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CAUSES, TIMING AND EFFECTS OF RADIOTHERAPY TREATMENT BREAKS IN NSIA-LUTH CANCER CENTRE

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ABSTRACT

Introduction: Cancer treatment includes several modalities that must be completed within specified periods to improve treatment outcome. Radiotherapy as a vital part of managing cancer demands that overall time be kept as short as possible to prevent repopulation of the cells which can affect local control and thus the overall survival of the patient. This study highlights the causes, timing, and patients' attitude to this break during radiotherapy treatment at NSIA-LUTH Cancer Centre (NLCC).

Methods: In this hospital based cross sectional study, 217 patients undergoing curative radiotherapy were recruited. Data analysis was done using STATA 16 and results were presented as measures of central tendency.

Results: The prevalent reasons for missing treatment included public holidays (82%), side effects (27.2%) and machine breakdown (11.1%). The average number of days missed due to machine breakdown was about 4 to 5 days and for side effects and public holidays was 2 to 3 days. Treatment break peaks was at the fourth week in gynecologic and head and neck cancers while second week in breast cancers. The findings showed significant association between increased number of missed treatment days and concurrent chemotherapy, and gynaecological cancers while reduced number of missed treatment days with increasing age.

Conclusion: We aimed to improve cancer care delivery by identifying the key factors causing interruptions and suggesting actionable recommendations. It is crucial to plan for the treatment period and avoid unnecessary breaks, which should be compensated to prevent adverse effects.

Therefore, we urge Nigerian public health services to prioritize the expansion of radiotherapy access through upgrades in equipment, workforce capacity, and aligning resources with the evolving needs of cancer patients in the country for research and clinical purposes

KEYWORDS: Radiotherapy, Treatment- Breaks, Cancer

INTRODUCTION

Cancer treatment, particularly radiotherapy, is a critical aspect of oncological care that aims to target and eradicate cancer cells while minimizing damage to healthy tissues. A conventional course of radiotherapy is scheduled five days per week over several weeks, depending on the cancer type.[1] Patients missing two or more scheduled radiation therapy appointments are classified as non-compliant and experience treatment breaks.[2]

It has been observed that interruptions in cancer treatment can have a detrimental effect on patients' treatment outcomes. Such breaks allow malignant cells to repopulate at an accelerated rate, leading to faster tumor growth.[3,4] To mitigate the effects of accelerated tumor regrowth and reduce the duration of treatment, preventive strategies have been taken such as hyperfractionation, hypofractionation and accelerated fractionation.[3]

Radiation treatment delays can be disease-related, treatment-related or patient-related factors. Disease-related factors include worsening clinical conditions or disease progression; treatment-related factors may be side effects and toxicity of the treatment regimen and patient-related factors are lack of awareness, difficulty in logistics due to the protracted course of treatment, and low socio-economic conditions.[5] Taking a break from treatment, even for a single day, can lead to a decrease in local control by 1.4% in head-and-neck cancers.[4]

Vanderpuye highlighted a significant number of African countries, precisely 29, which are currently unable to provide radiation services to their populations. Even in countries where these services are available, the cost of maintenance is often prohibitive, with limited expertise in managing equipment. As a result, these facilities are under great pressure, leading to extensive delays in the commencement of treatment for patients in need of radiation services.[6] Pozo et al also postulated that the majority of interruptions, accounting for almost 70%, were due to public holidays, servicing, or linear accelerator failure.[7]

According to a recent study on patients with head and neck cancer receiving definitive radiotherapy, taking a break from treatment, whether it is a short pause ranging from 2-8 days or a longer pause exceeding 8 days, can negatively impact the 5-year overall survival rate. Factors that may predict treatment interruption include comorbidities, insurance status, T stage, and receipt of systemic therapy. Identifying patients at risk for such breaks early on may aid in their prevention.[8]

This study aimed to investigate and understand the factors that contribute to treatment breaks in radiotherapy, including their causes, timing, and potential effects, within the context of the NSIA-LUTH Cancer Centre.

METHODS

This comprehensive cross-sectional study was conducted between March and August 2022 at the NSIA-LUTH Cancer Centre (NLCC) in Lagos, Nigeria. The Centre is the largest and most advanced cancer treatment centre in Nigeria offering radiotherapy, chemotherapy, targeted therapy, immunotherapy and other relevant cancer treatment. NLCC was built as a public-private partnership using Build-Operate-Transfer model. This has helped in reducing downtime of the treatment machines

to a minimum, ensuring more efficient operations and improved patient care.
We included all patients within the study period (March to August 2023) who were receiving curative/radical radiotherapy with the LINACs (IMRT/VMAT/3DCRT).

Data was retrieved using both Electronic Medical Records and phone calls. Electronic medical records provided an in-depth understanding of the patients' sociodemographic and cancer characteristics. The researchers used phone calls to collect information on patients' knowledge of cancer and its treatment, root causes of treatment interruptions, patients' attitudes towards treatment breaks, effects of treatment breaks, and preventive measures that could be implemented to avoid future treatment breaks.

Informed consent was obtained from all the patients before data collection. The data collected were analyzed using STATA 16 software. The software facilitated the use of descriptive statistics to summarize patient characteristics, treatment interruptions, and treatment outcomes.

This study was approved by the Lagos University Teaching Hospital Health Research and Ethics Committee.

RESULTS

The study included 217 patients who underwent curative radiotherapy. Table 1 summarizes the sociodemographic characteristics of the study participants. The mean age was 53 ± 13.7 years and 65.4% of the patients were predominantly female. Family members (97.2%) were most commonly responsible for the care payments. The clinical characteristics of the patients are presented in Table 2. Breast cancer was the most commonly reported tumor type (38%). Other tumors included gynaecological (19.2%), genitourinary (14.4%), head and neck (13.9%) and gastrointestinal cancers (8.2%). Stage 3 cancer was the most prevalent (35.6%). Approximately one-third (29.5%) of patients received concurrent chemotherapy. Among those receiving concurrent treatment, the most common chemotherapy drugs were cisplatin (66%), carboplatin (17%), Xeloda (17%) and Taxol (5.7%).

Table 1: Background characteristics of study participants

Variable	Study cohort	(%)
Age		
≤30 years	10	(4.6)
31-50 years	87	(40.1)
51-70 years	96	(44.2)
>70 years	24	(11.1)
Sex		
Female	142	(65.4)
Male	75	(34.6)
Religion		
Christian	186	(85.7)
Muslim	31	(14.3)
Ethnicity		
Hausa	7	(3.2)
Igbo	56	(25.8)
Other	62	(28.6)
Yoruba	92	(42.4)
Occupation		
Business	116	(53.5)
Civil servant	30	(13.8)
Private sector	39	(18)
Student	8	(3.7)
Unemployed	10	(4.6)
Unskilled	14	(6.5)
Marital status		
Married	194	(89.4)
Single	18	(8.3)
Widow/divorced	5	(2.3)
Highest level of education		
Secondary	72	(33.2)
Tertiary	145	(66.8)
Person responsible for payment of care*		
Insurance	10	(4.6)
Workplace	9	(4.1)
Family member	211	(97.2)
Friends	29	(13.4)

Self	54	(24.9)
Family/friends/acquaintance with cancer		
No	187	(86.2)
Yes	29	(13.4)
Past history of cancer		
No	210	(96.8)
Yes	7	(3.2)

*Multiple responses allowed

Table 2: Clinical features of cancer diagnosis

Site of cancer (N=208)	**Study cohort**	**(%)**
Breast	79	(38.0)
CNS	4	(1.9)
GIT	17	(8.2)
GUS	30	(14.4)
Gynaecological	40	(19.2)
Head & Neck	29	(13.9)
Sarcoma	5	(2.4)
Others	4	(1.9)
Stage of cancer (N=208)		
Stage 1	33	(15.9)
Stage 2	62	(29.8)
Stage 3	74	(35.6)
Stage 4	37	(17.8)
X	2	(1.0)
Concurrent treatment with radiotherapy (N=174)		
No	110	(50.7)
Yes	64	(29.5)
Concurrent treatment (n=53)		
Carboplatin	9	(17)
Cisplatin	35	(66)
Xeloda	9	(17)
Paclitaxel	1	(1.9)
Taxol	3	(5.7)
5- fluorouracil	1	(1.9)

All 217 patients were aware of what they were being treated for, with only a few (10.6%) aware of their prognosis. All patients were aware of the possible side effects of the

treatment. Most (64.1%) respondents had received cancer treatment prior to radiotherapy. Previous cancer treatments included chemotherapy (25.8%), chemotherapy combined with surgery (50.8%) and surgery alone (21.2%). Of all the patients, 93 (38.7%) reported other medical conditions which were majorly hypertension (24.9%) and diabetes (7.4%). Other conditions include asthma, bipolar disorder, glaucoma, hepatitis B infection, heart disease, peptic ulcer disease, retinal vascular disease, thyroid disorders, visual loss and vitiligo. Of the 93 patients with comorbidities; 35% were on other medications.

All respondents saw their doctors at least once a week to lodge complaints during radiotherapy treatment, and they all reported missing at least one session during radiotherapy treatment. Figure 1 shows the number of times the patients missed their radiotherapy treatment. Of the respondents who missed appointments, 39.5% missed 2-3 times, (20.9%) missed more than five times. Figure 2 highlights the reasons given by the respondents for missing treatment. Public holidays (59%) side effects (16%) and machine breakdown (8%) were the most reported reasons for missing their radiotherapy treatment.

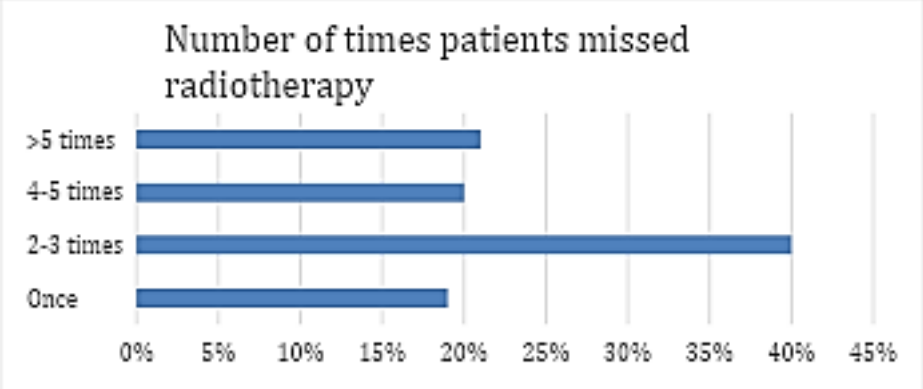

Figure 1: Number of times patients missed radiotherapy.

Figure 2: Reasons for missing radiotherapy

Figure 3 describes the attitudes and beliefs about radiotherapy. Respondents unanimously disagreed with any suggestion that radiotherapy was ineffective, a waste of time and money, or less preferable to alternative medicine. However, a significant proportion (91.2%) expressed concerns about the potential side effects of the treatment, whereas

the majority (81%) claimed to fully understand it. In terms of efficacy, 56% of respondents reported seeing improvement after previous sessions, while 10.2% did not. Nonetheless, almost all respondents (99.5%) expressed satisfaction with the quality of service they received during radiotherapy. Importantly, none of the respondents cited religious or cultural beliefs as a reason for not undergoing radiotherapy. Furthermore, most respondents (91.7%) did not believe that missing radiotherapy sessions would significantly affect their treatment response, and almost all (99.1%) held a neutral stance on whether missing sessions could increase the risk of cancer recurrence.

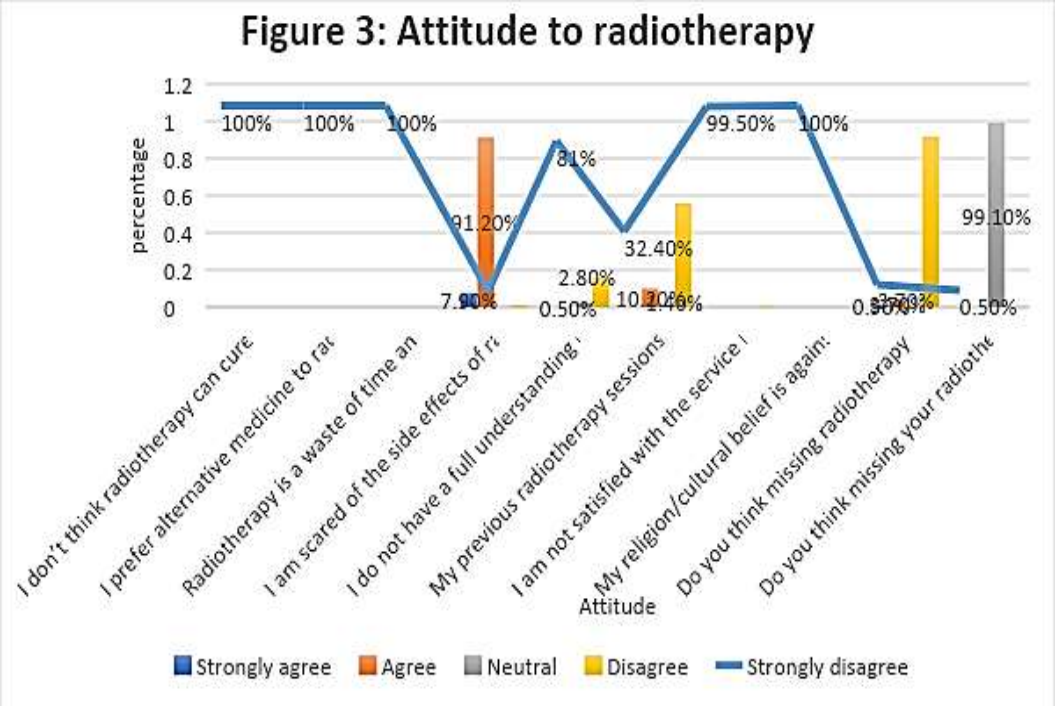

Figure 3: Attitude to radiotherapy

All respondents (100%) agreed that interruptions in radiotherapy affected their recovery. However, 99.5% of the patients reported no negative signs or symptoms after interruption in radiotherapy. Similarly, 99.1% of respondents indicated no improvement after treatment break.

All respondents (100%) agreed that regular maintenance of hospital equipment, staff availability, and prioritization of Public Holidays are essential for improving treatment planning. They also suggested improving communication with ambulance services to address transportation issues, providing psychological and social support for patients, training hospital staff to enhance the services provided, and ensuring proper communication between patients and doctors. The respondents highlighted the importance of regular follow-ups by the Centre via phone calls or messages. Some suggested that lowering the price of treatment (21.8%) and introducing a social support group (4.6%) would be beneficial.

Patients with gynecologic cancer were more likely to have more missed treatment days (β=0.257 p=0.028). Although increasing age and coexisting diabetes were not statistically significant predictors of missed treatment days (β= -0.035, p=0.078), they showed a trend towards significance. Concurrent chemotherapy did not increase the number of missed treatment days (β= -0.240 = 0.004). Additionally, there was no statistically significant association between gender, coexisting hypertension and the number of missed treatment days.

DISCUSSION

In this study, a cross-sectional survey was conducted at one of the major cancer centres in Nigeria to understand the causes, timing and effects of treatment interruption among patients undergoing curative radiotherapy.

All the respondents reported they had missed at least one radiotherapy appointment. According to Pozo et al., 73% of the participants missed at least one day of radiotherapy treatment.[7] Lee et al. found that 13.4% of patients experienced radiation treatment interruptions during their study on radiation therapy interruptions, which was lower compared to our study.[9] Twenty percent had missed only once, 39.5% of the respondents missed appointments 2-3 times and 20.9% missed more than five times. This rate is higher when compared to a study conducted in Iran that found treatment interruption in 29.3% of patients: 13.2% of patients had 1 to 3 days gap, 11.2% had a 4 to 30 days gap, and 4.9% of patients had more than 30 days gap.[1]

Studies have shown that public holidays can significantly impact radiotherapy treatment, leading to unscheduled treatment breaks and potentially negative effects on treatment outcomes.[5] In this study, public holidays were the most common cause of treatment break (59%). This is similar to findings in other studies (39-69%).[11,12]

To mitigate the impact of these breaks, various strategies have been proposed, including the use of Cox regression to evaluate their effect on treatment outcomes and the application of time factor principles in radiotherapy to compensate for interruption.[13,14]

Side effects (16%) were reported as the second cause experienced by these patients which is similar to a study conducted in India, which revealed that 20% of the respondents experienced treatment breaks due to treatment-related toxicity[15] and lower when compared to studies conducted in Iran (16.7%) and Vancouver (10%).[1] Interruptions due to side effects can be curbed by establishing side-effect clinics with managing specialists to improve patient outcomes.

The second most common cause of treatment break was machine breakdown (8%). A study by Razmjoo et al. indicated that the most frequent cause of stopping medical treatment in Iran is machine breakdown or maintenance, which accounts for 29.5%.[1] This machine breakdown increases the wait time which discourages patients from being compliant with treatment as shown in research conducted in Nigeria.[16,17] At the Golestan Hospital, Iran a study to identify the causes of treatment interruption among radiotherapy patients, revealed that the most common cause of interruption in the treatment course was equipment damage and/or maintenance (29.5%). Other causes were treatment side

effects and general conditions (16.7%), public holidays (8.1%), patients' death (5.3%), trip difficulties (4.7%) and treatment cost (1.9%).[1]

A solution to this is to schedule frequent maintenance, servicing of these machines, and investment in radiotherapy services in Nigeria, including private-public partnerships.[18] The establishment of NLCC, a private-public partnership has brought about a change in this narrative.

All the respondents believed that radiotherapy can cure cancer, which is encouraging, as their belief will improve the uptake of radiotherapy. The majority (96.2%) of respondents expressed a full understanding of radiotherapy. This positive perception highlights the importance of educating patients and having effective communication to establish trust and ensure adherence to treatment protocols. Almost all respondents were neutral about the statement that missing radiotherapy sessions can cause cancer recurrence.

Patient satisfaction with services received during radiotherapy was 99.5%, which corresponds to another study (94.9-98.8%).[19] Cancer treatment, including radiotherapy, can pose a financial burden on patients; however, all respondents did not think radiotherapy was a waste of time and finances, as after their radiotherapy sessions had shown improvement.

Although treatment interruptions can have a negative impact on recovery, the majority of patients did not report any adverse signs or symptoms after taking breaks during radiotherapy which is in contrast to previous studies that have shown detrimental effects of interruptions on treatment outcomes.[20,21] This implies that long-term follow-up is necessary to confirm this finding.

Areas of improvement suggested by respondents were prioritization of public holidays before commencing treatment, regular hospital equipment maintenance, staff availability and training, communication with ambulance service to improve transportation problems, provision of psychological and social support for patients, patient-doctor communication and regular follow-up by the Centre through phone calls or messages. Optimizing treatment delivery by addressing logistical barriers improves the patient experience.

Limitations

Given it's a single-centre setting, this limits the generalization of the findings to a broader patient population. Long-term treatment outcomes were not discussed due to lack of follow-up data.

CONCLUSION

In resource-constrained settings, our research aimed to improve cancer care delivery by identifying the key factors causing interruptions and suggesting actionable recommendations. To ensure that cancer patients receive timely and effective radiotherapy treatment, it is crucial to plan for the treatment period and avoid unnecessary breaks, which should be compensated to prevent adverse effects. The Nigerian government should prioritize the expansion of radiotherapy access through upgrades in equipment, workforce capacity, and infrastructure, aligning resources with the evolving needs of cancer patients in the country for research and clinical purposes.

Conflicts of interest

The authors declare that they have no conflicts of interest.

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