Original Article

A Histopathological Review of Cancer in Katsina State North-Western Nigeria

Asma'u Usman[1,*], Shamsu Sahalu Bello[2], Adam Shuaib[1], Abubakar Dahiru[1], Fatima Abubakar Rasheed[3], Aisha Abdurrahman[3], Mujittaba Isyaku Mashi[4], Abubakar Sani Lugga[5], Abdulhafiz Usman[1].

1.Department of Anatomic and Molecular Pathology, Federal Teaching Hospital Katsina, Nigeria. 2. Department of Pathology, General Amadi Rimi Specialist Hospital Katsina, Nigeria. 3. Department of Obstetrics and Gynaecology, Federal Teaching Hospital Katsina, Nigeria. 4. Department of Haematology and Blood Transfusion, Federal Teaching Hospital Katsina., Nigeria. 5. Department of Paediatrics, Federal Teaching Hospital Katsina, Nigeria.

Abstract

Background: Cancer is a public health concern globally, especially in Africa, and its incidence and mortality are rapidly growing. **Materials and Methods:** This was a 10-year review of all cancer cases received from 1st January 2012 to 31st December 2021 in the pathology laboratories of Federal Teaching Hospital Katsina, General Hospital Katsina and General Amadi Rimi Specialist Hospital Katsina. Data were obtained from departmental laboratory record registers, analyzed and organized into specific organ sites as categorized by the International Classification for Diseases for Oncology and presented in tables and charts according to organ sites and systems. **Results:** A total of 13,500 surgical specimens were received in the laboratories of which 2,359 (17.5%) were confirmed to be cancers. It involved 1378 females and 982 males with mean ages of 45.75 and 51.42 respectively, and a male-to-female ratio of 1:1.4. Cancer cases ranged between 2 months to 101 years with a mean age ± SD of 48.1± 19.7. The most common adult cancers were breast (19.3%), prostate (14.4%) and cervical (12.0%) with a median age of occurrence in the 5th, 8th and 6th decade respectively. The top paediatric cancers were retinoblastoma (15.8%), rhabdomyosarcoma (15.3%), acute lymphoblastic leukemia (10%) and Burkitt lymphoma (8.8%). The most commonly affected systems were the female genital tract (18.7%), breast (18%) and male genital tract (13.7%). **Conclusion:** This study shows that 1 in 6 surgical specimens received in the laboratories in Katsina are cancers with an overall increase over the years. The frequency, patterns, histological types and sociodemographic characteristics were determined. This will hopefully serve as baseline data for future cancer control policies and strategies including the establishment of a population-based cancer registry in the state.

Keywords: Histopathological, Cancer, Katsina, North-western Nigeria, Multicenter.

INTRODUCTION

Cancer is a major public health issue and is a major cause of morbidity and mortality globally with progressive increase in incidence over the years.[1] According to the GLOBOCAN estimates of cancer incidence produced by the International Agency for Research on Cancer (IARC), the burden of cancer globally in 2020 was about 19.3 million cases with nearly 10 million deaths. Worldwide, the most frequently diagnosed cancer in the year 2020 was female breast cancer with an estimated 2.3 million new cases accounting for 11.7% of new cancer diagnosis

Correspondence:
Asma'u Usman,
Department of Anatomic and Molecular Pathology,
Federal Teaching Hospital Katsina.
Email: asmauusman79@gmail.com

How to cite this article: Usman et al. A Histopathological Review of Cancer in Katsina State North-Western Nigeria. Ann Trop Pathol., **2024; 15 (1): 1-10**

cases which was followed by lung (11.4%), colorectal (10%), prostate (7.3%) and gastric cancer (5.6%).[2] Almost half (49.3%) of all diagnosed cancer cases in 2020 were seen in Asia with cancer-related mortality of 58.3%; followed by Europe with 22.8% cases and mortality of 19.6%, and then America with 20.9% cases and 14.2% mortality. However, a higher mortality rate of 58.3% in Asia and 7.2% in Africa was seen when compared to their incidences of 49.3% and 5.7% which was a result of divergent spread of types of cancer and higher mortality in these continents.[2] Again, in 2012, it was estimated that there were 847,000 new cancer cases and 591,000 cancer-related deaths in Africa which was also attributed to inequity in health care and the consequence of socioeconomic factors on cancer care and its aftermath. [3]

In Nigeria, an estimated 102,000 new cases of cancer are seen with 72,000 deaths yearly.[4] A comprehensive cancer database is lacking in Nigeria with the majority of data on cancer being derived incidence from hospital-based and few population-based cancer registry reports. Currently, the national system of cancer registries consists of only 13 population-based and 20 hospital-based cancer registries.[5] In Katsina State, there is no previous study on the burden of histopathologically diagnosed cancer cases. This informed the index multi-centre hospital-based study which aimed to determine the trend, frequency and pattern of cancer in Katsina State, Nigeria over 10 years.

MATERIALS AND METHODS

Study Design and Study Sites:

This was a retrospective cross-sectional, multicenter study of biopsy specimens received and accessioned at three hospitals in Katsina, Nigeria – the Federal Teaching Hospital Katsina (FTHKT), General Hospital (GHKT) and General Amadi Rimi Specialist Hospital (GARSH). Katsina is situated in the North-Western region of the country, latitude 12.98553 and longitude 7.617144. Katsina is the capital city of Katsina State which shares a border with The Republic of Niger to the north and the Nigerian states of Jigawa and Kano to the east, Kaduna to the south, and Zamfara to the west. The state has a land mass of 24,192 km^2 and an estimated population of 7,831,319. [6]

Federal Teaching Hospital Katsina is a 500-bed tertiary-level facility made up of 13 departments (eight clinical and 5 para-clinical departments) with pathology being one of the para-clinical departments. General Hospital Katsina and General Amadi Rimi Specialist Hospital are secondary health facilities located in the ancient city of Katsina that both have clinical and para-clinical departments including pathology. Both GHKT and GARSH are 210-bedded facilities. These 3 hospitals receive clients from Katsina, neighbouring states and neighbouring countries precisely the Niger Republic with FTHKT as the ultimate referral centre amongst them.

Materials:

All the archived cancer cases received from 1st January 2012 to 31st December 2021, inclusive, in the pathology laboratories of these hospitals were obtained from the pathology departmental record registers. Relevant biodata was obtained from the patients' folders and laboratory records.

Methods:

The cancers were sorted into specific organ sites as categorized by the International Classification for Diseases for Oncology, Third Edition (ICD-O-3). [7] The ICD-O-3 is a multidimensional classification system that categorizes tumours based on site and histology derived from research and pathology reports. Requests for histopathological evaluation of biopsies in the laboratories of the three hospitals also came from private hospitals, other government hospitals and hospitals in the neighbouring Niger Republic.

Inclusion and exclusion criteria:

All histological specimens that had confirmed cancer diagnosis were included in the study. Inconclusive cases and those with incomplete demographic and clinical data were excluded.

Tissue handling:

Specimens are usually brought in neutral buffered formalin (NBF) to the laboratories of these hospitals. On arrival of specimens received from both within and outside these hospitals at the reception, they were always inspected and the fixative was changed with NBF regardless of the type of fixative the specimen came in. After surgical dissection, tissue processing ensued. Limited immunohistochemistry for the 3 germ cell layers is available for diagnostic, prognostic and therapeutic intent.

Definitions:

Metastasis is a process whereby tumour cells move out from a primary mass and move through blood vessels and/or lymphatics to form a secondary growth at a distant site. [8] In this study, metastatic cancers were considered to be any affected secondary sites irrespective of having a known or unknown primary. Bone marrow cancers in this study are all cases of multiple myeloma, lymphomas, and acute and chronic leukaemias diagnosed from bone marrow aspirates (BMA). However, all diagnoses of lymphomas made from BMA and histology from the same patient were considered as one diagnosis and designated as the various lymphomas diagnosed via histology.

Ethical Approval:

Ethical clearance was received from the Health Research Ethics Committees (HREC) of the Federal Teaching Hospital Katsina and the State Ministry of Health (SMoH) for this study with HREC protocol numbers of 073 with approval dates from 02/05/2023

to 01/05/2024 and 719 with approval dates from 27/04/2023 to 28/04/2024 respectively.

Statistical Analysis:

All the data obtained were managed and analyzed using Statistical Package for Social Sciences (SPSS) version 28. The frequency distribution of variables was presented in tables and charts. Cancers diagnosed in 14-year-olds and below were termed paediatric cancers as seen in the article on children and young persons in the Child Rights Act (2003) of Nigeria.[9] They were presented as tables and charts according to their histological subtypes as frequencies and percentages in descending order.

RESULTS

There was a total of 13,500 surgical specimens seen in Katsina state over the ten (10) year study period out of which 66.2% (n=8,933) were from FTH Katsina, 23.1% (n=3,115) from GHKT and 10.7.4% (n=1,452) from GARSH. Of the 13,500 surgical specimens, 2,359 (17.5%) were cancer cases out of which 83% (1963) were from FTH Katsina, 10% (231) from GHKT and 7% (165) from GARSH. This is shown in Figure 1.

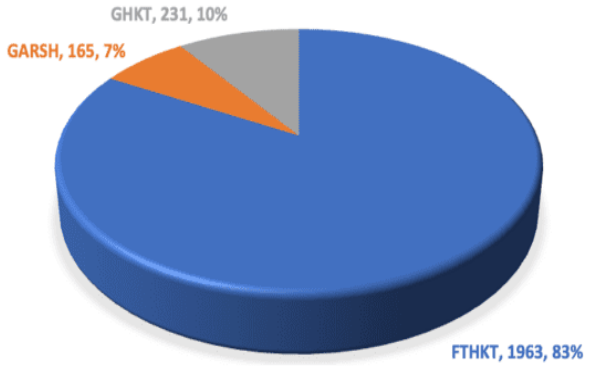

Figure 1: Distribution of Cancer According to Hospital.
Key: FTHKT: Federal Teaching Hospital Katsina, GHKT: General Hospital Katsina, GARSH: General Amadi Rimi Specialist Hospital.

The temporal trend over the research period is illustrated in Figure 2. The frequency of cancer cases ranged from 52 in 2012 to 399 in 2021. There was an increase from 2012 to 2013, a steady decline in 2014, a slow rise between 2014 and 2015, and a significant rise by the year 2016. The number of cancer cases peaked in 2019, which depicted the highest frequency for Katsina state during the period of study. After that, the cases dropped slightly to 399 in 2021.

Females constituted 58.4% (1378) of cases while males comprised 41.6% (981) with a male-to-female ratio of 1:1.4. Table 1 depicts the distribution of female and male cancers in the index study. Among the females, breast cancer was the most common cancer diagnosed (29.5%) followed by cervical cancer (19.0%) which is

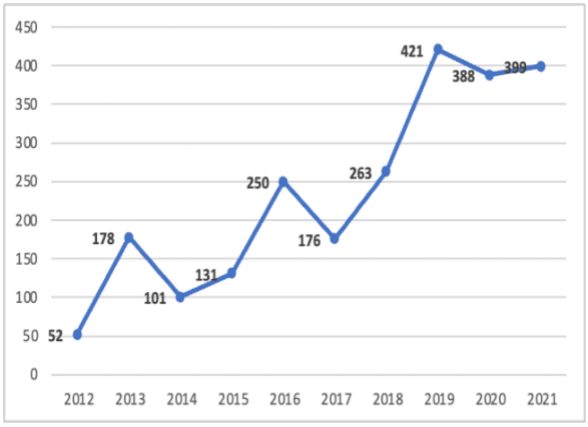

Figure 2: Temporal Trend of Cancer over 10-years.

Table 1: Distribution of Female and Male Cancers

S/N	Site (Female)	Frequency	Percentage (%)	Site (Male)	Frequency	Percentage (%)
1	Breast	411	29.5	Prostate	316	32.2
2	Cervix uteri	262	19	Connective Tissue**	68	7
3	Ovary	106	7.2	Bone marrow	63	6.4
4	Colorectum	71	5.6	Metastasis	63	6.4
5	Metastasis	65	4.7	Colorectum	60	6.1
6	Connective Tissue**	64	4.6	Non-Melanoma skin	58	6
7	Non-Melanoma skin	57	4.1	Stomach	53	5.4
8	Melanoma	38	2.7	Bladder	44	4.5
9	Gestational Trophoblastic Disease	33	2.4	Hodgkin Lymphoma	33	3.4
10	Bone marrow	30	2.2	Non-Hodgkin Lymphoma	32	3.3
11	Corpus uteri	29	2.1	Eye	28	3
12	Stomach	26	1.9	Melanoma	26	2.7
13	Bladder	20	1.5	Nasopharynx	24	2.4
14	Eye	20	1.5	Larynx and Hypopharynx	20	2
15	Non-Hodgkin Lymphoma	20	1.5	Bone	16	1.6
16	Thyroid	20	1.5	Kidney	14	1.4
17	Hodgkin Lymphoma	17	1.2	Salivary gland	12	1.2
18	Kidney	15	1.1	Breast	11	1.1
19	Nasopharynx	12	0.9	Testis	6	0.6
20	Bone	11	0.8	Liver	5	0.5
21	Salivary gland	11	0.8	Thyroid	5	0.5
22	Vulva	9	0.6	Kaposi Sarcoma	4	0.4
23	Liver	8	0.7	Oesophagus	4	0.4
24	Oral	7	0.5	Retroperitoneum	3	0.3
25	Larynx and Hypopharynx	6	0.4	Caecum	3	0.2
26	Caecum	2	0.2	Ileum	2	0.2
26	Vagina	2	0.2	Oral	2	0.2
28	CNS	1	0.1	CNS	1	0.1
29	Kaposi Sarcoma	1	0.1	Ear	1	0.1
30	Oesophagus	1	0.1	Pancreas	1	0.1
31	Retroperitoneum	1	0.1	Penis	1	0.1
32	Trachea	1	0.1	Spleen	1	0.1
33	Urethra	1	0.1	Tonsils	1	0.1
	Total	1378	100	Total	981	100

also the most frequent genital tract cancer. Other common cancers diagnosed among the females were cancers of the ovary (7.2%), colorectum (5.6%), metastasis (4.7%) and connective tissue (4.6%). Within males, prostate cancer was the most common accounting for 32.2% followed by cancers of the

Table 2: Distribution of Adult Cancers.

Ranking	Site	Frequency	Percentage (%)
1	Breast	422	19.30
2	Prostate	316	14.40
3	Cervix uteri	262	12.00
4	Colorectum	131	6.00
5	Metastasis	124	5.60
6	Non-Melanoma skin	114	5.20
7	Connective Tissue**	106	4.84
8	Ovary	97	4.43
9	Stomach	79	3.61
10	Bone marrow	68	3.10
11	Melanoma	64	2.92
12	Bladder	62	2.83
13	Hodgkin Lymphoma	37	1.70
14	Nasopharynx	33	1.50
15	Gestational Trophoblastic Disease	33	1.50
16	Non-Hodgkin Lymphoma	31	1.4
17	Corpus uteri	29	1.3
18	Larynx and Hypopharynx	26	1.12
19	Thyroid	24	1.10
20	Salivary gland	23	1.05
21	Bone	19	0.87
22	Eye	15	0.70
23	Kidney	12	0.64
24	Liver	11	0.50
25	Vulva	9	0.41
26	Oral	8	0.37
26	Kaposi Sarcoma	5	0.23
28	Oesophagus	5	0.23
29	Testis	5	0.23
30	Caecum	4	0.18
31	CNS	2	0.09
32	Ileum	2	0.09
33	Vagina	2	0.09
34	Ear	1	0.05
35	Lymph node	1	0.05
36	Pancreas	1	0.05
37	Penis	1	0.05
38	Retroperitoneum	1	0.05
39	Spleen	1	0.05
40	Tonsils	1	0.05
41	Trachea	1	0.05
42	Urethra	1	0.05
	Total	2189	100

** Connective tissue is synonymous with Soft tissue.
*Bone marrow are all cases of multiple myeloma, lymphomas, metastasis, and acute and chronic leukemias diagnosed from bone marrow aspirates (BMA).
** Connective tissue is synonymous with soft tissue.

connective tissue (7%), metastasis and bone marrow cancers each accounting for 6.4%. Breast and colorectal cancers as well as thyroid cancer were diagnosed in more females than males while cancers of the bone marrow, stomach, bladder, lymphomas and Kaposi sarcoma were twice as common in males than in females. All cases of retroperitoneal, ileal, splenic and pancreatic cancers were exclusively diagnosed in males in this study.

The age distribution of cancer cases over the 10 years is shown in Figure 3. The ages of affected persons ranged between 2 months to 101 years with mean age ± SD of 48.1± 19.7. Overall, there was a steady increase in the number of cancer cases from the 0-9-year age group to the 40-49-year age group with a peak seen in the 50–59-year age group. After that, it progressively decreased with the lowest frequency in the ≥ 100-year age group.

The age and gender distribution are shown in Figure 4. The peak age distribution in males was the 60-59-year age group with 220 cases with the lowest frequency seen as 2 cases in individuals aged 100 years and above. The peak age distribution in females was

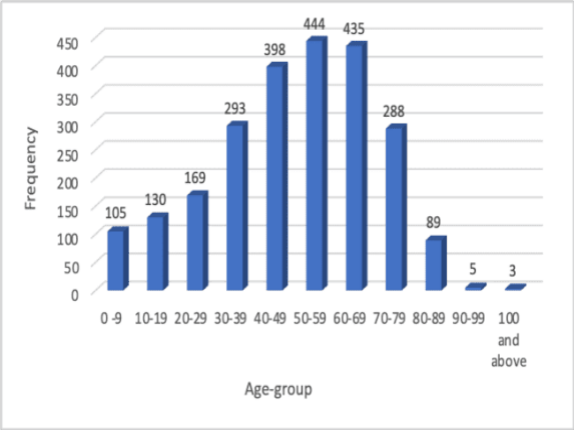

Figure 3: Distribution of Cancer based on Age Group.

bimodal and seen within the 40-49- and 50-59-year age groups with 293 cases each. The mean age ± SD of diagnosis in females and males were 45.75±17.38 and 51.42±22.19 respectively.

The distribution of all (adult and paediatric) cancers according to tissue type for both sexes is illustrated in Figure 6. It shows that breast cancer is the most commonly diagnosed cancer with 422 cases (18%), closely followed by prostate with 316 (13.4%) and cervix with 262 (11%). Other top ten cancer cases rated by tissue type include connective tissue (5.6%), colorectal (5.5%), metastasis (5.4%), non-melanoma skin (4.9%) and ovarian (4.5%) cancers. There was no case of lung cancer over the ten-year study period. There was also one case of each (0.05%) of cancers of the ear, pancreas, penis, spleen, tonsils, trachea, urethra and vagina.

The distribution of adult cancers in both sexes is depicted in Table 2. Breast cancer remained the commonest cancer among adults (n=422, 19.3%) followed by prostate cancer (n=316, 14.4%) then cervical cancer (n=262, 12%). This is similar to the trend seen in the distribution of all cancers according to the tissue type. The median age of occurrence was the 5th decade for breast, 8th decade for prostate, 6th decade for cervix, 4th decade for connective tissue, and 6th decade for colorectum, metastasis and non-melanoma skin.

Paediatric (≤ 14 years) cancer cases seen in both sexes are illustrated in Figure 6. There were 98 males and 72 females. Retinoblastoma was found to be the most common cancer accounting for 27 of 170 cases (15.8%) of all the paediatric cancers. Other cancers within the top ten rankings were rhabdomyosarcoma 26 of 170 cases (15.3%), acute lymphoblastic leukaemia 17 of 170 cases (10%), Burkitt lymphoma and

Nephroblastoma each with 15 of 170 cases (8.8%), Hodgkin lymphoma 13 of 170 cases (7.6%), Osteosarcoma 9 of 170 cases (5.2%) and acute myeloid leukaemia 6 of 170 cases (3.5%).

The proportion of paediatric cancers based on age grouping is seen in Figure 7. The mean age ± SD of cancer is 7.7± 4.1 with the peak seen in the 5-14 year-age group which accounted for 71% of all paediatric cancers.

The distribution of cancer according to body systems is depicted in Table 2. The specific systems were categorized based on the International Classification for Diseases for Oncology, third edition (ICD-0-3). Seventeen systems were identified and the female genital system was the most affected constituting 441 cases (18.7%) within which cancer of the cervix uteri made up 59.4% of the female genital cancers followed by the ovary (n=106, 24%), gestational trophoblastic disease (n=33, 7.5%), corpus uteri (n=29, 6.6%), vulva (n=9, 2%) and 2 cases (0.5%) of vaginal cancer. The second most affected system is the breast (18%). This is followed by the male genital system (324 cases; 13.7%) in which the majority (316 cases; 97.5%) were due to prostate cancer with 6 cases of testicular cancers and a single case each of penile cancer and metastatic cancer to the scrotum. Other systems in descending frequency were the digestive system (10.6%), skin (7.5%) and connective, subcutaneous and soft tissue (7.3%) to name a few. The 2 least occurring systems were CNS with 4 cases (0.16%) and Head and neck with 1 case (0.04%).

Table 3: Distribution Of Cancer by System.

S/N	System	Frequency	Percent
I	Female Genital	441	18.70
	Cervix uteri	262	11.10
	Ovary	106	4.50
	Gestational Trophoblastic Disease	33	1.40
	Corpus uteri	29	1.20
	Vulva	9	0.40
	Vagina	2	0.10
II	Breast	422	18.00
	Breast	422	18.00
III	Male Genital	324	13.70
	Prostate	316	13.37
	Testis	6	0.25
	Metastasis	1	0.04
	Penis	1	0.04
IV	Digestive	251	10.60
	Colorectum	131	5.50
	Stomach	79	3.30
	Liver	13	0.60
	Metastasis	7	0.30
	Non-Hodgkin Lymphoma	6	0.30
	Caecum	5	0.20
	Oesophagus	5	0.20
	Ileum	2	0.08
	Kaposi Sarcoma	1	0.04
	Pancreas	1	0.04
	Spleen	1	0.04
V	Skin	176	7.50
	Non-Melanoma skin	115	4.91
	Melanoma	58	2.47
	Metastasis	2	0.08
	Kaposi Sarcoma	1	0.04
VI	Connective, Subcutaneous & Soft Tissue	173	7.30
	Connective Tissue**	132	5.60
	Metastasis	17	0.68
	Non-Hodgkin Lymphoma	14	0.59
	Melanoma	6	0.25
	Kaposi Sarcoma	3	0.12
	Hodgkin Lymphoma	1	0.06
VII	Lymph node	134	5.70
	Metastasis	69	2.90
	Hodgkin Lymphoma	44	1.90
	Non-Hodgkin Lymphoma	21	0.90
VIII	Haematopoeitic & Reticuloendothelial	105	4.50
	Bone marrow	93	3.90
	Non-Hodgkin Lymphoma	6	0.30
	Hodgkin Lymphoma	4	0.20
	Metastasis	2	0.10
IX	Urinary Tract	94	3.90
	Bladder	64	2.66
	Kidney	29	1.20
	Urethra	1	0.04
X	Lips, Oral Cavity & Pharynx	70	2.90
	Nasopharynx	34	1.41
	Salivary gland	23	0.95
	Oral	9	0.37
	Non-Hodgkin Lymphoma	2	0.09
	Hodgkin Lymphoma	1	0.04
	Tonsils	1	0.04
XI	Eye	48	2.00
	Eye	48	2.00
XII	Retroperitoneum & Peritoneum	32	1.40
	Retroperitoneum	4	0.20
XIII	Respiratory	31	1.30
	Larynx and Hypopharynx	26	1.10
	Nasopharynx	2	0.08
	Ear	1	0.04
	Metastasis	1	0.04
	Trachea	1	0.04
XIV	Bones, Joints & Articular Cartilage	28	1.20
	Bone	27	1.16
	Metastasis	1	0.04
	Thyroid	25	1.10
	Thyroid	25	1.10
XV	CNS	4	0.16
	CNS	2	0.08
	Non-Hodgkin Lymphoma	2	0.08
XVI	Head & Neck	1	0.04
	Non-Hodgkin Lymphoma	1	0.04
	Total	2359	100.00

*Bone marrow are all cases of multiple myeloma, lymphomas, metastasis, and acute and chronic leukemias diagnosed from bone marrow aspirates (BMA).
** Connective tissue is synonymous with soft tissue.

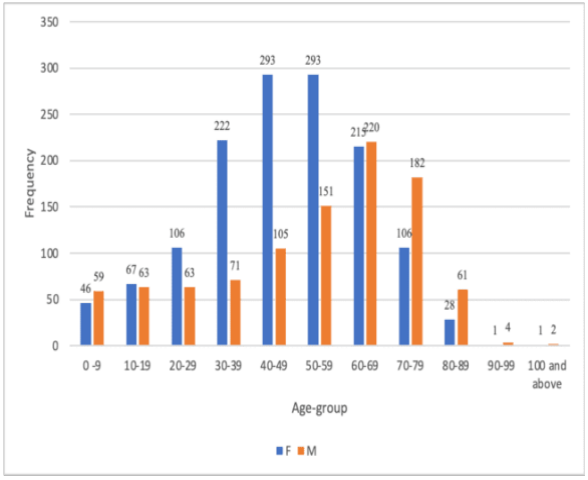

Figure 4: Age and Gender Distribution of Cancer.
Key: F – Females, M – Males.

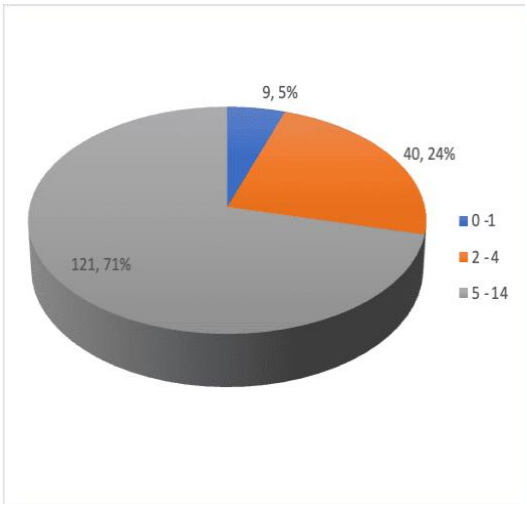

Figure 7: Proportion of Paediatric Cancer According to Age Group.

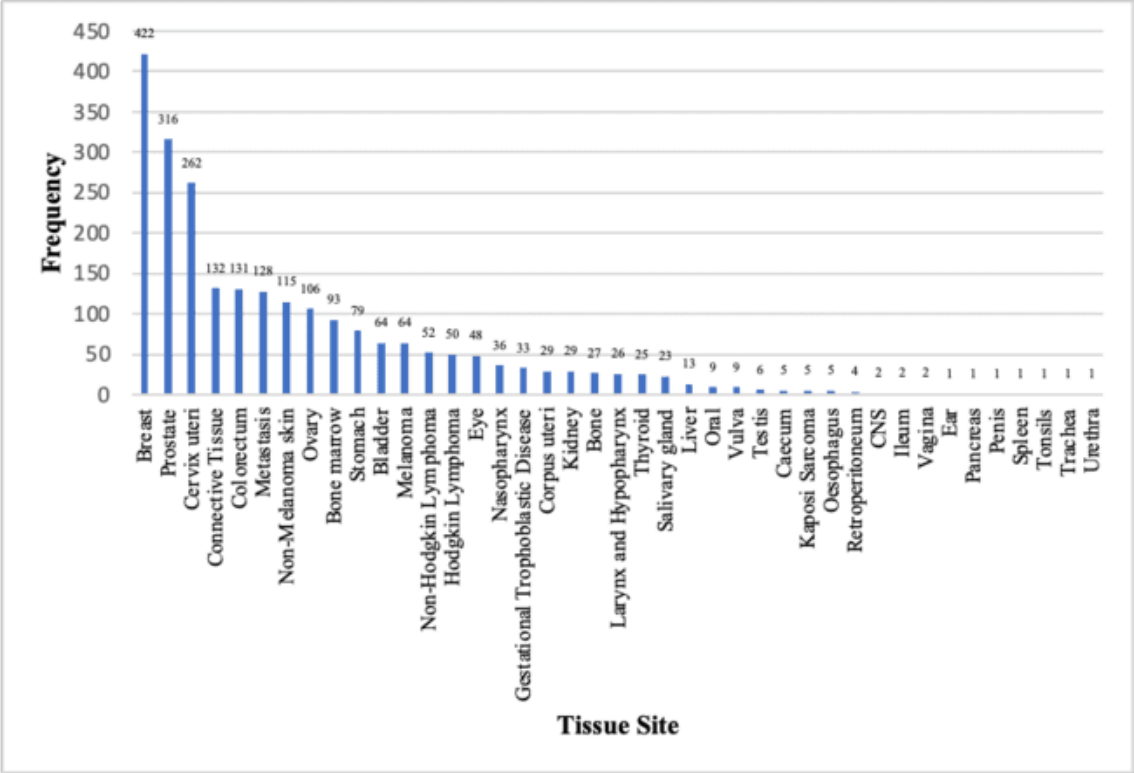

Figure 5: Distribution of Cancer According to Tissue Site

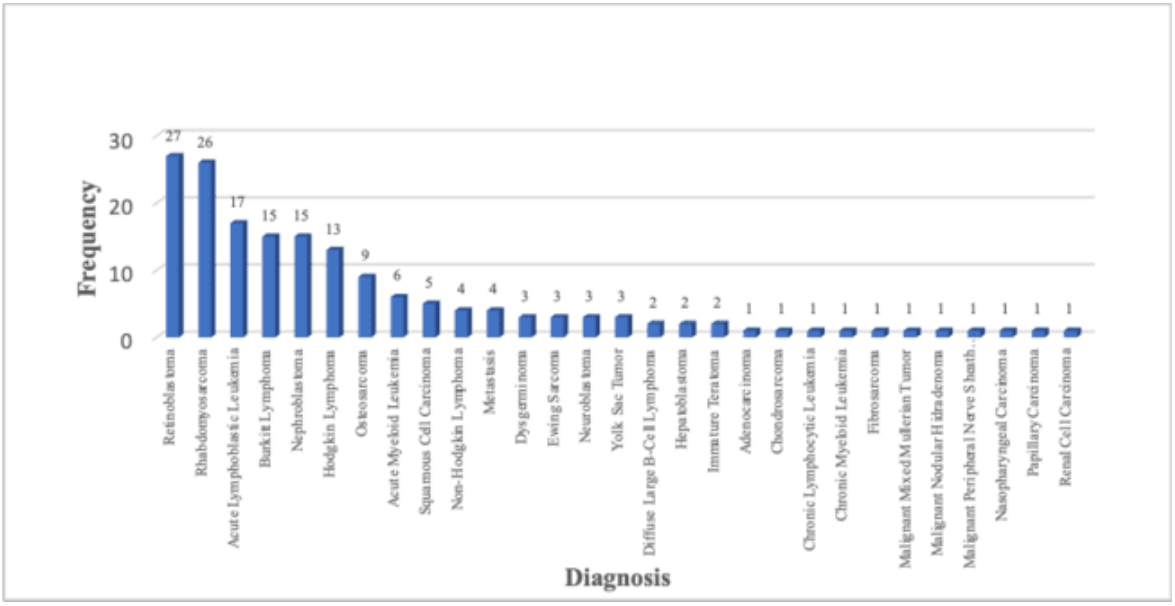

Figure 6: Distribution of Paediatric Cancer.

DISCUSSION

Cancer is a serious public health problem globally. It is the second most common cause of mortality the world over, after cardiovascular diseases.[10] Owing to the differences in lifestyle and environmental influence, the incidence of cancer varies across the globe and in various provinces and states within the same country. [10] Understanding these differences, therefore, is necessary for proper planning and implementation of programmes to reduce the menace of cancer.

Our hospital-based multicentre study shows that cancer accounted for 17.5% of all surgical samples received in the state. However, data from several hospital-based registries recorded differing values than the index study with lower values seen in Kano (13.7%) and Jos (14.6%) while higher values of 22.4% and 29.0% were reported in Akwa Ibom and Delta. [11-14]

Cancer registries from Kano, Zaria, Sokoto, Abuja, Ilorin and Ibadan show a rise in reported cases of cancer.[15-19] This aligns with our study where there was a marked increase in reported cancer cases at the end of the tenth year even though there were fluctuating rises and declines over the years. The decline in the early years could be attributed to a lack of residing Pathologists in the state at that time while the slight decline in the latter years is attributed to an increase in the cost of histology with concurrent prevailing economic situations and the COVID-19 pandemic.

There is a female predominance in the index study with a male-to-female ratio of 1:1.4 which may be attributed to the health-seeking behaviours of females and the large number of cervical and female breast cancers. This aligns with many studies in Nigeria[11-14,17,18,20,21] and the African continent data[22] where the distribution of cancer was higher in females. However, contrary findings were seen in Kano, Nigeria[15], Ghana[23], the UK[23], the USA[25] and global cancer data[2] where a male preponderance was seen.

The mean age ± SD of cancer diagnosis in patients for this study was 48.1± 19.7. This is similar to studies across Nigeria where a mean age of less than 50 years was seen. [14,17,20,26] This can be attributed to enhanced diagnosis and better access to health care. However, studies by Nwafor et al[13] in Akwa Ibom, Nigeria and Laryea et al[23] in Ghana showed contrary findings of the mean age of cancer diagnosis as more than 50 years. Additionally, in this study, we observed a peak in cancer incidence in the 6th decade of life which was in concordance with some Nigerian studies. [14,17,20] Contrary findings were however recorded in Akwa Ibom, Nigeria[13] with a peak seen in the 7th decade, in Ghana[23] with a peak in the 5th decade; and in Qatar[27] with a peak in the 7th decade. This trend may reflect the relationship between cancer and life expectancy.[28]

The commonest cancers in the state during the study period under review were breast, prostate and uterine cervix in adults, and retinoblastoma in children. We found out that the sites that are most affected by cancer in our environment, in descending order are breast, prostate, uterine cervix, soft tissue, colorectum, skin, ovary, bone marrow, stomach, urinary bladder, corpus uteri and lymph nodes. Though there is a slight variation in the incidence of cancer in other Nigerian studies, cancers of the breast and uterine cervix are the most frequent in women, and prostate cancer in men. [11-14] However, this is not what is obtainable in the USA and in some parts of Europe and Asia where lung cancer is the most common among both sexes,[29] whereas in countries such as Mongolia and Japan, the incidence of gastric cancer is higher than that of breast, prostate and cervix uteri.[30,31]

Breast cancer accounted for the highest number (422 cases) of histologically diagnosed malignancies in adults in this study, thus, contributing 18% of the total tumour burden. Similar findings were documented in Azare (22.7%), Sokoto (19.4%), Plateau(16.6%), Kano (14.1%) and Borno (13.9%)[11,12,17,20,32]. Likewise, the trend of breast cancer remains the same in Southern Nigeria, accounting for 26.4%-35.2% of the total cancer cases in the three geopolitical zones. [33-35] But even though breast cancer is the most common malignancy globally, the incidence of cases varies in different regions. It ranges from 36.2 per 100,000 in Africa, 29.1 per 100,000 in Asia, 91.9 per 100,000 in Northern America, 71.1 per 100,000 in Europe and 85.8 per 100,000 in Australia/New Zealand.[2] Nigeria currently has an incidence of 54.3 per 100,000.[18]

Worldwide, prostate cancer is the second most common adult male malignancy with the lowest incidence seen in South Central Asia; a low incidence in West, North and East Africa; a higher incidence in South Africa and the highest incidence in Northern and Western Europe.[2] This study showed prostate cancer as the second most common overall malignancy and the commonest cancer in males with a total of 316 cases accounting for 13.4% of all cancer cases. This aligns with available data from Kano and Bauchi in Nigeria, and England in the UK where prostate cancer accounted for 10.9%,13.9% and 13.5% of total malignancy respectively, and was ranked as the most frequent male malignancy and third in the overall tumour burden. [11,24,36] Similar to our study, it was the most common malignancy in males and the second most common cancer in Nnewi (15.1%) and Rivers (25.9%) States in Nigeria.[20,35] In contrast to these, Afolayan et al[19] in Ilorin reported it as the fifth most common malignancy (4.3%) and second most common malignancy in males. This disparity in ranking within Nigeria may be attributed to a lack of routine screening in most hospitals with cases seen when patients present with clinical disease.

Cervical cancer is ranked as the third most frequent cancer with 262 diagnosed cases representing 11.1% of all cancers. It is the most common female genital tract malignancy and the second most common female cancer after breast cancer. Higher frequencies of 213, 545 and 593 were observed in similar 10-year

reviews in Ilorin, Kano and Lagos states respectively. [33, 37, 38] This high value is likely due to the better availability of case detection in these states than in Katsina as a result of their higher population and higher number of residing Pathologists. However, in the early years of the study period, there was only one visiting Pathologist for the entire state, but the state subsequently produced its own three Pathologists who still cover the entire state. Contrary to our study, cervical cancer was ranked as the second most common cancer in Nigeria as seen in Kano, [11] Zaria, [16] Sokoto,[17] Calabar,[26] Abuja and Ibadan[18], and overall, in the African continent.[39] It was the most frequently diagnosed cancer in Bauchi[36] and Benin[40], Nigeria which is dissimilar to what was seen in our study where it was the third most common. The highest incidence rates were seen in sub-Saharan Africa, particularly in Eastern, Middle and Southern Africa which is comparable to what was found in our study. But lower rates of 7-10 folds were seen in North America, Australia, New Zealand and Western Asia.[2] This declining incidence, when compared to what is obtainable in Katsina and Africa at large, is likely due to better preventive measures including HPV vaccination and screening.

Colorectal cancer is the fifth most commonly diagnosed cancer and the third leading cause of death due to cancer globally.[10] This study showed that colorectal cancer ranked number four among the most frequently diagnosed malignancies in Katsina. This is probably attributed to increased consumption of red meat and a diet low in fibre. There is a need to carry out further research to precisely determine the factors responsible for the rise in the number of cases. This finding agrees with some Nigerian studies conducted in Kano, Bauchi and Akwa Ibom States. [11, 13,36] However, it differed from studies done in Delta and Nnewi, Nigeria, where higher figures were seen.[14,21] The highest rates of colorectal cancer are seen in Europe, Australia, New Zealand, and Northern America, with Hungary and Norway ranking first in men and women, respectively. The incidence rates in Eastern Asia are also among the highest.[2]

Tumours of the connective tissue comprised 5.6% of overall cases, ranking the fifth most common cancer in our review. This agreed with most studies from other parts of Nigeria, which reported a frequency of about 2.8% to 11.3% of all tumours. [11,41,42] In the paediatric age group of this study, the most frequent connective tissue tumour was rhabdomyosarcoma (15.3%) which aligned with reports from Jos and Port Harcourt where rhabdomyosarcoma was the most common childhood soft tissue tumour seen. [42,43] In Abuja, however, Amin et al[44] reported Kaposi sarcoma to be the most frequent soft tissue tumour. This could be explained by the high prevalence of HIV/AIDS in the region, and the fact that the hospital is a major referral centre for HIV patients. The aetiology of connective tissue tumours is largely unknown. Still, genetic and environmental factors (oncogenic viruses, exposure to irradiation, polycyclic aromatic hydrocarbons, agricultural and agro-allied chemicals, and immunosuppression) have been implicated.[44]

Metastatic cancers are the sixth most occurring cancer and comprise 5.2% of all malignancies. This is comparable to frequencies of 4.8% and 4% observed in Kano[11] and Delta[14] States respec- tively but a lower value of 2.9% was seen by Samaila et al in Zaria.[16] In this study, the most frequent sites for metastasis were the lymph node (53.9%), retroperitoneum/peritoneum (21.9%), and connective tissue (13.3%). Even though the lungs, liver, bone and brain are known to be common sites for metastasis generally, these sites were rarely encountered in our review because biopsies are not frequently obtained from these regions in our hospitals.

Non-melanoma skin accounts for 4.9% of cancer cases and is ranked seventh in this study. This contrasts with findings by Yusuf et al[11] and the GLOBOCAN 2020[2] estimates where higher incidence rates of 8.3% and 6.2% respectively, and 4th ranking amongst all cancers were seen. The bulk of the histological subtypes of skin cancers found in this study were squamous cell carcinoma in concordance with findings in Kano, Nigeria which may be attributed to malignant transformation of chronic skin ulcers caused by wound infections and chronic illnesses like diabetes. [11]

Ovarian cancer is the 8th most common overall cancer in our study accounting for 4.5% of cases and the second most common gynaecological cancer. Comparable findings were reported in Delta with 4% of cases.[14] Yet, lower figures of 2.1% were documented in Kano[11] whose finding is comparable to the global incidence of 1.6%.[2]

Other top ten cancers include those diagnosed from bone marrow cytology and stomach cancers. Bone marrow cancers represent 3.9% of all cases and comprise leukaemias, lymphomas and multiple myeloma. Stomach cancer as the 10th most common cancer in this study accounted for 3.3% of the cancer burden which is akin to 3.5% reported by Adogu et al[36] but higher than 1.9% by Yusuf et al. [11]

Paediatric cancers accounted for 7.2% of all cancers seen in this study with retinoblastoma as the most common. This corresponds with the findings from Kano[11] and Zaria, [16] in Nigeria where retinoblastoma was reported as the most common paediatric cancer but contrasts with reports by Adogu et al[36] and Ezenkwa et al[20] where lymphoma was found to be the most common.

The limitations of our data include the histopathological basis of our data which may not reflect the true number of cancer cases within our community, the lack of synoptic reporting and a very limited immunohistochemistry array for almost all the diagnosed cases. Secondly, the inherent ICD-O-3 coding used in this study to categorize the site of tumours may pose a problem concerning its acceptance amongst pathologists and specialists, and its use as a

standard reference for reporting. Also, the presence of metastasis, some of which have unknown primaries, necessitates accurate staging which was not possible as our data does not contain adequate components for proper staging. This combined with the lack of molecular testing for confirmatory diagnosis makes proper staging for both diagnosis and treatment difficult. Therefore, the establishment of a population-based cancer registry and possibly a regional diagnostic hub will go a long way in easing registration and collation of cancer cases, and diagnostic dilemmas respectively especially in low-resource settings such as ours.

CONCLUSION

This is a population-based study that offered insight into the burden and pattern of cancer in Katsina state. It demonstrated a female preponderance. Breast cancer was both the most frequent overall and female cancer while prostate cancer was the most common cancer in males. It is hoped that findings from this study will contribute to cancer control policies and strategies including the establishment of a population-based cancer registry in the state.

Financial Declaration

This research was privately funded. There was no financial grant or organizational funding received for this work. There was no funding or sponsorship for this study.

Conflict of Interest

There was no conflict of interest.

Acknowledgement

The authors would like to convey their sincere thanks to Ahmad Sani of the Department of Community Medicine Federal Teaching Hospital for going through the data analysis and highlighting inconsistencies.

REFERENCES

1. Sylla BS, Wild CP. A million africans a year dying from cancer by 2030: What can cancer research and control offer to the continent? Int J Cancer 2012;130:245–50. https://doi.org/10.1002/IJC.26333.
2. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA Cancer J Clin 2021;71:209–49. https://doi.org/10.3322/caac.21660.
3. Weiderpass E, Stewart B-. World cancer report. The International Agency for Research on Cancer (IARC) 2020.
4. Atuwo D. Nigeria National Cancer Control Plan 2018–2022. Abuja: 2018.
5. Akintola A, Odutola M, Olayinka T, Akinjola A, Nwokwu U, Adebamowo C. Nigerian National System of Cancer Registries Federal Ministry of Health of Nigeria Cancer in Nigeria: 2009 – 2016. Cancer in Nigeria: 2009 – 2016. 2nd ed., 2021.
6. Katsina State Ministry of Health. Strategic Health Development Plan 2010-2015. 2010:6–8.
7. Üstün TB. International Classification Systems for Health. International Encyclopedia of Public Health 2017:304–11. https://doi.org/10.1016/b978-0-12-803678-5.00237-x.
8. Kumar V, Abbas A, Aster J, Turner J. Robbins and Cotran Pathologic Basis of Disease Tenth Edition. Tenth. Philadelphia: Elsevier; 2020.
9. Nigeria: Act No. 26 of 2003, Child's Rights Act, 2003 2003. (accessed February 20, 2024).
10. Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin 2018;68:394–424. https://doi.org/10.3322/caac.21492.
11. Yusuf I, Atanda AT, Umar AB, Imam MI, Mohammed AZ, Ochicha O, et al. Cancer in Kano, Northwestern Nigeria: A 10-year update of the Kano cancer registry. Ann Trop Pathol 2017;8:87–93.
12. Mandong BM, Manasseh AN, Ayuba DM, Olugbenga SA, Emmanuel I, Kwaghe BV, et al. Burden of Cancer in Plateau State, Central Nigeria: A 27-Year Report from a Tertiary Hospital-Based Cancer Registry. JAMMR 2019;28:1–11. https://doi.org/10.9734/jammr/2018/v28i1130038.
13. Nwafor CC, Nwafor NN. The pattern and distribution of cancers in Akwa Ibom State, Nigeria. NigerJ Clin Pract 2018;21:603–8. https://doi.org/10.4103/njcp.njcp_316_17.
14. Uchendu OJ. Cancer Incidence in Nigeria: A Tertiary Hospital Experience. Asian Pac J Cancer Care 2020;5:27–32. https://doi.org/10.31557/apjcc.2020.5.1.27-32.
15. Mohammed AZ, Edino ST, Ochicha O, Gwarzo AK, Samaila AA. Cancer in Nigeria: a 10-year analysis of the Kano cancer registry. Niger J Med 2008;17:280–4.
16. Samaila M, Ayeni E, Ahmed S. Cancer pattern in a hospital-based registry. Arch Int Surg 2015;5:57–62. https://doi.org/10.4103/2278-9596.158815.
17. Saddiku D, Sahabi M, Abdullahi K. Epidemiological survey of malignant neoplasms in Sokoto, Nigeria. World J Res Rev 2017;4:10–5.
18. Jedy-Agba E, Curado MP, Ogunbiyi O, Oga E, Fabowale T, Igbinoba F, et al. Cancer incidence in Nigeria: a report from population-based cancer registries. Cancer Epidemiol 2012;36:e271-8. https://doi.org/10.1016/j.canep.2012.04.007.
19. Afolayan E, Ibrahim O, Ayilara G. Cancer Patterns In Ilorin: An Analysis Of Ilorin Cancer Registry Statistics. Trop J Health Sci 2012;19:42–6. https://doi.org/10.4314/tjhc.v19I1.
20. Ezenkwa US, Imam MI, Yusuf MO, Giade AS, Imoudu IAM, Katagum DA, et al. Cancer histotypes and trends in Azare, Northeast Nigeria: impact of diagnostic support disparity in data reporting. Ecancermedicalscience 2023;17. https://doi.org/10.3332/ecancer.2023.1538.
21. Ukah CO, Nwofor AM. Cancer Incidence in South-East Nigeria: A Report from Nnewi Cancer Registry. Cancer Incidence in South-East Nigeria Orient Journal of Medicine 2017;29:48–55.
22. Sharma R, Aashima, Nanda M, Fronterre C, Sewagudde P, Ssentongo AE, et al. Mapping Cancer in Africa: A Comprehensive and Comparable Characterization of 34 Cancer Types Using Estimates From GLOBOCAN 2020.

Front Public Health 2022;10 https://doi.org/10.3389/fpubh.2022.839835.
23. Laryea DO, Awuah B, Amoako YA, Osei-Bonsu E, Dogbe J, Larsen-Reindorf R, et al. Cancer incidence in Ghana, 2012: Evidence from a population-based cancer registry. BMC Cancer 2014;14:1–8. https://doi.org/10.1186/1471-2407-14-362.
24. Caul S, Broggio J. Cancer registration statistics, England 2017. Off Natl Stat 2019:1–6.
25. Siegel RL, Miller KD, Fuchs HE, Jemal A. Cancer statistics, 2022. CA Cancer J Clin 2022;72:7–33. https://doi.org/10.3322/caac.21708.
26. Ekanem IO, Parkin DM. Five year cancer incidence in Calabar, Nigeria (2009–2013). Cancer Epidemiol 2016;42:167–72. https://doi.org/https://doi.org/10.1016/j.canep.2016.04.014.
27. Bener A, Ayub H, Kakil R, Ibrahim W. Patterns of cancer incidence among the population of Qatar: a worldwide comparative study. Asian Pac J Cancer Prev 2008;9:19–24.
28. Danjin M, Toyin MK, Tolulope ED. A systematic review of life expectancy differences and the disease cycle as a major predictor in Africa: The Nigeria Scenarios. Access Journal of Nursing 2018;1:89–96.
29. Jani C, Marshall DC, Singh H, Goodall R, Shalhoub J, Al Omari O, et al. Lung cancer mortality in Europe and the USA between 2000 and 2017: an observational analysis. ERJ Open Res 2021;7:00311–2021. https://doi.org/10.1183/23120541.00311-2021.
30. Lonjid T, Sambuu T, Tumurbat N, Banzragch U, Dondov G, Badamjav T, et al. Incidence of Stomach and Esophageal Cancers in Mongolia: Data from 2009 to 2018. Euroasian J Hepatogastroenterol 2020;10:16–21. https://doi.org/10.5005/jp-journals-10018-1313.
31. Rawla P, Barsouk A. Epidemiology of gastric cancer: global trends, risk factors and prevention. Gastroenterology Rev 2019;14:26–38. https://doi.org/10.5114/pg.2018.80001.
32. Usman HA, Audu BM, Sanusi IM, Bukar M, Hamidu PU. Pattern of Cancers at a Rural Referral Centre in North-Eastern Nigeria. Bo Med J 2018;15:21–8. https://doi.org/10.31173/bomj.bomj_103_15.
33. Omosun A, Abayomi A, Ogboye O, Lajide D, Oladele D, Popoola A, et al. Distribution of Cancer and Cancer Screening and Treatment Services in Lagos: A 10-Year Review of Hospital Records. JCO Glob Oncol 2022: e2200107.
34. Obiorah CC, Abu EK. Breast cancer in Rivers State, Nigeria: Ten-year review of the Port Harcourt cancer registry. S Afri J Oncol 2019;3:a58. https://doi.org/10.4102/sajo.v3i0.58.
35. Akintola A, Odutola M, Olayinka T, Akinjiola A, Nwokwu UE, Adebamowo C editors. Cancer in Nigeria: 2009 – 2016. Nigeria: Nigerian National System of Cancer Registries. In: Akintola A, Odutola M, Olayinka T, Akinjiola A, Nwokwu UE, Adebamowo C, editors. Nigeria: Nigerian National System of Cancer Registries, Abuja: 2021.
36. Adogu I, Suleiman D, Malami S, Aminu M, Muhammed A. Pattern of cancer in Bauchi: Report from a depart-mental cancer registry. Niger J Med 2021;30:300–4. https://doi.org/10.4103/njm.njm_198_20.
37. Sule AA, Ochicha O. A histopathologic review of cervical cancer in Kano, Nigeria. Sahel Med J 2017;20:16–20.
38. Saidu R, Ibrahim KO, Adesina K. A review of the clinic-pathological presentation of cervical cancer in Ilorin, Nigeria. J Clin Oncol 2011;29:e15516-e15516. https://doi.org/https://doi.org/10.1200/jco.2011.29.15_suppl.e15516.
39. Parkin DM, Bray F, Ferlay J, Jemal A. Cancer in Africa 2012. Cancer Epidemiol Biomarkers Prev 2014;23:953–66. https://doi.org/10.1158/1055-9965.epi-14-0281.
40. Okobia MN AJ, Aligbe JU. Pattern of malignant diseases at the University of Benin Teaching Hospital. Trop Doct 2005;35:91.
41. Ibrahim KOO, Adepoju GF, Owoeye JFA, Abdulmajeed AA, Folaranmi OO, Taiwo MA. Orbital mesenchymal chondrosarcoma: Report of a rare tumor in a Nigerian girl. Ann Trop Pathol 2020;11:196–9. https://doi.org/10.4103/atp.atp_20_20.
42. Seleye-Fubara D, Nwosu SO, Bob-Yellowe E. Soft tissue sarcomas in the Niger Delta region of Nigeria (A Referal hospital's study). Niger J Med 2005;14:188–94.
43. Ode MB, Misauno MA, Nwadiaro HC, Onche II, Shitta AH, Amupitan I. Pattern and Distribution of Primary Bone Tumours in Jos Nigeria. IOSR J Dent Med Sci 2014;13:9–12.
44. Amin SM, Jibrin PG, Olusesi AD, Adowanka D. Soft Tissue Sarcomas in a Nigerian Tertiary Hospital. Arch Nig Med Med Sci 2023;11.