancer burden in different regions. However, incorporating all known risk factors in risk prediction models still underestimates risk among some strata of the population.⁴⁶ In addition to the known modifiable risk factors, there are genetic predispositions and gene-environmental interactions for which more studies are needed on the African continent.^{47,48} In Nigeria, Zheng and collaborators found 11.1% of women with breast cancer carried inherited genetic mutations in *BRCA1* and *BRCA2*,⁴⁹ while the prevalence is lower among women of European ancestry. Less established risk factors which are more prevalent among African women, such as the use of hair relaxers and dyes,^{8,9} skin lighteners⁸ as well as exposure to dichlorodiphenyltrichloroethane (DDT) (an endocrine modulator used for malaria control in many SSA countries), require more comprehensive studies across different African settings.⁷

Although the results in this article provide us with important insights to the changing breast cancer incidence rates across different African countries, the estimates from these registries are not perfect, as maintaining completeness and constancy in registration activities within Africa depends on several socioeconomic factors as well as political stability in these countries. Challenges in recorded data from the 2007 to 2009 period in Zimbabwe were documented in an earlier publication.² To minimise registration artefacts, we included only those registries with the most consistent registration activities, as evidenced by relatively constant numbers of registrations per year, as well as indicators such as MV% and DCO%, and excluded several long-established registries for which such consistency was uncertain. Five of those included (Harare, Uganda, Blantyre, Seychelles and Nairobi) have appeared in the one of last four volumes of CI5. The proportion of morphologically verified cases varies across registry area, ranging from 58.2% in Kampala Uganda to 97% in Seychelles. This could reflect differences in access to pathologic diagnostic services in different countries.

Given the long time series available, and previously reported time trends of breast cancer,⁴ we included data from The Gambia. The

fluctuations in the incidence rates observed in the Gambia are likely due to a deficit of cases in age groups 55 to 59 and 65 to 69 years as well as the uncertainty concerning age in older women, as many more women are registered aged exactly 60 and 70 (Figure S1). In addition, the registry is known to suffer incompleteness of case finding—particularly in older subjects⁵⁰—and this appears to be an increasing problem,²⁶ which probably accounts for the aberrant results from this registry. In addition to potential problems of registry quality, calculation of rates relies upon interpolations of population censuses usually done at 10-year intervals, so that the accuracy of our denominators will depend on the available census data.

Despite these challenges and limitations, these results highlight the need for urgent actions across the cancer continuum, from more in-depth risk factor profile studies across Africa, to the provision of adequate curative treatment and palliative care services at the national level to meet the demands of an increasing number of breast cancer patients.

They also highlight the necessity of supporting the maintenance of good quality population-based cancer registration activities.

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CONFLICT OF INTEREST

No conflicts of interest.

DATA ACCESSIBILITY

The data that support the findings of our study are available on request. All data requests will be evaluated by the AFCRN research committee. Details of the data application process are outlined on the AFCRN website <http://afcrn.org/index.php/research/how-to-apply/76-research-collaborations>.

ETHICS STATEMENT

Approval for our study was obtained from the AFCRN Research Committee and from participating registries. The study made use of routinely collected population-level anonymised data. The study was performed in accordance with the Declaration of Helsinki.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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