Systematic Review

Survival Timesof Lung, Breast, Cervical, And Prostate Cancer Patients in Africa

Abstract

Cancer is a leading cause of death and disability in Africa, and addressing this disease remains a significant challenge for many African countries. This paper examines the survival times of cancer in Africa through a critical review of 38 publications that comprise 27,795 samples with lung, breast, cervical, and prostate cancer. The overall survival time at one year was 77.4%, and the loco-regional rate of survival at three years was 71.8%. For cervical, breast, lung, and prostate cancer, the five-month survival time was 73.1-79.9%. The mean survival times for lung cancer patients at one year was 78.2%, and the mean annual survival times at three years was 52.8%. The mean age at the time of the study was 57.6 years. Total estimated pooled survival times for cancer patients in Africa was 60.66% (95% CI: 56.27, 65.06). And, the survival times of cancer patients in Southern Africa is 14.30%, 26.21% in Eastern Africa, 24.51% in Western Africa, and 41.06% in Central Africa. To improve survival times of lung, breast, cervical, and prostate cancer patients in Africa, it is important to increase awareness about cancer and its risk factors. And consortia should be promoted, whereby regions in Africa that have better resources can serve as mentors

Keywords: Survival Times, Cervical Cancer, Lung Cancer, Breast Cancer, Prostate Cancer, Africa

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1. INTRODUCTION

Cancer is a group of diseases characterised by the uncontrolled growth and spread of abnormal cells. Normally, cells in the body grow and divide in an orderly way, and old or damaged cells die and are replaced by new cells. But in cancer, this process goes awry. Old cells donot die and instead form a mass of tissue called a tumour, which can be benign (not cancerous) or malignant (cancerous). One continent that has struggled with the frequency of non-communicable diseases is Africa, particularly with the rising rates of cancer. The most prevalent and deadly malignancies on developing continents like Africa are cancers of all types (Oguntunde, Adejumo &Okagbue, 2017). A wide variety of disorders that can affect any part of the body are collectively referred to as "cancer" (Cormie, Atkinson & Bucci, 2018). One of the characteristics of cancer is the rapid proliferation of abnormal cells that can invade nearby body parts and spread to other organs after crossing their normal boundaries. There areabout 36 cancer types in about 47 countries; the World Health Organization (WHO) 's African region (AFRO) revealed that there were 811,200 new cancer cases (4.5% of the total world) and 534,000 cancer deaths (7.3% of the total world) reported in the AFRO countries in 2018 (Ingleby, Woods, Atherton, Baker, Elliss-Brookes & Belot, 2022).

Cervical, breast, prostate, and lung cancers are among the most common types of cancer in Africa. Every year in Africa, cervical cancer accounts for 19.6% of all malignancies that are newly diagnosed in women (Wassie & Fentie, 2021). A dismal prognosis is caused by the fact that the majority of patients have advanced cancer when they are diagnosed. There are also differences in the distribution of other prevalent malignancies both within and between nations. Cancer of the breast occurs mostly in women majorly in North Africa (27% of cases annually), where it is the most common cancer in women, than in sub-Saharan Africa (15.7% of cases annually), where it ranks second to cervical cancer. In comparison to rural areas, urban areas have a higher prevalence of breast cancer. Prostate cancer is mostly attributed to men, and it is the greatest killer of African males (Rawla, 2019). In comparison to North Africa, which has an age-standardised rate of 3 per 100,000 people per year, death rates from prostate cancer are higher in the west (age-standardised rate 6.6-11.6 per 100,000 people per year), the east (age-

standardised rate 11.7 per 100,000 people per year), and South Africa (age-standardised rate 6.3-45.7 per 100,000 people per year) (Mahal, Butler & Franco, 2019).

Cancer mortality, occurrence, and prevalence are impacted by Africa's geographic, climatic, economic, sociocultural, genetic, and environmental heterogeneity. In Africa, both sexes have a 125% chance of developing cancer by the age of 75, compared to 24% in Europe (Jemal, et al., 2011). About a quarter of all cancer cases in Africa are primarily brought on by infection.

Smoking is a risk factor for malignancies of the mouth, throat, and lungs that accounts for around 6% of all cancer-related deaths. Wide variations in tobacco smoking prevalence were found in Africa, according to the STEP-wise survey, which was conducted by the WHO among individuals 24-65 years old in 32 countries. Smoking is becoming more prevalent among young people, particularly among adolescent women in Nigeria (17%) (White, Bergin & Thomas, 2020). In Africa, improper housing plans and regulations are a widespread issue. Because homes lack adequate ventilation and there is no active regulating body to regulate emissions, occupants are susceptible to passive smoking and other environmental contaminants that are cancer risk factors (Garg, Iyer & Jindal, 2022).

The ability of the system to identify the disease and whether patients have quick access to adequate treatment are both reflected in survival times. Cancer patients with African heritage had the worst outcomes and the shortest survival times. Due to a combination of a late-stage upon diagnosis and restricted access to prompt and standard therapy, cancer survival is typically poor in this area (Allemani, Matsuda & Di Carlo, 2018). For instance, the 5-year relative survival times for colorectal cancer and cervical cancer in Uganda and Zimbabwe were 8.3% and 17.7%, 17.4%, and 30.5%, respectively. Only 6% of patients in Malawi survived for five years or longer after being diagnosed with cancer, with a median survival duration of roughly nine months (Miller, Siegel & Lin, 2016). To reduce the incidence of cancer in Africa, there is a need to shield light on the survival times of cancer patients. Based on this, this paper critically examined cancer survival times in Africa.

1.1.Research Aim

The main focus of this paper is to examine the survival times of cancer in Africa. This paper discussed cancer, its prevalence in Africa, its causes and the survival time in Africa. This paper focuses on cancer survival times in Africa. Four major types of cancer were reviewed in this paper, which is breast, cervical, prostate and lung cancer.

1.2.Research Objectives

- To outline the most prevailing cancer type in Africa.
- To understand the survival time of cancer in Africa.
- To analyse the survival time of cancer in various sub-regions in Africa.

2. LITERATURE REVIEW

Cancer is a significant global public health concern and a leading cause of death in many locations (Siegel et al., 2020). Inequalities between low- and high-income nations, including ethnic, socioeconomic, racial, and cultural differences, contribute to these disparities (Bahnassy et al., 2020). In 2018, the WHO's African region (AFRO) reported 811,200 new cases of cancer and 534,000 cancer deaths, accounting for 4.5% of the world's total and 7.3% of all cancer deaths globally. Cervical and breast cancers are the most common cancers among African women, while liver, prostate, and colon cancers are prevalent among African men. Childhood cancer survival times are much lower in Africa compared to high-income countries (Stefan et al., 2017).

Pinheiro et al. (2019) analysed cancer mortality data from South Florida, disaggregated by race and ethnicity. They found that African American females and males had the highest overall cancer mortality rates across all cancer types. Multiple myeloma, prostate, breast, stomach, lung, liver, and colorectal carcinoma cancer have the highest fatality rates. Mortality rates for Afro-Caribbean patients were also higher than those for white populations, with the highest rates seen in the prostate, stomach, premenopausal breast, multiple myeloma, and endometrial carcinoma. Lung cancer is more common in Afro-Caribbeans than colorectal and breast cancers.

It is important to note that cancer outcomes can vary due to various factors, including disease behaviour, impact on survival, and response to treatment. To address the specific cancer threats facing Africans and individuals of African ancestry, it is essential to examine the survival times of lung, breast, cervical, and prostate cancer patients in Africa.

2.1.Breast Cancer

Breast cancer is a type of cancer that originates in the breast tissue. It is the most common cancer among women worldwide, affecting millions of women each year. Breast cancer occurs when cells in the breast begin to grow abnormally and form a mass or lump. These abnormal cells can invade surrounding tissue and spread to other parts of the body, a process called metastasis. Breast cancer is a significant health issue for women in Africa, as it is one of the most common types of cancer among women worldwide. In recent years, breast cancer has overtaken all other cancers in women as the most prevalent type of cancer (Saxena et al., 2005).Breast cancer is the most commonly diagnosed cancer in African women and the second most common cause of cancer-related deaths in sub-Saharan Africa, following cervix cancer (Ferlay et al., 2019). Incidence has increased by more than 23% in the last six years, with 1.7 to 2.1 million new cases (Ferlay et al., 2018; Torre et al., 2015).The most prevalent cancer among women in Nigeria is breast cancer (Awodutire et al., 2018). It is a complicated illness with risk factors from the environment, genes, and way of life. Additionally, breast cancer is a group of clinically diverse disorders that can range from mild to severe. There are several variations in breast cancer epidemiology between different groups (Ferlay et al., 2015). It has been demonstrated that very aggressive triple-negative and inflammatory breast cancers are three times more prevalent in American women of African descent than in Caucasian women (Dhieb et al., 2019). Additionally, previous research has shown that prolonged histories of consanguinity, which are common in some higher-income countries in Asia and elsewhere, lower the frequency of mutations on the two key susceptibility genes BRCA1 and BRCA2, which cause the disease (Medimegh et al., 2015).

In sub-Saharan Africa, the five-year survival time for breast cancer is less than 40%, compared to 86% in the United States (Cumbera et al., 2017). Black women have a higher risk of breast

cancer recurrence, independent of age, tumour size, or tumour grade, which indicates that African ancestry is a predictive factor for low survival times (Maskarinec et al., 2011; Newman et al., 2006). Mammography is the gold standard for early identification and effective care of breast cancer, but screening programs in Africa face challenges due to a lack of funding, technical assistance, and trained personnel (Denny et al., 2017; Corbex et al., 2012). The breast cancer death rate is declining in developed nations, but in sub-Saharan Africa, the majority of women are diagnosed with the disease in advanced stages, and mammography is less efficient at detecting cancers in earlier stages, especially in younger women (Tsu et al., 2013). The inability to provide appropriate care, such as chemotherapy and radiotherapy facilities, is another significant barrier, and some women seek alternative and ineffective treatments due to poverty and cultural restrictions (Tetteh & Faulkner, 2016). Breast cancer is a significant health threat to African women due to poverty, cultural barriers and lack of resources, and more efforts are needed to improve screening and treatment options.Therefore, investigating the survival times of breast cancer patients in Africa is required.

2.2.Prostate Cancer

Prostate cancer is a type of cancer that affects the prostate gland, a small, walnut-shaped gland in the male reproductive system. It is one of the most common types of cancer among men, especially those over the age of 50. Prostate cancer occurs when cells in the prostate gland begin to grow abnormally and form a mass or tumour. These abnormal cells can spread to other parts of the body, a process known as metastasis. Around 90,000 people die from prostate cancer each year in Europe, making it the third most aggressive neoplasm globally and frequent cancer among men (Rawla, 2019). Over the past few decades, international recommendations for the treatment of prostate cancer cases have become more conservative. The most frequent interventions are a prostatectomy and/or external beam radiation therapy, which is followed by continued androgen deprivation therapy (ADT), also called chemical castration and maintenance. Few risk factors aside from age have been identified. The most well-known ones are genetic predispositions, diet, obesity, and smoking (Kenfield et al., 2011). There seems to be a significant ethnic correlation with prostate cancer. African-American men are more likely to be infected with cancer. The more likely people to get diagnosed with this type of cancer are

African Americans in the U.S.,who have a 2.5 times higher mortality rate from the condition (Demark-Wahnefried et al., 1998). A recent assessment of the literature revealed that health inequities like shortage of finance, non-availability of health insurance, and/or subpar health-seeking behaviour made African American males not to go for treatment compared to European American men. Additionally, worries about the adverse effects of therapy, like incontinence and sexual dysfunction, make some men reluctant to seek treatment.

Siegel et al. (2014) found that African-American males had significantly higher mortality rates from prostate cancer than individuals with European or Asian ancestry. Several studies have investigated the incidence, prevalence, aggressiveness, and survival times associated with this racial disparity. Some research suggests that inadequate access to medical care and screening and treatment facilities may contribute to poor outcomes for black men (Underwood et al., 2004; Schwartz, 2009), while other studies implicate genetic and germline disparities (Powell, 2007; Giovannucci et al., 1997; Bensen et al., 2013; Faisal et al., 2016). Despite accounting for socioeconomic and lifestyle differences, African ancestry remains a significant risk factor for prostate cancer (Park et al., 2015). Moul et al. (1996) and Faisal et al. (2014) suggest that race should be considered a separate prognostic factor for disease recurrence due to a more biologically aggressive phenotype in black men. However, the underlying cause of this disparity is not yet fully understood and requires further research (Tsodikov et al., 2017).

To better understand the natural history of prostate cancer in Africa, Tsodikov and colleagues developed three predictive models of prostate-specific antigen screening patterns in the U.S., using data from the National Health Interview Survey in 2005 and the Surveillance, Epidemiology and End Results programme between 1975 and 2000 (Tsodikov et al., 2017). They found that by age 85, 30-43% of black males had preclinical prostate cancer, which was significantly higher than the general population. Black men had a comparable diagnosis rate to the general population, but their likelihood of developing the metastatic disease at the time of diagnosis was 44-75% higher. These findings support previous studies using surgical pathology and autopsies that found black men have a higher probability of developing clinically relevant cancer (Powell et al., 2010).

Jaratlerdsiri et al. (2018) conducted whole-genome sequencing on paired tumour-normal tissues from African and non-African patients with prostate cancer. They found that African-derived

malignancies had more minor somatic variants and higher oncogenic driver mutations than those from Europe. African tumors had less PTEN loss, ERG fusions, and PIK3CA mutations but frequently obtained CCND1 and MYC. Additionally, genes controlling the calcium ion-ATPase signal transduction were altered in African tumours, a pathway commonly affected in prostate cancer. This highlights the importance of investigating the survival times of prostate cancer patients in Africa.

2.3.Cervical Cancer

Cervical cancer is a type of cancer that affects the cervix, which is the lower part of the uterus that opens into the vagina. It is caused by the abnormal growth of cells in the cervix, often due to infection with certain types of human papillomavirus (HPV).Cervical cancer can usually be detected early through regular screening tests, such as a Pap smear, and can often be successfully treated if caught early. Common symptoms include vaginal bleeding, abnormal vaginal discharge, and pelvic pain. Treatment options may include surgery, radiation therapy, chemotherapy, or a combination of these methods. HPV vaccination is also available to help prevent the development of cervical cancer. Cervical cancer is a major public health issue, particularly in low- and middle-income countries where access to screening and treatment may be limited.The fourth most frequent malignancy among women overall is cervical cancer. Nearly 12% of all female malignancies are found in low- and middle-income areas, accounting for around 85% of the global burden (Ginsburg et al., 2017). Contrarily, less than 1% of all females that contracted cervical cancer were in higher-income areas (Arbyn et al., 2020). Most victims of cervical cancer are women between 30 to 50 years old, as it is only cancer that is virtually fully avoidable and treatable if diagnosed on time. It is brought on by specific Human Papillomavirus (HPV) infections that are contracted through sexual contact (Lei et al., 2020). Worldwide, occurrences of cervical cancer and pre-cancerous cervical lesions are caused by two HPV types: 16 and 18 (Okunade, 2020). Moreover, there is proof linking HPV to a number of cancer types, such as oropharynx, anus, vulva, vagina, and penis cancers.

Several factors contribute to the high rate of prostate cancer in Africa. One factor is a lack of awareness about the disease, as well as limited access to screening and diagnosis. There are also

cultural and socioeconomic barriers to accessing healthcare, as well as a shortage of trained healthcare providers and adequate healthcare facilities.

The mortality rates of cervical cancer are significantly higher in developing and underdeveloped countries and lower in developed countries (Drokow et al., 2022).The most prevalent etiological factors for the aetiology of cervical cancer in Africa are human papillomavirus (HPV) types 16 and 18. (Kabir et al., 2019). HPV was observed to be prevalent in 97.0% of Malawians (Howitt et al., 2017), 92.1% of South Africans (Denny et al., 2014), 90.7% of Nigerians in Ibadan (Okolo et al., 2010), and 69.8% of Nigerians in Maiduguri (Kabir et al. 2019). In reality, immunocompetent women typically recover from their HPV infection (Lowy et al., 2008). Nonetheless, there is a greater chance of developing cervical cancer in women with underlying human immunodeficiency virus (HIV) infection than in women without HIV infection, with yearly detection rates of 1.4 vs 0.4 per 100 persons per year, respectively. This is a frequent condition in Africa (Looker et al., 2018; Liu et al., 2018; Massad et al., 2015). According to de Martel et al. (de Martel et al., 2020), SSA had the highest age-standardised incidence rate (ASIR; 19.3 cases per 100,000 people/years) of HPV-related cancer in the entire globe. About two-thirds of all cervical cancer cases caused by HPV16 and HPV18 might be avoided with the presently available HPV vaccines, according to a recent meta-analysis study by Drolet et al. (2019), which included midline papers published between February 1, 2014, and October 11, 2018. Additionally, especially in industrialised nations, cervical screening programmes with cytology, HPV detection, or both could stop the majority of the remaining cases. However, it faces a number of difficulties in Africa, including scarce finances, a lack of awareness about cervical cancer, and a lack of screening facilities (Getachew et al., 2019, Lyimo et al., 2012). The International Information Centre on HPV and Cancer 2017 indicated that Ethiopia's total rate of cervical cancer screening was 0.8%. (Ameya et al., 2017). Corresponding to that, Getachew et al. revealed in another study that it was 1%. (Getachew et al., 2019). All of these elements played a role in delayed diagnosis and lower survival times due to ineffective early identification.

2.4.Lung Cancer

Lung cancer is a type of cancer that affects the lungs, typically starting in the cells that line the air passages. It is the leading cause of cancer-related death worldwide, and the incidence of lung cancer is increasing in many countries, including those in Africa. There are two main types of lung cancer: small-cell lung cancer and non-small-cell lung cancer. The type of lung cancer a person has, as well as its stage (how far it has spread), will determine the best course of treatment. Smoking is the leading cause of lung cancer, but other risk factors include exposure to radon, air pollution, secondhand smoke, and a family history of the disease.

Around 2.1 million new instances of lung cancerwere reported in 2018 (Bray, et al., 2018). Lung cancer has long been the most prevalent cancer in the world. It is a very deadly malignancy that causes more than 1.6 million fatalities per year in the world (Chan & Hughes, 2015). Due to a greater understanding of the negative consequences and other risk factors associated with smoking, significant drops in the mortality rate of lung cancer have been seen in higher-income countries. On the other hand, in several low- and middle-income nations, the mortality rates and incidence of lung cancer incidence have increased (Torre, et al., 2016). This discrepancy is mostly caused by rising smoking rates (including tobacco, water pipes, cannabis, and passive smoking), as well as restricted access to screening, diagnosis, and targeted therapy. Other risk factors include exposure to pesticides, nickel, silica, dust, fumes, asbestos, and dust. There are nations in Africa that have not yet banned or restricted asbestos. In addition, the likelihood of developing lung cancer and passing away from it is rising throughout Africa due to longer life expectancies. Additionally, numerous studies have identified genetic indicators in the epidermal growth factor receptor, Kirsten rat sarcoma viral oncogene, and ALK genes that characterise the hereditary predisposition to develop lung cancer, particularly in North Africa (Dhieb et al., 2019). This paper is focused on evaluating the survival times of lung cancer patients in Africa

Research on racial disparities in lung cancer prevalence and outcomes has produced conflicting statistics. Some studies have found that black patients have fewer epidermal growth factor receptor mutations than white patients, while others have found no significant correlation between patient race and epidermal growth factor receptor mutations. Campbell et al. (2017) found no significant differences in mutational rates and copy number changes between black and white patients with lung cancer. Additionally, there was no significant difference in genetic

changes in the receptor tyrosine kinase/Ras/Raf pathway, including epidermal growth factor receptor and Kirsten rat sarcoma viral oncogene, between the two groups. Mitchell et al. (2019) also found no connection between ethnic differences, particularly in West African heritage, and lung cancer survival, which supports previous research suggesting that genetic heritage does not negatively affect lung cancer risk or survival.

Murphy et al. (2018) found that African Americans used more nicotine per cigarette than other American heritage groups. This finding is consistent with the fact that urine total nicotine equivalents, which is a more accurate indicator of smoking intensity than daily cigarette consumption, were higher in African Americans. Consequently, African Americans are exposed to higher levels of well-known tobacco carcinogens such as NNAL and polycyclic aromatic hydrocarbons.The findings suggest that exomic mutations do not contribute to the reported racial disparities in the development and prognosis of lung cancer between black and white populations. However, further research is needed to know the survival times of lung cancer patients in Africa.

3. METHODOLOGY

3.1 Research Design

This study used quantitative Systematic Reviews and Meta-analyses (PRISMA-P), a statistical method that integrates multiple related studies to provide a quantitative mixture of data (Mueller et al., 2018). This employs secondary data, and it analyses quantitative data from the outcomes of past investigations to achieve the research objective. Meta-analysis is a retrospective observational study that recaps data without experimental modification. The purpose of systematic reviews and meta-analyses is to compile and summarise data from various studies on a single topic (Atoyebi & Atoyebi, 2022). Meta-analysis can be used to summarise research findings, serve as a foundation for policymaking, and draw statistical inferences using processed data expressed by measures computed or pre-searched by formulae (Turner, Bird and Higgins, 2013; Pereira et al., 2019; Atoyebi & Atoyebi, 2022). PRISMA helps decision-makers understand and use the evidence more clearly (Atoyebi & Atoyebi, 2022). Meta-analysis has several advantages, including the application of useful disciplines in summarising research

findings, a more sophisticated approach than conventional review procedures, finding relationships obscured in other research summary methods, and offering an organised way of handling inconsistencies in research findings (Basu, 2017; Chamdani et al., 2022).

3.2 Study Location

Africa is the second-largest contingent on earth in both area and population. The African Mainland is an almost entirely isolated landmass connected to Western Asia only by a small land bridge in the Northeast. Africa occupies about 30,244,000 km^2 (11,700,000 mi2), approximately 6% of the planet's total surface. 20% of the surface of the globe is covered by the continent and the adjacent islands. The largest country in Africa is Algeria, which is followed by Sudan and the Democratic Republic of the Congo (Kinshasa). An estimated 1.37 billion people, or 14% of the world's population, live on the second-largest continent (in 2021). Africa's most populated country is Nigeria, which has a population of about 211 million.

Cancers of the cervix, breast, liver, and prostate, as well as Kaposi's sarcoma and non-lymphoma, Hodgkin's, are the most prevalent cancers in the African Region. In comparison to high-income countries, the survival time for cancer patients in Africa is presumed to be significantly lower.

Africa has five (5) sub-regions, and they are grouped thus:

Central Africa: Angola, Cameroon, Central African Republic, Chad, Congo Republic-Brazzaville, Democratic Republic of Congo, Equatorial Guinea, Gabon and Sao Tome & Principe.

Western Africa: Benin, Burkina Faso, Cape Verde, Cote D Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo.

Eastern Africa: Burundi, Comoros, Djibouti, Ethiopia, Eritrea, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Seychelles, Somalia, Tanzania, Uganda, Zambia and Zimbabwe.

Southern Africa: Botswana, Lesotho, Namibia, South Africa and Swaziland.

Northern Africa: Algeria, Egypt, Libya, Morocco, Sudan, and Tunisia.

3.3 Search Strategy

In order to find publications, keywords and Boolean operators were combined. The literature search was limited to those published in English and to studies published between 2010 and 2023. The researchers used a set of keywords related to mathematical thinking (such as, "Cancer" OR "Lung Cancer" OR "Breast Cancer" OR "Cervical Cancer" OR "Prostate Cancer") and a second set of keywords related to the Survival Time of Cancer Patients in Africa.

A Medline, EMBASE, Web of Science, Google Scholar, and PubMedof English-language articles published between 2010 and 2023 was conducted. Africa, prostate cancer, survival, cervical cancer, breast cancer, lung cancer, mortality, and race are just a few of the terms and keywords that were employed in searching the internet. For this paper, relevant papers were chosen using three layers of screening. First, all the identified abstracts were reviewed by the reviewer to identify any publications that met the criteria for inclusion, including survival times as the main exposure variable or at least one of the covariates, race as the outcome, and either overall survival or survival specific to cervical, breast, lung, or prostate cancer. Second, to ensure that the inclusion criteria were met, each pertinent publication underwent a careful review. Additional articles that were missed in the original search were looked up in the reference section of the chosen relevant publications. Third, a review and an abstract were done on the chosen publications. At this point, the papers were sorted to ensure that only one publication was chosen by identifying articles that used the same data sources, location, and overlapping time periods.

Author	Year	Study Design	Country	Sub-regions	Sample size	Cancer Type
Isabelle et al.	2018	Prospective	Mauritius	Eastern Africa	1225	Lung
Rodrigo et al.	2010	Cox	Zambia	Eastern Africa	1018	Lung
Mbatchou et al.	2021	Retrospective	Cameroon	Central Africa	1418	Lung
Nur and Amsalu	2023	Retrospective	Kenya	Eastern Africa	1620	Lung
Martin et al.	2017	Prospective	Nigeria	Western Africa	1818	Lung
Ismaili et al.	2021	Cross Sectional	Morocco	Northern Africa	1509	Lung
Helen et al.	2021	Retrospective	Nigeria	Western Africa	1115	Lung
Melanie et al.	2013	Retrospective	Zimbabwe	Eastern Africa	1502	Prostate
Yahaya et al.	2020	Retrospective	Uganda	Eastern Africa	1363	Prostate
Abdollah et al.	2016	Ecological	Algeria	Northern Africa	2002	Prostate

Magoha	2020	Prospective	Kenya	Eastern Africa	1590	Prostate
Roderic et al.	2022	Retrospective	Ivory Coast	Western Africa	1800	Prostate
Tobias et al.	2021	Comparative registry	Namibia	Southern Africa	1542	Prostate
Andamlak et al.	2022	Retrospective	Ethiopia	Eastern Africa	2220	Cervical
Mazvita et al	2020	Flexible Poisson regression	Seychelles	Eastern Africa	2765	Cervical
Salama et al.	2021	Retrospective	Uganda	Eastern Africa	2112	Cervical
Opoku et al.	2016	Retrospective	Ghana	Western Africa	1900	Cervical
Musa et al.	2016	Retrospective	Nigeria	Western Africa	1650	Cervical
Mulugeta et al.	2021	Retrospective	Ethiopia	Eastern Africa	2349	Cervical
Levi et al.	2018	Prospective	Zambia	Eastern Africa	1100	Cervical
Khaemba et al.	2013	Retrospective	Kenya	Eastern Africa	2307	Cervical
Wondimene et al.	2018	Retrospective	Ethiopia	Eastern Africa	3780	Breast
Tesfay et al.	2021	Retrospective	Ethiopia	Eastern Africa	3554	Breast
Khadije et al.	2020	Prospective	Tunisia	Northern Africa	3800	Breast
Mwendwa e al	2021	Retrospective	Burkina Faso	Western Africa	4160	Breast
Ngowa et al.	2015	Retrospective	Cameroon	Central Africa	3555	Breast
Ssentongo et al.	2020	Retrospective	Uganda	Eastern Africa	3900	Breast
Moses et al.	2015	Observational analytical	Zambia	Eastern Africa	4200	Breast
McKenzie et al.	2016	Prospective	South Africa	Southern Africa	3850	Breast
Paddy et al.	2022	Retrospective	Ghana	Western Africa	4190	Breast
Walburga et al.	2020	Prospective	Zimbabwe	Eastern Africa	3300	Breast
Yvonne et al.	2019	Prospective	Benin	Western Africa	3588	Breast
Zhan et al.	2018	Prospective	Ethiopia	Eastern Africa	3248	Breast
Yoanna et al.	2022	Prospective	South Africa	Southern Africa	4260	Breast
Yoanna et al.	2020	Prospective	Zambia	Eastern Africa	3264	Breast
Paddy et al.	2019	Retrospective	Zimbabwe	Eastern Africa	4070	Breast
Ssentongo	2018	Prospective	Ghana	Western Africa	3790	Breast
Maajani et al.	2019	Retrospective	Algeria	Northern Africa	3500	Breast

Table 1: Characteristics of Studies.

3.3 Study Selection

The CADIMA and Rayyan applications were specifically used to remove all duplicate publications acquired from various databases by the reviewer. The titles, full text and abstracts of papers discovered by the search strategy were examined to remove publications that werenot acceptable. The selection procedure follows the approach used in the previous systematic literature review (Atoyebi & Atoyebi, 2022). Potentially eligible articles were fully retrieved and evaluated for their eligibility.

Figure 1 displays the process of article search, identification, download, screening, and inclusion in the paper. A thorough search for published studies was conducted across various databases, including Medline, EMBASE, Web of Science, Google Scholar, PubMed, and African Journals Online, to identify studies reporting on cancer, overall survival, loco-regional recurrence, and/or disease-free survival. A total of 514 relevant studies were identified, out of which 38 met the eligibility criteria and were included in the meta-analysis.

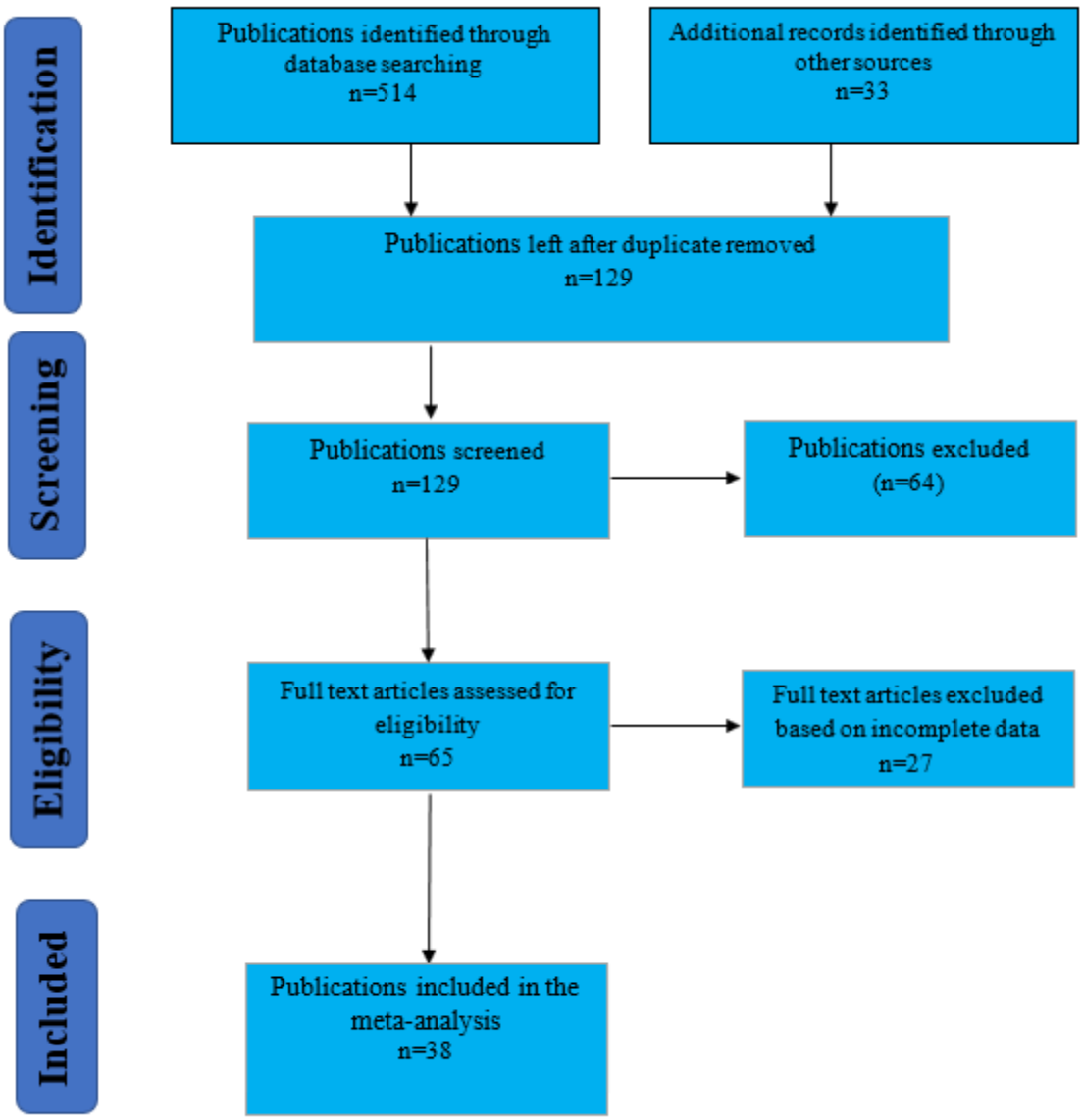

Figure 1: Flowchart of the publications selected for the Meta-Analysis
Source: Author's compilation

3.4 Exclusion and Inclusion Criteria

To ensure the result of the meta-analysis is not biased and applicable to just certain situations, the parameters of this study must be defined by creating exclusion and inclusion criteria (Atoyebi & Atoyebi, 2022). The inclusion criteria for this meta-analysis included original research articles that met the following requirements: (a) they were published between 2010 and 2023; (b) race,

specifically Africans, was the main exposure variable or covariate; and (c) one of the outcome variables was overall survival or survival specific to breast, lung, cervical, or prostate cancer. Only English-language articles were chosen.

This analysis excluded review articles and papers whose objective was to compare Whites and Blacks, publications that either compared Blacks with non-Blacks or non-Whites with Whites were also disregarded from the analysis.

3.5 Extraction of Data

Every final article submitted for the study was provided by a previously created checklist, which was then arranged to extract the data. The author's name, the publication year, the study period, the country of origin, and the survival time by year for each survival period are all listed on this checklist. To match the main goal and provide consistent extraction of the relevant exposure, decision criteria for data extraction were devised. Tierney and colleagues' method was used to estimate the survival time from the original Kaplan-Meier curves (Wells et al., 2010),where it wasnot specified.

3.6 Quality Assessment

The quality of a few publications was assessed using the Newcastle-Ottawa Scale (NOS) quality assessment form. The Newcastle, Australia and Ottawa, Canada Universities' continuous partnership is through which the NOS was developed. This tool is divided into three categories based on the final scores: good (3 or 4 stars in the selection domain, 1 or 2 stars in the comparability domain, and 2 or 3 stars in the outcome/exposure domain); fair (2 stars in the selection domain, 1 or 2 stars in the comparability domain, and 2 or 3 stars in the outcome/exposure domain); and poor (0 or 1 star in the selection domain or less). Studies were then categorised as having a low (≤5), moderate (6–8), or high (≥9) risk of bias based on the overall score for all items in the quality evaluation instrument.

3.7 Data Analysis

In order to conduct the study, STATA version 14 was used to import the extracted data from an excel sheet. Using the inverse variance (I^2) and the Cochran Q statistic, heterogeneity in reported survival times of cancer was evaluated. A cutoff of 25%, 50%, and 75% were designated as low, moderate, and severe heterogeneity, respectively, with a p-value less than 0.05. A random effects model was used to predict the pooled prevalence of cancer (breast, cervical, lung, and prostate) survival periods and was depicted using a forest plot with a 95% confidence range because heterogeneity was demonstrated among studies (I^2=96.6%, p=0.001). Meta-regression and sub-group analysis were carried out to look into the likely sources of heterogeneity. The age group, the year of the publication, methodology and population of the study-African subgroups (in central, southern, western, and eastern Africa) were included in the analysis.

To test the reliability of the findings, sensitivity analysis was carried out, in which the effects of removing one study at a time from the pooled estimate were investigated. Potential publication bias was evaluated using a funnel plot and Egger's regression test. In addition to the leave-one-out influence analysis, additional statistical tests were performed using Comprehensive Meta-Analysis (CMA) with a 5% significance threshold.

4 RESULTS AND INTERPRETATION

4.3 Study Characteristics

Ten (10) studies covering a total of 7,421 cervical cancer patients had sample sizes from 2,307 to 2,765 (median = 187.5). There were 18 articles covering a total of 11,074 breast cancer patients, with sample sizes from 3,255 to 4,264 (median = 202.3). Furthermore, 9 articles covering a total of 4,254 women with lung cancer used samples with sizes from 1,018 to 1,818 (median = 157.1). In addition, 7 articles covering a total of 5,046 prostate cancer patients used samples with sizes ranging from 1,502 to 2,002 (median = 162.6).

10 studies from Western Africa (Ghana, Cote d'Ivoire, Nigeria, Benin, and Burkina Faso) were included, as were 5 studies from Southern Africa (South Africa, Namibia), 4 studies from Northern Africa (Morocco, Algeria, and Tunisia), 23 studies from Eastern Africa (Ethiopia,

Uganda, Kenya, Zimbabwe, Mauritius, Seychelles, and Zambia), and 2 studies from Central Africa (Cameroon).

4.4 Analysis of Loco-regional Rate Survival

Eleven (11) articles with a sample size of 2,765 cervical cancer patients, 4,264 breast cancer patients, 1018 lung cancer patients, and 2002 prostate cancer patients reported one-year loco-regional rate survival. The loco-regional survival time at one year was 77.4% (95% CI: 60.2-88.5%). Fourteen articles with a sample size of 2,307 cervical cancer patients, 3,554 breast cancer patients, 1,418 lung cancer patients, and 1502 prostate cancer patients reported the three-year loco-regional rate survival. The loco-regional rate of survival at three years was 71.8% (95% CI: 55.4-85.1%). Nineteen (19) studies with a sample size of 2,349 cervical cancer patients, 3,255 breast cancer patients, 1,818 lung cancer patients and 1,542 prostate cancer patients reported the five-year loco-regional rate survival. The loco-regional rate survival over the course of five years ranged from 22.8% (95% CI: 17.7-34.6%) to 76.2% (95% CI: 73.1-79.9%).

4.5 Analysis of Overall Survival Times (O.S.)

This was computed as the amount of time (in years) between the index date and the earliest of the following dates: the closing date, the date of loss to follow-up, or the date of death from any cause. 11 publications with sample sizes of 1,794, 2210, 500 and 1100 patients with cervical cancer, breast cancer, lung cancer, and prostate cancer, respectively, reported the one-year survival time. The survival time after one year was 77.5% (95% CI: 73.4-81.1%). The 1-year survival times showed significant between-study variance (I^2=95.4%; p for heterogeneity 0.001). The three-year survival time for patients with cervical cancer, breast cancer, lung cancer, and prostate cancer was reported in 14 articles with sample sizes of 1336; 1500; 900 and 600 patients, respectively. (95% CI: 47.6-57.9%), the three-year survival time was 52.8%. The 3-year survival times showed significant between-study variance (I^2=96.0%; p for heterogeneity 0.001). 19 articles with sample sizes of 1377; 1200; 1300, and 640 patients for cervical cancer, breast

cancer, lung cancer, and prostate cancer patients, respectively, reported the five-year survival time (95% CI: 35.5-46%). The five-year survival time was 40.9%. The five-year survival time ranged from 3.9% (95% confidence interval: 1.9-8.0%) to 76.1% (95% confidence interval: 66.3-83.7%). The 5-year survival times showed significant between-study variance (I^2 = 96.2%; p for heterogeneity 0.002).

4.6 Meta-regression

With the use of a random-effects model, the study's findings revealed that the total estimated pooled survival durations for cancer patients were 60.66% (95% CI: 56.27, 65.06), with a heterogeneity index (I^2) of 95.8% (p=0.01).

The subgroup analysis based on the sub-region was conducted to account for the reported study heterogeneity (I^2 = 95.8%), and as a result, the survival times presentation among cancer patients were found to be 14.30% lower in Southern Africa, 26.21% lower in Eastern Africa, 24.51% lower in Western Africa, and 41.06% lower in Central Africa.

Sample size and year of publication were used as covariates in a meta-regression to determine the source of heterogeneity; the results revealed that these variables have no impact on the degree of heterogeneity between studies. Using a funnel plot and the objective Egger test with a 5% level of significance, a publishing bias was evaluated. The Egger tests failed to reach statistical significance with a p-value of 0.623, and a funnel plot revealed an uneven distribution that suggested publication bias.

Table 2 is the forest plot of regional sub-groups; it is a graphical representation of the results of a meta-analysis, in which the effect size (such as odds ratio or hazard ratio) and its confidence interval are plotted for each individual study as well as for the overall estimate.

Name of Study	Year	Statistics for each study					Sub-regions
		Event Rate	Lower limit	Upper limit	z-value	p-value	
Simone et al.	2022	0.163	0.122	0.313	-5.210	0.000	Eastern Africa
Isabelle et al	2018	0.181	0.192	0.200	-3.000	0.000	Eastern Africa
Rodrigo et al	2010	0.342	0.321	0.512	-4.019	0.000	Eastern Africa
Mbatchou et al	2021	0.211	0.265	0.412	-4.312	0.001	Central Africa
Nur and Amsalu	2023	0.200	0.234	0.361	-7.503	0.003	Eastern Africa
Martin et al	2017	0.193	0.196	0.250	-2.222	0.005	Western Africa
Ismaili et al	2021	0.211	0.163	0.197	-3.140	0.000	Northern Africa
Helen et al	2021	0.185	0.211	0.334	0.190	0.000	Western Africa
Melanie et al	2013	0.321	0.425	0.510	-1.100	0.002	Eastern Africa
Yahaya et al	2020	0.289	0.371	0.400	-0.031	0.001	Eastern Africa
Abdollah et al	2016	0.261	0.346	0.500	-2.612	0.005	Northern Africa
Magoha	2020	0.348	0.460	0.482	-1.912	0.000	Eastern Africa
Roderic et al	2022	0.290	0.293	0.350	-2.330	0.000	Western Africa
Tobias et al	2021	0.111	0.196	0.321	-2.121	0.002	Southern Africa
Drokow et al	2022	0.143	0.186	0.246	-4.100	0.002	Southern Africa
Andamlak et al	2022	0.260	0.227	0.269	-2.300	0.001	Eastern Africa
Mazvita et al	2020	0.536	0.312	0.409	3.151	0.001	Eastern Africa
Salama et al	2021	0.304	0.308	0.356	6.119	0.020	Eastern Africa
Opoku et al	2016	0.536	0.277	0.315	-4.312	0.003	Western Africa
Musa et al	2016	0.321	0.298	0.320	0.091	0.005	Western Africa
Mulugeta et al	2021	0.300	0.561	0.712	-8.222	0.003	Eastern Africa
Levi et al	2018	0.410	0.263	0.341	-1.346	0.001	Eastern Africa
Khaemba et al	2013	0.298	0.312	0.411	-3.912	0.000	Eastern Africa
Wondimene et al	2019	0.614	0.400	0.512	-5.365	0.000	Eastern Africa
Tesfay et al	2021	0.593	0.199	0.271	1.697	0.002	Eastern Africa
Khadije et al	2020	0.315	0.313	0.471	-0.132	0.030	Northern Africa
Mwendwa e al	2021	0.346	0.563	0.699	-3.641	0.500	Western Africa
Ngowa et al	2015	0.270	0.347	0.423	-5.306	0.004	Central Africa
Ssentongo et al	2020	0.196	0.612	0.650	-4.121	0.000	Eastern Africa
Moses et al.	2015	0.211	0.429	0.526	-7.121	0.040	Eastern Africa
McKenzie et al.	2016	0.251	0.311	0.393	3.003	0.070	Southern Africa
Paddy et al.	2022	0.169	0.286	0.300	-2.036	0.000	Western Africa
Walburga et al	2020	0.292	0.222	0.293	-6.541	0.001	Eastern Africa
Yvonne et al	2019	0.314	0.126	0.188	-3.013	0.003	Western Africa
Zhan et al.	2018	0.419	0.167	0.193	-1.436	0.003	Eastern Africa
Yoanna et al	2022	0.203	0.269	0.316	-5.413	0.003	Southern Africa
Yoanna et al	2020	0.264	0.298	0.332	-4.039	0.003	Eastern Africa
Paddy et al.	2019	0.215	0.411	0.523	-2.617	0.000	Eastern Africa
Ssentongo	2018	0.196	0.541	0.721	-7.121	0.020	Western Africa
Maajani et al	2019	0.187	0.199	0.211	-0.780	0.010	Northern Africa
Overall		**0.426**	**0.426**	**0.511**	**-4.223**	**0.002**	

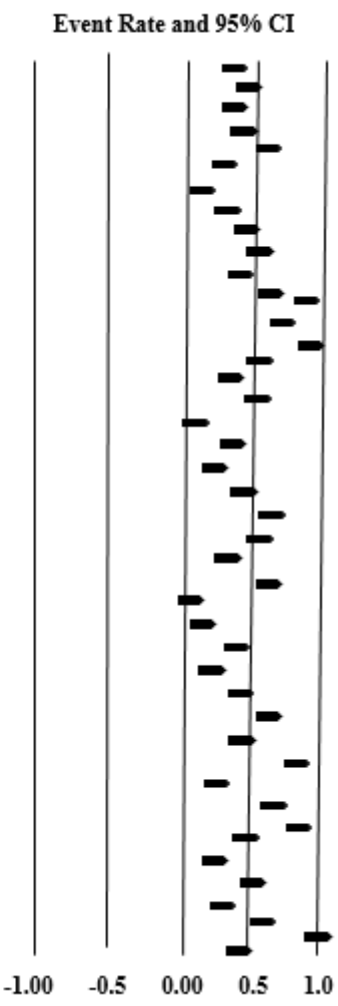

Table 2: Forest plot of regional sub-groups.

4.7 Heterogeneity source

Table 3 presents the Heterogeneity of Survival Times. The Cochran's Q metric determines if the same effect was examined by all studies, whereas the I^2 metric determines how much of total variability is influenced by heterogeneity. The heterogeneity chi-square test (p=0.01) and the I^2 value of 95.5–96.2% both indicated significant heterogeneity among the examined studies. The sub-group evaluation based on sub-region, country, and the region could not account for the heterogeneity. Chi-squared statistical analysis consistently produced a p-value of 0.05 for subgroup differences.

Heterogeneity Source	Coefficients	Std. Error	P value
Sample size	0.0000892	0.0017334	0.001
Year of Publication	0.0231892	2.083469	0.005

Table 3: Heterogeneity on Survival Times

4.8 Sensitivity analysis

This was employed to evaluate the results' consistency. When a particular article was eliminated from the analysis, the statistical significance of the results remained the same, demonstrating the validity and consistency of our findings.

4.9 Assessment of Quality of Evidence using Newcastle Ottawa Scale

Using NOS that has been modified for analytical cross-sectional investigations, the methodological quality of the conclusions of the included studies was critically assessed. The majority of the studies (85.7%) were found to be of moderate quality, which corresponds to a score of 7 "yes" out of 10, or about 87.5%. Only a small number of studies (14.3%) were rated as high quality, or a score of 9 "yes" out of 10, which is equivalent to 75%. Three studies lacked descriptions of cofounder handling tactics. The majority of investigations employed established standards or objective measurements of the conditions. The findings provided excellent proof of the pooled survival in cases when the study designs of the chosen publications were retrospective or prospective to reduce bias.

No statistically significant changes were discovered in the pooled estimation based on the amount of bias in the trials. Given the huge sample size, great variability and the evidence's resulting narrow confidence ranges, the evidence is assessed as having extremely low consistency and high accuracy. However, the findings of Egger's test and funnel plots did not

demonstrate sufficient indications of selection and reporting bias, giving rise to a high degree of confidence in the publication bias.

4.10 Publication Bias

Figure 2 is the flow chart for publication bias, which is the graphical representation of the steps taken in a systematic review to identify and assess the potential for publication bias.Both precision asymmetry funnel plots and Egger's test of the intercept results showed that the included studies were free of publication bias. According to the results of Egger's test, publication bias was not statistically significant because all survival times (p=0.68 for O.S., p=0.23 for LRR, and p=0.109 for DFS) were higher than 0.05. The funnel plots also revealed a symmetrical distribution of studies upon visual observation. According to the symmetrical funnel plot for each survival time, the study's conclusions were unaffected by publication bias.

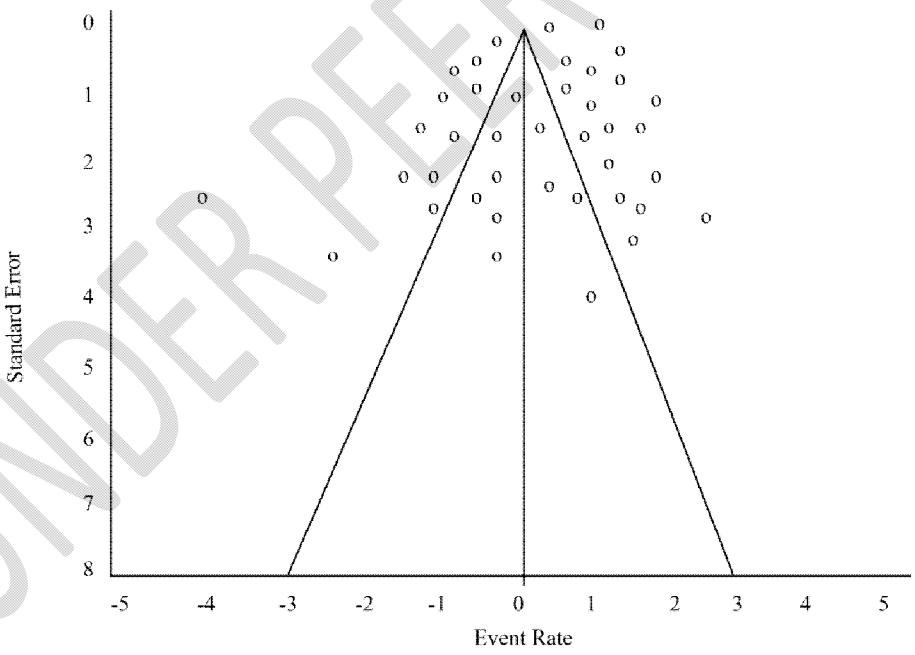

Figure 2: Flow Chart for Publication Bias

4.11 Discussion

The major goal of this study was to create a current evaluation of cancer survival times in Africa. In order to determine the prognosis, data from 38publications that comprised 27,795 individuals with lung, breast, cervical, and prostate cancer were integrated with follow-up data. Studies in general, were found to be of moderate quality.

Southern Africa had a 14.30% survival time of cancer patients, compared to Eastern Africa's 26.21%, Western Africa's 24.51%, and Central Africa's 41.06%. The study's findings demonstrated that patients had a good five-year survival time. The highest 5-year overall survival was found in the central zone of Africa (32%), followed by 21% from the east zone, 18% from the west zone, and 9% from the south zone. This might be partially explained by variations in socioeconomic position and government healthcare spending among different zones.

Compared to other developing regions, Africa is gradually improving its cancer patient survival times despite facing challenges such as poverty, inadequate healthcare infrastructure, delayed diagnosis leading to the increased burden, limited funding for cancer research, and insufficient awareness campaigns. It's crucial to expedite pathology advancement and address the shortage of qualified personnel to interpret diagnoses. Despite these obstacles, there are some positive developments. Numerous African nations are collaborating to create international and national partnerships to improve cancer care, which should result in a more systematic approach to cancer treatment.

5 CONCLUSION, RECOMMENDATION

5.3 Conclusion

This paper concludes that the total estimated pooled survival times for cancer patients in Africa is 60.66% (95% CI: 56.27, 65.06). And the survival times of cancer patients in Southern Africa is 14.30%, 26.21% in Eastern Africa, 24.51% in Western Africa, and 41.06% in Central Africa.Survival times for patients with lung, breast, cervical, and prostate cancer vary greatly depending on many factors, including the stage and aggressiveness of cancer, the availability of medical resources and treatment options, the patient's overall health and the health infrastructure

of the country. In Sub-Saharan Africa, late diagnosis and, consequently, low survival times are significantly influenced by lower levels of knowledge about cancer as well as other accessibility barriers to health services, such as greater distances between healthcare facilities. Inadequate management capabilities, diagnostic, screening, preventive, and late diagnosis are the reasons that reduce the survival timein Africa.

These results support Patra's analysis from 2017 which revealed that cancer can be treated and cured when discovered in its early stages. However, the majority of cancer patients who visit the radiotherapy department have the advanced disease due to a lack of public awareness of cancer, knowledge of the disease, and access to prompt and effective healthcare. A nation's economy could also be correlated with a number of factors known to impact survival times, including dietary intake, psychosocial well-being, access to healthcare, and the stage of a person's diagnosis. According to Ingleby et al. (2022), socioeconomic level and cancer survival are related.

5.4 Recommendations

It is important to note that every patient and every case is unique and that survival times can be greatly impacted by early detection, access to proper treatment, and overall health and lifestyle. Cancer patients in Africa should be educated that it is always better to consult with a doctor or medical professional to discuss individual prognoses and treatment options.

The government should implement a comprehensive national patient record-keeping system that connects all healthcare facilities. As a result, estimating illness burden and evaluating therapies will be simpler. Actual statistics rather than estimates would be available for statistical analysis, allowing for the creation of better projections.

Increasing awareness is crucial to reducing cancer survival times in Africa. This can be accomplished by including health education on cancer in the teaching curricula in Africa.

To boost survival times of lung, breast, cervical, and prostate cancer patients across Africa, consortia should be promoted, whereby regions in Africa that have better resources can serve as mentors.

Biostatisticians in Africa should derive and introduce a model for survival analysis that can accurately estimate cancer survival times.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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