



Mapping Evidence on the Burden of Breast, Cervical, and Prostate Cancers in Sub-Saharan Africa: A Scoping Review

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Specialty section:

This article was submitted to
Life-Course Epidemiology and Social
Inequalities in Health,
a section of the journal
Frontiers in Public Health

Received: 30 March 2022

Accepted: 24 May 2022

Published: 16 June 2022

Citation:

Musekiwa A, Moyo M, Mohammed M, Matsena-Zingoni Z, Twabi HS, Batidzirai JM, Singini GC, Kgarosi K, Mchunu N, Nevhungoni P, Silinda P, Ekwomadu T and Maposa I (2022) Mapping Evidence on the Burden of Breast, Cervical, and Prostate Cancers in Sub-Saharan Africa: A Scoping Review. *Front. Public Health* 10:908302. doi: 10.3389/fpubh.2022.908302

Background: Cancer remains a major public health problem, especially in Sub-Saharan Africa (SSA) where the provision of health care is poor. This scoping review mapped evidence in the literature regarding the burden of cervical, breast and prostate cancers in SSA.

Methods: We conducted this scoping review using the Arksey and O'Malley framework, with five steps: identifying the research question; searching for relevant studies; selecting studies; charting the data; and collating, summarizing, and reporting the data. We performed all the steps independently and resolved disagreements through discussion. We used Endnote software to manage references and the Rayyan software to screen studies.

Results: We found 138 studies that met our inclusion criteria from 2,751 studies identified through the electronic databases. The majority were retrospective studies of mostly registries and patient files ($n = 77$, 55.8%), followed by cross-sectional studies ($n = 51$, 36.9%). We included studies published from 1990 to 2021, with a sharp increase from 2010 to 2021. The quality of studies was overall satisfactory. Most studies were done in South Africa ($n = 20$) and Nigeria ($n = 17$). The majority were on cervical cancer ($n = 93$, 67.4%), followed by breast cancer (67, 48.6%) and the least were on prostate cancer (48, 34.8%). Concerning the burden of cancer, most reported prevalence and incidence. We also found a few studies investigating mortality, disability-adjusted life years (DALYs), and years of life lost (YLL).

Conclusions: We found many retrospective record review cross-sectional studies, mainly in South Africa and Nigeria, reporting the prevalence and incidence of cervical,

breast and prostate cancer in SSA. There were a few systematic and scoping reviews. There is a scarcity of cervical, breast and prostate cancer burden studies in several SSA countries. The findings in this study can inform policy on improving the public health systems and therefore reduce cancer incidence and mortality in SSA.

Keywords: breast cancer, cervical cancer, prostate cancer, burden, Sub-Saharan Africa

INTRODUCTION

The burden of cancer is on a rise in developing countries due to the demographic transitions and changes in life-style behaviors (1–4). The most common cancer cases among women in Sub-Saharan Africa (SSA) are breast (25% of all cancers) and cervical (24% of all cancers), while prostate cancer (23% of all cancers) is common among men in SSA (5, 6). Of all the 2018 cancer deaths among women in SSA, 21.7% were attributed to cervical cancer, making it the most common cause of cancer death in the region (7). Breast cancer mortality is high in SSA compared to developed countries (8–13). The prevalence of prostate cancer among men has been high in SSA as it is the leading cause of cancer deaths, particularly among men of African origins (14).

Determining the burden of prostate cancer within SSA has been challenging due to the lack of reliable reporting. The incidence of breast cancer has been reported to be higher in rural areas (60–75%) than in urban areas in SSA (15), and many of these women go untreated, mostly due to a lack of access to health care. One study found that prostate cancer is a serious challenge in African men and its actual incidence is underestimated in SSA settings due to poor access to healthcare, lack of screening, genetic predisposition, lifestyle and environmental factors (4). According to Jalloh et al. (16), most of the health interventions in SSA have focused on communicable diseases such as malaria, tuberculosis and HIV, however, cancer care has been given limited attention.

This study aims to determine recent trends in the burden, including incidence, prevalence, and disability-adjusted life years (DALYs), of breast, cervical and prostate cancer in SSA. Highlighting the burden of the three most common cancers helps bring disparate information reported in the literature to policy makers in an easy and accessible format, in one place. The focus is on SSA because this is where early marriages are rampant and hence girls younger than 15 years old are exposed to early sexual activity, thus increasing their risk of contracting Human Papilloma Virus (HPV), a risk factor for cervical cancer, at a young age (17). In addition, evidence has shown that cervical cancer is more prevalent in HIV-infected women compared to the HIV-uninfected, and their survival rates are poorer (18). Furthermore, breast and prostate cancer awareness and treatment are lower in SSA due to limited resources. This scoping review seeks to provide evidence on the burden of these three most common types of cancers in SSA. Results from this study

TABLE 1 | PCC framework used to determine the eligibility of the research question and to guide the selection of studies on the burden of breast, cervical and prostate cancers.

Population	Adult cancer patients (breast, cervical, prostate)
Concept	Burden of breast, cervical, and prostate cancer
Context	Sub-Saharan Africa

will add to the body of literature and help policy makers in making informed decisions that will improve the public health systems in reducing the cancer burden in SSA.

METHODS

Study Design

This scoping review aimed to collate, synthesize, and analyze the wide range of available evidence to map literature on the burden of breast, cervical and prostate cancers in SSA. The title was registered with the Open Science Framework (OSF) (<https://archive.org/details/osf-registrations-bna26-v1>). The scoping review used the Arksey and O'Malley framework (19) as reviewed and updated by Levac et al. (20) and the Joanna Briggs Institute 2020 guidelines (21). The framework has the following five steps that guide how scoping reviews are done:

- Step 1: Identifying the research question.
- Step 2: Identifying relevant studies.
- Step 3: Selecting studies
- Step 4: Charting the data.
- Step 5: Collating, summarizing and reporting the data.

The scoping review was reported using the Preferred Reporting Items for Systematic Reviews and Meta-analysis: Extension for Scoping Reviews (PRISMA-ScR) guidelines (22).

Identifying the Research Question

Our primary research question for the scoping review was: What evidence exists on the epidemiological burden of breast, cervical and prostate cancers in SSA? The measures of burden include spatial distribution, incidence, prevalence, quality-adjusted life years (QALYs), disability-adjusted life years (DALYs), and years of life lost (YLL).

To assess the eligibility of the research question, this scoping review utilized the Population, Concept and Context (PCC) mnemonic, derived by the Joanna Briggs Institute (21). The PCC statement guided the selection of studies (Table 1).

Abbreviations: MeSH, Medical Subject Headings; MMAT, Mixed Methods Appraisal Tool; PHC, Primary Healthcare; PRISMA-ScR, Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews; UN, United Nations; WHO, World Health Organization.

TABLE 2 | PubMed pilot search strategy for SSA studies on cervical, breast and prostate cancer.

Date	Database	Keywords
25/10/2021	PubMed	Search: (((("prostatic neoplasms"[MeSH Terms] OR Prostate cancer[Text Word] OR prostatic neoplasm*[Text Word] OR prostate tumour*[Text Word]) OR ("uterine cervical neoplasms"[MeSH Terms] OR Cervical cancer[Text Word] OR Cervix Cancer[Text Word] OR uterine cervical neoplasms[Text Word] OR cervical neoplasms[Text Word])) OR ("breast neoplasms"[MeSH Terms] OR Breast Cancer[Text Word] OR breast neoplasm[Text Word] OR Breast Tumor*[Text Word])) AND ("Global Burden of Disease"[MeSH Terms] OR burden[Text Word] OR "prevalence"[MeSH Terms] OR prevalence[Text Word]) AND (("africa south of the sahara"[MeSH Terms] OR Sub saharan Africa[Text Word] OR SSA[Text Word] OR Sub-saharan Africa[Text Word] OR Sub sahara Africa[Text Word]) OR ("Africa"[MeSH Terms] OR AFRICA[Text Word]) NOT ("Africa, Northern"[MeSH] OR Northern Africa[Text Word]))

Identifying Relevant Studies

We conducted a comprehensive search from inception to 25 October 2021, irrespective of language, in the following electronic databases: PubMed, Web of Science, and Scopus. The search strategy was developed with an experienced librarian (KK, who is also the co-author) using a variety of keywords related to the burden of breast, cervical and prostate cancers in SSA. A combination of these keywords and Medical Subject Heading (MeSH) terms were used and tailored appropriately to each database. In addition, we manually searched the reference lists of all included studies to identify additional literature. **Table 2** shows a pilot search strategy used in PubMed. The actual search strategies used are given in the **Supplementary Materials**.

Eligibility Criteria

We conducted an extensive title and abstract screening guided by the study's eligibility criteria to determine all eligible articles to be selected for this scoping review. To account for all eligible studies included in the review, the inclusion and exclusion criteria listed below were followed.

Inclusion Criteria

This study included all publications that adhered to the following criteria:

- Studies reporting on at least one of the types of cancers, that is, breast, cervical and prostate.
- Studies reporting on the burden (prevalence, incidence, QALYs, DALYs, and others) on at least one of breast, cervical and prostate cancers.
- All publications reporting evidence on the three cancers in different SSA countries; this was not limited by study design.
- Studies from all countries in SSA (all countries in Africa except Algeria, Egypt, Morocco, Tunisia, and Libya).

- Studies from inception to search date.

Exclusion Criteria

This review excluded studies based on the following:

- Any articles reporting on cancers other than cervical, breast and prostate cancers
- Northern African countries (Algeria, Egypt, Morocco, Tunisia, and Libya) which are not considered SSA.

Selecting Studies

We screened the titles of the associated selected articles from the different repositories. After that, we used EndNote 20 software to identify the duplicates in the qualified articles and deleted them. The abstracts of the qualified articles were examined by two independent reviewers using a screening tool that specifies inclusion and exclusion criteria. In this stage, the reviewers resolved any contradiction by involving a third reviewer. The two reviewers then explored the full text of the selected articles using the screening tool. After this phase, any contradictions arising were resolved independently by a third reviewer. For any articles that could not be accessed during the screening phase, the librarian assisted in retrieving the full-text articles. The database searches, keywords used, and the number of selected articles were properly reported. Also, the screening results were displayed using a PRISMA-ScR flow diagram (22).

Charting the Data

To extract relevant information from each of the selected articles, an electronic data charting form was developed with data extraction tool components, including author and date, title, country, study design, type of cancer (cervical, breast, prostate), type of burden reported, and key findings. The data extraction tool was piloted by two independent reviewers before use. Any appropriate changes were then applied as per the feedback received during the piloting stage and the tool was updated accordingly.

Quality Appraisal

We used the Mixed Methods Appraisal Tool (MMAT) V.2018 software (23) to assess the quality of studies since we anticipated different types of study designs to be included in the scoping review. The tool included the relevance of the study, the study design, adequacy and methodology, data collection, data analysis and the main study findings. The process of quality appraisal was performed independently and in duplicate by at least two review authors to avoid any bias. Disagreements between reviewers were resolved through discussion.

Collating, Summarizing and Reporting Results

We summarized the emerging themes for the burden of the three cancers using a narrative approach. The summary was structured around the burden and types of cancers. We also meticulously analyzed and reported any other emerging themes relevant to the research question. Where appropriate we used tables and graphs to visualize findings. The results of this scoping review were used to determine the gaps in knowledge regarding the burden of breast, cervical and prostate cancer in SSA.

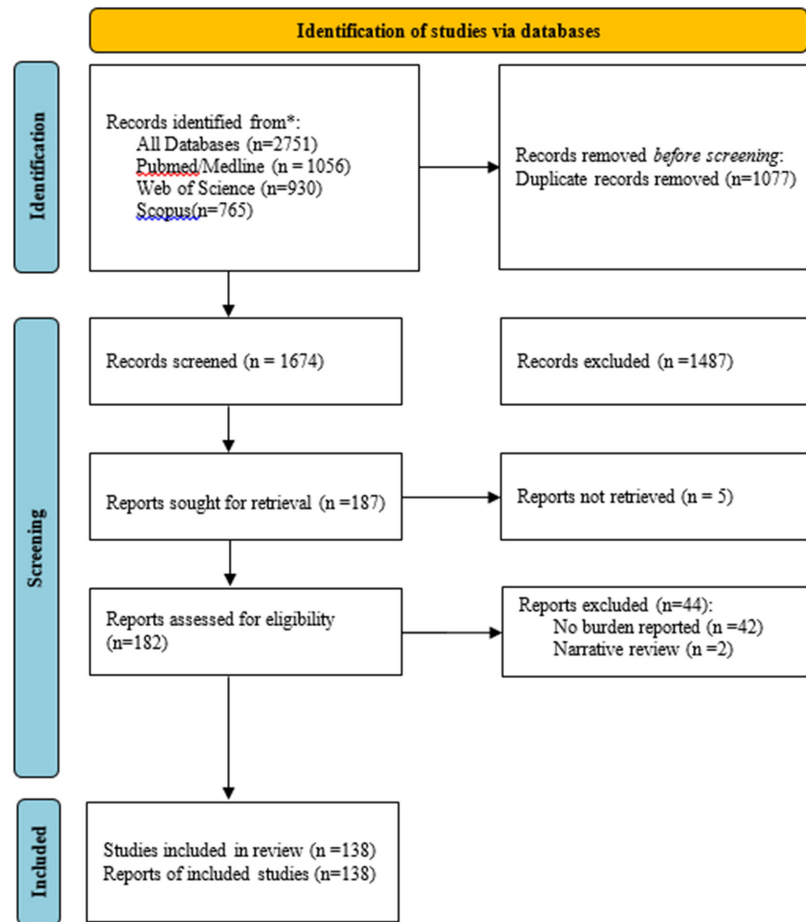


FIGURE 1 | PRISMA flow chart showing the number of studies included in a scoping review for breast, cervical and prostate cancer in Sub-Saharan Africa.

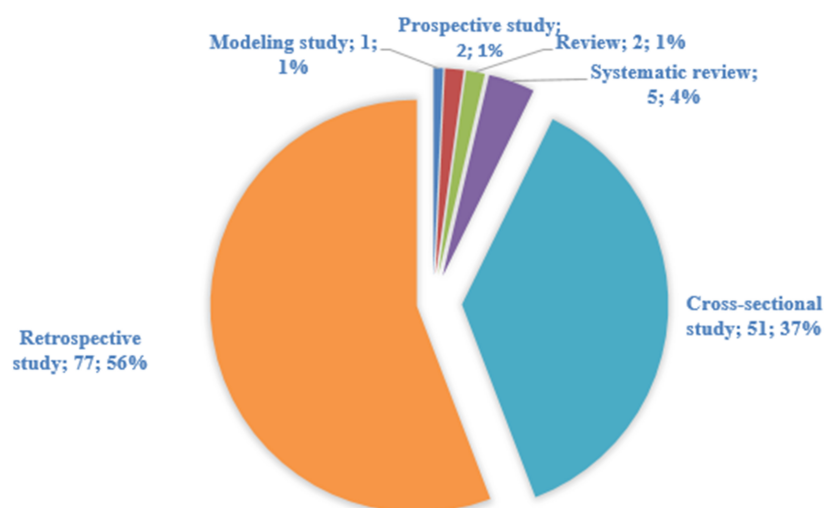


FIGURE 2 | Pie chart showing study designs for studies on breast, cervical and prostate cancer in Sub-Saharan Africa.

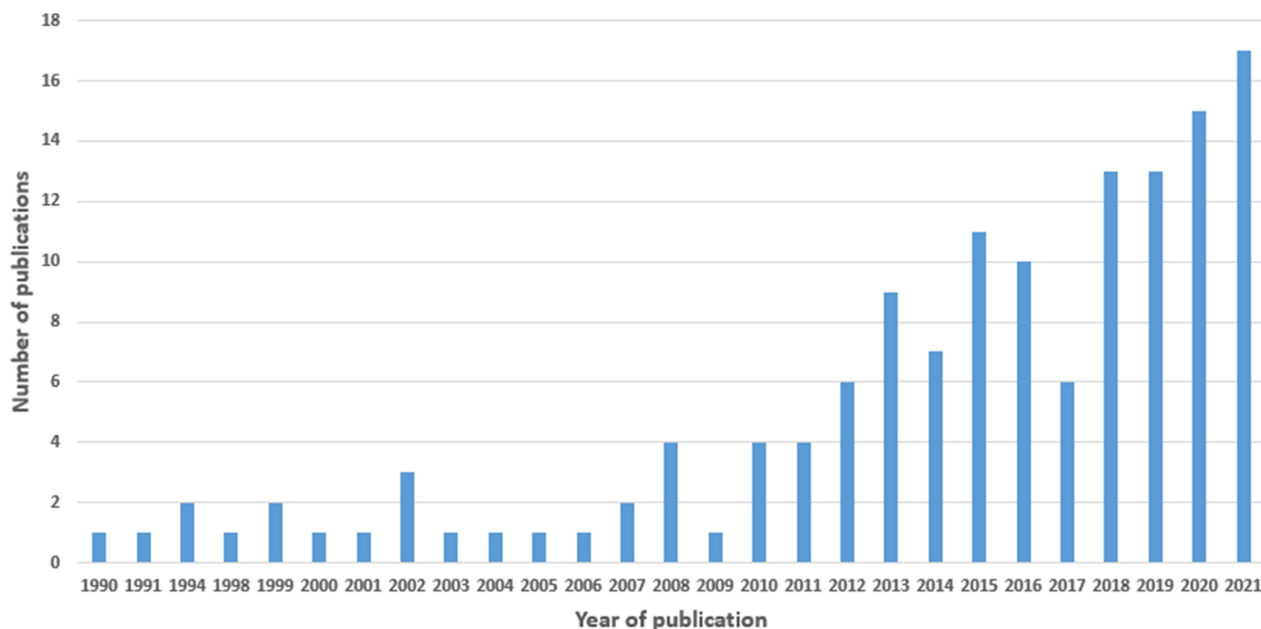


FIGURE 3 | Trend in the number of included studies over time in years, 1990 to 2021.

RESULTS

Results of the Search

A total of 2,751 studies were found in three electronic databases (PubMed, Web of Science, and Scopus). After removing 1,077 duplicate records, we remained with 1,674 records whose titles and abstracts were screened. Screening resulted in 1,487 records being excluded for being irrelevant, thus leaving 187 reports that were sought to have their full texts retrieved, however, five records could not be retrieved, and this resulted in 182 full-text reports that were assessed for eligibility by at least two reviewers. Finally, 44 records were excluded after the full-text screening, and therefore 138 studies were included in this scoping review (Figure 1).

Characteristics of Included Studies

Study Designs and Quality of Included Studies

Study Designs

The majority of the included studies were retrospective studies ($n = 77$, 55.8%) of mostly registries and patient files (6, 10, 24–98) followed by cross-sectional studies ($n = 51$, 36.9%) (99–149), systematic reviews ($n = 5$, 3.6%) (2, 150–153) and reviews ($n = 2$, 2.1%) (154, 155). There were two prospective studies (156, 157) and one modeling study (158) (Figure 2).

The prevalence studies had different target populations, with some only targeting cancer patients and calculating the percentage of each type of cancer. Some cross-sectional studies were targeting the general population, including screening studies.

Year of Publication

We included studies published from 1990 to 2021, with a sharp increase from 2010 to 2021 (Figure 3).

Quality of Studies (MMAT Tool)

The quality of studies, assessed using the Mixed Methods Assessment Tool (MMAT), is summarized in Table 3. The assessment excludes the five systematic reviews, two reviews, and the modeling study. Therefore, the assessment was carried out for 130 studies; the majority were quantitative studies ($n = 129$) and they satisfied all the qualities in the table; appropriate sampling strategy, representative sample, appropriate measurements, low nonresponse bias, and using appropriate statistical methods. There was one mixed-methods study (133), which had an adequate rationale for mixed methods and had both the quantitative and qualitative aspects adequately interpreted.

Spatial Distribution of Studies

While most studies were single-country studies, some were multi-country and global studies including African countries. There were 16 global studies including the African or SSA regions (27, 46, 69, 104, 106, 108, 109, 117, 121, 122, 127, 131, 142, 144, 145, 158) and there were 16 African multi-country studies (2, 6, 87, 119, 120, 138, 140, 141, 143, 148–154). From the single-country studies, majority were done in Nigeria ($n = 17$) (24, 25, 28, 29, 34, 45, 54, 64, 72, 75, 92, 93, 103, 113, 116, 124, 137) and South Africa ($n = 20$) (10, 26, 36, 42, 55, 65, 80–83, 86, 88, 89, 91, 98, 105, 110, 125, 129, 135), followed by Uganda ($n = 10$) (35, 40, 48, 59, 74, 78, 79, 90, 94, 95), then Malawi ($n = 9$) (37, 52, 53, 56, 66–68, 118, 133) and Ethiopia ($n = 9$) (33, 51, 63, 97, 101, 107, 112, 146, 157). We also found studies conducted in Ghana ($n = 6$) (50, 71, 111, 123, 134, 155), Kenya ($n = 5$) (70, 96, 115, 132, 139), Zambia ($n = 4$) (44, 77, 102, 126), and Eritrea ($n = 3$) (60–62). There were seven countries with two studies each [Botswana (43, 47), the Central African Republic (31, 32), Mozambique (57, 58), Rwanda (130, 136), Senegal (147, 156), Sudan (84, 114) and Zimbabwe (38, 39)]. The countries

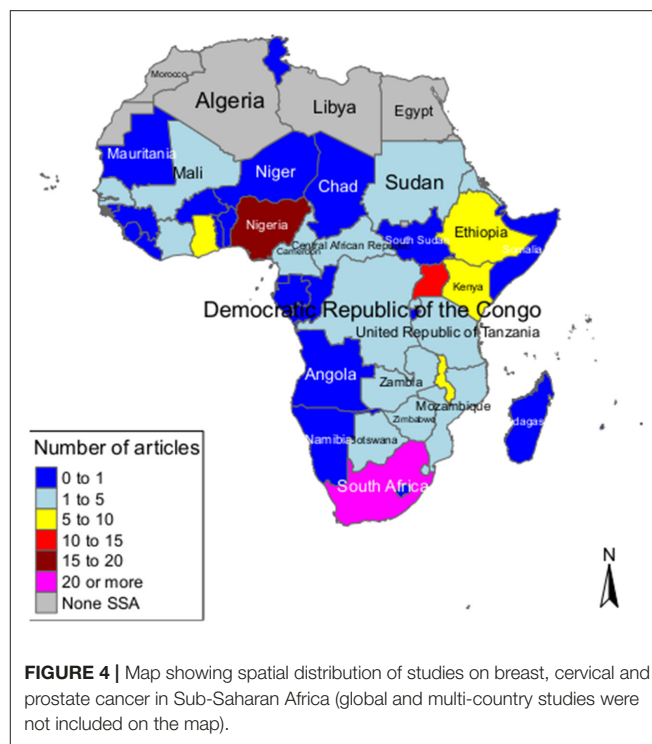
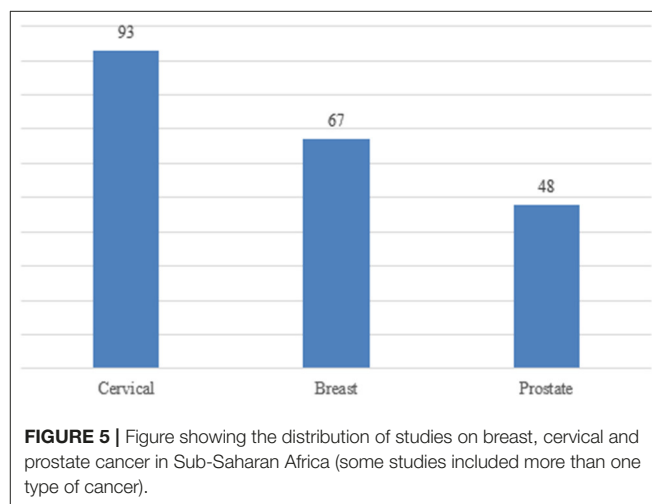
TABLE 3 | MMAT table for Sub-Saharan African studies on the burden of cervical, breast and prostate cancer.

Study type	Question	Yes	No	Cannot tell	Total
SCREENING QUESTIONS	S1. Are there clear research questions?	128	0	2	130
	S2. Do the collected data allow us to address the research questions?	129	0	1	130
QUANTITATIVE DESCRIPTIVE STUDIES	4.1. Is the sampling strategy relevant in addressing the research question?	127	1	1	129
	4.2. Is the sample representative of the target population?	126	1	2	129
	4.3. Are the measurements appropriate?	127	1	1	129
	4.4. Is the risk of nonresponse bias low?	70	24	35	129
	4.5. Is the statistical analysis appropriate to answer the research question?	125	1	3	129
MIXED METHODS STUDIES	5.1. Is there an adequate rationale for using a mixed-methods design to address the research question?	1	0	0	1
	5.2. Are the different components of the study effectively integrated to answer the research question?	0	1	0	1
	5.3. Are the outputs of the integration of qualitative and quantitative components adequately interpreted?	1	0	0	1
	5.4. Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?	0	1	0	1
	5.5. Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?	0	0	1	1

with a single study were Cote d'Ivoire (128), Democratic Republic of Congo (99), Mali (85), Swaziland (76), Tanzania (49), and The Gambia (30). We found no studies in the following SSA countries: Angola, Benin, Burkina Faso, Burundi, Cape Verde, Comoros, Equatorial Guinea, Gabon, Guinea, Guinea-Bissau, Lesotho, Liberia, Madagascar, Mauritania, Mauritius, Namibia, Niger, Sao Tome, Seychelles, Sierra Leone, Somalia, and Togo (Figure 4).

Types of Cancer

The majority of the studies were on cervical cancer ($n = 93$, 67.4%), followed by breast cancer (67, 48.6%) and the least were

**FIGURE 4 |** Map showing spatial distribution of studies on breast, cervical and prostate cancer in Sub-Saharan Africa (global and multi-country studies were not included on the map).**FIGURE 5 |** Figure showing the distribution of studies on breast, cervical and prostate cancer in Sub-Saharan Africa (some studies included more than one type of cancer).

on prostate cancer (48, 34.8%); some studies investigated all the three types of cancer ($n = 29$) while some reported two of the three cancers ($n = 15$) (Figure 5).

Burden of Cancer

Cervical Cancer

Prevalence Studies

A total of 51 studies reported the prevalence of cervical cancer in Sub-Saharan Africa, of which the majority ($n = 9$, 17.6%) were from Nigeria (28, 34, 45, 54, 64, 92, 93, 113, 137); these were retrospective record reviews of registries and patient files and two were cross-sectional studies (113, 137). This was followed

by six studies from Malawi: one cross-sectional study (118), one cross-sectional study of the Malawi Cancer Registry (133), two retrospective cohort studies (66, 68) and two retrospective record reviews of registries (53, 67). There were four studies from South Africa: a cross-sectional study (105), a retrospective cohort study (55), and two retrospective record reviews; registry (91) and patient files (65). There were also four studies from Uganda, which were retrospective record reviews of registries (59, 79, 94) and pathology reports (95). There were also three studies from Kenya: one cross-sectional study (132) and two retrospective record reviews of patient files (70) and registry (96). Another three studies were from Zambia: two cross-sectional studies (102, 126) and one retrospective record review of patient files (77). There were also three studies from Ethiopia: two cross-sectional studies (112, 146) and one retrospective review of patient files (51). There were two studies from Cameroon; both retrospective record reviews of patient files (41) and registry (73). One cross-sectional study was conducted in each of the following countries: Côte d'Ivoire (128), the Democratic Republic of Congo (99), Ghana (111), Rwanda (130), and Senegal (147). There was also one retrospective record review of patient files from Botswana (47) and another retrospective record review of smears from Swaziland (now called Eswatini) (76).

Six studies were African multi-country studies: two African studies; one cross-sectional study of Global Cancer Incidence, Mortality and Prevalence (GLOBOCAN), an online database providing global cancer statistics and estimates of incidence and mortality in 185 countries for 36 types of cancer, and all cancer sites combined (138) and a scoping review study (154), one cross-sectional study from South Africa and Uganda (120), and three systematic reviews [one from SSA (151), one from seven African countries (152) and one from Southern and Eastern Africa (153)]. There were three GLOBOCAN studies (104, 127, 145).

Incidence Studies

A total of 36 studies looked at the incidence of cervical cancer in Sub-Saharan Africa, of which the majority were from South Africa: two retrospective reviews of registries (10, 83), two retrospective cohort studies (81, 82), one retrospective record review of pathology reports (86) and one cross-sectional study (135). There were five studies from Uganda consisting of three record reviews of registries (35, 59, 74), one retrospective cohort study (40), and one retrospective record review of pathology reports (78). Three retrospective record reviews of registries were from Malawi (37, 52, 67). Two studies were retrospective record reviews of registries from Nigeria (24, 75). Two retrospective record reviews of registries from Zimbabwe (38, 39). Two Ethiopian retrospective record reviews of patient files (51) and registry (63) and two retrospective record reviews from Mozambique; one using pathology reports (57) and the other registry data (58).

There were five African multi-country studies: one systematic review including seven African countries (152) and four SSA studies; three cross-sectional studies (140, 141, 149) and one retrospective review of registry (6). There were five global studies, of which two were cross-sectional GLOBOCAN studies (109, 121), one cross-sectional study of Global Burden of Disease

Study (117), a retrospective record review of registry (27), and a modeling study (158).

There was one study from each of the following countries: one retrospective record review of registry from The Gambia (30), one retrospective review of pathology reports from Eritrea (61), Ghana (71) and Sudan (84).

Other Burden Measures

A total of 11 studies considered other measures of cervical cancer burden; five studies reported mortality globally including Africa (117, 144), South Africa (129), Kenya (139) and Ethiopia (97). One cross-sectional study reported the population attributable fraction in a GLOBOCAN study (108). Two cross-sectional studies reported the disability-adjusted life years (DALYs) in Kenya (115) and for the SSA region (119). One GLOBOCAN study reported years of life lost (YLL) (148). Two cross-sectional studies in South Africa reported odds ratios for cervical cancer comparing HIV infected with HIV uninfected individuals (42, 110).

Breast Cancer

Prevalence Studies

A total of 32 studies reported the prevalence of breast cancer in Sub-Saharan Africa. Five studies were from Nigeria, of which four were retrospective record reviews of registries (28, 45, 64, 72) and one was a cross-sectional study (116). Four studies were from Ethiopia, three cross-sectional studies (101, 107, 146) and one retrospective review of patient files (51). Three studies were from Malawi, where one was a retrospective review of the registry (53) and two were retrospective cohort studies (66, 68). There were three studies from Uganda, two were retrospective record reviews of pathology reports (90, 95) and one was a retrospective record review of registry (59). Two studies were from South Africa, one retrospective record review (26) and a cross-sectional study of Demographic and Health Survey (DHS) data (125). Two studies were from Ghana, of which one was a cross-sectional study (134) and the other a retrospective record review of patient files (50). There was one study from each of the following countries: a retrospective record review of pathology reports from the Central African Republic (32), another retrospective record review of non-governmental records in Botswana (43), one cross-sectional study from Sudan (114), one cross-sectional study in both South Africa and Uganda (120), one retrospective record review of registry from Kenya (96), and a retrospective record review of pathology reports in Zambia (44).

There were two studies covering the whole of Africa, one a scoping review (154) and the other a GLOBOCAN cross-sectional study (138). There were also two GLOBOCAN cross-sectional studies (104, 145).

Incidence Studies

There were 28 studies reporting the incidence of breast cancer in Sub-Saharan Africa. Ten of the studies were covering the whole of Africa or SSA; a systematic review (2), three cross-sectional GLOBOCAN studies (122, 131, 143), three cross-sectional studies of the WHO database (106), Global Burden of Disease Study (117) and registries (141), two retrospective record review of

registries (87, 117) and a retrospective cohort study (69). In South Africa, there were three incidence studies on breast cancer; two retrospective record reviews of registries (89) and mammograms (98) and a cross-sectional study of the Statistics South Africa registry (135). There were also three studies from Uganda; one retrospective cohort study (40), and retrospective record review of registry (35) and pathology reports (78).

There were two Ethiopian studies on the incidence of breast cancer; one prospective observational study (157) and a retrospective record review of a registry (63). Also, two incidence studies in Mozambique consisted of a retrospective record review of pathology reports (57) and registry (58).

There was one incidence study from each of the following countries: a retrospective record review of registry in Nigeria (24), The Gambia (30), the Central African Republic (31), Eritrea (62), Malawi (37), Zimbabwe (38), Mali (85), and Sudan (84).

Other Burden Measures

A total of 12 studies considered other measures of breast cancer burden; mortality was measured by nine studies (46, 48, 69, 98, 117, 129, 139, 143, 144). DALYs were reported by four incidence studies (46, 69, 117, 119). One study reported quality of life (156) and another reported economic burden (142).

Prostate Cancer

Prevalence Studies

A total of 23 studies reported the prevalence of prostate cancer in Sub-Saharan Africa, of which seven were from Nigeria (25, 28, 45, 64, 103, 116, 124), three from Malawi (67, 118, 133); consisting mainly of retrospective record review of patient files and registries as well as cross-sectional studies (116, 124). The two prevalence studies from Ghana consisted of a cross-sectional study (123) and a review (155). There was one study from each of the following countries: a retrospective record review of registry from Kenya (96), Uganda (59), a cross-sectional study from Cameroon (100), a retrospective record review of pathology reports from South Africa (80) and Zambia (44), a retrospective cohort study from Tanzania (49), a cross-sectional study from Rwanda (136). The two studies that reported on the whole of Africa (138, 154) and two global studies including Africa (104, 145).

Incidence Studies

A total of 17 studies focused on the incidence of prostate cancer in Sub-Saharan Africa. There was one systematic review covering the entire African region (150). There were two global studies (46, 117) and two SSA studies (87, 141). There were two retrospective record reviews of pathology reports (57) and registry (58) from Mozambique. There were also two retrospective record reviews from South Africa (36, 88) and Uganda (35, 78). There was one retrospective record review of pathology reports from Eritrea (60), Ethiopia (63), Malawi (37), one retrospective record review of patient files in Nigeria (29), one retrospective record review of registries from The Gambia (30) and Zimbabwe (38).

Other Burden Measures

A total of eight studies considered other measures of prostate cancer burden; mortality was measured by seven studies (33,

46, 117, 129, 135, 139, 144). DALYs were reported by three incidence studies (46, 117, 119). One study reported years of life lost (YLL) (135).

DISCUSSION

The objective of this scoping review was to map the evidence on the burden of the three most common cancers in Sub-Saharan Africa, namely cervical, breast and prostate cancers. We comprehensively searched PubMed, Web of Science and Scopus databases, and included 138 studies: 93 on cervical cancer, 67 on breast cancer, and 48 on prostate cancer. This shows a disproportionation in the distribution of cancer studies in SSA. Cervical and breast cancer receive more funding compared to prostate cancer, as they form sexual and reproductive health (SRH). Although breast cancer is the commonest cancer in SSA and globally (145), there are more studies on cervical cancer in the region. This could be because cervical cancer has been historically identified as AIDS-defining cancer (159), making cervical cancer screening a priority for women living with HIV. Poor resourced SSA countries have utilized the well-established HIV care platforms to screen for cervical cancer and donor funds have supported cervical cancer prevention and treatment programs in the region compared to breast cancer. While cervical cancer prevention HPV vaccines are widely available even in SSA, vaccinations against breast cancer are not yet available (160).

Majority of studies were done in South Africa and Nigeria. We identified some countries where there was no study on any of the three cancers. One of the reasons for this unavailability of cancer studies in some SSA countries could be because countries in SSA differ in terms of cancer control, with some countries putting in more resources than others. It has been reported that the cancer burden reported for SSA might be underestimated due to lack of appropriate screening, and diagnosis, poor access to treatment and care, and limitations in the technical workforce and infrastructure (14, 161). State-of-the-art cancer treatment and care, which includes cancer diagnostic equipment, is expensive, and since most countries in SSA are developing, they may not be able to acquire such equipment (162, 163). Additionally, the quality of the cancer data systems is poor, hence the possibility of having scarce research data in some of the SSA countries (164).

Most of the included studies were retrospective record review studies of mainly registries and patient files ($n = 77$), followed by cross-sectional studies ($n = 51$), in addition to some systematic reviews and prospective studies. The trend is similar elsewhere because cancer is a chronic condition which takes a while to detect; hence, most studies are done on existing data. Cross-sectional studies are also easier to perform since they involve cancer screening and surveillance activities that may be easily available at a public healthcare facility. There was only one study that included modeling and a few prospective studies were identified in this study. This shows that there is still a gap in research that employs modeling of the burden of prostate, cervical and breast cancer in SSA using prospective and statistical modeling. The main advantage of using modeling is that you

estimate DALYs and the results can be standardized by age group, making it easier for interpretation. The benefits of using prospective studies include reporting of quality of life of the patients and assessing time-to events like mortality. These studies allow one to report results beyond prevalence and incidences and the risk of occurrence of an outcome of interest can be estimated, which is more informative than the prevalence estimate.

Majority of studies reported prevalence and incidence of the cancers, but we also found studies reporting mortality, DALYs, and YLL. The quality of studies was overall satisfactory. We also identified a gap in the literature on these three types of cancer in SSA. Firstly, there were countries with no specific study on any of these three types of cancer. Secondly, we found few nationwide population-based surveys of these cancers to determine their true prevalence since most studies reported the proportion of each of the cancers from oncology records where the target population were only cancer patients. Multi-country studies were relatively few in this study. To understand more about the regional picture of prostate, cervical and breast cancer in SSA, multi-country studies are more preferred as these studies show the heavily burdened countries across the region and those that are performing well. This comparison allows key stakeholders to share information and knowledge across the SSA region. Moreover, national surveys on cancer are important for monitoring and surveillance of non-communicable diseases like cancer indicators, to inform policy. The reduction in the burden of breast, prostate and cervical cancers in SSA starts with the implementation of efforts within each country; hence, nationwide studies are important and these can feed into multi-country studies.

To our knowledge, this is the first scoping review on the burden of cervical, breast and prostate cancers in SSA. There is a published scoping review (165) that mapped evidence on the prevalence, incidence, mortality and trends of HPV-associated cancers in SSA, which only found eight studies (six reviews and two quantitative studies). Another systematic review investigated only the incidence of prostate cancer in Africa (150). Our scoping review is different because we investigated the three most common cancers in SSA, namely the breast, cervical and prostate cancers. However, our conclusions in identifying gaps in effective cancer registry systems in Africa are similar to the previously published reviews.

We used a very experienced librarian who is also part of the co-authors to perform a comprehensive search in three main electronic databases. The search strategy used medical subject headings (MeSH) terms and was not limited in language or date; we searched all studies from inception to the current search date. Pairs of co-authors performed each of the processes, including screening of studies, data extraction, and charting, repeatedly. We used EndNote 20 software to manage the references and used the Rayyan software in screening the studies.

Study Limitations

However, this study has some limitations. The main limitation is that we only searched three electronic databases and did not search the grey literature such as theses and dissertations

of universities. We excluded some studies that did not report the cancer burden indicators defined in this scoping review. Nonetheless, since we identified 138 studies, it is more likely that these included studies are representative of the trends and patterns in the burden of cervical, breast and prostate cancer studies in SSA.

CONCLUSIONS AND RECOMMENDATIONS

We have identified a lack of comprehensive studies quantifying the burden of cervical, breast, and prostate cancers in SSA. This is crucial to help policy makers to decide on appropriate policies. Other countries in SSA do not have a single study on any of these three main cancers, thereby reflecting a great need for setting up research priorities, including funding frameworks for such essential studies. We recommend that countries in SSA expand their national surveys to include measures of cancer burden – more specifically the burden of cervical, breast and prostate cancers. Our scoping review enriched the pool of knowledge and provided a deeper understanding of the burden (incidence, prevalence, and DALYs) of cervical, breast, and prostate cancers in SSA, which could inform the public health systems' decision-making. Policy responses to the growing burden of cancer in general and more specifically that of cervical, breast, and prostate cancers will be required in less developed countries such as those in SSA to mitigate the threat caused by these cancers. This scoping review provided useful, relevant, timely and easily accessible information on the burden of the three cancers to facilitate the efforts by policymakers to decisively ramp up prevention and treatment interventions. These results can also help set research priorities for future cancer burden studies as well as help identify opportunities to improve existing policy frameworks around cancer prevention and treatment, especially for cervical, breast and prostate cancers in SSA.

AUTHOR CONTRIBUTIONS

AM conceptualized the topic with assistance from MMoy, MMoh, ZM-Z, HT, JB, GS, KK, NM, PN, PS, TE, and IM who contributed equally to the writing, research, critical review and proofreading of the manuscript. KK performed the search with assistance from MMoy and TE. All authors contributed to the article and approved the submitted version.

FUNDING

This research was funded in part by the National Science Foundation, grant number 134651, to the MASAMU Advanced Study Institute.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpubh.2022.908302/full#supplementary-material>

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