Scientific Research Publishing

Surgical Science, 2026, 17(1), 14-29
https://www.scirp.org/journal/ss
ISSN Online: 2157-9415
ISSN Print: 2157-9407

Histopathological Trends of Cancer in Burundi: A Retrospective Review

Ndayikengurukiye Omar[1], Helmy Bin Hazmi[2], Isabel Lim Fong[2], Ngendahayo Louis[1], Irangabiye Eloi[2]

[1]Doctoral School, Faculty of Medicine, University of Burundi, Bujumbura, Burundi
[2]Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak, Kota Samarahan, Malaysia
Email: oma.ndayi@gmail.com

How to cite this paper: Omar, N., Hazmi, H.B., Fong, I.L., Louis, N. and Eloi, I. (2026) Histopathological Trends of Cancer in Burundi: A Retrospective Review. *Surgical Science*, **17**, 14-29.
https://doi.org/10.4236/ss.2026.171002

Received: June 11, 2025
Accepted: January 18, 2026
Published: January 21, 2026

Abstract

Cancer epidemiology in Burundi is insufficiently documented, and institution-based data are essential to complement national and global estimates. This study aimed to describe the demographic, clinical, and histopathological characteristics of cancer cases diagnosed at two major pathology centers in Burundi and to compare these findings with GLOBOCAN estimates. A retrospective descriptive analysis was conducted using cancer cases diagnosed at Bujapath-CHUK. Data on age, sex, cancer site, and histological type were analyzed and compared with GLOBOCAN 2020 and 2022 estimates for Burundi. Cancer predominantly affected middle-aged and older adults, with a mean age of 52.5 years and a median of 56 years. The majority of cases occurred in the 25 - 64-year age group, indicating a substantial burden among economically productive populations. Pediatric cancers, including retinoblastoma and bone tumors, were also identified. The male-to-female ratio was nearly equal, reflecting the significant contribution of female cancers, particularly breast and cervical cancer. Breast, skin, prostate, and colorectal cancers accounted for more than 65% of cases. Histologically, carcinoma and adenocarcinoma represented approximately 80% of diagnoses. Infection-related cancers, including Kaposi sarcoma and hepatocellular carcinoma, were present, underscoring the influence of HIV and viral hepatitis. Overall, the observed patterns showed strong concordance with GLOBOCAN incidence rankings for Burundi. The cancer profile observed in this institutional cohort aligns closely with GLOBOCAN estimates for Burundi and highlights a substantial burden among working-age adults. Despite limitations related to institutional representativeness and absence of age-standardized rates, these findings provide valuable evidence to inform cancer prevention, early detection, and national cancer control strategies.

Keywords

Cancer Epidemiology, GLOBOCAN, Burundi, Cancer Incidence, Histopathology, Sub-Saharan Africa

1. Introduction

Cancer represents an escalating global public health challenge, with low- and middle-income countries (LMICs) bearing a disproportionate burden of cancer incidence and mortality. According to the GLOBOCAN 2020 report [1], more than 70% of cancer-related deaths now occur in LMICs, largely due to late-stage diagnosis, limited access to diagnostic and treatment services, and weak cancer surveillance systems. Sub-Saharan Africa is among the most affected regions, with cancer incidence projected to double by 2040, driven by population growth, aging, epidemiological transition, persistent infectious diseases, and changing lifestyle and environmental exposures [1] [2].

A defining feature of cancer epidemiology in sub-Saharan Africa is the high proportion of **infection-related cancers**. Oncogenic infections such as human papillomavirus (HPV), hepatitis B and C viruses (HBV/HCV), Epstein-Barr virus (EBV), and human immunodeficiency virus (HIV) contribute substantially to cancers of the cervix, liver, nasopharynx, stomach, and Kaposi sarcoma [3] [4]. In Burundi, these infections remain endemic, while preventive interventions—such as HPV vaccination, hepatitis B vaccination, and systematic screening—are still limited. As a result, infection-related cancers are likely to play a major role in the national cancer burden, although precise local data remain scarce.

Beyond infections, **lifestyle and environmental risk factors** are increasingly relevant in the region. Tobacco use, alcohol consumption, dietary changes toward processed and low-fiber foods, physical inactivity, and exposure to environmental pollutants associated with urbanization have been linked to rising incidences of colorectal, liver, breast, and stomach cancers [2] [5]. However, the impact of these factors in Burundi has not been well characterized, underscoring the need for locally generated epidemiological evidence.

Despite the growing cancer burden, Burundi lacks a population-based cancer registry. Available national estimates rely largely on modeled data from international sources such as GLOBOCAN [1], which suggest that breast, cervical, prostate, and colorectal cancers are among the most prevalent. The absence of comprehensive local data limits effective planning for cancer prevention, early detection, staging, and treatment services.

In this context, histopathology services at referral institutions—namely the University Hospital Centre of Kamenge (CHUK) and the Bujumbura Pathology Centre (BujaPath)—play a central role in cancer diagnosis. Hematoxylin and Eosin (H&E) staining remains the cornerstone of histopathological diagnosis in resource-limited settings, offering reliable morphological classification of tumors at relatively low cost [6] [7]. While H&E alone does not provide detailed molecular

characterization or staging information, it remains indispensable for confirming malignancy and guiding initial clinical decision-making.

This study aims to address the national data gap by providing a descriptive analysis of 1708 histologically confirmed cancer cases diagnosed using H&E staining in Burundi between January 2021 and December 2023. The study focuses on age and sex distribution, organ involvement, and histological cancer types, with comparisons to global and regional patterns reported in GLOBOCAN 2020 [1]. Although cancer staging and treatment data were not systematically available, the findings provide critical baseline evidence to inform future cancer control strategies, including prevention of infection-related cancers, lifestyle interventions, and strengthening diagnostic and treatment pathways.

2. Literature Review

Cancer remains a leading cause of morbidity and mortality worldwide. In 2020 alone, approximately 19.3 million new cancer cases and 10 million cancer-related deaths were reported globally [1]. Breast, lung, colorectal, prostate, and stomach cancers account for the majority of cases, with carcinomas and adenocarcinomas representing the dominant histological subtypes [1].

In contrast to high-income countries—where cancer predominantly affects older populations (median age ≥ 65 years)—LMICs experience earlier onset, often affecting individuals in their economically productive years [2] [3]. This pattern has significant socioeconomic implications, particularly in sub-Saharan Africa.

Infection-associated malignancies are disproportionately common in sub-Saharan Africa, accounting for up to one-third of cancers in some countries [3] [4]. Cervical cancer (HPV), hepatocellular carcinoma (HBV/HCV), and Kaposi sarcoma (HIV) are particularly prevalent due to limited vaccination coverage, inadequate screening programs, and delayed diagnosis. Evidence shows that HPV vaccination, hepatitis B vaccination, early antiviral treatment, and cervical cancer screening can significantly reduce cancer incidence [3] [5]. However, implementation of these preventive strategies remains suboptimal in Burundi, highlighting an urgent public health gap.

Alongside infectious causes, lifestyle-related and environmental factors are increasingly shaping cancer epidemiology in Africa. Tobacco smoking and alcohol consumption contribute to cancers of the lung, liver, esophagus, and head and neck, while dietary patterns low in fruits and fiber and high in processed foods are linked to colorectal and stomach cancers [2] [5]. Environmental pollution and occupational exposures further compound cancer risk, particularly in rapidly urbanizing settings. These factors may partially explain the rising incidence of non-infection-related cancers observed in recent African studies [2].

Sub-Saharan Africa exhibits a distinct cancer profile characterized by high burdens of breast, cervical, prostate, liver, and colorectal cancers, alongside notable pediatric malignancies such as retinoblastoma, Burkitt lymphoma, and osteosarcoma [4] [5]. Studies by Bray et al. and others confirm that aggressive cancers

frequently present at younger ages and advanced stages, largely due to delayed health-seeking behavior and limited diagnostic capacity [2] [4].

Hematoxylin and Eosin staining remains the foundation of cancer diagnosis worldwide and is particularly vital in resource-constrained settings [6] [7]. H&E allows reliable differentiation of major tumor categories, including carcinoma, sarcoma, lymphoma, and melanoma, and supports organ-specific cancer classification. Studies from Uganda, Rwanda, and Tanzania demonstrate that H&E-based diagnoses accurately reflect regional cancer patterns and can support cancer surveillance efforts in the absence of advanced molecular tools [8] [9].

Globally, breast and cervical cancers dominate among females, while prostate and liver cancers are most common among males [1]. Similar gender-specific trends have been reported across African studies [8] [10]. Organ-specific patterns—such as the predominance of adenocarcinoma in the breast, stomach, and colorectum—are consistent with global observations [11]. Pediatric cancers, although less frequent, remain clinically significant due to their aggressive nature and diagnostic challenges [5] [12].

While histological diagnosis is essential, cancer staging and treatment information are crucial for understanding disease severity, prognosis, and management strategies. Many studies in LMICs, including Burundi, lack comprehensive staging and treatment data due to fragmented clinical records and limited oncology services [13]. This gap underscores the need to integrate pathology data with clinical oncology services and cancer registries.

Recent literature emphasizes that strengthening basic pathology services—including systematic use of H&E staining—is a critical first step toward effective cancer control in LMICs [7] [8] [13]. The experience from BujaPath and CHUK demonstrates that even in the absence of advanced diagnostics, H&E-based data can generate valuable epidemiological insights, inform prevention strategies for infection-related cancers, and support the development of national cancer surveillance systems.

3. Research Methodology

3.1. Study Design and Setting

This was a retrospective descriptive study conducted at two major cancer diagnostic facilities in Burundi: the Bujumbura Pathology Centre (BujaPath) and the University Hospital Centre of Kamenge (CHUK). These centers serve as national reference laboratories for histopathological diagnosis and receive specimens from multiple provinces across the country.

3.2. Study Period

The study covered a period of 36 months, from January 2021 to December 2023.

3.3. Ethical Considerations

Ethical approval for this study was obtained from the relevant institutional au-

thorities of BujaPath and CHUK. Given the retrospective nature of the study, the requirement for informed consent was waived. All patient data were fully anonymized prior to analysis to ensure confidentiality and compliance with ethical standards for research involving human data.

3.4. Data Collection and Inclusion Criteria

Data were collected from pathology request forms, histopathology registers, and archived diagnostic reports at BujaPath and CHUK. Inclusion criteria comprised all patients with histologically confirmed malignancies diagnosed during the study period using Haematoxylin and Eosin (H&E) staining. Cases diagnosed exclusively by cytology or immunohistochemistry (IHC) without an H&E component were excluded.

3.5. Laboratory Procedure

All specimens were processed using the standard Haematoxylin and Eosin (H&E) staining technique. Tissue samples were fixed in 10% buffered formalin, embedded in paraffin, sectioned at 3 - 5 μm, and stained with H&E. Histopathological diagnoses were established by certified anatomical pathologists at each center.

3.6. Data Analysis

Anonymized data were analyzed using descriptive statistical methods. Variables included patient age, sex, organ or tissue involved, and histological cancer type. Age was categorized into standard WHO-defined age groups. Frequencies and percentages were calculated, and comparisons with international cancer statistics (GLOBOCAN 2020) were made for contextual interpretation.

3.7. Statistical Software

Statistical analyses were performed using SPSS software to generate tables, graphs, and charts and to support descriptive statistical interpretation.

4. Results

4.1. Descriptive Statistics for Patient Age

Descriptive statistics (Table 1) were calculated for patient age across 1,708 valid cases. The **mean age** was **52.53 years** (SD = 19.33), with a **median of 56.0 years** and a **mode of 60.0 years**. Patient ages ranged from **0.1 years (approximately 1 month)** to **100 years**, with a total cumulative age of **89,716.9 years**.

Table 1. Descriptive statistics of patient age (n = 1708).

		Patient-Gender	Types of Organs	Types of Cancer	Patient-Age
N	Valid	1708	1708	1708	1708
	Missing	0	0	0	0
Mean					52.527

Continued

Median		56.000
Mode		60.0
Std. Deviation		19.3289
Minimum		0.1
Maximum		100.0
Sum		89716.9
Percentiles	25	41.000
	50	56.000
	75	67.000

- Percentile analysis showed that:
- **25%** of patients were younger than **41 years**,
- **50%** were younger than **56 years**,
- **75%** were younger than **67 years**.

These results indicate a **predominantly middle-aged to older patient population**, with a slightly **right-skewed distribution** due to a higher proportion of older individuals. The wide age range reflects a **diverse cancer population**, including both pediatric and geriatric cases.

4.2. Patient Distribution by Age Group

Age was categorized into five groups:

- **0 - 14 years (Children)**
- **15 - 24 years (Youth)**
- **25 - 44 years (Adults)**
- **45 - 64 years (Middle-aged adults)**
- **65+ years (Older adults)**

The **mean age group** was **2.92**, with a **median and mode of 3**, indicating that most patients belonged to **Age Group 3 (Adults: 25 - 44 years)**. The standard deviation (**SD = 0.96**) suggests moderate variability, while the range (1 - 5) confirms representation across all age groups.

Overall, the majority of cancer patients were **adults aged 25 - 44 years**, with substantial representation of both pediatric and older adult cases. Approximately **25%** of patients were aged **65 years and above**, while a similar proportion were younger than **25 years** (Table 2).

Table 2. Descriptive statistics of age groups.

		Patient-Gender	Types of Organs	Types Of Cancer	Age Group
N	Valid	1708	1708	1708	1708
	Missing	0	0	0	0
Mean					2.92

Continued

Median		3.00
Mode		3
Std. Deviation		0.961
Minimum		1
Maximum		5
Sum		4987
Percentiles	25	2.00
	50	3.00
	75	4.00

4.3. Gender Distribution of Cancer Patients

A total of **1708 patients** were included in the analysis (Table 3). Of these:

- **864 patients (50.6%)** were **female**,
- **844 patients (49.4%)** were **male**.

This indicates an almost **equal gender distribution** among cancer patients in the study population.

Table 3. Gender distribution of patients.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	864	50.6	50.6	50.6
	Male	844	49.4	49.4	100.0
	Total	1708	100.0	100.0	

4.4. Distribution of Cancer by Organ Type

The most frequently affected organs were (Figure 1):

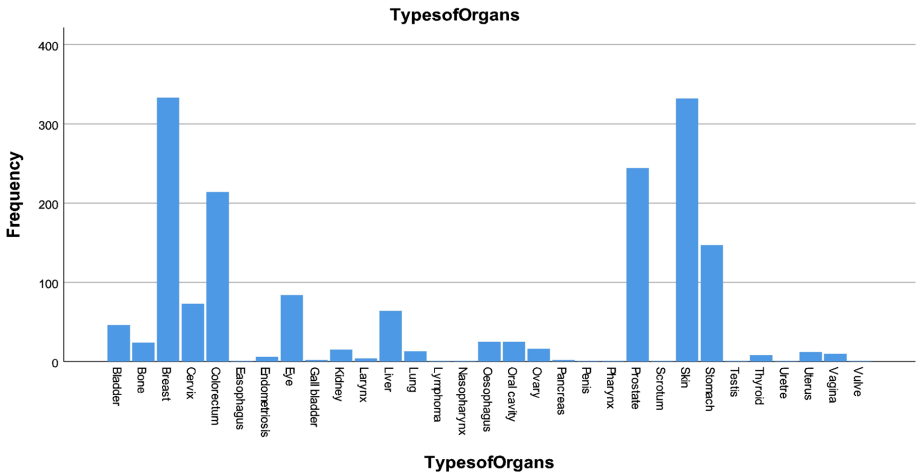

Figure 1. Distribution of cancer cases by organ.

- **Skin (~19.5%)**,
- **Breast (~19.5%)**,
- **Prostate (~14.3%)**,
- **Colorectum (~12.5%)**.

Together, these four organs accounted for **more than 65% of all cancer cases**. Other notable sites included:

- **Stomach (~8.6%)**,
- **Cervix (~4.3%)**,
- **Liver and Lymphoma (~3.7% each)**.

Organs with very low frequencies (<1%) included the **esophagus, gall bladder, larynx, pancreas, testis, thyroid, vulva, and uterus**. Rare cases were observed in the **eye, penis, pharynx, vagina, nasopharynx, and scrotum**.

4.5. Distribution of Cancer Types (Histological Classification)

Two histological types dominated (Figure 2):

- **Carcinoma (~41%)**,
- **Adenocarcinoma (~39%)**.

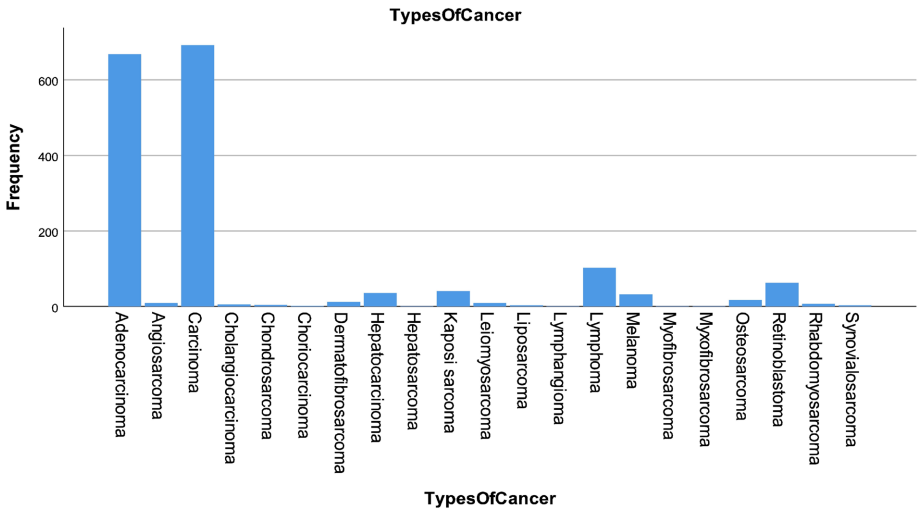

Figure 2. Age group distribution by gender.

Together, they represented approximately **80% of all cancer cases**, reflecting the predominance of epithelial malignancies commonly found in the breast, prostate, colon, stomach, and lungs.

Other cancer types included:

- **Melanoma (~6%)**,
- **Kaposi sarcoma, retinoblastoma, osteosarcoma, and rhabdomyosarcoma (1 - 2% each)**,
- **Lymphoma, hepatocarcinoma, chondrosarcoma, and others (<1%)**.

4.6. Age Group Distribution by Gender

Female patients were slightly younger on average than male patients. Females

demonstrated a **slight positive skew**, indicating younger cases, whereas males showed a **negative skew**, reflecting a higher proportion of older patients. Male patients also exhibited a **greater age spread**, as indicated by a higher standard deviation and interquartile range. (Figure 3)

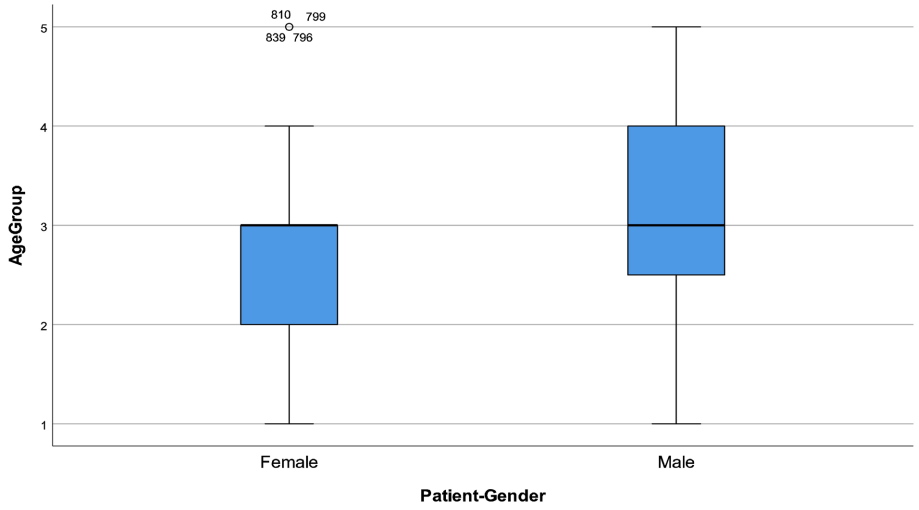

Figure 3. Age group distribution by gender.

4.7. Distribution of Cancer by Organ Across Age Groups

Most cancer types were concentrated in **Age Groups 3 and 4** (Adults and Middle-aged adults). Certain cancers, such as **prostate, stomach, bladder, pancreas, and thyroid**, were predominantly observed in **older age groups (4 and 5)**, consistent with known epidemiological patterns. (Figure 4)

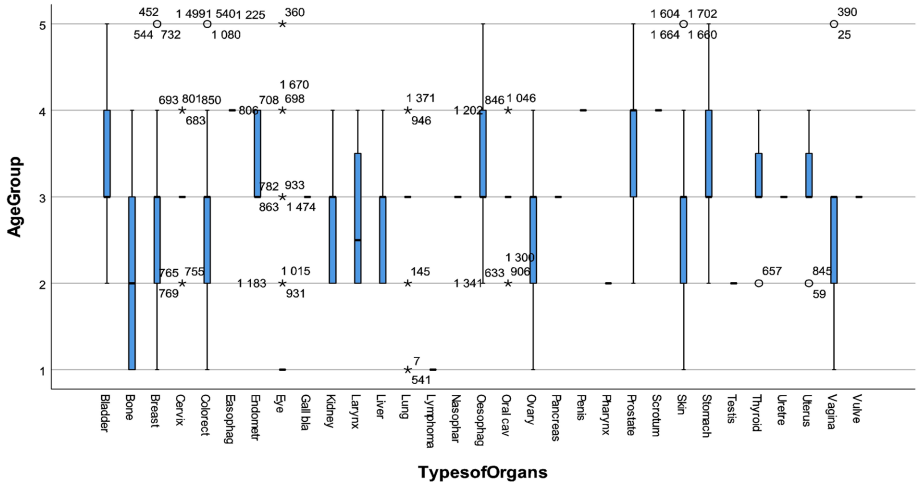

Figure 4. Organ-specific cancer distribution by age group.

Pediatric-associated cancers, including **retinoblastoma (eye), lymphoma, and osteosarcoma (bone)**, clustered mainly in **Age Groups 1 and 2**. Cancers such as **breast, colorectum, and liver** affected a broader age range, spanning from young adults to the elderly.

Outliers indicated rare cases of atypical age at diagnosis, emphasizing the importance of individualized clinical evaluation.

4.8. Distribution of Cancer Types (Histology) by Age Group

Adenocarcinoma and carcinoma were widely distributed across **Age Groups 3 - 5**, peaking in **middle-aged adults**. (Figure 5)

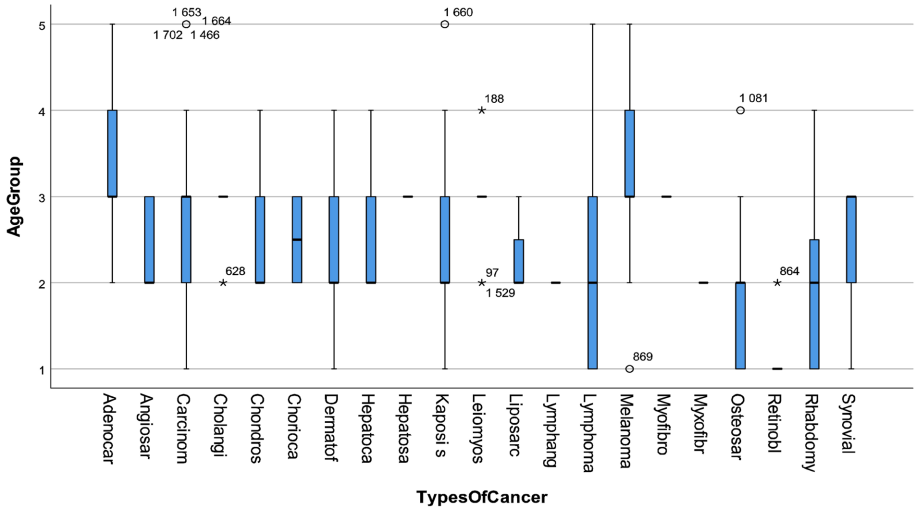

Figure 5. Distribution of histological cancer types across age groups.

Melanoma showed a similar pattern, increasing with age and cumulative exposure.

Retinoblastoma was almost exclusively found in **Age Group 1**, confirming its pediatric nature.

Osteosarcoma, rhabdomyosarcoma, and synovial sarcoma clustered in **Age Groups 1 and 2**.

Lymphomas were observed across **Age Groups 2 - 4**, indicating broader age involvement.

Kaposi sarcoma and hepatocarcinoma showed mixed age distribution, possibly reflecting immunological or infectious factors.

4.9. Gender-Based Distribution of Organ-Specific Cancer Cases

Among **female patients**, **breast cancer** was overwhelmingly predominant, followed by **cervical and uterine cancers**. **Colorectal and ovarian cancers** were also observed but at lower frequencies. (Figure 6)

Among **male patients**, **prostate cancer** was the most common, followed by **liver, stomach, colorectal, and bladder cancers**. **Testicular, scrotal, and penile cancers** were exclusively observed in males, as expected.

4.10. Distribution of Cancer Types by Gender

Adenocarcinoma was more common in **males**, with nearly **480 cases**, compared to approximately **200 cases in females**. (Figure 7)

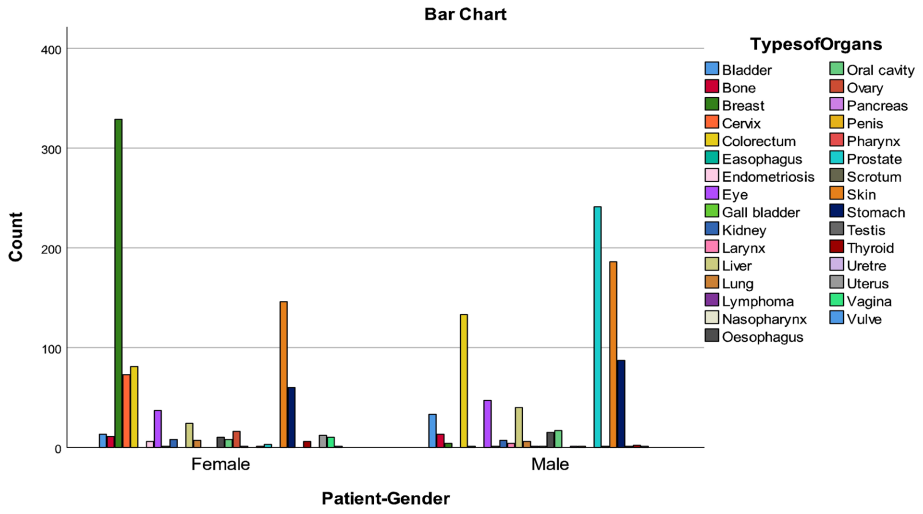

Figure 6. Organ-specific cancer distribution by gender.

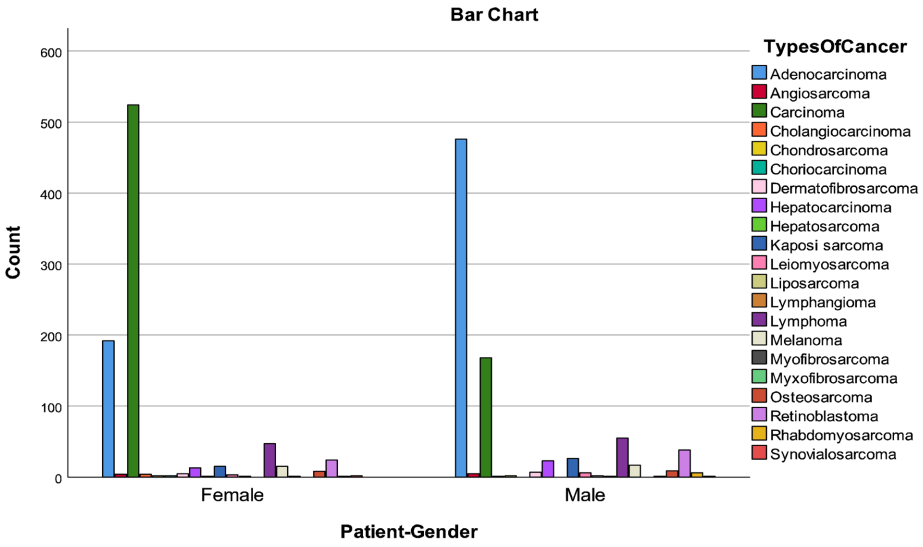

Figure 7. Cancer type distribution by gender.

Carcinoma was more prevalent in **females**, with over **500 cases**, compared to around **180 cases in males**.

Other cancers, including **Kaposi sarcoma and lymphoma**, were present in both genders.

Rare cancers showed very low frequencies and relatively even gender distribution.

4.11. Distribution of Cancer Types across Organs

Breast cancer showed the highest number of cases (approximately 330), predominantly composed of **carcinoma and adenocarcinoma**, and followed by stomach cancer with around **250 cases**, mainly adenocarcinoma. Colorectal cancer accounted for approximately **180 cases**, ranking third in overall frequency. (**Figure 8**)

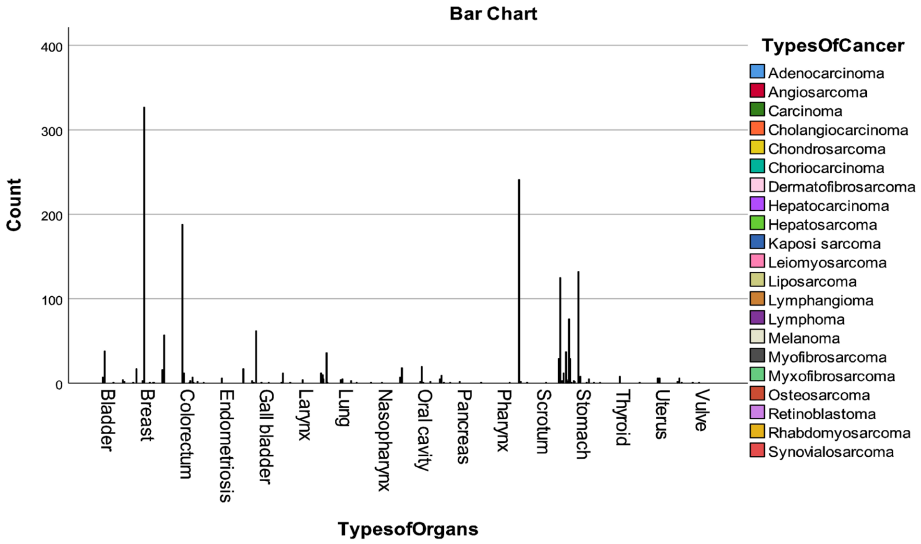

Figure 8. Distribution of cancer types by organ.

Scrotal and pancreatic cancers demonstrated **moderate case numbers** and exhibited **diverse histological profiles**, suggesting varied pathological origins. In contrast, cancers of the **larynx, thyroid, gall bladder, uterus, and vulva** were rare, each accounting for fewer than **20 cases**.

Overall, **carcinoma and adenocarcinoma** were strongly associated with the **breast, stomach, and colorectum**, while **rare malignancies** such as **synovial sarcoma, rhabdomyosarcoma, and chondrosarcoma** were confined to a limited number of organs and occurred at very low frequencies. Most organs showed relatively low case counts, possibly reflecting lower incidence or detection rates, whereas certain organs, including the **scrotum and pancreas**, displayed a broader spectrum of cancer types, indicating **heterogeneous pathology**.

5. Discussion

The present analysis shows that cancer in this cohort predominantly affected **middle-aged and older adults**, with a mean age of 52.5 years and a median of 56 years. This age profile is consistent with **GLOBOCAN 2020 estimates for Burundi**, which indicate that the majority of cancer cases occur after the age of 40, with incidence rising steadily with advancing age [1]. Similar age patterns have been reported across sub-Saharan Africa, reflecting cumulative carcinogenic exposure and biological aging processes [14]. However, the mean age observed in this study remains **lower than that reported in high-income countries**, where cancer diagnoses typically peak after 60 - 65 years, a difference attributed to lower life expectancy and a higher burden of infection-related cancers in African populations [15].

The concentration of cases within the **25 - 64-year age group** mirrors GLOBOCAN data for Burundi, which show that a substantial proportion of cancer cases occur among economically productive adults [1]. This pattern has been consistently reported in recent African studies and highlights the significant socioeconomic impact of cancer in low-resource settings [16]. The presence of pediatric

cases, including retinoblastoma and bone tumors, aligns with global and regional evidence indicating a relatively higher proportional burden of childhood cancers in low- and middle-income countries [17].

Gender distribution in this cohort was nearly equal, contrasting with the **global male predominance reported by GLOBOCAN**, but closely aligning with estimates for Burundi, where female cancers—particularly breast and cervical cancer—contribute substantially to overall incidence [1]. This balance may also reflect higher healthcare utilization among women, facilitating earlier diagnosis [18].

Organ-specific analysis revealed that **breast, skin, prostate, and colorectal cancers** accounted for more than 65% of cases. This distribution is broadly consistent with **GLOBOCAN Burundi profiles**, where breast cancer is the leading cancer overall and prostate cancer is the most common among men [1]. The notable contribution of colorectal cancer supports evidence of an **epidemiological transition** associated with urbanization and lifestyle changes [19].

Histologically, the predominance of **carcinoma and adenocarcinoma (~80%)** reflects global patterns where epithelial malignancies dominate cancer diagnoses [14]. The presence of Kaposi sarcoma and hepatocellular carcinoma is consistent with Burundi's burden of **HIV- and hepatitis-related cancers**, which remain significant contributors to cancer incidence in sub-Saharan Africa [10] [15].

Overall, these findings (**Table 4**, **Table 5**) show strong concordance with **GLOBOCAN estimates for Burundi**, while providing institution-level evidence to guide targeted prevention, screening, and cancer control strategies [20].

Table 4. Comparison of study findings with GLOBOCAN 2020 data.

Variable	Study Results	GLOBOCAN 2020 Findings	Interpretation (Discussion)
Age distribution	Mean age: 52.5 years; median: 56 years; majority aged 25 - 64 years	Median age > 60 years globally; earlier onset in sub-Saharan Africa	Confirms earlier cancer onset in African populations due to lower life expectancy and infection-related risk factors
Pediatric cancers	Retinoblastoma and osteosarcoma identified	Higher proportional burden of childhood cancers in low- and middle-income countries	Consistent with GLOBOCAN estimates for pediatric malignancies in resource-limited settings
Sex distribution	Nearly equal male-to-female ratio	Global male predominance; reduced sex gap in Africa	Reflects high incidence of female cancers, particularly breast and cervical cancers
Leading cancer sites	Breast, skin, prostate, and colorectal cancers (>65%)	Breast and prostate cancers predominate globally and regionally	Largely concordant with GLOBOCAN patterns; elevated skin cancer may reflect local environmental factors
Colorectal cancer	Among the four most frequent cancers	Rising incidence in transitioning economies	Suggests epidemiological transition linked to urbanization and lifestyle changes

Continued

Histological types	Carcinoma and adenocarcinoma (~80%)	Epithelial malignancies predominate globally	Fully consistent with global pathological distributions
Infection-related cancers	Kaposi sarcoma and hepatocellular carcinoma present	High burden of infection-associated cancers in sub-Saharan Africa	Highlights ongoing impact of HIV and viral hepatitis
Age-sex patterns	Prostate cancer in older men; breast cancer at younger female ages	Similar global and regional trends	Aligns with established age- and sex-specific cancer epidemiology

Table 5. Comparison of local cancer findings with GLOBOCAN 2022 burundi incidence rankings.

Cancer Type	Local Study Frequency	GLOBOCAN 2022 Burundi Ranking (Both Sexes)	Notes/Interpretation
Cervix uteri	~4.3% (observed)	**1st most common** (1457 cases, 18.2%)	Cervical cancer is the leading cancer in both sexes nationally (GCO 2022) (Global Cancer Observatory)
Breast	~19.5%	**2nd most common** (863 cases, 10.8%)	Strong concordance; high female burden aligns with national estimates (Global Cancer Observatory)
Prostate	~14.3%	**3rd most common** (822 cases, 10.3%)	Matches the top male cancer nationally (Global Cancer Observatory)
Kaposi sarcoma	~3 - 4%	**4th most common** (446 cases, 5.6%)	Consistent though proportion lower locally (Global Cancer Observatory)
Esophageal cancer	<1%	**5th most common** (458 cases, 5.7%)	Present in both datasets; proportion varies (Global Cancer Observatory)
Colorectal	~12.5%	Ranked within top 10 both sexes	Local colorectal frequency notably higher; national numbers include colorectal among frequent sites (Global Cancer Observatory)
Liver/NHL	~3.7% each	Occurs in top 10	Reflects broader national distribution patterns (Global Cancer Observatory)

6. Conclusions

This study demonstrates that the cancer burden in the analyzed cohort is concentrated mainly among **middle-aged and older adults**, with patterns that closely mirror **GLOBOCAN estimates for Burundi**. The predominance of cancers in the 25 - 64-year age group highlights a substantial impact on the economically productive population.

The **near-equal gender distribution** reflects the high contribution of female cancers—particularly breast and cervical cancer—alongside male-dominant cancers such as prostate cancer. Organ-specific and histological patterns, dominated by epithelial malignancies (carcinoma and adenocarcinoma), are consistent with

regional and global epidemiological profiles. The presence of infection-related cancers, including Kaposi sarcoma and hepatocellular carcinoma, underscores the persistent role of **HIV and viral hepatitis** in shaping the cancer landscape in Burundi. Overall, the findings confirm strong concordance with GLOBOCAN data while providing valuable **institution-level evidence** to support national cancer control efforts.

Several limitations should be considered when interpreting these results. First, the study is based on data from two institutions **Bujapath-Chuk** and may not fully represent the **national cancer burden**, particularly for rural or underserved populations. Second, the absence of **age-standardized incidence rates** limits direct quantitative comparison with GLOBOCAN estimates. Third, potential **underdiagnosis and referral bias** may have influenced the observed cancer distribution, especially for cancers requiring advanced diagnostic capacity. Finally, limited information on staging, treatment outcomes, and survival restricts broader interpretation of disease severity and prognosis.

To strengthen cancer control in Burundi, the following actions are recommended:

- **Enhance population-based cancer registration** to improve national representativeness and enable accurate incidence and survival analyses.
- **Expand early detection and screening programs**, particularly for breast, cervical, and colorectal cancers, targeting adults in the 25 - 64-year age group.
- **Strengthen diagnostic and pathology services** to reduce underdiagnosis and improve histological confirmation.

Promote future **multicenter and longitudinal studies** incorporating staging and outcome data to better inform evidence-based cancer policy and resource allocation.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Sung, H., Ferlay, J., Siegel, R.L., Laversanne, M., Soerjomataram, I., Jemal, A., *et al.* (2021) Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. *CA*: *A Cancer Journal for Clinicians*, **71**, 209-249. https://doi.org/10.3322/caac.21660

[2] Bray, F., Jemal, A., Grey, N., Ferlay, J. and Forman, D. (2012) Global Cancer Transitions According to the Human Development Index (2008-2030): A Population-Based Study. *The Lancet Oncology*, **13**, 790-801. https://doi.org/10.1016/s1470-2045(12)70211-5

[3] Jemal, A., Bray, F., Forman, D., O'Brien, M., Ferlay, J., Center, M., *et al.* (2012) Cancer Burden in Africa and Opportunities for Prevention. *Cancer*, **118**, 4372-4384. https://doi.org/10.1002/cncr.27410

[4] Stefan, D.C. (2015) Cancer Care in Africa: An Overview of Resources. *Journal of Global Oncology*, **1**, 30-36. https://doi.org/10.1200/jgo.2015.000406

[5] Howard, S.C., Metzger, M.L., Wilimas, J.A., Quintana, Y., Pui, C., Robison, L.L., *et*

al. (2007) Childhood Cancer Epidemiology in Low-Income Countries. *Cancer*, **112**, 461-472. https://doi.org/10.1002/cncr.23205

[6] Kumar, V., Abbas, A.K. and Aster, J.C. (2021) Robbins and Cotran Pathologic Basis of Disease. 10th Edition, Elsevier.

[7] Rosai, J. (2018) Rosai and Ackerman's Surgical Pathology. 11th Edition, Elsevier.

[8] Wabinga, H.R., Parkin, D.M., Nambooze, S. and Amero, J. (2001) Cancer Survival in Kampala, Uganda, 1993-1997. *International Journal of Cancer*, **92**, 133-138.

[9] Ferlay, J., Soerjomataram, I., Dikshit, R., Eser, S., Mathers, C., Rebelo, M., *et al.* (2014) Cancer Incidence and Mortality Worldwide: Sources, Methods and Major Patterns in GLOBOCAN 2012. *International Journal of Cancer*, **136**, E359-E386. Https://Doi.Org/10.1002/Ijc.29210

[10] Parkin, D.M. (2006) The Global Health Burden of Infection-Associated Cancers in the Year 2002. *International Journal of Cancer*, **118**, 3030-3044. https://doi.org/10.1002/ijc.21731

[11] WHO Classification of Tumours Editorial Board (2019) WHO classification of Tumours of the Breast. 5th Edition, International Agency for Research on Cancer.

[12] Farmer, P., Frenk, J., Knaul, F.M., Shulman, L.N., Alleyne, G., Armstrong, L., *et al.* (2010) Expansion of Cancer Care and Control in Countries of Low and Middle Income: A Call to Action. *The Lancet*, **376**, 1186-1193. https://doi.org/10.1016/s0140-6736(10)61152-x

[13] Sung, H., Ferlay, J., Bray, F. and IARC Working Group (2020) Strengthening Pathology and Cancer Registration in Low-Resource Settings. *International Journal of Cancer*, **146**, 2431-2438.

[14] Bray, F., Laversanne, M., Weiderpass, E. and Soerjomataram, I. (2021) The Ever-increasing Importance of Cancer as a Leading Cause of Premature Death Worldwide. *Cancer*, **127**, 3029-3030. https://doi.org/10.1002/cncr.33587

[15] Joko-Fru, W.Y., Miranda-Filho, A., Soerjomataram, I., Egue, M., Adebamowo, C. and Bray, F. (2020) Cancer burden in Sub-Saharan Africa. *International Journal of Cancer*, **146,** 965-975.

[16] Adeloye, D., Sowunmi, O.Y., Jacobs, W., David, R.A., Adeosun, A.A., Amuta, A.O., Chan, K.Y. and Auta, A. (2021) Estimating the Incidence of Cancers in Africa: A Systematic Review and Meta-Analysis. B*MJ Global Health*, **6**, e004076.

[17] Steliarova-Foucher, E., Colombet, M., Ries, L.A.G., Moreno, F., Dolya, A., Bray, F., Hesseling, P., Shin, H.Y. and Stiller, C.A. (2021) International Incidence of Childhood Cancer, 2001-2010. *The Lancet Oncology*, **22**, 663-674.

[18] Jedy-Agba, E., McCormack, V., Adebamowo, C. and dos-Santos-Silva, I. (2016) Stage at Diagnosis of Breast Cancer in Sub-Saharan Africa: A Systematic Review and Meta-analysis. *The Lancet Global Health*, **4**, e923-e935. https://doi.org/10.1016/s2214-109x(16)30259-5

[19] Arnold, M., Sierra, M.S., Laversanne, M., Soerjomataram, I., Jemal, A. and Bray, F. (2016) Global Patterns and Trends in Colorectal Cancer Incidence and Mortality. *Gut*, **66**, 683-691. https://doi.org/10.1136/gutjnl-2015-310912

[20] GLOBOCAN 2022—Burundi Fact SheetGlobal Cancer Observatory (2024) Burundi Cancer Statistics (2022): Incidence and Mortality Fact Sheet. International Agency for Research on Cancer. https://gco.iarc.who.int/media/globocan/factsheets/populations/108-burundi-fact-sheet.pdf