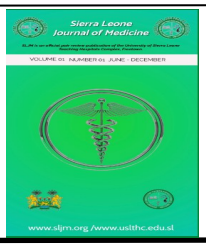
ORIGINAL ARTICLE

ISSN: 3007-4487

SIERRA LEONE JOURNAL OF MEDICINE

The Official Journal of University of Sierra Leone Teaching Hospitals Complex

Journal Homepage: www.sljm.org



Trends in the Incidence of Cancer in Ekiti, Southwestern Nigeria 2013 – 2017

[1-2]Omonisi Abidemi E., [3]Erinomo Olagoke O., [2]Inubile Adekoya J., [3]Ojo Adebayo., [2]Ibitoye Oluwatoyin, [4]Dada Oluwamayowa E., [5]Martins-Adetoye Olufunke E., [6]Ogundipe Kolawole O., [7]Ajayi Ebenezar A., [8]Okere Raymond A., [9]Olabanji Kayode A.

[1]Department of Anatomic Pathology, Ekiti State University & Ekiti State University Teaching Hospital, Ado-Ekiti, Nigeria.[2]Ekiti Cancer Registry, Ekiti State University Teaching Hospital, Ado-Ekiti, Nigeria. [3]Department of Morbid Anatomy, Federal Teaching Hospital, Ido-Ekiti, Nigeria. [4]Department of Health Information Management, Federal Teaching Hospital, Ido-Ekiti, Nigeria. [5]Department of Nursing, Ekiti State University Teaching Hospital ,Ado-Ekiti, Nigeria. [6]Department of Surgery, Ekiti State University & Ekiti State University Teaching Hospital, Ado-Ekiti, Nigeria. [7]Department of Medicine, Ekiti State University and Ekiti State University Teaching Hospital, Ado-Ekiti, Nigeria. [8]Department of Obstetrics & Gynaecology, Federal Teaching Hospital, Ido-Ekiti, Nigeria. [9]Department of Surgery, Obafemi Awolowo University, Ile-Ife, Nigeria.

Corresponding Author: O. Abidemi;abidemi.omonisi@gmail.com

ARTICLE INFO

Article History

Received: May 27, 2024

Accepted: October 16, 2024

Published: March 16, 2025

Corresponding Author:
Omonisi E. Abidemi

Technical Information

How to Cite: Omonisi AE et al. Trends in the Incidence of Cancer in Ekiti, Southwestern Nigeria 2013 – 2017: SLJM 2024;Vol 1(2) pp 30-38. https://doi.org/10.69524/72tdjf54

Editor-in-Chief: Prof. Kehinde S. Oluwadiya, University of Sierra Leone Teaching Hospitals Complex, Freetown, Sierra Leone.

Funding: No funding was received for this study.

Ethical Consideration

Conflict of interest: The authors declare they have no conflicts of interest that are directly or indirectly related to the research.

ABSTRACT

Background: Data from the population-based cancer registries have been shown to be very useful for cancer research and the development of national cancer control programmes. The data from other older population-based cancer registries outside Ekiti State was used in the past to develop cancer intervention which does not give a true picture of the reality. The Ekiti Cancer Registry was the first population-based cancer registry established in Ekiti State, basically, to assess the incidence and monitor the trend of cancer in Ekiti State.

Methods: The data from the Ekiti Cancer Registry was extracted in all laboratories, diagnostic centres, wards, clinics, death certificate and autopsy registers from health facilities and hospitals in the catchment area of the registry which are Ado and Ido-Osi Local Government where cancer cases were diagnosed and or managed. The data was abstracted and entered into the CanReg 5 database. Analysis was conducted using the CanReg 5 software.

Results: We report the first cancer incidence results of the five years of registration (2013- 2017). A total of one thousand two hundred and six (1206) cases of cancer were registered; six hundred and forty-one (641) women with an age standardized rate (ASR) of 91.5 per 100,000 population and five hundred and sixty-five (565) men with an ASR 81.5 per 100,000 population. The top three common cancers recorded were breast, cervical and lymphomas in the women, and prostate, lymphomas and colon cancer in men. Surprisingly, the ASR of prostate cancer (46.0 per 100,000) is higher than that of breast (ASR 39.5 per 100,000). These figures suggest a departure from most reports in the region, which reported a higher ASR for breast cancer when compared to prostate cancer.

Conclusions: There is an urgent need to further study the various epidemiological factors that might be responsible for the high ASR for Prostate Cancer. This is the very first cancer incidence report from Ekiti State, and this would provide the needed platform for a more specific cancer control programme in the geographical region.

Key words: Trends, Incidence, Cancer Registry, Ekiti, Nigeria.

1. INTRODUCTION

The global cancer burden has been consistently increasing from 18[1]. million captured in 2018 GLOBOCAN report 1 to 19.3 million cases as reported by GLOBOCAN 2020[2]. Unfortunately, developing countries continue to be most hit by cancer and many countries in this category have not regarded cancer as a high priority health problem because the exact extent of the problem is not known in these developing countries[3-4]. The literature was very scanty on cancer in Africa during the early 1900s and it does appear at that time, as if cancer was rare in Africa. Currently, about a century thereafter, Africa has experienced epidemiological transition by the increasing number of non-communicable diseases including cancer cases[5] as evidenced by the increasing numerous publications on cancer from the continent.[6-7]

Cancer registries are primarily established to assess the burden of cancer in a well-defined geographical location. Cancer registration is the systemic collection, storage, analysis, interpretation

and reporting of data on patients with cancer[8]. There are basically three types of cancer registries namely hospital-based cancer registries, specialized cancer registries and population-based cancer registries[8]. The hospital cancer registries are responsible for recording data on all types of cancer diagnosed at a particular hospital; specialized cancer registries are responsible for recording data on a particular type of cancer and a well-documented example of specialized cancer registry is the Gilda Radner Familiar Ovarian Cancer Registry located at Ros-well Park Cancer Institute ,Buffalo in New York which records cancer information on families with ovarian cancer[9] and lastly, the population based cancer registries which are the most important registries which record data on all types of cancer within a well-defined catchment area or population. Population based cancer registries are vital to the assessment of cancer burden in a geographically location and mostly used globally for the calculation of cancer incidence, and the development of the national cancer control plan[10-11]. Unfortunately, the distribution of population-based cancer registries in the developing countries are grossly inadequate and significant numbers of these countries in Africa lack a national cancer control plan[4]. The developed countries have more population-based cancer registries when compared with the developing countries[2]. There are a total of 700 cancer registries reporting high-quality data on cancer incidence and mortality across[12] while Botswana in southern Africa has a single national cancer registry[2]. The number and spread of population-based cancer registries play a role in data generation in cancer burden assessment in a particular country. The Africa continent especially the sub-Saharan Africa is greatly underserved by the number of active population-based cancer registries except for countries like Nigeria, Kenya, South Africa and other members of the African Cancer Registries Network (AFRCN) [13], cancer registration is either absent or rudimentary in countries that are not members of the AFRCRN in sub-Saharan Africa. Nigeria currently hosts forty-two cancer registries being the highest number of cancer registries domiciled in a particular country in sub-Saharan Africa, comprising of 21 population-based cancer registries and 21 hospital-based cancer registries[14]. The oldest population-based cancer registry in Nigeria is the Ibadan Cancer Registry and data from this registry were used to estimate the overall cancer incidence in the country close to three decades[6,15-16].

The burden of cancer in Ekiti State was not known for several years and this warranted researchers and policy makers to quote figures from other registries outside Ekiti in instituting cancer prevention and control programmes in the State.

We report the first cancer incidence from Ekiti for the five-year period 2013- 2017 in this publication. This report will serve as a template for future reports that would emanate from this registry and also serve as the basis for local, national and regional comparison.

2. METHODOLOGY

2.1 Catchment Topography :

Ekiti State consists of many rural populations with a significant number of the populace involved in agricultural activities. The topography of the region is essentially mountainous, and the diets and lifestyle differs from those living in the cosmopolitan cities. Ekiti State is potentially rich in several mineral deposits such as kaolin, columbite, and gold[17].

2.2 Registry Establishment, Structure and Official Regulations:

Table 1: The 2006 National Population Estimates in Ado and Ido-Osi Local Government Areas by ECR in Ekiti State, Nigeria; Age Distribution by Sex.

Age Groups	Total	Sex	
		Males	Females
	ADO & IDO L.G.A		
0 – 4	50,249	25,907	24,342
5-9	53,973	28,183	25,790
10 - 14	59,771	31,096	28,675
15 – 19	61,026	31,998	29,028
20 – 24	63,816	32,861	30,955
25 – 29	45,581	22,869	22,712
30 – 34	29,015	13,758	15,257
35 – 39	24,146	11,188	12,958
40 – 44	21,369	10,991	10,378
45 – 49	17,365	9,117	8,248
50 – 54	14,873	8,328	6,545
55 – 59	7,995	4,373	3,622
60 – 64	8,475	4,680	3,795
65 – 69	4,590	2,396	2,194
70 – 74	4,338	2,582	1,756
75 – 79	2,113	1,141	972
80 – 84	2,436	1,194	1,242
85+	2,560	1,362	1,198
TOTAL	473,691	244,024	229,667

Ekiti cancer registry was established in 2014, located in Ekiti State which is one of the States in Nigeria. The registry covers the population of two Local Government Areas (LGA) namely Ado and Ido-Osi with a population at the national census 2006 of 473,691[18].

The Ekiti Cancer Registry (ECR) is headed by a Principal Investigator, a Consultant Anatomic Pathologist and assisted by a Registrar, who directly supervises the abstractors. There are trained data abstractors, and the Registry also has a trained Bio-Statistician, who does the coding, data capturing and analysis using the CanReg5 software. The Registry has a medical record officer, who assists in retrieving the case notes of patients diagnosed with cancers. The medical record officer also assists in the safekeeping of our records.

The Registry also has a follow-up Nurse who assists in counselling patients diagnosed with cancers and follow up of patients. The registry has an active advisory committee and an operational committee. The advisory committee meets quarterly to review the registry's activities while the operational committee which consists of the registry staff meets weekly to review the registry's activities for the week. The meeting is usually coordinated by the Cancer Registry Director.

The registry has the hospital management board approval supporting its establishment and functioning.

2.3 Cancer Registration

Ekiti Cancer Registry is a population-based registry domiciled at Funmilayo Olayinka Diagnostic Centre within the premises of Ekiti State University Teaching Hospital, Ado-Ekiti, Ekiti State, Nigeria. The cancer registrars actively collect data on new cases from wards and clinics within the catchment where cancer patients are diagnosed and managed (Ekiti State University Teaching Hospital, Ado-Ekiti, Federal Teaching Hospital, Ido-Ekiti; Gilead Specialist Clinic, Ado-Ekiti; Mother & Child Specialist Ado-Ekiti, Itunu Oluwa Hospital, Ado-Ekiti), as well as other hospitals. The registrars also visit outpatient departments, radiology diagnostic centres and pathology departments to extract cases on cancer. The autopsy registers and death certificates are scrutinized for cases diagnosed of cancer. The registry uses the cancer notification form (abstraction form) designed by the Nigerian System of Cancer Registries and African Cancer Registry Network standard operational manuals (Appendix 1). [19].

Abstracted cases were reported on the cancer registry abstract form which captures all the key variables, including age and inci-

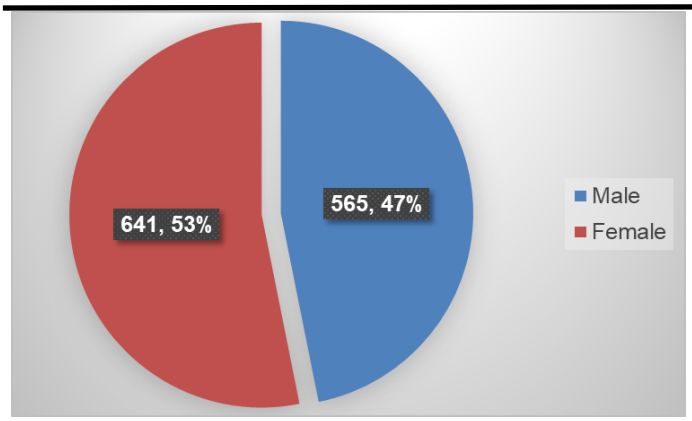


Figure 1: The Gender Ratio of Cancer Cases in ECR, 2013-2017

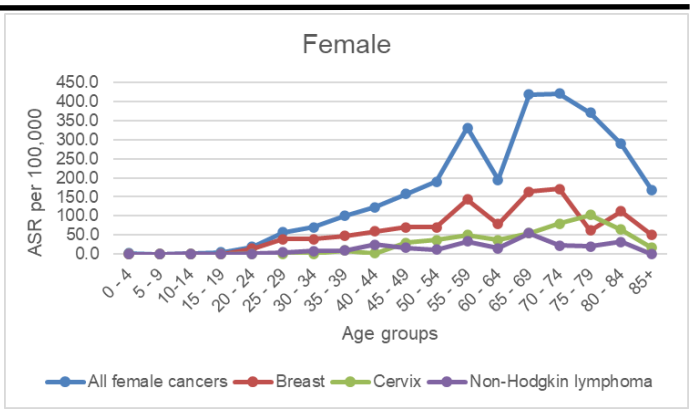


Figure 2: Age Specific Rates Per 100,000 Females

dence date. The registry uses the ICD-0-3 coding system [20]. Coding was done by the registry staff deployed from the Medical Record Department.

The CanReg5 cancer registration system (version 5.00.42) developed by the International Agency for Research on Cancer (IARC) was used for data processing and management. The CanReg system has in-built quality control and to prevent duplication. The biostatistician who is a staff of ECR is well versed in using Can Reg, including the analysis package. The registry monthly performs back up of their data using an external hard drive. Completed abstraction form entered into CanReg are filled and archived in a cabinet at the registry's office. The cabinet is regularly checked to ensure safety and confidentiality of data.

2.4 Population Data

The population figures of the Ado and Ido-Osi Local Government Areas (LGAs) based on the 2006 census figure as compiled by the National Population Commission was used to calculate the Age Specific Incidence Rates[18]. The 2006 population census, which is the most recent was used as the basis for the population estimates to calculate the incidence rates for each year. The total population covered by the registry according to the 2006 population census figure by the National Population Commission was 473,691 with 244,024 male (51.5%) and 229,667 female (48.5%) as shown in table 1.

The total cases registered, and the annual crude and age specific incidence rates were calculated according to sex and ICD-10 category for the period (2013-2017) using the CanReg 5 software. Age adjustment was carried out by calculation of cumulative rates (0-85), and age standardized incidence rates (ASR), by the direct method and world standard population[21].

2.5 Data Analysis

The total cases registered, and the annual crude and age specific incidence rates were calculated according to sex and ICD-10 category for the period (2013-2017) using the CanReg 5 software (Version 5.00.44k,2023,Lyon, France). Age adjustment was carried out by calculation of cumulative rates (0- 85), and age standardized incidence rates (ASR), by the direct method and world standard population[21]. A separate analysis was carried out for childhood cancers (ages less than 15) according to the diagnostic categories of the International Classification of Childhood Cancer (ICCC-3)22, with incidence rates for 5-years age groups 0-4, 5-9 and 10-14, together with crude and cumulative (0-14) rates per million.

2.6 Ethical Consideration

This study was approved by the Ethics and Research Committee of Ekiti State University Teaching Hospital, Ado-Ekiti, Nigeria with protocol number: EKSUTH/A67/2024/04/003.

3. RESULT

One thousand, two hundred and six (1206) cases of cancer were registered in the five- year period (2013-2017), among which 641 were females equivalent to overall Age – Standardized Incidence Rate (ASR) of 91.5 per 100,000 and 565 cancer cases were males corresponding to an ASR of 81.5 per 100,000. More females were diagnosed with cancers during the period under review as shown in Figure 1. In the females, all cancers in the females show an increasing trend from the age group 15- 19 and peak at age group 55-59 as shown in (Figure 2). All male cancers show an increasing trend from age group 30- 34 and peak at age group 75-79 as shown in Figure 3. Morphologic diagnosis accounted for 75% of all cancer cases recorded in the ECR during the study period, 2013-2017 as illustrated in Figure 4.

In females, the most common cancer is cancer of breast with 297 cases representing ASR of 39.5 per 100,000 of all cancers in the females. Cancer of the breast was followed by cancer of the uterine cervix with 73 cases representing ASR of 12.6 per 100,000. Breast cancer was seen in age from 15 years and cervical cancer was recorded from aged 35 years.

In males, the most common cancer is the cancer of prostate with 290 cases representing ASR of 46.0 per 100,000 of all cancers in the males. Cancer of the prostate was followed by lymphoma with 49 cases representing ASR of 6.2 per 100,000.

Sixteen cancers were registered in children aged 0-14, and the most common cancer was Burkitt lymphoma as shown in Table 2The comparison of the Age Specific Incidence (ASI) of some cancers in our study was done with some regional cancer registries in Africa as shown in Figure 5.

4. DISCUSSION

Most publications from high income, low and middle high-income countries reported the disproportional increasing incidence of cancer in these regions of the world[23-24]. Some regions of the world such as Africa had previously enjoyed a low incidence of cancer[25]. However, cancers have emerged as a major health crisis in Africa and the existing African's healthcare systems are being overstressed and cannot cope with the current surge in the incidence of cancer in this continent[26-28].

There are remarkable differences in the cancer incidence and mortality rates of specific cancer across the various geographical regions of the world[29]. This suggests the role of environmental factors in determining the aetiology, incidence and trend of cancer in a specific location.

Although, the study site is located in the southwestern Nigeria, ECR is in same geopolitical zone of the country where the oldest

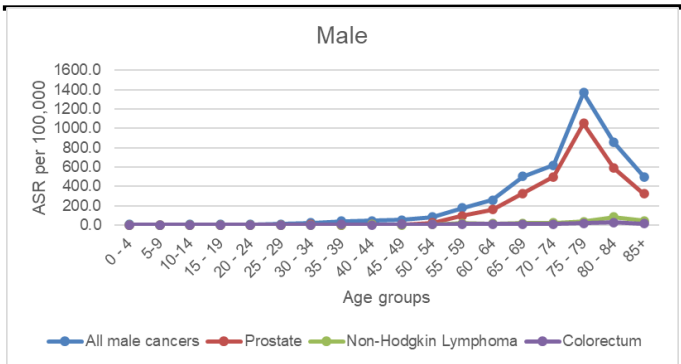


Figure 3: Age Specific Rates Per 100,000 (Leading Cancer Sites) Males

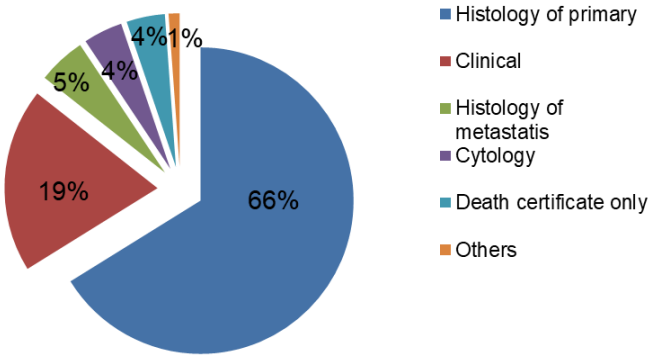


Figure 4: Major Basis of Diagnosis 2013 – 2017 Both Gender

population cancer registry (Ibadan Cancer Registry) is located. However, the topography, lifestyle of the people and meal preference in the study population are different [30]. Not until 2014, there was no population – based cancer registry in Ekiti State. The few publications on cancer from the study area were based on the histopathology diagnoses from the Department of Pathology and from the Hospital Based Cancer Registry[31]. Within five years of the establishment of the population-based cancer registry (ECR) the registry has contributed data for the publication of Cancer in Sub Saharan Africa[32].

A larger proportion of the cancer cases reported in the state were diagnosed in the catchment area which is Ado and Ido-Osi LGAs of the ECR. The population pyramid of the catchment area is similar to the typical young age population structure in most nations in Africa with a broad base and a narrowed apex[33].

Cancer registration in Nigeria is well coordinated by the National System of Cancer Registries (NSCR)[34]. This national system was established in 2009 under the supervision of the Federal Ministry of Health to provide training, technical support and mentorship for the over 30 cancer registries in the countries[35]. NSCR as part of her several efforts to ensure a uniform system in cancer reporting in the country designed a cancer notification form that is called Nigerian Cancer Registry System Case Notification Form as shown in figure 1. This notification form ensures similar reporting format in all the cancer registries in Nigeria.

The most updated national population estimates in the registry's catchment area shows that there are more males than females in the coverage population as shown in table1. However, in this study, the ASR of cancer of all sites in the females (91.5 per 100,000) is greater than the calculated ASR of all sites in the males (81.5 per 100,000) .

The calculated ASR for all sites in the females at ECR (91.5 per 100,000) is higher than the calculated ASR (86.9 per 100,000) in the females at Calabar Cancer Registry (2009- 2013)[34]. The Calabar Cancer Registry is a population-based registry that is in a different geopolitical zone (South South) in Nigeria[35]. Calabar Cancer Registry has the most recent and comprehensive five-year cancer incidence report published in 2016 from NSCR. This comprehensive cancer incidence report is coming eight years after the last report from Calabar Cancer Registry within the NSCR. The calculated ASR for all sites in the males at ECR (81.5 per 100,000), this is also higher than the calculated ASR (78.8 per 100,000) in the males at Calabar Cancer Registry (2009- 2013)[35]. Although, Calabar Cancer Registry was established much earlier, the operations at both registries are similar, and both are active members of NSCR and African Cancer Registries Network (AFCRN)[32,34]. It is noteworthy that both registries cover the population of two Local Government Areas (LGAs) in their respective State.

The calculated ASR for all sites in females at ECR (91.5 per 100,000) is also higher than the calculated ASR (78.4 per 100,000) in the females at Cancer Registry of Cotonou (Benin Republic, West Africa) Cancer Registry 2014-2016. 36 However, the calculated ASR for all sites in males at ECR (81.5 per 100,000) is lower than that of the calculated ASR at Cancer Registry of Cotonou (Benin Republic, West Africa) (91.8. per 100,000)[36]. Cancer Registry of Cotonou shares many similarities with Ekiti Cancer Registry; both registries started cancer registration same year, both are located in same region of Africa (West Africa), the compared results from both cancer registries are the first cancer incidence report since their establishment, both registries are active members of African Cancer Registry Network and use the methods and definitions of the Standard Operating Procedure (SOP) Manual of the African Cancer Registry Network for their running of both registries, and the duration of both studies are very close (2014 - 2016 & 2013 – 2017) respectively.

Breast cancer is the most common cancer in the females with an ASR of 39.5 per 100,000 which is almost thrice the ASR of the cervical cancer (12.6 per 100,000) which is the second most common cancer in the females. The calculated ASR for breast cancer at ECR is slightly higher than the calculated ASR at Calabar Cancer Registry; 2009- 2013 (35.0 per 100,000) and also higher than the calculated values at Cancer Registry of Cotonou; 2014- 2016 (22.6 per 100,000)[36].

Prostate cancer is the most common cancer of the males with an ASR 46.0 in this study. This is higher than the calculated ASR for breast cancer 39.5 per 100,000 in this study. The higher value of ASR of prostate cancer than that of the breast was also reported by the Calabar Cancer Registry[35]. The Cancer Registry of Cotonou also reported a higher ASR for Prostate cancer when compared with the calculated value for breast cancer[36].

The implication of the above is that prostate cancer may likely overtake breast cancer in this region as the most common overall cancer. There is therefore a need to monitor the trends and incidences of both cancers very closely.

The total number of cancer cases recorded in the females outnumbered that recorded in the males as shown in figure 1. The Ekiti State Government organized free community-based breast and cervical cancer screenings for women within the registry's catchment area in the year 2013 and 2017. Some of the patients that were newly diagnosed with breast and cervical cancers during the free community-based cancer screening programmes were

Table 2: Patterns of Childhood Cancers in Age Groups with Relative Frequency and Crude Rate

Cancers	Age Group 0-4	Age Group 5-9	Age Group 10-14	Total	M/F ratio	Relative Frequency (%)	Crude Rate Per Million
Leukemia	0	0	2	2	1.0	12.5	2.5
Lymphoma	2	1	2	5	4.0	31.3	6.1
Brain, Nervous system	0	0	0	0	0.0	0.0	0.0
Retinoblastoma	0	0	0	0	0.0	0.0	0.0
Nephroblastoma	1	0	0	1	1.0	6.3	1.2
Hepatic tumor	0	0	0	0	0.0	0.0	0.0
Bone tumor	0	1	0	1	1.0	6.3	1.2
Soft tissue sarcoma	0	0	0	0	0.0	0.0	0.0
Other carcinomas	5	0	2	7	2.5	43.6	8.5
Total:				**16**		**100.0%**	**19.5**

also captured by ECR but sadly, many of them eventually could not continue with their definitive treatment due to the high cost of orthodox medical care as health financing in Nigeria is still largely out –of- pocket financing[37]. Many of these patients that benefitted from the free breast and cervical cancer screening opted for traditional method of healing for the treatment of their undiagnosed cancers but were diagnosed with the advanced stage of the disease during the free cancer screening programmes. It is important to state that due to the widespread poverty especially in most rural communities in Nigeria, many Nigerians would naturally turn out in large numbers to access free medical programme like the one stated above. The Ekiti Cancer Registry staff participated actively in the community-based cancer screenings and were able to capture the data, and also follow-up the patients diagnosed with cancer during the screening programme. This illustrates one of the usefulness of cancer registries in cancer control programmes[38].

It is therefore, crucial to establish a platform of linking all free cancer screening programmes in Nigeria to the national cancer registry's database which is currently lacking at the moment. Lymphomas are relatively very common in both males and females in this study. The registry covers both rural and semi-urban populations where farming is one of the major occupations of the populace with the common use of pesticides and herbicides to prevent damage to crops or stored grains in order to boast production of crops. The exposure to these agro-allied chemicals has been linked to the development of lymphomas[39]. A recent publication from Ife-Ijesha cancer registry which is in same geopolitical zone of this study population also reported similar observation on the increasing number of cases of lymphomas in their series[40].

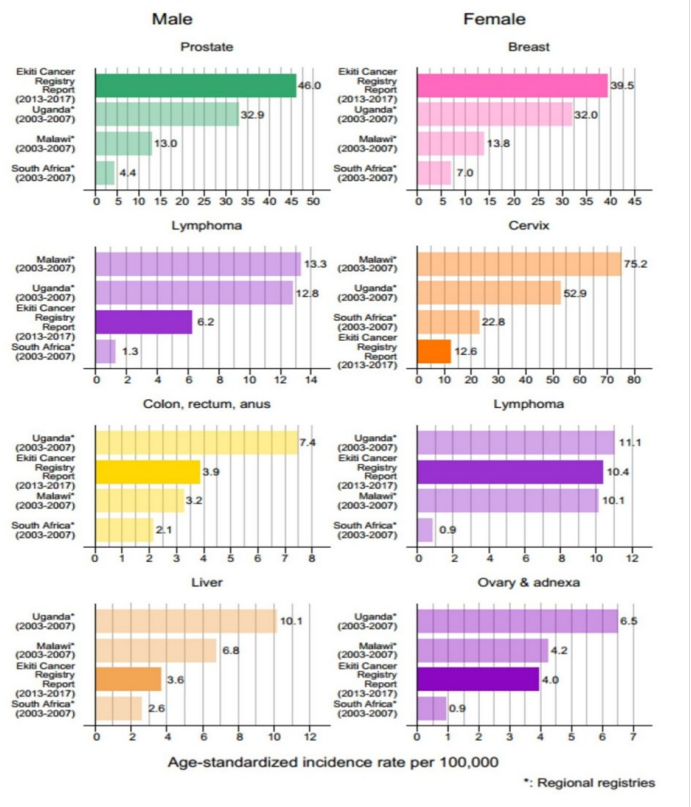


Figure 5: Comparison of Age Standardized Incidence Rate of Common Cancers Across Some Regional Registries in Africa.

Most male cancer cases showed an increasing incidence from the age group 40- 44 as shown in figure 3.It might be appropriate based on this finding to commence male cancer screening in this setting from age 40 years.

The morphologic diagnosis accounted for 75% of cases documented over the study period, as shown in figure 4. This is almost comparable to the percentage of morphological diagnosed cancer cases reported by the Ibadan Cancer Registry over 2009 - 2012 report[41]

Burkitt's lymphoma accounted for the most common childhood cancer in this study as shown in table 2. This finding is consistent with most reports from Africa that also reported Burkitt's lymphoma as the most common childhood cancer[42-44].

This study also compared the calculated ASR for some common cancers in ECR with some selected regional population-based cancer registries in Africa, who are also members of the African Cancer Registries Network (AFCRN) as shown in figure 6. The ASR for prostate cancer at ECR is higher than the calculated ASRs at Uganda, Malawi and South Africa cancer registries. The calculated ASRs for Lymphomas in the males at the Uganda and Malawi Cancer Registries are higher than the calculated ASR for Lymphoma at ECR. The high incidence of lymphomas in East Africa has been linked with the high prevalence of HIV/AIDs in the region[45]. Similarly, the incidence of HIV/AIDS is also high in South Africa[46] but surprisingly, the ASR for Lymphomas is very low in South Africa. In the females the ASR for breast cancer at ECR is higher than all the other three registries but as expected, ECR has the lowest ASR (12.8 per 100,000) for cervical cancer when compared with the other registries namely, Malawi (75.2 per 100,000), Uganda (52.9 per 100,000) and South Africa (22.8 per 100,000). Although, cervical cancer is generally believed to be caused by Human Papilloma Viruses (HPVs)[47], it is strongly associated with HIV/AIDS and is one of the criteria for AIDS defining illness among women with HIV infection[48]. The higher prevalence of HIV/AIDS in Malawi, Uganda and South Africa when compared to this study location might be responsible.

4.1 Conclusion

Cancer is increasing globally, and the high-income countries have established significant numbers of cancer registries to be able to assess the burden of the disease. The situation in low-and -middle

incomes especially sub-Saharan Africa is different. The geographically spread of the cancer registries especially population-based cancer registries in Affrica is still grossly inadequate. This might probably account for the most significant reason why the true burden of cancer in many countries is based on speculation.

Cancer registries are globally used to study the incidence of different cancers within the registry's catchment areas.

The calculation of the incidence of cancer in a particular location is very vital because this will aid the determination of underlying predisposing factors, assist planning and judicious resources mobilization and prioritization for cancer control programmes.

Breast cancer is the most common cancer in the females in Nigeria as previously reported by 49-50 and this observed as the most common cancer in the females in this study. Prostate cancer is the most common cancer in the males 46and emerged as the cancer with the highest ASR in this study. It is very noteworthy to report that Lymphomas are among the topmost common first third cancers in both sexes in this study. It is therefore very important to explore the epidemiological factors that might be responsible for increasing the incidence of lymphomas in this studied population.

This publication has also exposed some deficiencies, especially in the management of childhood cancers in our environment.

4.2 Acknowledgement

The authors acknowledge the support and encouragement of the founder and pioneer Director of the Nigerian National System of Cancer Registries (NSCR) who approved the establishment of the Ekiti Cancer Registry after a Consultancy Visit; Prof. Clement Adebamowo and his team, the Coordinators of African Cancer Registries Network (AFRCN) represented by Prof. Max Parkin and the Mrs. Biying Liu, the Federal Ministry of Health, Abuja, Nigeria and Ekiti State Government.

Limitation

The major limitation of this study was the utilization of the 2006 census to calculate the variables in this study. Unfortunately, the 2006 census was the latest census in Nigeria as of the time of conducting this study.

Contribution Roles Taxonomy (CRediT) Statement

Omonisi AE: Conceptualization, Validation, Formal analysis, Investigation, Resources, Methodology, Data Curation, Visualization, Writing-Original draft, Writing-review & editing, Supervision

Erinomo OO: Validation, Formal analysis, Investigation, Resources, Methodology, Data Curation, Visualization, Writing-review & editing, Supervision

Inubile AJ : Data Curation, Formal analysis, Investigation , Methodology, Writing-review & editing,

Ojo A : Data Curation, Formal analysis, Investigation , Methodology, Writing-review & editing,

Ibitoye O: Data Curation, Formal analysis, Investigation , Writing-review & editing,

Dada OE: Data Curation, Formal analysis, Investigation , Writing-review & editing,

Martins-Adetoye OE: Formal analysis, Investigation , Writing-review & editing,

Ogundipe KO: Validation, Formal analysis, Investigation, Resources, Visualization, Writing-review & editing, Supervision

Ajayi EA: Validation, Formal analysis, Investigation, Resources, Methodology, Visualization, Writing-review & editing, Supervision

Okere RA: Validation, Resources ,Supervision

Olabanji KA: Resources, Writing-review & editing, Supervision.

Conflicts of Interest

The authors declare that there are no conflicts of interest

REFERENCE

1. IARC's Global Cancer Observatory [Internet].2024 Feb 01. (cited 2024 Feb 20). Available from: http://gco.iarc.fr/today/end/data. sources. methods.
2. Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre L A, Jemal A. Global Cancer Statistics GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA Cancer J Clin. 2018; 68:394-424.
3. Owen, O' D. Access to health care in developing countries: breaking down demand side barriers. Cad. Saúde Pública. 2007: vol.23 no.12 Rio de Janeiro. . Accessed September 12,2023.
4. Sloan FA, Gelband H. Institute of Medicine (US) Committee on Cancer Control in Low- and Middle-Income Countries. Cancer Control Opportunities in Low- and Middle-Income Countries. Washington (DC): National Academies Press (US). 8, Cancer Centers in Low- and Middle-Income Countries. Available from: https://www.ncbi.nlm.nih.gov/books/NBK54037/2007. Accessed September 12, 2023.
5. National Research Council (US). The Continuing Epidemiological Transition in Sub-Saharan Africa: A Workshop Summary. Washington (DC): National Academies Press (US). The Epidemiological Transition in Africa: Are There Lessons from Asia? 2012. Available from: https://www.ncbi.nlm.nih.gov/books/NBK114529/.
6. Parkin DM, Ferlay J, Hamdi-Cheriff M, Sitas F, Thomas JO. editors. Cancer in Africa: Epidemiology and Prevention. IARC Press; Lyon. IARC Scientific Publications. 2003. No. 153
7. Parkin DM, Jemal A, Bray F, Korir AR, Kamate B, Singh E et al. Cancer in Sub-Saharan Africa Vol.III. Union for International Cancer Control Geneva, Switzerland. 2019.
8. Jensen OM, Parkin DM, MacLennan R, Muir CS, Skeet RG (eds): Cancer Registration: Principles and Methods, Lyon, France, International Agency for Research on Cancer, IARC Scientific Publication. 1991. No.95.
9. Piver MS: The Gilda Radner Familial Ovarian Cancer Registry 1981-2000. Euro J Gynaecol Oncol. 2000;325-333.
10. Wabinga HR, Nambooze S, Amulen PM, Okello C , Mbus L, Parkin DM. Trends in the incidence of cancer in Kampala, Uganda 1991–2010. Int. J. Cancer: 2013;(135): 432–439
11. Wang YC, Wei LJ, Liu JT, Li SX, Qing-sheng Wang QS. Comparison of Cancer Incidence between China and the USA. Cancer Biol Med.2012; 9(2): 128–132. doi: 10.3969/j.issn.2095-3941.2012.02.009
12. Zheng RS, Chen R, Han BF, Wang SM, Li L, Sun K et al. Cancer Incidence and Mortality in China, 2022. Journal of the national Cancer Center. 2024;(4):47-53.

13. African Cancer Registry Network. How to apply. http://afrcn.org/index.php/rearch/how -to-apply.
14. Nigerian System of Cancer Registries, National Institute for Cancer Research and Treatment (NSCR-NICRAT). Newsletter. 2024; 8(1): 13
15. Edington GM, Maclean CM. A cancer rate survey in Ibadan, Western Nigeria.br. J. Cancer.1965;471-481.
16. Adebamowo CA, Ajayi OO. Cancer in Nigeria. West Afr J Med. 2000;19(3): 170-91.
17. https://en.wikipedia.org/wiki/Ekiti State . Accessed August 16, 2023.
18. Federal Republic of Nigeria, National Policy on population for sustainable development. Federal Republic of Nigeria official gazette.2009; 96(2):837. Accessed August 16, 2023.
19. Finesse AM, Somdyala N, Chokunonga E, Parkin DM. Manual standard procedure for cancer registration in sub-saharan Africa. AFCRN 2015;111:20-43.
20. Percy C, Fritz A, Jack A, Shanmugarathan S, Sobin L, Parkin DM et al. International Classification of Diseases for Oncology (ICD-0), 3rd ed. Geneva: World Health Organization 2000.
21. Doll R, Smith PG. Comparison between registries; age-standardized rates in: Muir CS, Shanmugarathan (Eds). Cancer incidence in Five continents; 7, IARC Scientific Publication. 1982.pp 671-675.
22. Steliarova-Foucher E, Stiller C, Lacour B, Kaatsch P. International Classification of Childhood cancer, third edition. Cancer 2005; 103:1457-67.
23. The International Agency for Research on Cancer (IARC): The World Cancer Report 2020: Cancer Research for Cancer Prevention.
24. Torre LA, Siegel RL, Ward EM, Jemal A . Global cancer incidence and mortality rates and trends- an update. Cancer Epidemiol Biomarkers Prev.2015: OF1- OF12.
25. Okobia MN. Cancer acre in sub-Saharan Africa – Urgent need for population- based cancer registries. Ethiop. J. Health Dev.2003;17(2):89-98.
26. Bello-Morhason IO, Odedina F, Rebbeck TR, Danguo JM, Denny L, Adewole IF. Challenges and opportunities in cancer control in Africa: a perspective from the African Organization for Research and Training in Cancer. Lancet Oncol.2013; 14:e142-5.
27. Stefan DC. Cancer care in Africa: An overview of resources. J Glob Oncol 2015;1:30-36.
28. Boyle P, Ngoma T, Sullivan R, Brawley. Cancer in Africa: the way forward ecancer .2019:13 953.
29. Klassen AC, Platz EA. What can geography tell us about prostate cancer? Am J Prev. Med.2006; 30(2):57-S15).
30. https://ekitistate.gov.ng/about-ekiti/people-culture/. Accessed September 12, 2023.
31. Babatunde OA, Elegbede O, Ayodele LM, Sunday DA. Prevalence and outcome of Cancers in Ekiti state, southwest Nigeria. Journal of Clinical Oncology. 2013;31(15 suppl):suppl; 12553.DOI: 10.1200/jco.2013.31.15 suppl.e12553.
32. Parkin DM, Jemal A, Bray F, Korir AR, Kamate B, Singh E et.al. Cancer in Sub-Saharan Africa Vol.III. Union for International Cancer Control Geneva, Switzerland. 2019.
33. United Nations Economic Commission for Africa. The Demographic profile of Africa.https://www.uneca.org/sites/default/files/PublicationFiles/demographic profile revs april 25.pdf. Accessed September 24, 2023.
34. Jedy-Agba EE, Oga EA, Odutola M, Abdullahi YM, Popoola A, Achara P et al. Developing national cancer registration in developing countries-case study of the Nigerian national system of cancer registries.https://doi.org/10.3389/fpubh.2015.00186. Accessed July 2,2019.
35. Ekanem IA,Parkin DM. Five year cancer incidence in Calabar, Nigeria (2009-2013). Cancer Epidemiology. 2016;42:167-172.
36. Egue M,Gnangnon FH,Akele-Akpo M-T,Parkin DM. Cancer incidence in Cotonou (Benin) , 2014- 2016 (First results from the cancer registry of Cotonou).https://doi.org/10.1016/j.canep.2019.01.006. Accessed May 15, 2020.
37. Aregbeshola BS, Khan MS. Out-of- pocket payments, catastrophic health expenditure and poverty among households in Nigeria . Int J Health Policy Manag. 2010;7(9):798-806.
38. Armstrong BK. The role of the cancer registry in cancer control. Cancer Causes & Control. 1992;3(6):569-579.
39. Schinasi L, Leon ME. Non-Hodgkin lymphoma and occupational exposure to agricultural pesticide chemical groups and active ingredients: a systematic review and meta-analysis. Int J Environ Res Public Health. 2018;11(4):4449-4527.
40. Omonisi A, Soremekun A, Olasode. Probable Risk Factors Responsible for the Increasing Trend of Non-Hodgkin's Lymphoma in Ife-Ijesha Southwestern, Nigeria: A Call for an Epidemiological Study. European Journal of Research. 2020;5(7): 87-95
41. Ogunbiyi JO, Fabowale AO, Ladipo AA. Cancer Incidence and Top Ten cancers in Eleven Local Government Areas in Ibadan and its Environs,2004-2008: Ibadan Cancer Registry, Nigeria Technical Report.2010.
42. Omonisi A, Komolafe A, Adefehinti O, Olasode B, Lawal O, Durosinmi M et al. Cancer in Ife-Ijesha, Southwestern Nigeria: An Account of a 20- year Cancer Registration from Ife -Ijesha Cancer Registry International Journal of Internal Medicine .2020;9(1): 11-19.
43. Okongo F, Ogwang DM, Liu B, Parkin DM. Cancer incidence in Northern Uganda (2013-2016). Int.J. Cancer. https://onlinelibrary.wiley.com/doi/full/10.1002/ijc.32053. Accessed May 17,2020.

44. Hämmerl L, Colombet M, Rochford R et al. The burden of Burkitt lymphoma in Africa. Infect Agents Cancer. 14, 17 https://doi.org/10.1186/s13027-019-0236-7.

45. Chinula L, Moses A, Gopal S. HIV-associated malignancies in sub-Saharan Africa: progress, challenges, opportunities. Curr Opin HIV AIDS. 2017 Jan; 12(1): 89–95.

46. Mabaso M., Makola L., Naidoo I, Mlangeni LL, Jooste S, Simbayi L. (2012). HIV prevalence in South Africa through gender and racial lenses: results from the 2012 population -based national household survey. Int J Equity Health .2012;18:167. https://doi.org/10.1186/s12939-019-1055-6.

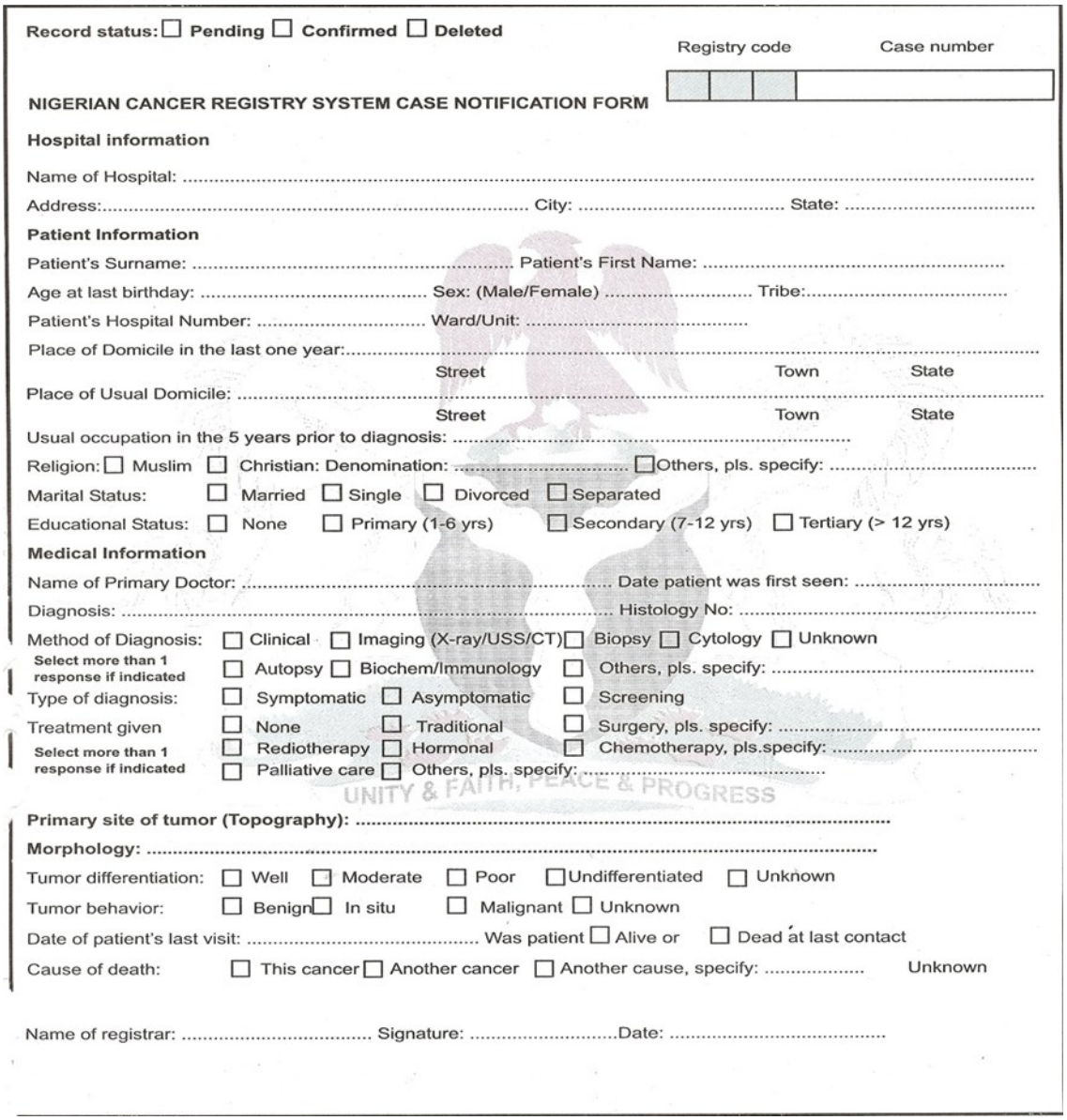
47. Chan CK, Aimagambetova G, Ukybassova T, Kongrtay K, Azizan A. "Human Papillomavirus Infection and Cervical Cancer: Epidemiology, Screening, and Vaccination—Review of Current Perspectives", Journal of Oncology. https://doi.org/10.1155/2019/3257939. Accessed September 10, 2020.

48. Ghebre RG, Grover S, Xu M, Linus T. Chuang LT, Simonds H. Cervical cancer control in HIV-infected women: Past, present and future. Gynaecol Oncol Rep. 2017; 21: 101–108.

49. Jedy-Agba E, Curado MP, Ogunbiyi O, Oga E, Fabowale T, Osubor G et al. Cancer Incidence in Nigeria: A Report from Population-based Cancer Registries. Cancer Epidemiol.236 (5):e271-278.doi:10.1016/j.canep.2012.04.007. Accessed June 15,2019.

50. Sowunmi A, Alabi A, Fatiregun O, Olatunji T, Okoro US, Etti D et al. Trend of cancer incidence in an oncology center in Nigeria. West Afr J Radiol.2018; 25:52-6

Appendix 1: Prototype of the cancer notification form used in ECR



Record status: ☐ Pending ☐ Confirmed ☐ Deleted

Registry code | Case number

NIGERIAN CANCER REGISTRY SYSTEM CASE NOTIFICATION FORM

Hospital information

Name of Hospital: .....

Address: ..... City: ..... State: .....

Patient Information

Patient's Surname: ..... Patient's First Name: .....

Age at last birthday: ..... Sex: (Male/Female) ..... Tribe: .....

Patient's Hospital Number: ..... Ward/Unit: .....

Place of Domicile in the last one year: .....

Street Town State

Place of Usual Domicile: .....

Street Town State

Usual occupation in the 5 years prior to diagnosis: .....

Religion: ☐ Muslim ☐ Christian: Denomination: ..... ☐ Others, pls. specify: .....

Marital Status: ☐ Married ☐ Single ☐ Divorced ☐ Separated

Educational Status: ☐ None ☐ Primary (1-6 yrs) ☐ Secondary (7-12 yrs) ☐ Tertiary (> 12 yrs)

Medical Information

Name of Primary Doctor: ..... Date patient was first seen: .....

Diagnosis: ..... Histology No: .....

Method of Diagnosis: ☐ Clinical ☐ Imaging (X-ray/USS/CT) ☐ Biopsy ☐ Cytology ☐ Unknown

Select more than 1 response if indicated: ☐ Autopsy ☐ Biochem/Immunology ☐ Others, pls. specify: .....

Type of diagnosis: ☐ Symptomatic ☐ Asymptomatic ☐ Screening

Treatment given: ☐ None ☐ Traditional ☐ Surgery, pls. specify: .....

Select more than 1 response if indicated: ☐ Rediotherapy ☐ Hormonal ☐ Chemotherapy, pls.specify: .....

☐ Palliative care ☐ Others, pls. specify: .....

UNITY & FAITH, PEACE & PROGRESS

Primary site of tumor (Topography): .....

Morphology: .....

Tumor differentiation: ☐ Well ☐ Moderate ☐ Poor ☐ Undifferentiated ☐ Unknown

Tumor behavior: ☐ Benign ☐ In situ ☐ Malignant ☐ Unknown

Date of patient's last visit: ..... Was patient ☐ Alive or ☐ Dead at last contact

Cause of death: ☐ This cancer ☐ Another cancer ☐ Another cause, specify: ..... Unknown

Name of registrar: ..... Signature: .....Date: .....