

Original Article

Profile of Cancer in Addis Ababa: From the only Population Based Cancer Registry in Ethiopia (2012-2021)

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Abstract

Background: The incidence of Cancer is increasing worldwide; it is estimated to increase from over 14 million in 2012 to 22 million by the year 2030, with a significant increase in low- and middle-income countries. Data from population-based cancer registries are the only reliable source to monitor the incidence, pattern, and trend of Cancer. The first population-based registry in Ethiopia was established in 2012 to collect data on topography, age and sex distribution, and profile and trend of Cancer in Addis Ababa City.

Objective: The primary aim of this study is to determine the prevalence and temporal distribution of cancer within the urban confines of Addis Ababa over the course of the period spanning from 2012 to 2021.

Methods All invasive cancer cases diagnosed among Addis Ababa residents from January 2012 to December 2021 were included. The frequency of Cancer by tumor site, sex, and age group in the study period was presented. The age-standardized incidence rates and cumulative incidence rates for the top ten cancer types for males and females were calculated. Age-specific rate by 5-year interval was graphically presented to show the distribution of cases by age group for the top five cancers. Cancer trend was assessed using joint regression analysis and adjusted standard rates.

Results: A total of 25,391 invasive cancers were diagnosed from January 2012 to December 2021 in Addis Ababa, with two-thirds of the cases occurring in females. The median age at diagnosis was 50 years for females and 52 years for males. Forty-three percent of the cases occurred in age <50 years in females compared to 29% of the cases in men.

The three most common cancers among females were breast (35%), cervix uteri (14%), and colorectal (6.8%). Colorectal Cancer (13.5%), prostate (8.8%), and Lymphoma (8.5%) were the top three among males. For both sexes combined, female breast, cervix, and colorectal cancers account for 40% of total cases. For all cancer types combined, the age-standardized rate in females (138.9 cases/100,000) was twice higher than in males (76.2 cases/100,000). Likewise, the lifetime probability of developing Cancer was considerably higher in females than in males (14.65% versus 8.45%), with 4.38% and 2.51% for breast and cervical Cancer, respectively. In males, colorectal Cancer has the highest rate (1.26%), followed by prostate cancer (1.15%).

Conclusions Breast, cervical, and colorectal cancers account for four in ten cancer cases diagnosed in Addis Ababa; this underscores the need for the implementation of proven preventive and screening measures to reduce the morbidity and mortality associated with these cancers. [*Ethiop. J. Health Dev.* 2023; 37(4): 00-00]

Keywords: Cancer Registry, Cancer Incidence, Addis Ababa, Ethiopia

Introduction

The incidence of Cancer is increasing worldwide; the annual number of cancer cases in the world is estimated to increase from over 14 million in 2012 to 22 million by the year 2030, with a significant increase in low- and middle-income countries. This is mainly due to increases in aging, population growth, changes in reproductive factors, rapid economic development, and urbanization (1, 2, 3).

In 2020, an estimated 801,382 new cancer cases and 520,158 cancer deaths occurred in sub-Saharan Africa 2020. Cancer of the breast and cervix combined account for one-third of cases in both sexes. In males, prostate cancer is the leading Cancer, followed by liver cancer in most sub-Saharan countries (3).

Population-based cancer registry data are the most reliable source of information for cancer control program planning, monitoring, and evaluating the effect of preventive and screening interventions. Cancer registration coverage in Africa is low, and about 20 countries do not have any cancer registry. Only seven countries in Africa were found to have

high-quality data to be included in the International Agency for Research on Cancer (IARC) Cancer

Incidence in five Continents (CI-5) volume X (3, 4, 5, 6).

The Addis Ababa population-based Cancer Registry (AAPBCR) is the first and the only population-based cancer registry in Ethiopia. It was established in 2012 under a female reproductive organ cancer research project with financial and technical support from Martin Luther University, Halle. Since 2014, the registry has been funded by the American Cancer Society.

The purpose of the AAPBCR is to collect all incident cases of invasive cancer cases diagnosed in Addis Ababa City and describe the frequency, rate, and patterns by demographic, morphologic, and clinical characteristics. The result from this data is used for planning and evaluation of cancer control programs in the city and identification of emerging trends in cancer rates.

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This paper describes the cancer profile in Addis Ababa during the last ten years using data obtained from AAPBCR. This will guide the cancer control program in the country and serve as a baseline to monitor and evaluate the trend and effect of cancer control interventions over time.

Material and Method

Addis Ababa is the capital city of Ethiopia and is located at an altitude ranging from 1800 m to 2400m above sea level. It is multi-ethnic population originating from different parts of the country. The total population of the city in 2017 was estimated to be around 3.5 million. Life expectancy in Ethiopia has improved by 21.93 from 46.91 years in 1990 to 68.84 years in 2019. Addis Ababa has the highest life expectancy of 70.86 years (23,24).

AAPBCR registers all incident cases of Cancer among Addis Ababa residents. The central statistics office defines Addis Ababa resident as any resident who stayed at least 6 months in the city. Patients from other parts of the country were excluded. Trained contact persons in each health facility register all incident cancer cases from selected government and private health facilities. In a few facilities, however, AAPBCR staff actively collects the cases from the

health institutions. The registry uses a standard data collection form developed by IARC to collect demographic data tumor-related data like cancer topography, morphology, behavior of the tumor, and basis of diagnosis. International Classification of Diseases for Oncology (ICD O 3) was used to code each cancer type (29). For childhood cancer, the cases are coded according to the International Classification of Childhood Cancer (ICCC) (30). CanReg5 software, developed by the International Agency for Research on Cancer (IARC) was used for data entry, analysis, and management. Frequency, age and sex distribution, age-standardized rate, and cumulative risk of Cancer by sex were calculated. Cancer trend was assessed using joint regression analysis and adjusted standard rates. The results are presented using pie charts, tables, and graphs.

Results

A total of 25,391 cancer cases were registered between January 2012 and December 2021; 67% of the cases were among women. By age, the majority of the cases in females occurred in a relatively younger age group between the ages of 30 to 49 (43%) as compared to males, where a higher rate is seen between the ages of 50 to 69(39%) of the cases (Figure 1).

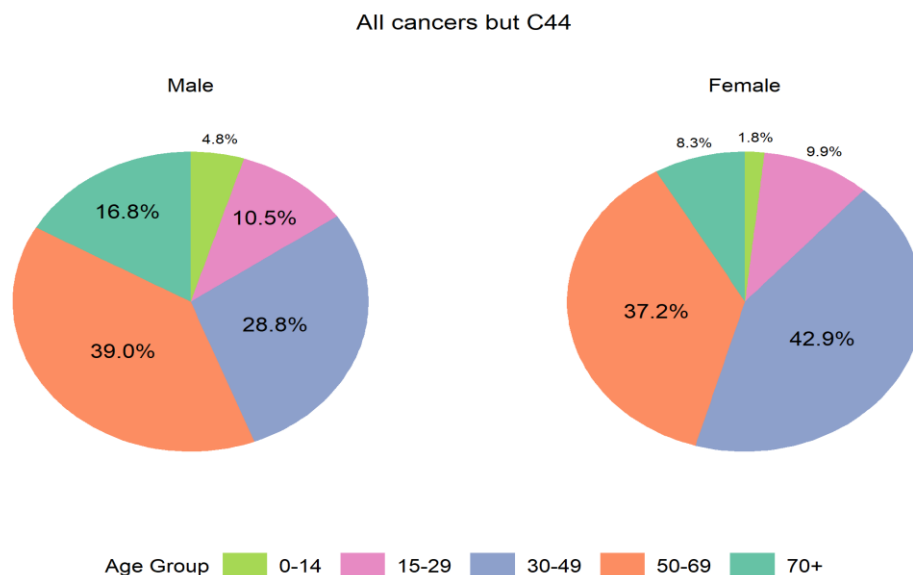


Figure 1. Cancer distribution by age and sex in Addis Ababa, Ethiopia, from 2012 to 2021

Frequency and site of Cancer

Figure 2 shows the top ten most common cancers in Addis Ababa. Breast cancer was the leading (n=6014;35%), followed by cervical cancer (n=2399;14%), and

colorectal cancer (n=1095;6.4%). In men, colorectal Cancer was the leading (n=1,123;13.5%), followed by prostate cancer (n=745;8.9%) and Lymphoma (n=708;8.5%).

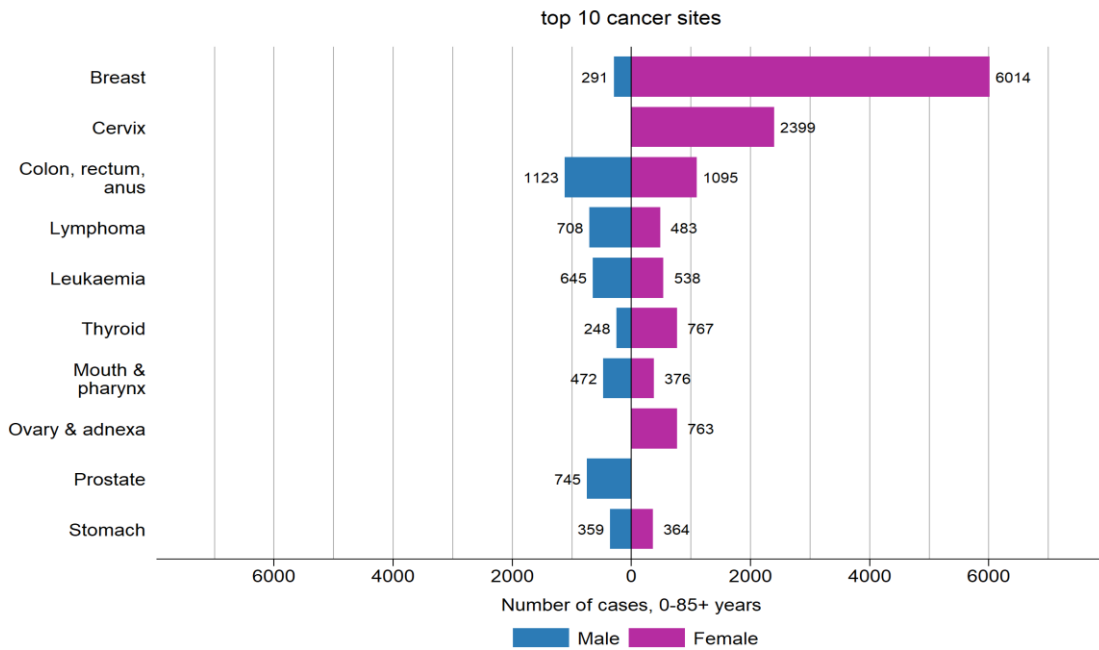


Figure 2. Top 10 cancers among males and females of Addis Ababa, Ethiopia, from 2012 to 2021
Age-standardized rates of top 10 cancers

Age-standardized rates for the top 10 cancers for men and women are shown in Figure 3. Among men, colorectal Cancer has the highest age-standardized rates (10.3 cases /100 000), followed by prostate

cancer (9.5 cases /100 000) and Lymphoma (5.7 cases /100 000). While among women, breast cancer has the highest ASR (42.5/100 000), followed by cervix uteri (21.2/100 000) and colorectal (9.1 /100 000).

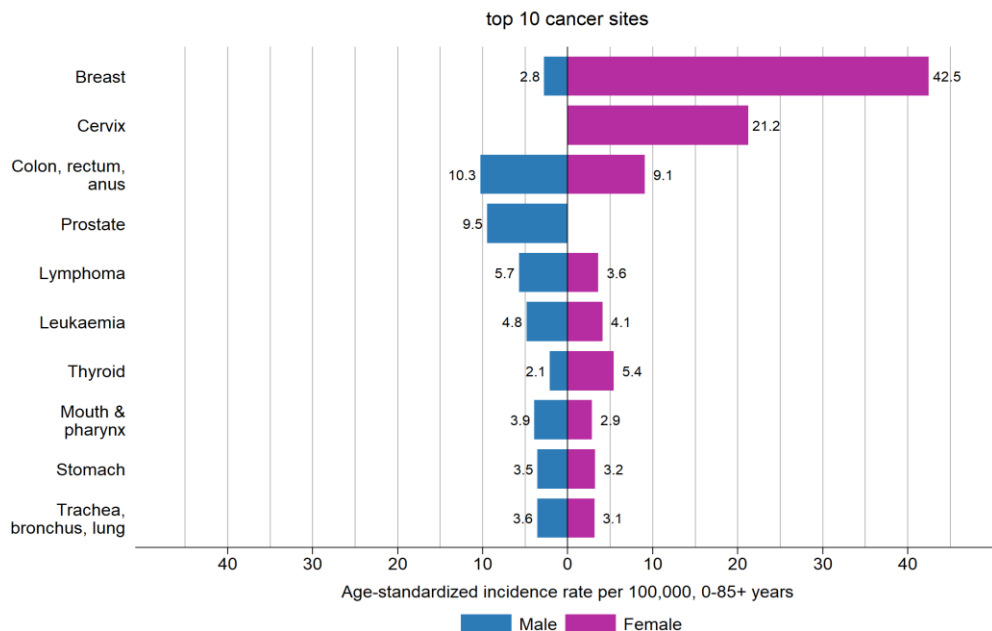


Figure 3. ASR of top 10 cancers in males and females of Addis Ababa, Ethiopia, from 2012 to 2021

Cumulative incidence rate of top 10 cancers (0-74 years)

The lifetime probability of developing Cancer is almost twice as high in females (14.65%) than in males (8.45%). Among women, the lifetime probability of developing Cancer was highest for

breast cancer (4.56%), followed by cervical Cancer (2.62 %.) Inmen, the lifetime risk was highest for colorectal Cancer (1.26%), followed by prostate cancer (1.15%).

Age-specific rate of top five cancers

Figure 4 portrays age-specific incidence rates for selected cancer types by sex. In general, incidence rates increase with advancing age. In men, the incidence of most cancers increased after age 40 and reached its peak at 80. Among women, rates began to

increase at younger ages and reached their peak between the age of 50 and 60. Breast cancer has the highest incidence of all the cancer types, with the rate rising to over 100 cases per 100,000 in the 50-64-year age group.

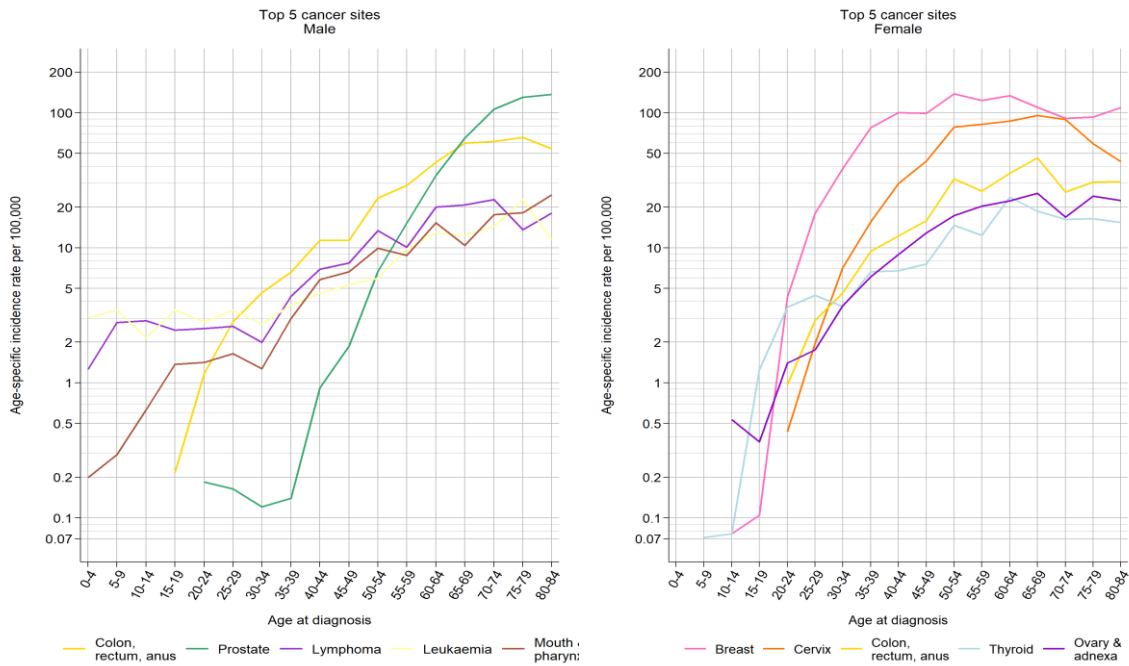


Figure 4. Age-specific rate of top 10 cancers among males and females of Addis Ababa, Ethiopia, from 2012 to 2021

Trend of common cancers in Addis Ababa

In almost all solid malignancies, there was an increased trend in incidence during the study period. Prostate and pancreas cancer have the highest increase.

Only two hematologic malignancies, Lymphoma, and leukemia, have shown a declining trend in the last ten years (Figure 5).

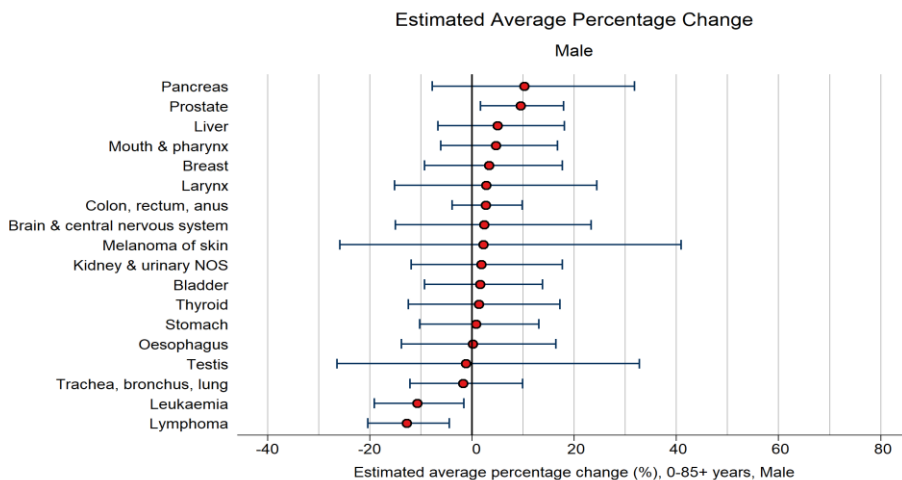


Figure 5. Cancer incidence trend in Addis Ababa, Ethiopia, from 2012 to 2021

Basis of Diagnosis

Approximately 91% of the diagnoses were morphologically verified. In the remaining cases, cancer diagnoses were based on imaging findings, tumor markers, and death certificates. The percentage

of patients with morphologic diagnosis is higher (95%) for all accessible areas like breast, uterine cervix, leukemia, and head and neck cancers and relatively lower for deep-seated sites like brain and pancreatic cancers.

Childhood cancer (0 to 14 years)

A total of 699 (2.8%) of cancer cases were diagnosed in children. The majority of cases were males and occurred in the age group 0- 4 with an ASR of 97.9/ million. Approximately half of the patients had hematologic malignancies, leukemia (n= 210; 30 %)

and Lymphoma (n=121; 17 %); this was followed by soft tissue sarcoma in 82 cases (11 %) and renal tumors in 78 cases (11, 2%). The incidence of the top ten cancers by age group and sex ratio are shown in Table 1.

Table 1: Incidence of childhood cancer, classified according to the International Classification of Childhood Cancer (ICCC-3).

ICCC3	Number of cases						Rates per million				
	0-4	5-9	10-14	All	M/F	% total	0-4	5-9	10-14	Crude	ASR
All	292	214	193	699	1.3	100.0	97.9	77.5	79.7	85.6	86.0
I Leukemia	87	76	47	210	1.3	30.0	29.2	27.5	19.4	25.7	25.8
II Lymphomas	30	46	45	121	2.8	17.3	10.1	16.7	18.6	14.8	14.7
III CNS neoplasms	5	7	9	21	1.1	3.0	1.7	2.5	3.7	2.6	2.5
IV Neuroblastoma	15	8	2	25	1.1	3.6	5.0	2.9	0.8	3.1	3.1
V Soft tissue sarcomas	38	20	24	82	1.6	11.7	12.7	7.2	9.9	10.0	10.1
VI Retinoblastoma	33	4	0	37	1.3	5.3	11.1	1.4	0.0	4.5	4.8
VI I Renal tumors	51	23	4	78	1.1	11.2	17.1	8.3	1.7	9.6	9.8
VI II Hepatic tumours	5		1	10	1.0	1.4	1.7	1.4	0.4	1.2	1.2
IX Malignant bone tumors	2	14	30	46	1.2	6.6	0.7	5.1	12.4	5.6	5.5
X Germ cell tumours	7	2	8	17	0.1	2.4	2.3	0.7	3.3	2.1	2.1
XI Other	19	10	23	52	1.1	7.4	6.4	3.6	9.5	6.4	6.4

Discussion

Cancers occurring in females account for two-thirds of the total cases, with breast and cervical Cancer accounting for 50% of all cancer cases in women. Male Cancer accounts for only a third of cases, much less than most countries of the world, including neighboring countries such as Sudan, Khartoum (46.2%), and Kenya, Nairobi (43%). This difference is largely due to a lower rate of prostate, lung, esophageal, liver, and Kaposi's sarcoma cancers compared to other countries (11, 16,17). The other possible explanation is under registration of cases diagnosed by imaging and tumor markers like liver and prostate cancer.

The pattern of incidence in women is generally similar to most African countries, with breast and cervix leading in 29 and 19 sub-Saharan countries, respectively. Among men, colon and rectal cancer are the leading Cancer followed by prostate cancer, which is different from most African countries where prostate cancer ranks first in 40 African countries, followed by liver and colorectal Cancer (3).

The ASR for Cancer in women (132.3 cases /100,000) is comparable to neighboring countries such as Sudan (124.3/100000) and East Africa region (125/100,000) but lower than that in Kenya (168 cases per 100,000)

(4, 5). The rate is much lower than in economically developed regions such as North America (274/100 000). For men, the ASR (73.8 cases /100 000) is lower than Sudan (90.8/100,000) and Kenya (161/100,000). However, it is considerably lower than in North America (334/100,000). This is due to a lower rate of cancers like Kaposi `sarcoma and esophageal Cancer as compared to the other Eastern African nations and a lower rate of lung and prostate Cancer compared to most of the world (3,4).

Breast Cancer

Breast cancer is the most common Cancer among women in most of the world. The global incidence rate of BC increased overall by 1.44% per year (95% CI=1.42, 1.47), with statistically significant increases in all age groups and in 6 out of 7 regions (5, 20). The incidence varied significantly with the level of development, lifestyle, and age structure of the country, with the highest rate in countries such as Australia and New Zealand; the most rapid increase in incidence was observed in sub-Saharan Africa between mid-1990 and mid-2010 (3, 18,27).

Breast cancer is the leading Cancer in four of the six regions in Ethiopia (19). Breast cancer has the highest ASR, with a cumulative lifetime risk of 4.56%. Overall, the ASR is comparable to Sudan, Zimbabwe,

and Nigeria but lower than Kenya (11, 12, 15, 16). The age-specific rate shows a sharp increase after the age of 40, reaching a peak of 135 cases per 100 000 between the age of 50 to 55. With increasing life expectancy, urbanization, late childbearing age, and low breastfeeding rate, the burden is expected to increase further. Increasing public awareness and screening in this age group is appropriate to reduce breast cancer morbidity and mortality (1, 2, 3).

Cervical Cancer

Cervical Cancer is the second most prevalent Cancer in Addis Ababa. It accounts for 13 % of cancers in women. The incidence rate in the city (21.1 cases/100,000) is much lower than in most sub-Saharan countries, such as Zimbabwe, Uganda, and Kenya and is similar to Nigeria. This is likely due to relatively lower HIV prevalence compared to other sub-Saharan countries (21, 22, 23). The burden of cervical Cancer is very low in the developed world due to long-term implementation of screening programs. This is a disease of developing countries where public screening is unavailable or very low. It is associated with sexual and reproductive factors and infection by oncogenic HPV subtypes. The burden is higher in women infected with human immunodeficiency virus (HIV), which increases their risk of developing precancerous cervical lesions and cervical Cancer (21, 22).

In August 2020, the WHO launched a Global strategy to eliminate cervical Cancer by 2030 with HPV vaccination. Ethiopia introduced cervical cancer screening using VIA to reduce the burden of cervical Cancer in the country. Increasing uptake through awareness creation and strengthening of HPV vaccination of school children will reduce the burden.

Colorectal Cancer

Colorectal Cancer is the third most common Cancer worldwide in men and the second in women. It was a rare disease in Africa some decades ago, but it is now the fifth most common Cancer (12). The rate has increased significantly over the past decade in 157 of 204 countries (25). It is the leading Cancer in men and the third in women in the city. In previous similar studies, CRC ranked first in men and fourth in women (19). The rate is similar to Zimbabwe and Kenya (9,12) and higher than Sudan and Nigeria (11, 15). The age-specific rate increases with age from 5 cases /100,000 in the 30's to a peak of about 50 cases /100,000 in the 60 to 70-year age group.

Prostate cancer

Prostate cancer is the most commonly diagnosed Cancer in more than 50% of the countries. The incidence varies across the world from 6.3 to 83.4 per 100,000 (4, 5). An increase in trend was reported from 1995 -2018 in most sub-Saharan countries. This is likely due to improved screening and diagnostic tests like PSA and transurethral resection biopsy (26,28). The ASR of prostate cancer in Addis Ababa, 9.8 cases per 100,000, is lower than most countries in the world, including Kenya, Uganda, and Zimbabwe, and similar

to Sudan (9, 10, 11, 12, and 13). The ASR increased from 10 cases per 100,000 at age 50 to 100 cases per 100,000 at age 70. The lower incidence of prostate cancer in Addis Ababa reflects a lack of PSA screening and the age structure of our population, where 90% of the city population is below the age of 60 years.

Data quality and completeness are the most important aspects of registration. Data quality indicators established by IARC (CI5 –IX) include a percentage of morphologically verified (MV) cases, which must be between 75% and 98%, and the percentage of missing cases less than 10% (6, 8). About 90% of the cases were morphologically verified (MV), indicating good-quality data. This is higher than in most African countries like Uganda (55%), Zimbabwe (64%), Sudan, and Khartoum (60%), and is comparable to Kenya, Nairobi, Egypt, Algeria, Abuja, and Nigeria (11, 12, 13, 14, 15).

Conclusions and recommendations

In conclusion, this prospectively collected ten-year data is the first of its kind in the country to document the patterns of Cancer by sex and age groups in Addis Ababa. Our data showed that breast, cervical, colorectal, and prostate cancer and Lymphoma combined account for 50 % of the cancer burden in the city. The data shows an increasing trend in most types of Cancer. Public health measures to increase awareness of cancer prevention and screening with improved capacity for diagnosis and treatment will reduce morbidity and mortality associated with these cancers. The establishment of a similar population-based registry in different parts of the country is crucial to getting representative national data for the country.

Conflict of Interest

The authors declare that there is no conflict of interest in this study.

Data Availability Statement

Data is available upon the reasonable request of the corresponding author.

Source of funding

The data used for this study was collected under the cancer registry program with research funds from MLU and the American Cancer Society. However, the funder has no role in the design, conduct, analysis, interpretation of the findings, and write-up of the manuscript.

Ethics Statement

Ethical approval of this study was obtained from the Institutional Review Board of the Oncology Department, College of Health Sciences, Addis Ababa University.

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References

- Ahmdin Jemal, Paolo Vineis, Freddie Bray, Lindsey Torre, David Forman, The cancer Atlas, second Edition, IARC
- World Cancer Report 2014, IARC, WHO.
- Sung H, Ferlay J, Seigel RL, Layersanne M, Soerjomataram I, Jemal A, et al. Global Cancer Statistics 2020 GLOBOCAN Estimate of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA: Cancer J Clin. 2021;71(3):209-49
- Freddie Bray, D. Maxwell Parkin on Behalf of AFCRN. Cancer in Sub-Saharan Africa in 2020: A review of the current estimate of the National Burden, Data, Gaps, and Future needs. The Lancet, June 2022, 23(6): 719 -728.
- Jacques Ferlay, Hai-Rim Shin, Freddie Bray, David Forman, Colin Mathers, Donald Maxwell Parkin. Estimates of Worldwide burden of Cancer in 2008: GLOBOCAN 2008. Int. J. Cancer: 2010;127, 2893-2917
- Freddie Bray, D. Maxwell Parkin on behalf of AFCRN. Cancer in sub-Saharan Africa in 2020: A review of the current estimate of the National Burden, Data, Gaps, and future needs. The Lancet, June 2022, 23(6):719-728
- Abidemi E. Omonisi, Biying Liu, Donald Maxwell Parkin Population-Based Cancer Registration in sub-Saharan Africa: Its Role in Research and Cancer Control JCO 2020;6, 1721-1728)
- Curado, M. P., B. Edward H.R. Shin, H. Storm, J. Ferlay, M. Heanue, et al. Cancer Incidence in Five Continents, Vol IX. IARC, Lyon, IARC Scientific Publication no.160.
- Francis Okongo, David Martin Ogwang, Biying Liu, Donald Maxwell Parkin. Cancer incidence in Northern Uganda. Int. J. Cancer: 2019;144(12): 2985-2991
- Chokunonga, E., Borok, Z., M. Cheringje, A. M. Nyakabau, and D. M. Parkin. Trends in incidence of Cancer in the black population of Harare, Zimbabwe 1991-2010. Int. J. Cancer. 2013;133(3): 721-729
- Parkin. D.M., J. Ferlay, M. Hamid-Cherif, F. Sitas, J. O. Thomas, H. Wabinga et al. Cancer in Africa. Epidemiology and Prevention. IARC Press, Lyon, IARC Scientific Publication 2003;153
- Intisar E. Saeed, Hsin-Yi Weng, Kamal H. Mohammed, Sulma I. Mohammed. Cancer Incidence in Khartoum, Sudan: First result from the cancer Registry, 2009 – 2010. Cancer Medicine 2014; 3(4) :1075 – 1083
- Anne Korir, Nathan Okerosi, Victor Ronoh, Geoffrey Mutuma, Max Prkin. Incidence of Cancer in Nairobi, Kenya (2004-2008). Int J. Cancer 137 (9): 2053-2059
- Parkin DM, Bray F, Ferlay J, Jemal A. Cancer in Africa 2012. Cancer Epidemiology and Prevention Biomarkers, 2014 Apr 3: cebp-0281.
- Jemal A, Borok M, Manraj SS, N'da GG, Ogunbiyi FJ, Liu B, Bray F. Cancer in Sub-Saharan Africa. IARC Scientific Publications .2018; 167
- Ekanem IO, Parkin DM. Five-year cancer incidence in Calabar, Nigeria (2009–2013). Cancer epidemiology, 2016 ;1(42) :167-72
- Chokunonga E, Borok MZ, Chirenje ZM. Cancer Incidence in Harare: Triennial Report 2010-2012, African Cancer Registry Network 2013.
- Wabinga HR, Namboozee S, Amulen PM, Okello C, Mbus L, Parkin DM. Trends in the incidence of cancer in Kampala, Uganda 1991–2010. International Journal of cancer. 2014; 135 (2):432-9.
- Sarah M. Limaa, b, Rebecca D. Kehma, Mary Beth Terry, Global breast cancer incidence and mortality (city trends by region, age groups, and fertility patterns Clinical Medicine 2021; 38 Article 100985
- Solomon Tessema Memirie, Mahlet Kifle, Habtemariam, Mathewos Assefa, Binyam Tefera Deressa, Getamesay Abayneh, Biniam Estimate of cancer incidence in Ethiopia in 2015 using population-based cancer registry data. J. Glob Oncol 2016;4: 1-11
- Samuel O Azubuike, Louise Hayes, & Richard McNally. Rising global burden of Breast cancer: the case of sub-Saharan Africa and implication for regional development: a review. World Journal of Surgical Oncology 2018;16(63))
- IARC Monographs on the Evaluation of Carcinogenic Risks to Humans Volume 64, Human Papillomavirus. Lyon, France,
- Prevalence of HIV, total (% population age 15- 49)- Sub-Saharan Africa. UNAIDS estimate 2021
- Central Statistics Agency Ethiopia, and ICF International, Ethiopia Demographic and Health Survey 2011, Addis Ababa Ethiopia
- GBD Ethiopia sub-national level Disease Burden Initiative Collaborator. Progress in Health among regions of Ethiopia, 1990 - 2019: a sub-national country analysis for the Global Burden of Disease study 2019. The Lancet 2022;399:322-335
- GBD 2019 Colorectal cancer collaboration. Global, Regional and national burden of colorectal Cancer and its risk factors, 1991-2019: A systemic analysis for the Global Burden of Disease Study 2019. Lancet Gastroentrol & Hepatol, 2022; 7(7) :627
- Baade PD, Youlten DR, Krnjak LJ. International epidemiology of prostate cancer:

- geographical distribution and secular trends. *Mol Nutr Food Res.*2009; 53(2):171- 84
27. Joko-Fru WY, Jedy Agab E, Korir A, et al. The evolving epidemic of Breast cancer in Sub-Saharan Africa: result from Africa Cancer Registry Network. *Int. J Cancer.* 2020; 147: 2131- 2141
 28. Seraphin TP, Joko Fru WY, Kamate B, et al. Rising Prostate cancer incidence in Sub-Saharan Africa: a trend analysis of data from Africa Cancer Registry Network. *Epidemiol Biomarkers Prev.* January 2021;30 (1) 158-165
 29. Fritz et al., *International Classification of Diseases for Oncology (ICD O 3)*, 2000.
 30. Steliarova-Foucher, E, Stiller C, Lacour B, Kaatsch P. *International Classification of Childhood Cancer*, third edition. *Cancer.*2005,103(7) 1457-67