Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Cancer Presentation, Treatment Patterns, Healthcare Utilisation, Documented Mortality, and Direct Medical Costs at a Tertiary Hospital in Nigeria: A Five-Year Retrospective Study

Stephen Olaide Aremu
Nasarawa State University
Victor Emmanuel
victoremmanuel556@gmail.com

Nasarawa State University
Aliyu Abubakar Wasagu
Nasarawa State University
Ibrahim Yusuf Kana
Nasarawa State University
Awayimbo Ruth Jaggu
Nasarawa State University
Aishat Temitope Kasali
Nasarawa State University
Obele Festus Maji
Nasarawa State University
Aisha Ahmad
Nasarawa State University
Olade Ikize George
Nasarawa State University
Felix Okwudilichukwu Nwarienne
Nasarawa State University
Adeyanju Temitope Peter
Nasarawa State University
Adamu Ishaku Akyala
Nasarawa State University

Research Article

Keywords: Cancer, advanced-stage presentation, treatment default, healthcare utilisation, direct medical costs, Nigeria

Posted Date: November 25th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11382445/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Cancer Presentation, Treatment Patterns, Healthcare Utilisation, Documented Mortality, and Direct Medical Costs at a Tertiary Hospital in Nigeria: A Five-Year Retrospective Study

Stephen Olaide Aremu[1], Victor Emmanuel[1], Aliyu Abubakar Wasagu[1], Ibrahim Yusuf Kana[1], Awayimbo Ruth Jaggu[1], Aishat Temitope Kasali[1], Obele Festus Maji[1], Aisha Ahmad[1], Olade Ikize George[1], Felix Okwudilichukwu Nwarienne[1], Adeyanju Temitope Peter[1], Adamu Ishaku Akyala[1]

1- **Global Health and Infectious Diseases Control Institute, Nasarawa State University, Keffi, Nasarawa State, Nigeria.**

The first three authors are equal contributors

Corresponding Author: Victor Emmanuel

Corresponding Author's Email: victoremmanuel556@gmail.com

Abstract

Background: Cancer places a substantial burden on healthcare systems, particularly in low- and middle-income countries. Facility-level evidence on cancer presentation, treatment patterns, healthcare utilisation, and costs is essential for service planning.

Objective: To assess cancer presentation, treatment patterns, hospital utilisation, documented mortality, and direct medical costs at Federal Medical Centre (FMC), Keffi, Nigeria, from 2021 to 2025.

Methods: This retrospective hospital-based study reviewed 530 eligible records of patients with liver, cervical, breast, lung, prostate, or colorectal cancer. Descriptive statistics, chi-square tests, multivariable logistic regression, group comparisons, and multiple linear regression were used as appropriate. Direct medical costs were summarised by component.

Results: Patients had a mean age of 50.4 ± 19.4 years, and 50.4% were male. Liver cancer was the most frequently recorded type (20.6%). Advanced-stage disease (stages III–IV) occurred in 52.6% of patients. The logistic regression model showed poor discrimination (AUC = 0.527), with no statistically significant overall association between assessed predictors and advanced-stage

presentation (p = 0.989). Palliative care was the most frequently recorded treatment category (26.6%), while 36.4% of patients were documented as having defaulted from treatment. Hospital utilisation did not differ significantly across treatment categories, and the length-of-stay model was not statistically significant (p = 0.171; R^2 = 0.022). A documented death was recorded for 51.1% of patients, but incomplete follow-up precluded survival analysis. Mean recorded direct medical cost was ₦1,866,244 per patient; chemotherapy, surgery, and radiotherapy accounted for 76.1% of total costs.

Conclusion: Advanced-stage presentation and documented treatment default were common. These findings provide facility-level evidence to inform cancer service planning, treatment follow-up, and resource allocation. Prospective studies are needed to investigate factors associated with advanced-stage presentation and treatment default and establish patient outcomes.

Keywords: *Cancer; advanced-stage presentation; treatment default; healthcare utilisation; direct medical costs; Nigeria.*

Highlights

- Liver cancer was the most frequently recorded cancer type among 530 patients.
- Advanced-stage disease affected 52.6% of patients at presentation.
- Treatment default was documented in 36.4% of patients.
- No significant associations were found with advanced-stage presentation or length of stay.
- Mean direct medical cost was ₦1.87 million per patient, with three treatment components accounting for 76.1% of costs.

Introduction

Cancer remains a major global public health challenge, contributing substantially to premature mortality, disability, and healthcare expenditure [1-2]. The burden is particularly concerning in low- and middle-income countries, where health systems often face limited diagnostic and treatment capacity alongside increasing demand for cancer care. In these settings, patients may encounter barriers to timely diagnosis and access to appropriate treatment, resulting in presentation at more advanced stages of disease and greater demands on already constrained health services [3-4].

In Nigeria, cancer care is delivered within a health system characterised by substantial geographic, financial, and infrastructural barriers. Patients may present to tertiary hospitals with established disease requiring complex diagnostic and therapeutic interventions [5-6]. The pattern of cancers managed at individual tertiary hospitals may also reflect the population served, referral pathways, availability of specialised services, and access to diagnosis. Consequently, hospital-based evidence is important for understanding the types of cancers being managed, the stage at presentation, and the patterns of treatment and healthcare utilisation within specific settings.

Beyond the distribution of cancer types, the stage at presentation has important implications for the intensity of treatment and use of hospital resources. Advanced disease may require prolonged or repeated treatment, including chemotherapy, radiotherapy, surgery, and palliative care [5,7,8]. Cancer management may therefore place substantial demands on hospitals through inpatient admissions, outpatient visits, prolonged hospital stays, and intensive care. The financial consequences are also important, particularly in settings where patients and health systems bear considerable direct medical costs [9-11]. However, evidence describing the relationship between cancer presentation, treatment patterns, hospital utilisation, documented mortality, and direct medical costs within individual Nigerian tertiary hospitals remains limited.

Federal Medical Centre, Keffi, serves patients from Nasarawa State and surrounding communities and provides tertiary-level healthcare within a region where access to specialised cancer services may be constrained. Despite the importance of understanding the cancer burden managed at the facility, there is limited published evidence describing the characteristics of patients presenting

with cancer, the distribution of recorded cancer types and stage, treatment patterns, healthcare utilisation, documented mortality, and direct medical costs over an extended period.

This study therefore assessed cancer presentation, treatment patterns, hospital utilisation, documented mortality status, and direct medical costs among patients managed at Federal Medical Centre, Keffi, Nasarawa State, Nigeria, between January 2021 and December 2025. Specifically, the study described the sociodemographic and clinical characteristics of patients and the annual distribution of recorded cancer cases; examined factors associated with advanced-stage presentation; assessed treatment patterns and hospital utilisation; examined factors associated with length of hospital stay; and estimated direct medical costs and their major components.

Methods

Study design and setting

This was a retrospective, hospital-based record review conducted at Oncology Unit of Federal Medical Centre (FMC), Keffi, Nasarawa State, Nigeria. A tertiary healthcare facility serving Nasarawa State and surrounding communities. Records of patients diagnosed with selected cancers and managed at the hospital between 1 January 2021 and 31 December 2025 were reviewed. The study examined sociodemographic and clinical characteristics, cancer type and stage at presentation, treatment patterns and status, hospital utilisation, documented mortality, and direct medical costs. Reporting followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) and Reporting of studies Conducted using Observational Routinely-collected health Data (RECORD) guidelines.

Study population and eligibility criteria

The study included patients with documented liver, cervical, breast, lung, prostate, or colorectal cancer managed at FMC Keffi during the study period. These cancers were selected based on their clinical and public-health importance and representation in the hospital cancer records.

Potentially eligible records were identified from hospital cancer/oncology records and verified against individual patient medical records and relevant clinical documentation. Cancer diagnoses were accepted when documented in the medical record and supported by available clinical, imaging, histopathological, cytological, operative, or other relevant diagnostic evidence.

Records were eligible if they contained a documented diagnosis of one of the six included cancers during the study period. Records without adequate documentation to establish the diagnosis or that did not meet the study criteria were excluded. Missing individual variables did not constitute grounds for exclusion. A total of 530 eligible patient records were included. The individual patient was the unit of analysis, and duplicate records and multiple encounters relating to the same patient were consolidated to avoid double counting.

Data sources and data collection

Data were extracted retrospectively from eligible patient records using a structured data-extraction form. Variables included age, sex, marital status, occupation, education, residence, family history of cancer, comorbidities, cancer type and stage, treatment modality and status, hospital utilisation, documented mortality, and direct medical costs. Extracted data were checked for completeness and consistency before analysis.

Variables and operational definitions

Sociodemographic variables included age (recorded in years and categorised as <20, 20-29, 30-39, 40-49, 50-59, 60-69, and ≥70 years), sex, marital status, occupation, educational level, and place of residence (rural or urban). Cancer type was classified according to the diagnosis documented in the medical records as liver, cervical, breast, lung, prostate, or colorectal cancer.

Cancer stage was obtained from the medical records according to the staging system applicable to the cancer type, including the tumour-node-metastasis (TNM) system or the International Federation of Gynecology and Obstetrics (FIGO) system, where applicable. For the advanced-stage analysis, stages I and II were classified as non-advanced, whereas stages III and IV were classified as advanced. Family history was defined as a documented history of cancer among relatives. Comorbidity was defined as the presence of at least one documented coexisting medical condition.

Treatment modality was classified as chemotherapy, radiotherapy, surgery, or palliative care. Each patient was assigned a single treatment modality based on the category documented in the medical record. This variable represented the recorded treatment classification used in the treatment-modality analysis. In regression analysis, treatment modality was entered as a categorical variable,

with chemotherapy as the reference category. Treatment status was classified as completed, ongoing, or defaulted according to the documented treatment record.

Hospital utilisation was assessed using length of hospital stay (days), number of hospital admissions, outpatient visits, and intensive care unit (ICU) days recorded during the study period (2021-2025). Length of stay represented the total inpatient days across documented admissions for each patient.

Mortality status was based on documented evidence of death at the time of data abstraction. Patients without a recorded death were classified as having no documented death; this did not necessarily establish that they were alive. Because dates of death and follow-up duration were inconsistently recorded, mortality was analysed as documented mortality status rather than as survival or in-hospital mortality. No time-to-event analysis was undertaken.

Direct medical costs were obtained from hospital billing records and expressed in Nigerian naira (NGN) at recorded prices for 2021–2025, without inflation adjustment. Cost components included chemotherapy, surgery, radiotherapy, hospital admission, drugs, blood transfusion, laboratory investigations, and other documented direct medical costs. The mean cost for each component was calculated across all 530 patients, with zero assigned where a service was not received. Total direct medical cost for each patient was calculated as the sum of the recorded cancer-related cost components. The component costs and patient-level total costs were checked for consistency before analysis.

Statistical analysis

Data were analysed using SPSS 25. Categorical variables were summarised using frequencies and percentages, while continuous variables were summarised using means and standard deviations or medians and interquartile ranges, as appropriate.

Annual recorded cancer cases from 2021 to 2025 were described using frequencies and percentages. Because the study was hospital-based and lacked a population denominator, these figures were not interpreted as population incidence.

Associations between categorical variables were assessed using Pearson's chi-square test or Fisher's exact test where appropriate, with Cramer's V used to assess strength of association.

Factors associated with advanced-stage presentation were examined using multivariable binary logistic regression, with stages III–IV classified as advanced and stages I–II as non-advanced. Adjusted odds ratios (aORs) and 95% confidence intervals (CIs) were reported. The model included age, sex, residence, education, family history, comorbidity, and cancer type based on clinical relevance.

Differences in hospital utilisation across treatment modalities were assessed using one-way ANOVA or the Kruskal–Wallis test, as appropriate. Factors associated with length of hospital stay were examined using multiple ordinary least-squares linear regression. The model included age, sex, residence, advanced stage, comorbidity, and treatment modality, with chemotherapy as the reference category. Adjusted coefficients, 95% CIs, and p-values were reported. Model assumptions, including linearity, normality and homoscedasticity of residuals, multicollinearity, and influential observations, were assessed.

Direct medical costs were summarised by component and as total cost per patient using means (SD) and medians (IQR), and where appropriate, according to cancer type, stage, and treatment modality. Documented mortality was summarised descriptively; no survival or mortality regression analysis was performed because consistent dates of death and follow-up were unavailable.

All tests were two-sided, with statistical significance set at $p < 0.05$. No adjustment for multiple comparisons was applied.

Ethical considerations

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki (2013 version) as adopted by the World Medical Association. Ethical approval for the study was obtained from the Health Research Ethics Committee of the Federal Medical Center, Keffi (FMC, Keffi), a fully registered committee under the National Health Research Ethics Committee (NHREC), FMH-Ref No: C.5187/76IT. Approval was granted after a defense of the research proposal during the Committee's ethical screening interview held on 14th June 2026. Administrative permission was also secured from the hospital's management. Written informed

consent was obtained from all participants after explaining the study's purpose, confidentiality, and voluntary nature. Participants were assured that refusal to participate would not affect their access to ANC services.

Results

Participant characteristics

A total of 530 eligible patient records were included in the analysis. The patients had a mean age of 50.4 years (SD = 19.4) and a median age of 48.5 years (IQR: 34.0–67.0), with ages ranging from 18 to 85 years. Patients aged 70 years or older constituted the largest age group (114, 21.5%), followed by those aged 40–49 years (98, 18.5%). The sex distribution was nearly equal, with males accounting for 267 (50.4%) patients and females for 263 (49.6%). Regarding other sociodemographic characteristics, single patients represented the most common marital status (28.3%), civil servants were the largest occupational group (22.8%), and over a quarter of the patients had no formal education (27.4%). The distribution by place of residence was also nearly equal, with 267 (50.4%) patients residing in rural areas and 263 (49.6%) in urban areas. Table 1 presents the detailed sociodemographic characteristics, while Figure 1 illustrates the age and sex distribution of the patients using a population pyramid.

Table 1: Socio-demographic Characteristics of Cancer Patients (N = 530)

Variable	Category	Frequency (n)	Percentage (%)
Sex	Male	267	50.4
	Female	263	49.6
Age group (years)	<20	15	2.8
	20–29	86	16.2
	30–39	70	13.2
	40–49	98	18.5
	50–59	79	14.9
	60–69	68	12.8
	≥70	114	21.5
Marital status	Single	150	28.3

	Divorced	140	26.4
	Married	122	23.0
	Widowed	118	22.3
Occupation	Civil servant	121	22.8
	Student	107	20.2
	Business	107	20.2
	Farmer	98	18.5
	Trader	97	18.3
Educational level	Tertiary	130	24.5
	Secondary	130	24.5
	Primary	125	23.6
	No Formal Education	145	27.4
Residence	Rural	267	50.4
	Urban	263	49.6

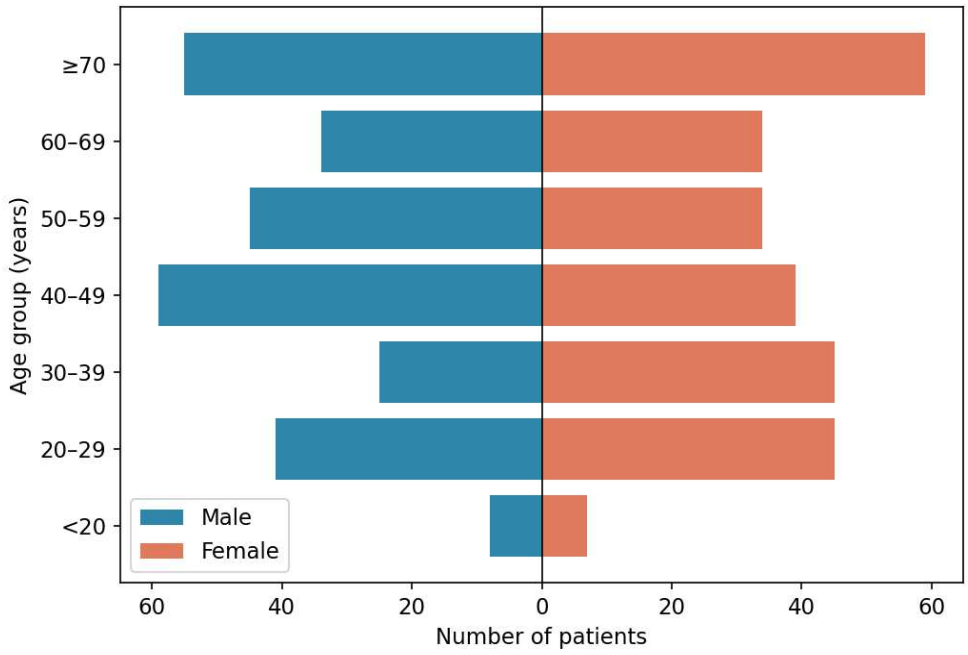

Figure 1: Population Pyramid of Cancer Patients by Age Group and Sex

Annual distribution of recorded cancer cases

Between January 2021 and December 2025, 530 eligible cancer patient records were included in the study. The annual number of recorded cases ranged from 101 in 2024 to 112 in 2021, with 106, 106, and 105 cases in 2022, 2023, and 2025, respectively. There was no consistent increase or decrease over the five-year period (Table 2).

Table 2. Annual distribution of recorded cancer cases, 2021-2025

Year	Recorded cases, n	% of total
2021	112	21.1
2022	106	20.0
2023	106	20.0
2024	101	19.1
2025	105	19.8
Total	530	100.0

Note: Recorded cases represent eligible cancer patient records included in the hospital-based study dataset and should not be interpreted as population incidence.

Distribution of cancer types

Liver cancer was the most frequently recorded cancer type, accounting for 20.6% of the study records, followed by cervical cancer (16.8%) and breast cancer (16.6%). Colorectal cancer was the least frequently recorded type (14.7%). The distribution of cancer types is presented in Table 3 and illustrated in Figure 2.

Table 3. Distribution of recorded cancer types (N = 530)

Cancer type	n (%)
Liver	109 (20.6)
Cervical	89 (16.8)
Breast	88 (16.6)
Lung	84 (15.8)
Prostate	82 (15.5)
Colorectal	78 (14.7)
Total	530 (100.0)

Note: Figures are based on hospital records and do not represent population incidence.

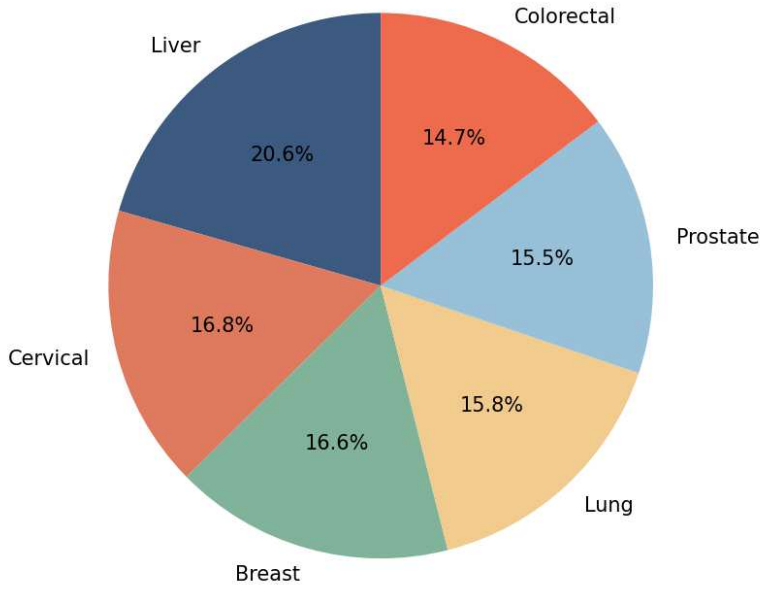

Figure 2: Distribution of Cancer Types

Sociodemographic characteristics and cancer type

Cancer type was not significantly associated with sex ($\chi^2 = 7.17$, df = 5, p = 0.208), residence ($\chi^2 = 5.68$, df = 5, p = 0.339), marital status ($\chi^2 = 14.22$, df = 15, p = 0.509), or educational level ($\chi^2 = 11.82$, df = 15, p = 0.692). Occupation was significantly associated with cancer type ($\chi^2 = 39.11$, df = 20, p = 0.006), with a small effect size (Cramér's V = 0.136), and the association remained significant after Bonferroni correction for five comparisons (adjusted $\alpha = 0.01$) (Table 4).

Table 4. Chi-square tests of association between Sociodemographic factors and cancer type (N = 530)

Factor	χ^2	Df	p-value	Cramer's V
Sex	7.17	5	0.208	0.116
Residence	5.68	5	0.339	0.104
Marital status	14.22	15	0.509	0.095
Educational level	11.82	15	0.692	0.086
Occupation	39.11	20	0.006	0.136

Note: Bonferroni-adjusted α = 0.01 for five comparisons

Factors associated with advanced-stage presentation

Among the 530 patients, 279 (52.6%) presented with advanced-stage cancer (Stages III–IV), while 251 (47.4%) had Stage I–II disease. In multivariable logistic regression, none of the assessed factors, including age, sex, residence, educational level, family history of cancer, and comorbidity, was significantly associated with advanced-stage presentation (all $p > 0.05$; Table 5). The model showed limited discriminatory ability (AUC = 0.527) and low explanatory power (McFadden pseudo-(R^2) = 0.002); the overall likelihood-ratio test was not statistically significant ($p = 0.989$). The confidence intervals indicate uncertainty in the adjusted estimates, and modest associations cannot be excluded.

Table 5: Multivariable Logistic Regression - Predictors of Advanced-Stage Cancer (III–IV)

Predictor	Adjusted OR	95% CI	p-value
Age (per year)	1.004	0.993–1.015	0.463
Sex: Male (vs. Female)	0.940	0.626–1.412	0.766
Residence: Urban (vs. Rural)	0.973	0.650–1.457	0.895

Education: Primary (vs. Tertiary)	0.996	0.607–1.635	0.987
Education: Secondary (vs. Tertiary)	0.902	0.551–1.477	0.681
Family history: Yes (vs. No)	1.121	0.750–1.677	0.577
Comorbidity: Yes (vs. No)	0.989	0.660–1.482	0.958

Note: OR = odds ratio; CI = confidence interval. Reference categories: female, rural, tertiary education, no family history, no comorbidity. Model: likelihood-ratio p = 0.989; McFadden pseudo-R^2 = 0.002; AUC = 0.527.

Treatment patterns and treatment status

Among the 530 patients, palliative care was the most frequently documented treatment modality (n = 141, 26.6%), followed by radiotherapy (n = 135, 25.5%), chemotherapy (n = 128, 24.2%), and surgery (n = 126, 23.8%) (Table 6). Treatment was documented as defaulted for 193 patients (36.4%), ongoing for 172 (32.5%), and completed for 165 (31.1%).

Treatment modality was not significantly associated with cancer type (χ^2 = 10.99, df = 15, p = 0.754), stage at presentation (Stages I-IV; χ^2 = 5.44, df = 9, p = 0.794), or treatment status (χ^2 = 3.86, df = 6, p = 0.696) (Table 7). The distribution of treatment status was similar across treatment modalities (Figure 3), with defaulting ranging from approximately 35% to 39% in all groups.

Table 6. Treatment modality and treatment status (N = 530)

Variable	Category	n (%)
Treatment modality	Palliative care	141 (26.6)
	Radiotherapy	135 (25.5)
	Chemotherapy	128 (24.2)
	Surgery	126 (23.8)

Treatment status	Defaulted	193 (36.4)
	Ongoing	172 (32.5)
	Completed	165 (31.1)

Table 7. Chi-square tests of association with treatment modality

Association	χ^2	df	p-value
Treatment modality × cancer type	10.99	15	0.754
Treatment modality × stage	5.44	9	0.794
Treatment modality × treatment status	3.86	6	0.696

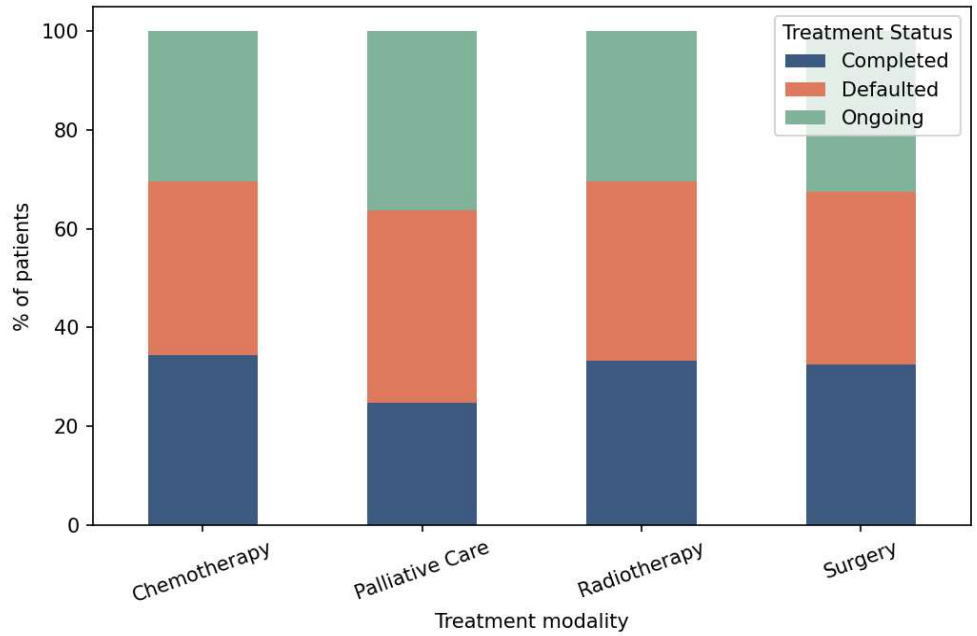

Figure 3. Treatment status by treatment modality

Hospital utilisation by treatment modality

Hospital utilisation was assessed using length of hospital stay, number of admissions, outpatient visits, and ICU days across the four treatment modalities (Table 8). No statistically significant differences were detected across modalities for any of the four indicators using either ANOVA or the Kruskal-Wallis test (all $p > 0.05$).

Mean length of stay ranged from 14.6 days (surgery) to 16.1 days (chemotherapy and radiotherapy), mean admissions from 2.9 to 3.2, mean outpatient visits from 7.7 to 8.5, and mean ICU days from 7.1 to 8.0. Means, standard deviations, and exact p-values are shown in Table 8, and the distributions overlapped substantially across modalities (Figure 4).

Table 8: Hospital Utilization Indicators by Treatment Modality (Mean ± SD)

Indicator	Chemotherapy	Palliative Care	Radiotherapy	Surgery	ANOVA p	Kruskal-Wallis p
Length of stay (days)	16.1 ± 8.8	14.8 ± 8.3	16.1 ± 8.8	14.6 ± 8.6	0.331	0.357
Admissions (n)	3.2 ± 1.5	2.9 ± 1.4	3.0 ± 1.4	3.1 ± 1.4	0.283	0.287
Outpatient visits (n)	8.5 ± 4.4	8.1 ± 4.3	7.7 ± 4.1	8.3 ± 4.3	0.435	0.409
ICU days	7.1 ± 4.5	8.0 ± 4.2	8.0 ± 4.6	7.4 ± 4.7	0.237	0.224

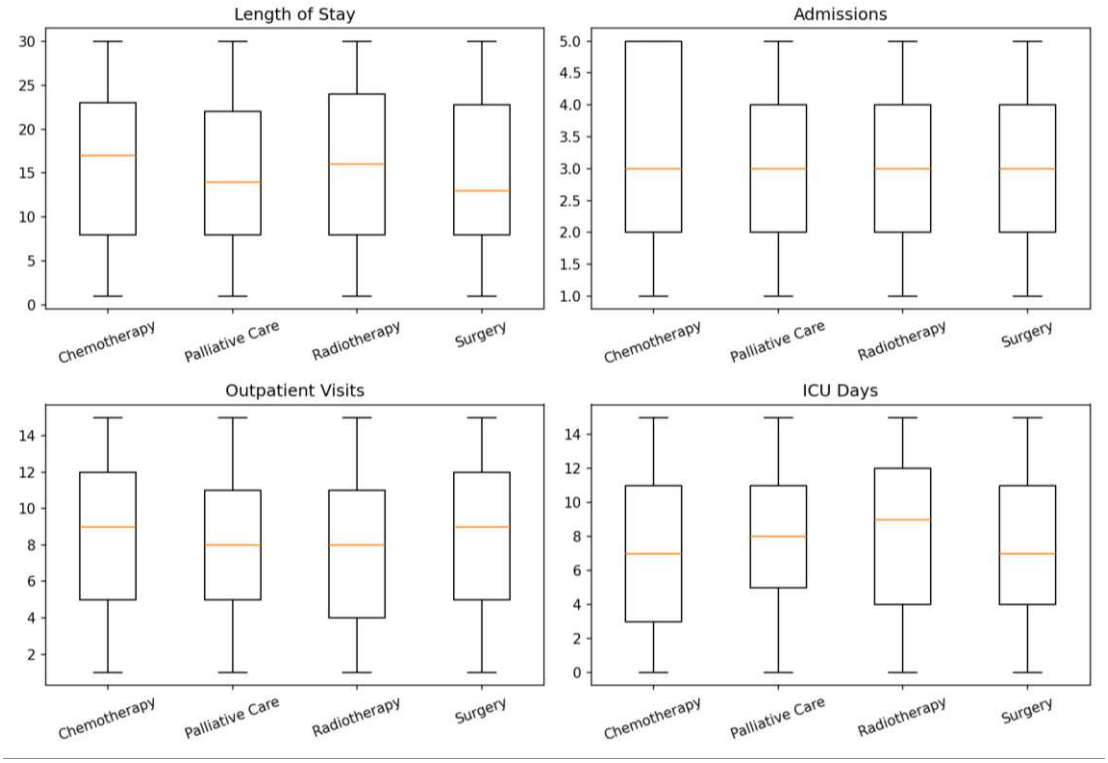

Figure 4: Boxplots of Hospital Utilization Indicators by Treatment Modality

Factors associated with length of hospital stay

Multiple linear regression was used to examine factors associated with length of hospital stay, adjusting for age, sex, residence, disease stage (III–IV vs I–II), comorbidity status, and treatment modality (reference: chemotherapy; N = 530). The overall model was not statistically significant ($F(8, 521) = 1.45$, $p = 0.171$) and explained little of the variation in length of stay ($R^2 = 0.022$; adjusted $R^2 = 0.007$). None of the predictors was significantly associated with length of stay (all $p > 0.05$; Table 9). Urban residence (B = 1.361 days, 95% CI: −0.119 to 2.841; p = 0.071) and comorbidity (B = 1.359 days, 95% CI: −0.121 to 2.839; p = 0.072) had positive estimated associations with length of stay, but both confidence intervals included zero. The regression coefficients and their 95% confidence intervals are presented in Figure 6

Table 9. Multiple linear regression analysis of factors associated with length of hospital stay (N = 530)

Factor	B (days)	95% CI	p-value
Age (per year)	0.004	−0.034 to 0.042	0.831
Sex: Male (vs. Female)	−1.059	−2.532 to 0.414	0.159
Residence: Urban (vs. Rural)	1.361	−0.119 to 2.841	0.071
Advanced stage (III–IV vs. I–II)	0.028	−1.445 to 1.501	0.971
Comorbidity: Yes (vs. No)	1.359	−0.121 to 2.839	0.072
Palliative care (vs. Chemotherapy)	−1.105	−3.174 to 0.963	0.294
Radiotherapy (vs. Chemotherapy)	0.123	−1.970 to 2.216	0.908
Surgery (vs. Chemotherapy)	−1.282	−3.410 to 0.847	0.237

Note: B = unstandardised regression coefficient from ordinary least squares regression; CI = confidence interval. Coefficients are adjusted for all other variables included in the model. Reference categories were female (sex), rural (residence), Stage I–II (disease stage), no comorbidity, and chemotherapy (treatment modality). Overall model: $F(8, 521) = 1.45$, $p = 0.171$; $R^2 = 0.022$; adjusted $R^2 = 0.007$.

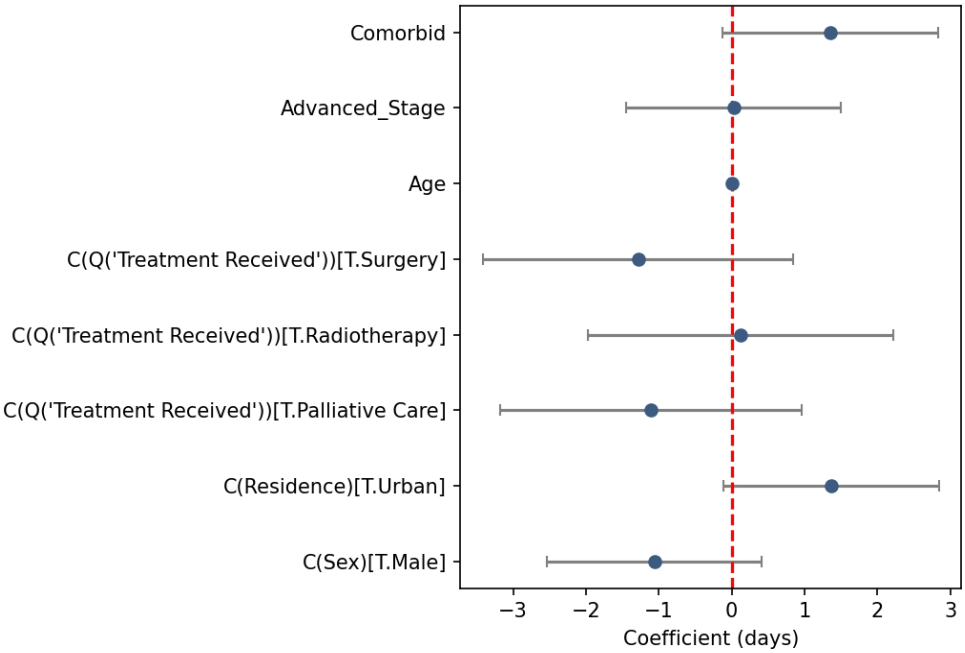

Figure 6: Coefficient plot of predictors of length of hospital stay.

Documented mortality status

Among the 530 cancer patient records reviewed, 271 (51.1%) documented that the patient was deceased at the time of data abstraction, while 259 (48.9%) had no documented death (Table 10). These figures describe the status recorded in the available hospital records and should not be interpreted as a population-level mortality rate, case fatality, or survival. A time-to-event analysis was not performed because the records did not provide sufficiently consistent information on dates of death and duration of follow-up.

Table 10. Documented mortality status among cancer patients (N = 530)

Mortality status	n	%
Deceased	271	51.1
No documented death	259	48.9
Total	530	100.0

Note: Status is as documented in patient records at the time of data abstraction. "No documented death" does not establish that the patient was alive. The figures do not represent case fatality or survival

Direct medical cost of cancer management

The mean total direct medical cost per patient was NGN 1,866,244 (SD = NGN 683,935) (Table 11). Chemotherapy accounted for the largest share (mean NGN 660,963; 35.4%), followed by surgery (NGN 433,031; 23.2%) and radiotherapy (NGN 327,034; 17.5%). Together these three treatment components made up 76.1% of total direct medical cost. Hospital admission, drugs, blood transfusion, laboratory investigations, and other medical costs together accounted for the remaining 23.9%.

Table 11. Mean direct medical cost per patient by cost category (N = 530)

Cost category	Mean cost (NGN)	% of total direct cost
Chemotherapy	660,963	35.4
Surgery	433,031	23.2
Radiotherapy	327,034	17.5
Hospital admission	170,535	9.1
Drugs	117,516	6.3
Blood transfusion	80,623	4.3
Laboratory	49,847	2.7
Other medical costs	26,695	1.4
Total	**1,866,244**	**100.0**

Note: NGN = Nigerian naira. Costs are means across all 530 patients, with zero cost assigned where a service was not received, and are as recorded in hospital billing records (2021-2025) - without inflation adjustment.

Discussion

Principal findings

Among 530 cancer patients whose records were reviewed at Federal Medical Centre, Keffi, between 2021 and 2025, liver cancer was the most frequently recorded cancer type (20.6%), and 52.6% presented with advanced-stage disease (stages III-IV). Treatment was documented as defaulted for 36.4% of patients, and 51.1% were documented as deceased at data abstraction; survival and case-fatality rates could not be estimated. The mean direct medical cost was NGN 1,866,244 per patient, with chemotherapy, surgery, and radiotherapy accounting for 76.1% of the total. No statistically significant associations were identified between the assessed sociodemographic and clinical variables and advanced-stage presentation or length of hospital stay, and length of stay, admissions, outpatient visits, and ICU days did not differ significantly across treatment modalities, although the wide confidence intervals mean that modest associations cannot be excluded. Occupation was associated with cancer type, but the association was weak. These findings describe cancer care patterns and resource utilisation at the study facility and should

be interpreted within the limitations of a hospital-based cross-sectional study using retrospective medical records.

Patient characteristics and distribution of cancer types

The mean age of patients was 50.4 ± 19.4 years, with a median of 48.5 years. This was comparable to the mean ages reported in a private cancer centre in Lagos (52 years) and a tertiary hospital in Delta State (50.17 years) [12,13]. However, differences in study populations and cancer types may limit direct comparisons.

Males accounted for 50.4% of patients and females 49.6%. This nearly equal distribution differed from the female predominance reported in studies conducted at a Lagos cancer centre (73%), the University of Ilorin Teaching Hospital (54%), and the Federal Teaching Hospital, Gombe (79%) [12,14,15]. These findings describe differences in the sex composition of the hospital-based samples and should not be interpreted as differences in population-level cancer occurrence.

Liver cancer was the most frequently recorded cancer type (20.6%), followed by cervical (16.8%), breast (16.6%), lung (15.8%), prostate (15.5%), and colorectal (14.7%) cancers. This pattern differed from that reported by Uchendu et al. (2020), who identified breast cancer as the most common cancer (36.5%), followed by colorectal (11.7%) and prostate (8.1%) cancers. Adenike et al. [16] similarly reported breast cancer as the most frequently recorded cancer among females and prostate cancer among males, while Adeniji et al. [14] identified prostate cancer as the most frequently recorded cancer overall at the University of Ilorin Teaching Hospital. These differences indicate variation in the distribution of recorded cancer types across the study settings. However, the present findings represent the patients and cancer types included in this study and cannot establish the distribution of cancer in the wider population.

Stage at presentation and associated factors

In this study, 52.6% (279/530) of patients presented with advanced-stage cancer (stages III–IV), lower than the 72.8% reported at Lagos University Teaching Hospital [17] and 68.8% (42/61) among breast cancer patients by Elenwo et al. [18]. Peteru et al. [19] reported stage III and IV presentation in 49.1% and 1.3% of breast cancer patients, respectively, compared with 55.3% and 3.9% reported by Ali-Gombe et al. [20]. Agbonrofo et al. [21] also reported delayed presentation in 92% of cancer patients in the Niger Delta. Despite variations in cancer types and definitions,

these findings highlight the persistent burden of advanced or delayed cancer presentation in Nigerian healthcare settings.

Multivariable logistic regression identified no statistically significant associations between the assessed sociodemographic and clinical variables and advanced-stage presentation. The model had poor discriminatory performance (AUC = 0.527; McFadden pseudo-R^2 = 0.002), and its overall likelihood-ratio test was not significant (p = 0.989). Thus, the included variables provided little discrimination between early- and advanced-stage disease in this sample.

In contrast, Tesfaw et al. [22] associated advanced-stage breast cancer with rural residence, longer travel distances, delayed presentation, lack of breast self-examination, and initial misdiagnosis. Birtukan et al. [23] also identified rural residence, indirect referral, financial difficulties, and screening recommendations during healthcare visits as predictors of advanced-stage presentation. These findings highlight the potential relevance of healthcare access and diagnostic pathways, although the studies included different populations and factors not assessed in the present study.

The high proportion of advanced-stage disease underscores the importance of timely diagnosis and access to cancer care. However, because screening history, symptom duration, diagnostic delays, and access barriers were not assessed, this study cannot establish why patients presented at advanced stages. Further multicentre research incorporating these factors is warranted.

Treatment patterns and documented treatment default

Palliative care was the most frequently recorded treatment category (26.6%), followed by radiotherapy (25.5%), chemotherapy (24.2%), and surgery (23.8%). Although advanced-stage disease affected more than half of the patients, the relationship between stage and treatment modality was not statistically significant. This finding should be interpreted cautiously, particularly because treatment was recorded as a single category per patient, which may not capture multimodal cancer management.

More than one-third of patients (36.4%) were recorded as having defaulted. This was similar in magnitude to the 33.3% chemotherapy default rate reported among 60 breast cancer patients at Federal Medical Centre, Yenagoa [24] and the 38% chemotherapy abandonment reported among Nigerian women with non-metastatic breast cancer in the multicountry ABC-DO cohort [25]. However, these comparisons are limited by differences in cancer types, study populations, and

definitions of default or abandonment. In a Nigerian colorectal cancer registry, cost was the main reason for 37% of patients who did not undergo recommended surgery, while personal reasons accounted for 30% [6].

The available records did not establish reasons for treatment default. Furthermore, treatment status may have been influenced by the time elapsed since diagnosis, particularly for patients classified as having ongoing treatment. These findings highlight the need for clear treatment-status definitions and systematic follow-up to support continuity of cancer care.

Hospital utilisation and length of stay

Length of stay did not differ significantly across treatment categories (ANOVA, $p = 0.331$; Kruskal–Wallis test, $p = 0.357$). Hospital admissions, outpatient visits, and ICU days also showed no significant differences by treatment modality. The multivariable regression model was not statistically significant ($F(8, 521) = 1.45$, $p = 0.171$; $R^2 = 0.022$), indicating that the included variables explained little variation in length of stay.

A South African study of patients undergoing colorectal cancer resection identified clinical and postoperative factors associated with prolonged hospital stay [26]. Differences from the present findings may reflect the studies' populations and variables assessed, as the current study included multiple cancer types and treatment categories.

Financial and health-system barriers may also influence hospital utilisation. Among 341 surgical patients in north-central Nigeria who remained hospitalised for more than 48 hours after being declared fit for discharge, lack of finance accounted for 96.5% of cases, while absence of a caregiver accounted for 3.5%; the mean additional stay was 17.6 days [27]. Similarly, a multicentre study found that 72%–89% of breast cancer patients in Nigeria paid entirely out of pocket for treatment [28]. A systematic review also identified high diagnostic and treatment costs and poor coordination across healthcare levels as barriers to timely cancer care in sub-Saharan Africa [29]. However, the extent to which these financial and health-system barriers contributed to prolonged hospital stay in the present study could not be determined.

Further research should examine clinical severity, treatment complications, discharge readiness, financial barriers, and caregiver availability to better explain variation in hospital utilisation.

Documented mortality

A documented death was recorded for 271 (51.1%) of the 530 patients, while 259 (48.9%) had no documented death in the available records. This proportion represents documented mortality status at the time of data abstraction and should not be interpreted as a mortality rate or survival estimate because follow-up duration varied and dates of death were inconsistently recorded. Furthermore, the vital status of patients without a documented death could not be confirmed, and causes of death were not analysed.

Direct comparison with other Nigerian studies is limited by differences in study populations and outcome measures. At Lagos State University Teaching Hospital, cancer accounted for 17.2% of 6,592 hospital deaths over ten years [30]. Similarly, a study conducted in the medical wards of a teaching hospital in southeastern Nigeria reported that cancer accounted for 7.6% of deaths and 1.7% of medical admissions [31]. These findings describe the contribution of cancer to hospital deaths rather than the proportion of cancer patients who died. Therefore, direct comparison with the present findings is inappropriate.

Future prospective studies with defined follow-up periods, confirmed vital status, and systematic recording of dates and cause.

Public Health and Health-Service Implications

The high proportion of advanced-stage presentation (52.6%) highlights the importance of timely cancer diagnosis and appropriate referral pathways. The proportion of patients recorded as having defaulted from treatment (36.4%) underscores the need for systematic treatment-status documentation and follow-up. Chemotherapy, surgery, and radiotherapy accounted for 76.1% of recorded direct medical costs, providing facility-level information relevant to resource planning. However, the reasons for advanced-stage presentation and treatment default, patients' financial barriers, and cancer survival could not be established from the available records. These findings should inform service planning at the study facility, with further research needed to investigate factors underlying advanced-stage presentation and treatment default.

Strengths and limitations

This study reviewed 530 patient records spanning five years, providing a facility-level description of cancer types, stage at presentation, treatment patterns, hospital utilisation, documented mortality, and direct medical costs. Inclusion of multiple cancer types and the use of hospital billing records enabled assessment of several aspects of cancer care within the study setting.

However, the retrospective, single-facility design limits generalisability to other settings. Findings were dependent on the completeness and accuracy of existing medical and billing records, and unrecorded information may have affected the assessment of clinical characteristics and treatment patterns. Inconsistent documentation of death dates and follow-up, together with unconfirmed vital status for some patients, precluded survival analysis. Reasons for treatment default, screening history, symptom duration, and diagnostic delays were unavailable, limiting interpretation of advanced-stage presentation and treatment discontinuation. Costs were based on recorded prices from 2021–2025 without inflation adjustment and did not establish the full economic burden on patients, including indirect costs. Finally, the hospital-based distribution of recorded cancer cases should not be interpreted as population-level incidence.

Conclusion

This five-year review of 530 patient records at FMC Keffi found that liver cancer was the most frequently recorded cancer type, and more than half of the patients presented with advanced-stage disease. Treatment default was documented in 36.4% of patients, while the mean recorded direct medical cost was ₦1,866,244 per patient. No statistically significant associations were identified between the assessed factors and advanced-stage presentation or length of hospital stay; however, these findings should be interpreted in light of the study's methodological limitations. The findings provide facility-level evidence to inform cancer service planning, strengthen treatment follow-up, and improve clinical and cost documentation. Prospective studies with more complete follow-up are needed to establish patient outcomes and investigate factors associated with advanced-stage presentation and treatment default.

Contributions of Authors

SOA, VE, and AAW conceived and designed the study. SOA, VE, AAW, IYK, ARJ, ATK, OFM, AA, OIG, FON, ATP, and AIA contributed to study implementation, data collection, data analysis, and interpretation of the findings. SOA, VE, and AAW drafted the manuscript. IYK, ARJ, ATK, OFM, AA, OIG, FON, ATP, and AIA critically reviewed the manuscript and contributed to its revision. All authors reviewed and approved the final version of the manuscript and agreed to be accountable for all aspects of the work. SOA, VE, and AAW contributed equally to this work.

Ethical Considerations

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki (2013 version) as adopted by the World Medical Association. Ethical approval for the study was obtained from the Health Research Ethics Committee of the Federal Medical Center, Keffi (FMC, Keffi), a fully registered committee under the National Health Research Ethics Committee (NHREC), FMH-Ref No: C.5187/76IT. Approval was granted after a defense of the research proposal during the Committee's ethical screening interview held on 14th June 2026. Administrative permission was also secured from the hospital's management. Written informed consent was obtained from all participants after explaining the study's purpose, confidentiality, and voluntary nature. Participants were assured that refusal to participate would not affect their access to ANC services.

Data Availability

The dataset analyzed during this study is not publicly available due to patient confidentiality considerations but may be obtained from the corresponding author upon reasonable request, subject to applicable ethical and institutional approvals.

Code Availability

Not applicable.

Funding

This study received no specific grant from any funding agency.

Consent for Publication

Not applicable.

Competing Interests

The authors declare that they have no competing interests.

Acknowledgments

Not applicable

References

1. Wu Z, Xia F, Lin R. Global burden of cancer and associated risk factors in 204 countries and territories, 1980–2021: a systematic analysis for the GBD 2021. J Hematol Oncol. 2024;17(1):119. doi:10.1186/s13045-024-01640-8.
2. Balch CM, Liao N, Lam DSC, Weitzel JN, Xu RH, Attard G, et al. The global cancer crisis: a review of growing burden, deepening inequality and initiatives for prevention and early detection. Ecancermedicalscience. 2026;20:2071. doi:10.3332/ecancer.2026.2071.
3. Gizaw AT, Woldie I, Yilma AN, Tadesse M, Sisay AL, Sebero FM, et al. Barriers to timely diagnosis and treatment of childhood cancer in Sub-Sahara Africa: a qualitative systematic review. BMC Cancer. 2025;25(1):1600. doi:10.1186/s12885-025-15092-x.
4. Bamodu OA, Chung CC. Cancer care disparities: overcoming barriers to cancer control in low- and middle-income countries. JCO Glob Oncol. 2024;10. doi:10.1200/GO.23.00439.
5. Ogunniyi TJ, Fatokun BS, Isah KO, Abdulbaki A, Emiola AR, Batisani K. Current status of cancer diagnosis and treatment in Nigeria. Health Sci Rep. 2025;8(6). doi:10.1002/hsr2.70877.
6. Sharma A, Alatise OI, Adisa AO, Arowolo OA, Olasehinde O, Famurewa OC, et al. Treatment of colorectal cancer in Sub-Saharan Africa: results from a prospective Nigerian hospital registry. J Surg Oncol. 2020;121(2):342-9. doi:10.1002/jso.25768.
7. Fekete Z, Fekete A, Kacsó G. Treatment classification by intent in oncology—the need for meaningful definitions: curative, palliative and potentially life-prolonging. J Pers Med. 2024;14(9):932. doi:10.3390/jpm14090932.

8. Mee T, Kirkby NF, Defourny NN, Kirkby KJ, Burnet NG. The use of radiotherapy, surgery and chemotherapy in the curative treatment of cancer: results from the FORTY (Favourable Outcomes from RadioTherapY) project. Br J Radiol. 2023;96(1152):20230334. doi:10.1259/bjr.20230334.
9. Faiman B. The cost of care: financial and social factors in cancer management. J Adv Pract Oncol. 2024;15(1):13-4. doi:10.6004/jadpro.2024.15.1.1.
10. Gaji LD, Okoronkwo I, Ishaku S, Chinweuba A, Oyedele E, Abua M. Economic burden of households affected by cancer among patients attending Jos University Teaching Hospital, Plateau State, Nigeria. J Public Health Dis. 2020;3(2):24-34. doi:10.31248/JPHD2020.065.
11. Carrera P, Kantarjian H, Blinder V. The financial burden and distress of patients with cancer: understanding and stepping-up action on the financial toxicity of cancer treatment. CA Cancer J Clin. 2018;68(2):153-65. doi:10.3322/caac.21443.
12. Fapohunda A, Fakolade A, Omiye J, Afolaranmi O, Arowojolu O, Oyebamiji T, et al. Cancer presentation patterns in Lagos, Nigeria: experience from a private cancer center. J Public Health Afr. 2020;11(2):1138. doi:10.4081/jphia.2020.1138.
13. Uchendu OJ. Cancer incidence in Nigeria: a tertiary hospital experience. Asian Pac J Cancer Care. 2020;5(1):27-32. doi:10.31557/apjcc.2020.5.1.27-32.
14. Adeniji KA, Folaranmi OO, Odetunde OA, Adegboye O, Ibiyeye KM, Ighodalo JE, et al. Changing pattern of cancer distribution: experience from a tertiary health institution in Nigeria and review of literature. Niger J Clin Pract. 2023;26(7):902-7. doi:10.4103/njcp.njcp_520_22.
15. Bobbo KA, Babuga AU, Rayyanu ZS, Adamu A, Bojude DA. Sex disparity in cancer occurrence and treatment among cancer patients: a 2-year retrospective study of the oncology unit, Federal Teaching Hospital, Gombe. Niger J Oncol. 2025;1(2):266-79. doi:10.67579/njo.2025.zg6ha74d.
16. 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;8. doi:10.1200/GO.22.00107.
17. Awofeso O, Roberts AA, Salako O, Balogun L, Okediji P. Prevalence and pattern of late-stage presentation in women with breast and cervical cancers in Lagos University Teaching Hospital, Nigeria. Niger Med J. 2018;59(6):74-9. doi:10.4103/nmj.NMJ_112_17.

18. Elenwo SN, Ijah RFOA, Dimoko AA. Factors associated with late presentation of breast cancer in a teaching hospital in Port Harcourt, Nigeria. Niger Health J. 2022;22(1):140-52. doi:10.60787/tnhj.v22i1.516.
19. Inunduh PS, Otene SA, Labe RM, Swende LT, Popoola BO, Daniel DA, et al. Late cancer presentation and increase palliative care burden on healthcare delivery in Makurdi Benue State: a need for strategic intervention. J Clin Oncol Rep. 2024;3(1). doi:10.58489/2836-5062/019.
20. Ali-Gombe M, Mustapha MI, Folasire A, Ntekim A, Campbell OB. Pattern of survival of breast cancer patients in a tertiary hospital in South West Nigeria. ecancermedicalscience. 2021;15:1192. doi:10.3332/ecancer.2021.1192.
21. Agbonrofo PI, Eriba LO. Audit of delayed presentation in breast cancer from a tertiary centre in the Niger Delta, Nigeria. Ibom Med J. 2020;13(3):164-71. doi:10.61386/imj.v13i3.203.
22. Aragaw T, Mulu T, Tamire T, Yosef T. Factors associated with advanced-stage diagnosis of breast cancer in north-west Ethiopia: a cross-sectional study. ecancermedicalscience. 2021;15:1214. doi:10.3332/ecancer.2021.1214.
23. Shewarega B, Getachew S, Kassaw NA, Yesufe AA, Trabizsch J, Dandena Y, et al. Predictors of advanced-stage presentation among patients with a diagnosis of breast and cervical cancer in Ethiopia. Oncologist. 2025;30(2). doi:10.1093/oncolo/oyaf019.
24. Dimoko A, Alagoa PJ. Chemotherapy default among breast cancer patients in Yenagoa, Nigeria: patterns and predictors. Ethiop J Med Health Sci. 2026;5(2):529-38. doi:10.82127/by979h98.
25. Foerster M, McCormack V, Anderson BO, Boucheron P, Zietsman A, Cubasch H, et al. Treatment guideline concordance, initiation, and abandonment in patients with non-metastatic breast cancer from the African Breast Cancer-Disparities in Outcomes (ABC-DO) cohort in sub-Saharan Africa: a prospective cohort study. Lancet Oncol. 2022;23(6):729-38. doi:10.1016/S1470-2045(22)00198-X.
26. Achilonu OJ, Fabian J, Bebington B, Singh E, Nimako G, Eijkemans RMJC, Musenge E. Use of machine learning and statistical algorithms to predict hospital length of stay following colorectal cancer resection: a South African pilot study. Front Oncol. 2021;11:644045. doi:10.3389/fonc.2021.644045.

27. Akhiwu H, Akhiwu H, Njem JM, Ojukwu B, Nnawuihe UC, Alu SA, et al. Factors that contribute to prolonged hospital stay after discharge among surgical patients in a tertiary hospital in North Central Nigeria. Niger Dent J. 2024;32(1). doi:10.61172/ndj.v32i1.259.
28. Twahir M, Oyesegun R, Yarney J, Gachii A, Edusa C, Nwogu C, et al. Real-world challenges for patients with breast cancer in sub-Saharan Africa: a retrospective observational study of access to care in Ghana, Kenya and Nigeria. BMJ Open. 2021;11(3). doi:10.1136/bmjopen-2020-041900.
29. Lombe DC, Mwamba M, Msadabwe S, Bond V, Simwinga M, Ssemata AS, et al. Delays in seeking, reaching and access to quality cancer care in sub-Saharan Africa: a systematic review. BMJ Open. 2023;13(4). doi:10.1136/bmjopen-2022-067715.
30. Fatiregun OA, Bakare O, Ayeni S, Oyerinde A, Sowunmi AC, Popoola A, et al. 10-year mortality pattern among cancer patients in Lagos State University Teaching Hospital, Ikeja, Lagos. Front Oncol. 2020;10:573036. doi:10.3389/fonc.2020.573036.
31. Arodiwe EB, Ike SO, Nwokediuko SC, Ijoma CK, Ulasi II. Pattern of cancer deaths in the medical wards of a teaching hospital in South East Nigeria. Niger J Clin Pract. 2013;16(4):505-10. doi:10.4103/1119-3077.116901.