

Documented Treatment-Related Morbidity and Mortality among Patients Receiving Radiotherapy at Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria: A Hospital-Based Retrospective Record-Review Study

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How to cite this paper: Bawa, J., Dao, A., Bello, B., Ibrahim, H., Bashiru, K., Anka, S., Maikudi, A., Salihu, A.A., Mafara, S., Kabir, I. and Chuks, I.K. (2026) Documented Treatment-Related Morbidity and Mortality among Patients Receiving Radiotherapy at Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria: A Hospital-Based Retrospective Record-Review Study. *Journal of Cancer Therapy*, 17, 521-537. <https://doi.org/10.4236/jct.2026.1710043>

Received: September 6, 2026

Accepted: October 18, 2026

Published: October 21, 2026

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Abstract

Background: Evidence on outcomes among patients receiving radiotherapy in north-western Nigeria remains limited. This study described documented treatment-related morbidity and mortality and examined factors associated with these outcomes among patients treated at Usmanu Danfodiyo University Teaching Hospital, Sokoto. **Methods:** A hospital-based retrospective record-review study was conducted among 402 adult patients with histologically confirmed cancer who received radiotherapy at Usmanu Danfodiyo University Teaching Hospital between June 2024 and December 2025. Data were extracted from clinical and radiotherapy records. Documented treatment-related morbidity and recorded mortality were analysed as separate outcomes. Associations were assessed using logistic regression and reported as adjusted odds ratios (AORs) with 95% confidence intervals (CIs). **Results:** Most patients were female (66.2%) and younger than 60 years (74.4%). Head and neck (26.6%), breast (24.9%), and cervical (19.9%) cancers were the most frequently treated malignancies. Documented treatment-related morbidity was recorded in 266/402 patients (66.2%), and a death was documented in 86/402 records (21.4%) during the record-review period. Frequently documented complications included anemia (21.6%), skin reactions (20.9%), mucositis (19.2%), and

fatigue (18.4%). Recorded mortality was independently associated with age 60 years or older (AOR 1.82, 95% CI 1.07 - 3.21), comorbidity (AOR 1.71, 95% CI 1.01 - 3.08), underweight body mass index (AOR 2.04, 95% CI 1.13 - 3.88), stage IV disease (AOR 4.63, 95% CI 2.24 - 8.87), poor performance status (AOR 2.88, 95% CI 1.52 - 5.22), metastatic disease (AOR 2.66, 95% CI 1.34 - 4.98), palliative treatment intent (AOR 4.12, 95% CI 2.21 - 7.84). **Conclusion:** Documented morbidity and recorded deaths were common in this record-review cohort and were associated with markers of clinical vulnerability and disease burden. Because death dates and complete vital-status follow-up were unavailable, mortality findings should not be interpreted as survival estimates or directly comparable mortality risks.

Keywords

Radiotherapy, Morbidity, Mortality, Sokoto, Nigeria

1. Introduction

Cancer is a major and growing global public-health challenge, accounting for an estimated 20 million new cases and 9.7 million cancer-related deaths in 2022 [1]. The burden is projected to rise substantially in coming decades because of population growth, population ageing, and changing exposure to modifiable risk factors [2] [3]. This increase is expected to be particularly pronounced in low- and middle-income countries (LMICs), where health systems frequently face limitations in prevention, early detection, diagnostic capacity, treatment infrastructure, workforce availability, and access to essential cancer medicines and technologies [1].

Sub-Saharan Africa carries a disproportionate burden of poor cancer outcomes. Although the region accounts for a smaller proportion of global cancer incidence than high-income settings, mortality relative to incidence is high. This disparity reflects late-stage diagnosis, low participation in screening programs, constrained pathology and imaging services, shortages of oncology specialists, fragmented referral pathways, and substantial out-of-pocket costs [4] [5]. These challenges can delay the initiation of potentially curative treatment and may contribute to interruptions in care after treatment has begun.

Nigeria has a substantial and increasing cancer burden. Breast, cervical, prostate, colorectal, and head and neck cancers are among the commonly diagnosed malignancies, although their relative frequency varies by geographic region, sex, age, access to diagnostic services, and referral patterns [5]. Many patients present with locally advanced or metastatic disease, when treatment options may be limited and the likelihood of cure is reduced. The consequences of delayed presentation are especially important for malignancies for which radiotherapy is a central component of definitive, adjuvant, or palliative management, including cervical, breast, prostate, head and neck, colorectal, and selected haematological and paediatric cancers.

Radiotherapy is an essential modality in modern cancer care. It is estimated that approximately one-half of patients with cancer will require radiotherapy at least once during the course of their illness [6]. Depending on tumor site, stage, histology, and patient factors, radiotherapy may be delivered with curative intent, as adjuvant or neoadjuvant therapy, concurrently with systemic therapy, or for palliation of symptoms such as pain, bleeding, obstruction, neurological compromise, or mass effect. Its effectiveness relies not only on appropriate treatment indication and technical delivery, but also on timely initiation, completion of the prescribed course, supportive care, and adequate follow-up.

Despite its therapeutic benefit, radiotherapy may be associated with acute and late adverse effects. The nature and severity of these effects depend on the irradiated anatomical site, total dose, dose per fraction, treatment volume, technique, use of concurrent chemotherapy, baseline nutritional status, comorbidities, and performance status. Acute toxicities may include fatigue, skin reaction, mucositis, dysphagia, nausea, diarrhea, urinary symptoms, and hematological abnormalities, particularly among patients receiving combined chemoradiotherapy. Late effects may involve fibrosis, organ dysfunction, endocrine abnormalities, sexual dysfunction, chronic bowel or bladder symptoms, and other site-specific complications [7]. Consistent documentation and grading of toxicities are therefore important for clinical decision-making, quality improvement, and the development of supportive-care interventions.

Treatment-related morbidity may adversely influence quality of life, functional capacity, and adherence to planned therapy. Severe toxicities, uncontrolled symptoms, financial hardship, transportation challenges, prolonged waiting times, and inadequate social support can contribute to treatment interruption or non-completion. In turn, treatment interruption may compromise tumor control in selected curative-treatment settings, although the clinical implications depend on cancer type, disease stage, treatment intent, and the duration and timing of interruption [8]. Patients with advanced disease, poor Eastern Cooperative Oncology Group performance status, undernutrition, metastatic disease, and significant comorbidity may be especially vulnerable to adverse outcomes during cancer treatment [9]-[11].

Evidence describing radiotherapy outcomes in Nigeria remains limited, particularly in north-western settings. Local data are needed because the distribution of cancers treated, stage at presentation, treatment resources, referral pathways, supportive-care capacity, and barriers to treatment completion may differ considerably across centres. Such evidence can identify groups requiring intensified assessment and support, inform service planning, and guide interventions aimed at reducing avoidable morbidity and improving continuity of care.

Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto, provides radiotherapy and oncology services to patients from Sokoto State and neighbouring areas of north-western Nigeria. However, data on documented treatment-related morbidity, mortality, and their associated clinical and treatment factors

among patients receiving radiotherapy at the centre are scarce. This study therefore aimed to determine the prevalence of documented morbidity and recorded mortality among patients receiving radiotherapy at UDUTH and to identify sociodemographic, clinical, and treatment-related factors associated with these outcomes.

2. Materials and Methods

2.1. Study Design, Setting, and Period

This hospital-based retrospective record-review study was conducted at the Department of Radiation and Oncology, Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria. UDUTH provides radiotherapy and oncology services to patients from Sokoto State and neighbouring states in north-western Nigeria.

The study reviewed records of patients who received radiotherapy between 1 June 2024 and 31 December 2025. Individual dates of death, dates of last clinical contact, and vital-status ascertainment after treatment were not systematically available in the retrospective dataset. Therefore, individual follow-up duration and censoring time could not be calculated. The mortality outcome was defined as a death documented in the available medical, radiotherapy, or follow-up record during the record-review period. Patients without a documented death were classified as having no recorded death in the available records; this classification did not confirm that they were alive. Accordingly, mortality was reported as a recorded all-cause mortality proportion and was not analyzed as a time-to-event or survival outcome.

2.2. Study Population and Eligibility Criteria

The study population comprised adult patients aged 18 years or older with histologically confirmed malignancy who received at least one fraction of radiotherapy at UDUTH during the study period.

Patients were eligible if their records contained the minimum information required for analysis, including demographic characteristics, cancer diagnosis, treatment details, and outcome documentation. Patients whose records lacked key variables required to define the study outcomes, those for whom radiotherapy was planned but not commenced, and those referred to another centre before treatment outcome ascertainment were excluded.

Over the study period, 433 patients were registered in ARIA system. 31 were excluded (seventeen with incomplete baseline records and fourteen without EBRT), leaving 402 patients for analysis.

2.3. Data Collection and Variables

Data were extracted using a structured, pretested data-extraction form from patients' case notes, radiotherapy treatment charts, treatment summaries, and available follow-up clinic records. The extraction form was designed to capture demographic, clinical, treatment, and outcome data.

Extracted data were rechecked against the original clinical and radiotherapy records by the principal investigator. Discrepancies were resolved by source-document review; unresolved values were coded as missing before the analytic dataset was locked.

The extracted variables included age at radiotherapy initiation, sex, primary cancer site, disease stage, Eastern Cooperative Oncology Group (ECOG) performance status, body mass index, documented comorbidities, time from diagnosis to radiotherapy initiation, metastatic status, treatment intent, treatment modality, prescribed and delivered radiotherapy dose, prescribed and delivered number of fractions, treatment completion status, documented treatment-related morbidity, and documented death in the available record.

2.4. Radiotherapy Treatment Procedure

All patients underwent computed tomography simulation using a 64-slice GE CT simulator (GE Healthcare, Milwaukee, WI, USA). Patients were positioned and immobilized according to the tumor site and institutional protocol. Appropriate immobilization devices were used to promote reproducible positioning throughout treatment. Simulation images were acquired with an appropriate slice thickness for treatment planning, and images were transferred to the treatment-planning system for target delineation and plan generation.

Target volumes and organs at risk were delineated in accordance with institutional practice and the principles outlined in ICRU Reports 50 and 62 [12] [13]. Treatment prescription, dose reporting, and plan evaluation followed the applicable ICRU recommendations [12]-[14]. Target volumes and organs at risk were delineated by the treating radiation oncologist. Site-specific target delineation and dose constraints were individualized according to disease site, clinical stage, treatment intent, and relevant institutional protocols.

Curative-intent radiotherapy was delivered using intensity-modulated radiotherapy (IMRT) or volumetric-modulated arc therapy (VMAT). Treatment plans aimed to achieve adequate planning target volume coverage while respecting dose constraints for relevant organs at risk. Image guidance and verification procedures were performed in accordance with institutional practice before and during treatment.

Palliative radiotherapy was delivered using three-dimensional conformal radiotherapy (3D-CRT). Common palliative regimens included 20 Gy in five fractions and 30 Gy in 10 fractions, selected according to the indication for palliation, tumor site, symptom burden, performance status, prognosis, and treating physician's judgment.

For curative treatment, the prescribed regimens varied by primary tumor site. Regarding the institutional radiotherapy protocol, patients with breast cancer received 40.05 Gy in 15 fractions. Patients with head and neck cancer received 70 Gy in 35 fractions. Patients with prostate cancer received 60 Gy in 20 fractions. Patients with cervical cancer received 70 Gy in 35 fractions. Definitive cervical-cancer treatment was delivered using external-beam radiotherapy because in-

tracavitary brachytherapy was unavailable at the centre during the study period. Patients with rectal cancer were treated according to institutional multidisciplinary recommendations and individual treatment decisions.

Concurrent chemotherapy was intended for eligible patients with head and neck, cervical, and rectal cancers treated with curative intent, subject to clinical fitness, renal and hematological function, disease characteristics, drug availability, and the treating multidisciplinary team's decision.

2.5. Outcome Definitions

The outcomes were assessed and analyzed separately.

Documented treatment-related morbidity was defined as events documented in available records during the treatment and record-review period. Adverse events could include anemia, radiation dermatitis, mucositis, fatigue, nausea or vomiting, diarrhea, dysphagia, urinary symptoms, or other clinician-documented complications. The adverse effects were documented adverse events in medical record.

Recorded all-cause mortality was defined as any death documented in the available medical, radiotherapy, or follow-up record during the record-review period.

Treatment completion was defined as receipt of the planned radiotherapy course, according to the treating radiation oncologist's prescription. Treatment completion was classified after radiotherapy had commenced and was considered a post-baseline treatment-course variable.

2.6. Data Analysis

Data were coded, cleaned, and analyzed using IBM SPSS Statistics version 25. Categorical variables were summarized using frequencies and percentages. Continuous variables were assessed for distribution and presented as mean with standard deviation or median with interquartile range, as appropriate.

The prevalence of documented treatment-related morbidity and the proportion of patients with recorded mortality were calculated separately, with 95% confidence intervals. Associations between potential explanatory variables and each outcome were first assessed using chi-square tests or Fisher's exact tests, where appropriate.

Separate multivariable binary logistic-regression models were fitted for documented treatment-related morbidity and recorded all-cause mortality. Candidate variables were selected on the basis of clinical relevance and bivariable association with the outcome at $p < 0.20$. The primary adjusted models included age (<60 years versus ≥ 60 years), comorbidity (No versus Yes), ECOG performance status (0 - 2 versus 3 - 4), cancer stage (stage I, II, III, and stage IV), metastatic status (distant metastasis absent versus distant metastasis present), and treatment intent (curative versus palliative). Body mass index was classified as underweight, normal weight, overweight, or obesity. In multivariable logistic-regression analyses, normal BMI was the reference category; underweight, overweight, and obesity were entered as separate indicator variables.

Treatment completion was not included in the primary adjusted models because it was determined after treatment initiation and could be affected by morbidity, clinical deterioration, disease progression, or death. Before modelling, multicollinearity was assessed using variance inflation factors and tolerance statistics. Model calibration was evaluated using the Hosmer-Lemeshow goodness-of-fit test, and discrimination was assessed using the area under the receiver-operating-characteristic curve.

Body mass index was categorized as underweight, normal weight, overweight, or obesity. In logistic-regression analyses, normal BMI was used as the reference category. The primary BMI comparison assessed underweight or normal versus overweight or obesity BMI; where other BMI categories were included, overweight and obesity were entered as separate indicator variables.

The final multivariable models were carefully specified to account for the clinical relationships among cancer stage, metastatic status, and treatment intent. Diagnostic assessment for multicollinearity was performed before model fitting to support stable and interpretable estimates. Results are presented as adjusted odds ratios (AORs) with 95% confidence intervals (CIs) and two-sided p-values. Statistical significance was defined as $p < 0.05$.

2.7. Ethical Considerations

Ethical approval was obtained from the Health Research Ethics Committee of Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria (approval number: UDUTH/HREC/2026/1512/V2; approved on 8 September 2026). Patient confidentiality was maintained through anonymization of extracted data and secure data handling.

3. Results

3.1. Patient Characteristics

A total of 402 eligible patients who received radiotherapy at Usmanu Danfodiyo University Teaching Hospital between June 2024 and December 2025 were included in the analysis. The sociodemographic characteristics are summarized in **Table 1** below.

Table 1. Baseline sociodemographic and clinical characteristics of the study population.

Variables	Categories	Total Sample n (%)
Gender	Male	136 (33.8)
	Female	266 (66.2)
Age	< 60yrs	299 (74.4)
	≥ 60yrs	103 (25.6)
Comorbidities	Yes	140 (34.8)
	No	262 (65.2)

Continued

BMI (kg/m²)	Underweight	83 (20.65)
	Normal	226 (56.22)
	Overweight	65 (16.17)
	Obesity	28 (6.97)
ECOG PS	0	72 (17.91)
	1	80 (19.90)
	2	105 (26.12)
	3	101 (25.12)
	4	44 (10.95)
Duration of Diagnosis	≥6 months	291 (72.4)
	<6 months	111 (27.6)
Stage	IV	114 (28.4)
	III	172 (42.8)
	II	77 (19.2)
	I	39 (9.7)
Distant metastasis	Present	86(21.4)
	Absent	316 (78.6)
Treatment intent	Curative	339 (84.3)
	palliative	63 (15.7)
Treatment Modality*	Radiotherapy	331 (82.3)
	Chemoradiation	71 (17.7)
Treatment Completion	Completed	277 (68.9)
	Not Completed	125 (31.1)

ECOG PS 2 was the most common category, documented in 105 patients (26.1%), followed by ECOG PS 3 in 101 patients (25.1%). Eighty patients (19.9%) had ECOG PS 1, while 72 patients (17.9%) had ECOG PS 0. ECOG PS 4 was recorded in 44 patients (11.0%). Overall, 145 patients (36.1%) had poor performance status (ECOG PS 3-4).

The liver was the most common site of metastasis, documented in 28 patients, followed by bone metastases in 19 patients and lung and brain metastases in 15 patients each. Metastases involving multiple sites—including combinations of the liver, bone, brain, and/or lungs—were documented in 9 patients. Regarding the cancer type, head and neck cancers were the most frequently treated malignancies, accounting for 107 patients (26.6%), followed by breast cancer in 100 patients (24.9%) and cervical cancer in 80 patients (19.9%). Other cancer types collectively accounted for 73 patients (18.2%). Colorectal cancer was recorded in 30 patients (7.5%), while prostate cancer was the least common diagnosis, occurring in 12 patients (3.0%).

3.2. Documented Morbidity

Documented treatment-related morbidity was recorded in 266 of 402 patients (66.2%). The most frequently documented adverse events were anemia in 87 patients (21.6%), skin reactions in 84 (20.9%), mucositis in 77 (19.2%), and fatigue in 74 (18.4%). Because more than one adverse event may have been recorded for an individual patient, these event-specific frequencies should not be summed (**Tables 2-3**).

Table 2. Bivariable associations with documented treatment-related morbidity; include morbidity-specific p-values (N = 402).

Variables	Categories	Total Sample n (%)	Documented morbidity		P-value
			Yes. (%)	No. (%)	
Gender	Male	136 (33.8)	88 (64.7)	48 (35.3)	0.657
	Female	266 (66.2)	178 (66.9)	88 (33.1)	
Age	<60	299 (74.4)	190 (63.5)	109 (36.5)	0.058
	≥60	103 (25.6)	76 (73.8)	27 (26.2)	
Comorbidities	Yes	140 (34.8)	106 (75.7)	34 (24.3)	0.003*
	No	262 (65.2)	160 (61.1)	102 (38.9)	
BMI (kg/m ²)	Underweight	83 (20.65)	64 (77.1)	19 (22.9)	0.118
	Normal	226 (56.22)	142 (62.8)	84 (37.2)	
	Overweight	65 (16.17)	41 (63.1)	24 (36.9)	
	Obesity	28 (6.97)	19 (67.9)	9 (32.1)	
ECOG PS	0	72 (17.91)	38 (52.8)	34 (47.2)	0.033*
	1	80 (19.90)	50 (62.5)	30 (37.5)	
	2	105 (26.12)	73 (69.5)	32 (30.5)	
	3	101 (25.12)	76 (75.2)	25 (24.8)	
	4	44 (10.95)	29 (65.9)	15 (34.1)	
Duration of Diagnosis	≥6 months	291 (72.4)	201 (69.1)	90 (30.9)	0.046*
	<6 months	111 (27.6)	65 (58.6)	46 (41.4)	
Stage	IV	114 (28.4)	89 (78.1)	25 (21.9)	<0.001*
	III	172 (42.8)	119 (69.2)	53 (30.8)	
	II	77 (19.2)	45 (58.4)	32 (41.6)	
	I	39 (9.7)	13 (33.3)	26 (66.7)	
Distant metastasis	Present	86(21.4)	70 (81.4)	16 (18.6)	<0.001*
	Absent	316 (78.6)	196 (62.0)	120 (38.0)	
Treatment intent	Curative	339 (84.3)	214 (63.1)	125 (36.9)	0.003*
	Palliative	63 (15.7)	52 (82.5)	11 (17.5)	
Treatment Modality	Radiotherapy	331 (82.3)	214 (64.7)	117 (35.3)	0.165
	Chemoradiation	71 (17.7)	52 (73.2)	19 (26.8)	
Treatment Completion	Completed	277 (68.9)	177 (63.9)	100 (36.1)	0.152
	Not Completed	125 (31.1)	89 (71.2)	36 (28.8)	

Note: * Statistically significant (p < 0.05).

Table 3. Bivariable and multivariable logistic regression analysis of factors associated with documented treatment-related morbidity among patients receiving radiotherapy at Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria (N = 402).

Variables	Categories	COR (95% CI) Morbidity	P-value	AOR (95% CI) Morbidity	P-value
Age	≥60 vs <60 years	1.62 (1.08 - 2.74)	0.042*	1.44 (1.01 - 2.58)	0.127
Gender	Female vs Male	1.11 (0.73 - 1.89)	0.667	—	—
Comorbidity	Yes vs No	2.01 (1.21 - 3.33)	0.007*	1.88 (1.12 - 3.17)	0.017*
BMI	Underweight vs Normal	2.27 (1.30 - 3.94)	0.004*	1.97 (1.14 - 3.62)	0.021*
Cancer Stage	Stage IV vs Stage I	4.81 (2.14 - 8.62)	<0.001*	3.96 (1.88 - 7.31)	<0.001*
ECOG Status	ECOG 3 - 4 vs 0 - 2	3.06 (1.74 - 5.27)	<0.001*	2.61 (1.42 - 4.81)	0.002*
Metastasis	Present vs Absent	2.74 (1.41 - 4.88)	0.001*	2.22 (1.16 - 4.26)	0.016*
Treatment Intent	Palliative vs Curative	3.88 (2.04 - 7.11)	<0.001*	3.24 (1.86 - 6.42)	<0.001*
Treatment Modality	Chemo-radiation vs Radiotherapy	1.74 (1.01 - 3.09)	0.052	—	—

Note: COR: *Crude Odds Ratio*; AOR: *Adjusted Odds Ratio*.

3.3. Recorded Mortality

A death was documented in 86 of 402 patients (21.4%) during the record-review period; no death was recorded for the remaining 316 patients (78.6%). Because dates of death, last contact, and verified vital status were not systematically available, this proportion should not be interpreted as a survival estimate or as a directly comparable mortality risk across patient groups. Mortality was higher among patients aged 60 years or older than among those younger than 60 years, among patients with comorbidity than those without comorbidity, and among underweight or normal patients than those with normal BMI (**Table 4**).

Table 4. Bivariable associations with recorded mortality; include mortality-specific p-values (N = 402).

Variables	Categories	Total Sample n (%)	Documented death, n/N (%)		P-value
			Recorded Death (%)	No recorded death (%)	
Gender	Male	136 (33.8)	32 (23.5)	104 (76.5)	0.455
	Female	266 (66.2)	54 (20.3)	212 (79.7)	
Age	< 60	299 (74.4)	52 (17.4)	247 (82.6)	<0.001*
	≥ 60	103 (25.6)	34 (33.0)	69 (67.0)	
Comorbidities	Yes	140 (34.8)	40 (28.6)	100 (71.4)	0.010*
	No	262 (65.2)	46 (17.6)	216 (82.4)	
BMI (kg/m ²)	Underweight	83 (20.65)	28 (33.7)	55 (66.3)	0.021*
	Normal	226 (56.22)	40 (17.7)	186 (82.3)	
	Overweight	65 (16.17)	12 (18.5)	53 (81.5)	
	Obesity	28 (6.97)	6 (21.4)	22 (78.6)	

Continued

ECOG PS	0	72 (17.91)	8 (11.1)	64 (88.9)	0.016*
	1	80 (19.90)	12 (15.0)	68 (85.0)	
	2	105 (26.12)	24 (22.9)	81 (77.1)	
	3	101 (25.12)	31 (30.7)	70 (69.3)	
	4	44 (10.95)	11 (25.0)	33 (75.0)	
Duration of Diagnosis	≥ 6 months	291 (72.4)	69 (23.7)	222 (76.3)	0.066
	< 6 months	111 (27.6)	17 (15.3)	94 (84.7)	
Stage	IV	114 (28.4)	41 (36.0)	73 (64.0)	<0.001*
	III	172 (42.8)	38 (22.1)	134 (77.9)	
	II	77 (19.2)	10 (13.0)	67 (87.0)	
	I	39 (9.7)	2 (5.1)	37 (94.9)	
Distant metastasis	Present	86(21.4)	65 (75.6)	21(24.4)	<0.001*
	Absent	316 (78.6)	21(6.6)	295(93.4)	
Treatment intent	Curative	339 (84.3)	59 (17.4)	280 (82.6)	<0.001*
	Palliative	63 (15.7)	27 (42.9)	36 (57.1)	
Treatment Modality	Radiotherapy	331 (82.3)	63 (19.0)	268 (81.0)	0.013*
	Chemoradiation	71 (17.7)	23 (32.4)	48 (67.6)	
Treatment Completion	Completed	277 (68.9)	41(14.8)	236 (85.2)	<0.001*
	Not Completed	125 (31.1)	45 (36.0)	80 (64.0)	

Note: * Statistically significant ($p < 0.05$).

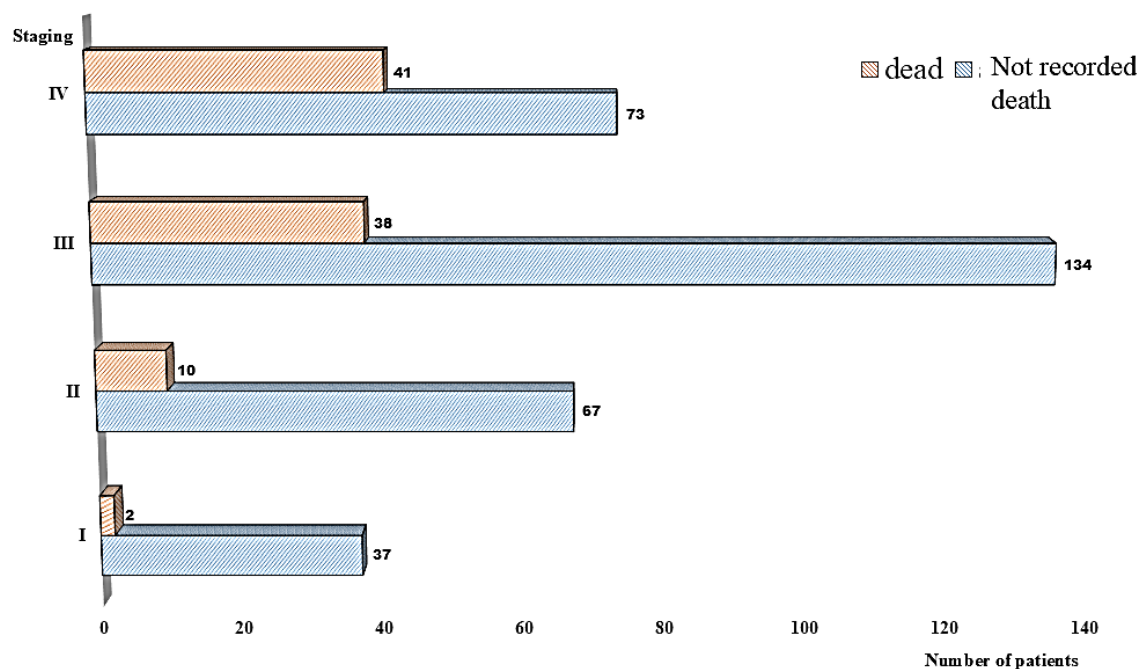


Figure 1. Distribution of recorded mortality by cancer staging among patient receiving radiotherapy at UDUTH, Sokoto.

Figure 1 below shows the distribution of documented deaths and patients with no recorded death across cancer stages among patients receiving radiotherapy at UDUTH. Recorded death was most frequent among patients with stage IV disease and decreased progressively across lower stages.

Bars show the number of patients dead or not recorded death in available records within each staging category.

Figure 2 below presents the distribution of documented deaths and patients with no recorded death by primary cancer type among patients who received radiotherapy at UDUTH. The largest numbers of documented deaths occurred among patients with head and neck, cervical, and breast cancers; these counts should be interpreted alongside the different group sizes.

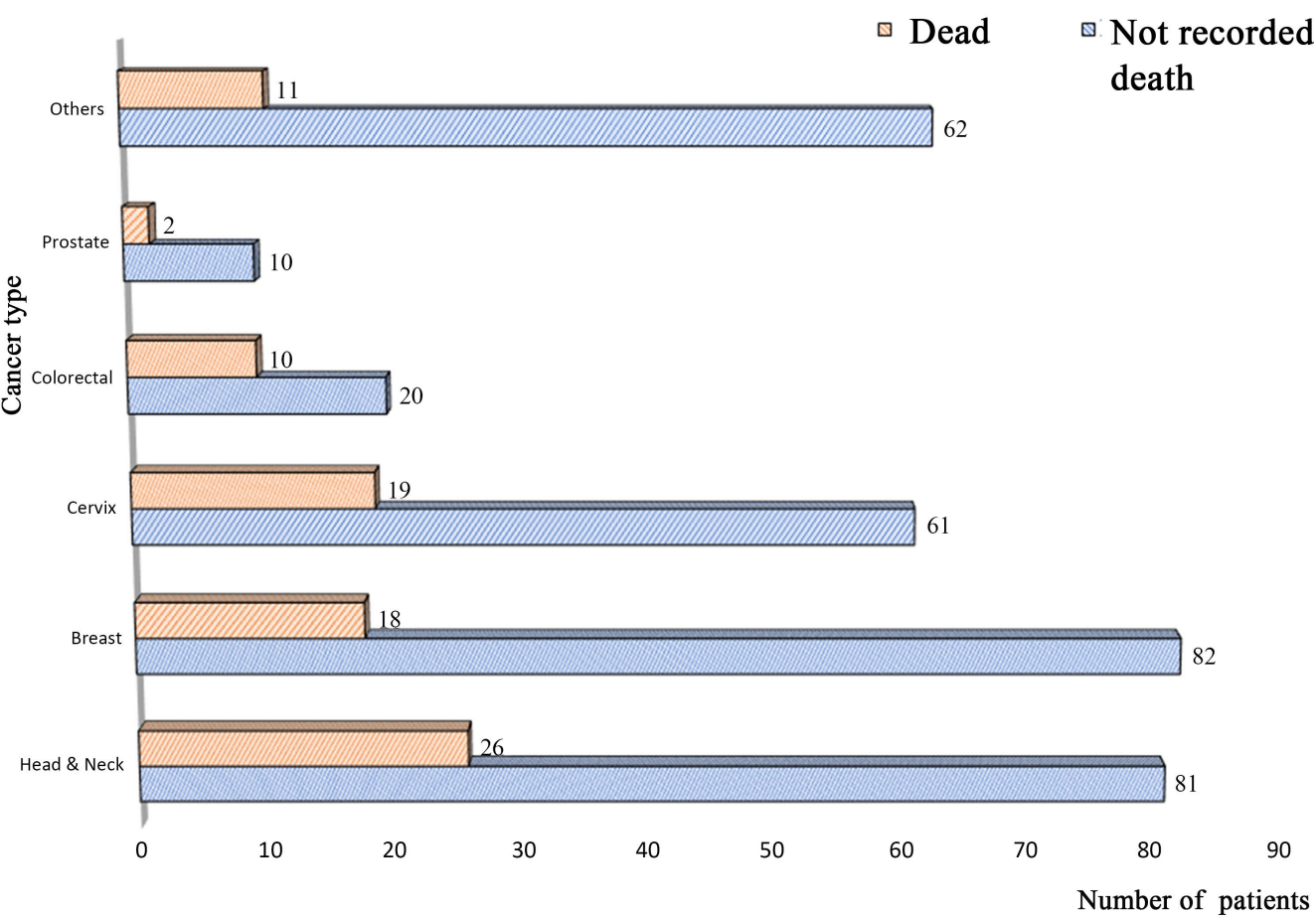


Figure 2. Distribution of recorded mortality by cancer type among patients receiving radiotherapy in UDUTH, Sokoto.

Colorectal cancer had the highest mortality proportion, with 10 deaths among 30 patients (33.3%), followed by head and neck cancer, with 26 deaths among 107 patients (24.3%), and cervical cancer, with 19 deaths among 80 patients (23.8%). Mortality was lower among patients with breast cancer (18/100, 18.0%), prostate cancer (2/12, 16.7%), and cancers grouped as “other” (11/73, 15.1%) (**Table 5**).

Table 5. Bivariable and multivariable logistic regression analysis of factors associated with recorded mortality among patients receiving radiotherapy at Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria (N = 402).

Variables	Categories	COR (95% CI) Mortality	P-value	AOR (95% CI) Mortality	P-value
Age	≥60 vs <60 years	2.34 (1.28 - 3.81)	0.007*	1.82 (1.07 - 3.21)	0.033*
Gender	Female vs Male	0.83 (0.51 - 1.57)	0.656	—	—
Comorbidity	Yes vs No	1.94 (1.12 - 3.26)	0.015*	1.71 (1.01 - 3.08)	0.059
BMI	Underweight vs normal	1.17 (1.26 - 4.41)	0.007*	2.04 (1.13 - 3.88)	0.023*
Cancer Stage	Stage IV vs Stage I	5.22 (2.61 - 9.74)	<0.001*	4.63 (2.24 - 8.87)	<0.001*
ECOG Status	ECOG 3 - 4 vs 0 - 2	3.41 (1.81 - 6.04)	<0.001*	2.88 (1.52 - 5.22)	0.001*
Metastasis	Present vs Absent	3.07 (1.64 - 5.58)	<0.001*	2.66 (1.34 - 4.98)	0.003*
Treatment Intent	Palliative vs Curative	4.76 (2.58 - 8.88)	<0.001*	4.12 (2.21 - 7.84)	<0.001*
Treatment Modality	Chemo-radiation vs Radiotherapy	2.01 (1.11 - 3.74)	0.024*	—	—

Note: * Statistically significant ($p < 0.05$).

3.4. Treatment Completion

Of 402 patients, 277 (68.9%) completed the prescribed radiotherapy course and 125 (31.1%) did not complete treatment. Documented morbidity was recorded in 89 of 125 patients who did not complete treatment (71.2%) and in 177 of 277 patients who completed treatment (63.9%). A recorded death was documented in 45 patients who did not complete treatment (36.0%) and in 41 patients who completed treatment (14.8%). These exploratory comparisons describe associations only and should not be interpreted as causal effects of treatment completion.

4. Discussion

This retrospective single-centre study found that documented treatment-related morbidity was common among patients receiving radiotherapy at UDUTH, occurring in approximately two-thirds of the cohort. A death was documented in 21.4% of records during the record-review period. These findings should be interpreted in the context of a case mix characterized by advanced disease: 71.2% of patients had stage III or IV. The results highlight the clinical burden faced by radiotherapy services in north-western Nigeria and identify patient groups that may benefit from intensified supportive care and closer follow-up.

Anemia, skin reactions, mucositis, and fatigue were the most frequently documented adverse events. These events may reflect the combined effects of tumor-related inflammation, nutritional compromise, the anatomical sites treated, radiation exposure to normal tissues, and concurrent systemic treatment. However, as the study relied on routine documentation rather than prospective toxicity scoring, the observed prevalence represents documented morbidity and may underestimate the true frequency of adverse events [15]. The absence of standardized grading also prevents direct comparison of severity with studies using the Com-

mon Terminology Criteria for Adverse Events. This limitation should be considered when comparing the findings with reports from other centres.

Older age, comorbidity, and underweight BMI were independently associated with both documented morbidity and recorded mortality. Patients aged 60 years or older had higher odds of morbidity and mortality than younger patients, while comorbidity was associated with 88% higher odds of morbidity and 71% higher odds of mortality. These patterns are clinically plausible because advanced age and chronic illness may reduce physiological reserve, complicate treatment delivery, and increase vulnerability to acute illness during cancer therapy [16]. Underweight patients also had nearly twofold higher adjusted odds of both morbidity and mortality than patients with normal BMI. This finding supports systematic nutritional screening and early intervention as part of routine oncology care; ESPEN guidance recommends structured identification, prevention, and management of malnutrition throughout cancer treatment [17].

Disease burden was strongly associated with adverse outcomes. Compared with stage I disease, stage IV disease was associated with nearly fourfold higher odds of documented morbidity and more than fourfold higher odds of recorded mortality. Similarly, poor performance status and distant metastasis were associated with increased odds of both outcomes. These associations are expected because advanced disease may be accompanied by greater symptom burden, impaired nutritional and functional status, and a higher likelihood of palliative treatment. Nevertheless, stage, metastatic status, and treatment intent are clinically interconnected; therefore, the adjusted estimates should be interpreted as associations within this dataset rather than independent causal effects. The finding that mortality rose from 5.1% in stage I disease to 36.0% in stage IV disease reinforces the importance of strategies that promote earlier presentation, diagnostic assessment, referral, and timely access to treatment.

Palliative treatment intent was associated with higher odds of morbidity and mortality. This should not be interpreted as an adverse effect of palliative radiotherapy. Instead, it primarily reflects the clinical characteristics of patients selected for palliative treatment, who commonly have advanced, metastatic, symptomatic, or incurable disease. Palliative radiotherapy remains an important intervention for symptom relief and quality of life; its benefit should be evaluated using outcomes appropriate to palliative care, such as pain relief, bleeding control, functional improvement, and patient-reported quality of life, rather than mortality alone. Similarly, the higher crude mortality observed in selected cancer sites must be interpreted cautiously because site-specific groups differed in sample size, stage distribution, treatment intent, systemic therapy exposure, dose prescription, and available follow-up.

Non-completion of radiotherapy was associated with a higher frequency of documented morbidity and recorded death. However, treatment completion occurs after treatment initiation and may be influenced by toxicity, functional decline, disease progression, financial or logistical barriers, hospitalisation, or death. Re-

verse causation is therefore plausible. The observed association should be interpreted as exploratory and cannot establish that treatment non-completion caused adverse outcomes. Prospective studies recording the timing and reasons for interruption, toxicity onset, disease progression, and vital status are required to clarify these relationships. In curative radiotherapy, unplanned prolongation of overall treatment time may compromise local tumor control, particularly for rapidly proliferating tumors such as head and neck and cervical cancers [8] [18]. Services should therefore monitor treatment interruptions prospectively, document their causes, and institute context-appropriate measures to support treatment completion and compensate for clinically meaningful interruptions when appropriate [8] [18].

The present findings have several practical implications. At radiotherapy initiation, patients who are older, underweight, have comorbidity, poor ECOG performance status, advanced-stage disease, or metastatic disease should be flagged for proactive multidisciplinary assessment. Nutritional evaluation, management of anemia and symptoms, early palliative-care integration where indicated, and active follow-up for missed appointments may help mitigate potentially modifiable contributors to poor outcomes. Future prospective multicentre studies should use standardized toxicity grading, prospectively collect treatment interruptions and their causes, distinguish planned from delivered dose and fractions, record concurrent chemotherapy administration, and apply a defined survival follow-up period. Such work would permit more reliable estimates of treatment toxicity, survival, and the consequences of service-related barriers [17].

5. Conclusion and Recommendations

In this record-review cohort, documented morbidity and recorded death were more frequent among patients with markers of clinical vulnerability and advanced disease. Because death dates and complete vital-status follow-up were unavailable, these mortality findings should not be interpreted as survival estimates or directly comparable mortality risks. Recommended actions include:

- 1) Integrate routine nutritional screening and timely dietetic support into oncology and radiotherapy care.
- 2) Establish a treatment-interruption register documenting cause, duration, and corrective action for every missed treatment.
- 3) Prioritize symptom assessment and supportive care for patients with poor performance status, underweight BMI, comorbidity, or advanced disease.
- 4) Strengthen early diagnosis, referral pathways, and access to oncology services to reduce the high proportion of advanced-stage presentation.
- 5) Conduct prospective multicentre studies using standardized toxicity grading and defined follow-up to evaluate survival and treatment outcomes across Nigeria.

6. Strengths and Limitations

This study provides data from a radiotherapy centre serving north-western Nige-

ria, where evidence on treatment outcomes is limited. It included 402 patients with several common cancer types and evaluated documented treatment-related morbidity and recorded all-cause mortality as separate outcomes using demographic, clinical, disease-related, and treatment variables.

Several limitations should be considered. The retrospective single-centre design limits generalizability and depends on the completeness of routine records. Adverse events were identified from clinician documentation and were not prospectively graded using a standardised tool such as CTCAE [15]; morbidity may therefore have been under-recorded or inconsistently classified. Dates of death, last contact, and verified vital status were not systematically available, precluding calculation of follow-up time, censoring, or survival estimates. Recorded mortality may consequently be under-ascertained and should not be interpreted as directly comparable mortality risk. Residual confounding is possible because stage, metastasis, treatment intent, treatment characteristics, and treatment completion are closely related. Socioeconomic factors, travel distance, chemotherapy details, reasons for interruption, and cause of death were not consistently available.

Author Contributions

JB and AD conceived the study. JB performed data collection and analysis. BB and HI supervised the study. All authors contributed to manuscript preparation and approved the final version.

Conflicts of Interest

The authors declare no conflict of interest.

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