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Barriers to radiotherapy access at the University College Hospital in Ibadan, Nigeria

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ABSTRACT

Introduction: Nigeria has the biggest gap between radiotherapy availability and need, with one machine per 19.4 million people, compared to one machine per 250,000 people in high-income countries. This study aims to identify its patient-level barriers to radiotherapy access.
Material and methods: This was a cross sectional study consisting of patient questionnaires ($n = 50$) conducted in January 2016 to assess patient demographics, types of cancers seen, barriers to receiving radiotherapy, health beliefs and practices, and factors leading to treatment delay.
Results: Eighty percent of patients could not afford radiotherapy without financial assistance and only 6% of the patients had federal insurance, which did not cover radiotherapy services. Of the patients who had completed radiotherapy treatment, 91.3% had experienced treatment delay or often cancellation due to healthcare worker strike, power failure, machine breakdown, or prolonged wait time. The timeliness of a patient's radiotherapy care correlated with their employment status and distance from radiotherapy center ($p < 0.05$).
Conclusions: Barriers to care at a radiotherapy center in a low- and middle-income country (LMIC) have previously not been well characterized. These findings can be used to inform efforts to expand the availability of radiotherapy and improve current treatment capacity in Nigeria and in other LMICs.

Introduction

The proportion of cancer cases occurring in the developing world is expected to shift from 56% in 2008 to greater than 70% in 2030, and cancer rates will nearly double in some low-income countries where screening programs are scarce and awareness is limited [1]. Due to these limitations, patients in these areas often present with inoperable advanced-stage malignancy requiring multiple treatment modalities, including radiotherapy. It is estimated that the proportion of cancer patients who should receive external beam radiation is approximately 50% [2,3]. However, there is a worldwide shortage of radiotherapy, with over 50% of cancer patients in low and middle income countries (LMICs) lacking access to radiotherapy services [4]. More alarmingly, greater than 90% of cancer patients in low-income countries lack access to radiotherapy services [4]. Yet this fundamental component of cancer treatment has been absent from global heath discussions and has received limited international funding.

Prior studies show that Africa is the least developed region with respect to radiotherapy services, with less than one teletherapy machine per one million people [5]. Most radiotherapy departments in Africa are basic, delivering palliative and simple, curative services based on two-dimensional imaging and treatment planning, with only 2% of centers equipped with modern imaging equipment and treatment planning software 5. According to the International Atomic Energy Agency, the biggest gap between radiotherapy machine availability and need is in Nigeria. Nigeria has only one radiotherapy machine per population of 19.4 million people, compared to the one machine per 250,000 people available in high income countries [6,7]. As in other under-resourced countries, the paucity of radiotherapy machines requires that patients travel long distances for daily treatment, thus decreasing the likelihood that

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patients will receive curative or palliative radiotherapy [8]. In addition to travel and accommodation expenses, lack of cancer awareness, poverty, beliefs that cancer is caused by evil spirits, and fear or mistrust of medical care also limit access to care [9].

Efforts to increase access to radiotherapy in Nigeria began with the acquisition of a cobalt-60 machine at the Lagos University Teaching Hospital in 1968. By the end of 2010, the number of commissioned teletherapy machines increased to eight, comprising three Cobalt-60 machines and five linear accelerators (Linacs). However, this increase in radiotherapy centers is only a marginal improvement, considering that Nigeria's rapidly growing population, which is the seventh largest in the world, is projected to surpass that of the United States (US) in 2050, making it the third largest [10]. Moreover, at any given time only one or two of these teletherapy centers are functioning due to lack of radiation therapy accessories or the breakdown of essential electrical or mechanical machine components [11]. Given these disparities in radiotherapy, there is a need to increase the availability of radiotherapy, optimize existing resources and promote greater equity in cancer treatment access in Nigeria and other under-resourced countries.

Organizations like the International Cancer Expert Corps and the International Atomic Energy Association (IAEA) have accepted the clarion call to improve cancer care and expand the availability of radiotherapy to LMICs [12]. To better support these efforts, there is a need to understand the barriers to effective patient care. To this end, this is a formative research study that aims to identify the social, cultural, political, and economic barriers to receiving radiotherapy care in Nigeria.

Materials and methods

This was a cross sectional study consisting of patient questionnaires, conducted from January 4, 2016 to January 20, 2016, in the Radiation Oncology Department at University College Hospital (UCH), University of Ibadan (UI) in Ibadan, Oyo State, Nigeria. This study was approved by the UI/UCH Ethics Committee. Written informed consent was obtained from each patient participant before inclusion in the study.

The study questionnaire was based on a reading level below the 8th grade and was pre-tested with a sample of five Nigerian patients for comprehension prior to data collection. During clinic days at the Radiation Oncology Department, all patients encountered in the waiting room were approached and asked if they would like to complete an interviewer-administered questionnaire about barriers to receiving radiotherapy treatment. Initially, the inclusion criteria were limited to patients who were currently receiving radiotherapy treatment, but given that the radiotherapy machine at UCH was not working at the time of the study, the inclusion criteria were modified to include patients who were told that they required radiotherapy in the future or patients who had already received radiotherapy. Fifty patients were interviewed, with four requiring a Yoruba language translator. Five patients were approached but did not meet the inclusion criteria and another five patients refused to participate.

After informed consent, patients answered questions regarding their sociodemographic characteristics as well as information regarding their cancer diagnosis and treatment. Educational attainment in all of Nigeria and in Oyo State was obtained from the 2013 Nigeria Demographic and Health Survey for comparison purposes [13]. Miles traveled to get to UCH was computed by determining the distance from home town to Ibadan, Nigeria [14].

Statistical analysis

Univariate analysis of sociodemographic factors, perceived barriers to care, and previous cancer care experiences was done. Among those who had prior radiotherapy, univariate and multivariable linear regression was used to assess the relationship between sociodemographic factors and length of time from diagnosis to radiation treatment. We used the "gvselect" Stata program to determine the set of independent variables with the lowest Akaike Information Criterion value for inclusion in the multivariable linear regression model. The covariates included in the regression model were treatment location, number of children, employment status, and distance from patient's home to the hospital. Collinearity was checked by calculating the variance inflation factors, which were all below 2.0. Listed p-values are from two-sided tests. Data was analyzed using Stata 13.1 (StataCorp. 2013. Stata Statistical Software: Release 13. College Station, TX: StataCorp LP).

Results

As of January 2016, there were eight radiotherapy centers in Nigeria, one private center and seven public centers (See Supplemental file). During the time of the study, only two centers had functioning radiotherapy machines. The sociodemographic characteristics of the 50 sampled patients are presented in Table 1. The median distance from home to UCH was 126 miles. Over 50% of the sampled population had attended graduate school, university, or technical training, compared to 5.6–8.9% in all of Nigeria and roughly 9% in Oyo State. Only 6% of the patients had federal health insurance, but the federal health insurance does not include comprehensive cancer coverage. Eighty percent of patients were unable to afford radiotherapy without financial assistance.

Information regarding the patient's knowledge, beliefs, and practices related to cancer is presented in Table 2. Patients waited a median of 2 months between symptom onset and seeking care. Only 46% of patients had heard of cancer through media or social networks prior to their diagnosis. Nearly a third (26%) of patients believed that witchcraft could cause cancer. Most patients (92%) believed that cancer can be cured.

Table 3 shows the treatment characteristics of the study population. None of the patients were currently receiving radiotherapy as the machine at UCH was inoperative. Most (86%) patients had received prior chemotherapy and 43% had received prior radiotherapy. Ninety-one percent of the patients who had prior radiotherapy experienced a treatment delay (n = 47). Reported causes of treatment delay included healthcare workers' strikes (13%), power failure (15%), machine breakdown (83%), and/or prolonged wait times from high patient volumes (26%). Among those who received radiotherapy, the median length of time between diagnosis and their first course of radiotherapy treatment was 12.2 months. Of the 21 patients who had received prior radiotherapy, 19% had received radiotherapy at a private radiotherapy center. All prior radiotherapy recipients had also received chemotherapy. Prior treatments received also included surgery (62.5%) and treatments from traditional healers (19.6%).

The results of the linear regression with months between diagnosis and radiotherapy treatment as the dependent variable is shown in Table 4. There was no significant relationship between length of treatment delay and age, educational level, borrowing of money for treatment, usage of a traditional healer, sex, treatment in a public versus private center, or prior surgery. For each unit increase in miles from home to UCH the time between diagnosis and treatment significantly increased by one day. Being unemployed significantly increased time to treatment by 10.7 months.

Discussion and recommendations

Currently, there are no studies that characterize patient-experienced barriers to receiving radiotherapy in an

Table 1
Sociodemographic characteristics of patients in the Radiation Oncology Department at University College Hospital in Ibadan, Nigeria.

	Median (Range)		
Age (in years)	55 (18–88)		
Distance from home to UCH (in miles)	126 (0–847)		
	n (%)		
Mode of transportation			
Walking	1 (2%)		
Car	25 (50%)		
Public transportation (bus)	24 (48%)		
Female sex	37(74%)		
Highest Educational level		Education Level in Nigeria [11] (Male, Female)	Educational Level in Oyo State [11]
None	5 (10%)	29.5%, 40.4%	21.9%, 24.9%
Primary School (completed 6th grade)	12 (24%)	9.8%, 9.5%	10.7%, 11.9%
Secondary (completed high school)	6 (12%)	15.2%, 10.6%	21.1%, 15.2%
Completed more than Secondary	27 (54%)	8.9%, 5.6%	8.6%, 8.7%
Technical/vocational training	3 (6%)		
University	18 (36%)		
Graduate school	6 (12%)		
Marital status			
Single	2 (4%)		
Married	45 (90%)		
Widowed	3 (6%)		
Occupation			
Unemployed	27 (54%)		
Proportion unemployed due to cancer	19 (70.4%)		
Artisan*	2 (4%)		
Office work/professional	12 (24%)		
Business owner	2 (4%)		
Unskilled employment/informal income generating activities	5 (10%)		
Patients with federal insurance	3 (6%)		
Method of payment for care			
Borrowed or gifted money from family, friends, or church	40 (80%)		
Employer	1 (2%)		
Insurance	0 (0%)		
Completely self-pay	10 (20%)		

* Artisan refers to carpenter, plumber, electrician, farmer.

Table 2
Cancer beliefs and care-seeking practices among patients in the Radiation Oncology Department at University College Hospital in Ibadan, Nigeria.

	Median (Range)
Months between symptom onset and care seeking	2 months (0–60)
	n (%)
Cancer found during routine screening	0 (0%)
Awareness of cancer through media or social networks before diagnosis	23 (46%)
Patient-identified cancer risk factors	
Drinking unsafe water/eating unsafe food	7 (14%)
Smoking	24 (48%)
Alcohol	16 (32%)
Viral or bacterial infection	8 (16%)
Environmental pollution	15 (30%)
Physical trauma	4 (8%)
Family history	21 (42%)
Witchcraft	13 (26%)
Don't know	17 (34%)
Belief that cancer can be cured	46 (92%)

under-resourced country. Eighty percent of the sampled patients were unable to afford radiotherapy treatment without assistance. Patients who are unable to receive assistance to pay for radiotherapy treatment may elect for treatment with chemotherapy, which

Table 3
Distribution of tumor types and prior treatment among patients in the Radiation Oncology Department at University College Hospital in Ibadan, Nigeria.

	Males n(%)	Females n(%)	Prevalence in Nigeria n(%) [1]
Type of cancer			
Breast	18 (36%)	0 (0%)	37.7%
Colorectal	0 (0%)	0 (0%)	3.7%
Lung	0 (0%)	2 (4%)	0.4%
Prostate	0 (0%)	0 (0%)	13.4%
Cervical	11 (22%)	0 (0%)	15.4%
Anal	2 (4%)	0 (0%)	NA
Vaginal	2 (4%)	0 (0%)	NA
Eye	0 (0%)	2 (4%)	NA
Other*	4 (8%)	9 (18%)	NA
Currently receiving radiotherapy	0 (0%)		
Prior treatments received			
Chemotherapy	43 (86%)		
Radiation	23 (46%)		
% who had a delay	91.3%		
Surgery	30 (62.5%)		
Traditional healer	9 (19.6%)		
	Median (Range)		
Length of time between diagnosis and radiotherapy treatment	12.2 months (1–44.7)		

* 8 head and neck, 2 hematological, 1 ovarian, 1 rhabdomyosarcoma of the thigh, 1 skin.

Table 4
Results of linear regression analyses with months between diagnosis and radiotherapy initiation (treatment delay) as outcome variable.

Independent Variable	Univariate Analysis ß (p value)	Multivariable Analysis[±] Adjusted ß (p value)
Borrowed money for treatment? (Yes = 1, No = 0 (ref))	11.6 (p = 0.067)	NA
Used traditional healer? (Yes = 1, No = 0 (ref))	3.2 (p = 0.630)	NA
Distance from home to UCH (in miles)	0.03[*] (p = 0.006)[**]	0.04 (p = 0.002)[**]
Unemployed? (Yes = 1, No = 0 (ref))	7.8 (p = 0.0.131)	10.7 (p = 0.023)[**]
Sex (Female = 1, Male = 0(ref))	2.1 (p = 0.748)	2.5 (p = 0.685)
Number of children	0.4 (p = 0.504)	1.0 (p = 0.067)
Treated in a public center? (Yes = 1, No = 0 (ref))	2.6 (p = 0.706)	7.8 (p = 0.118)
Surgery (Yes = 1, No = 0 (ref))	9.4 (p = 0.087)	NA
Age	-0.08 (p = 0.551)	NA

[±] Covariates in multivariable regression model include treatment location, number of children, employment status, and distance from patient's home to the hospital.
[*] ß of 0.03 corresponds to 1 day increase in time between diagnosis and radiotherapy for each unit increase in miles from home to UCH.
[**] $p < 0.05$.

is less expensive, or opt out of all treatments. The federal government does not offer comprehensive cancer coverage, even for those with the National Health Insurance Scheme (NHIS) [11] In addition to the disparity in radiotherapy access by socioeconomic status, it is important to note the disparities by educational level. Given that sampled patients were more educated than the general population, efforts need to be made to understand why these disparities exist.

Women composed 74% of our sample and although the 5-year prevalence of prostate cancer in Nigeria is 12.4%, no male in this study had prostate cancer. This gender bias is inconsistent with prior studies suggesting that women have limited access to healthcare resulting from their economic dependence on men [15,16]. However, the prior studies examined other medical issues rather than cancer care-seeking behaviors. It is possible that this discrepancy can be attributed to the fact that most of the prostate cancer cases in Nigeria are seen by the urologists prior to referral for radiotherapy, and there is often no utility for a radiotherapy referral if the machine is not working. This could also indicate that men in Nigeria are not receiving appropriate cancer screening or seeking cancer care. Except in select cases, for example when low-income or minority neighborhoods are selected for toxic dumping sites and thus have a disproportionate exposure to environmental carcinogens, cancer does not discriminate [17] Further efforts need to be made to increase the number of men seeking cancer care in Nigeria and ensure that all patients have equitable access regardless of socioeconomic status, sex, or educational level.

The aforementioned disparities in access to radiotherapy may be related to a lack of cancer awareness. Less than half of the patients had heard about cancer though their social networks or knew that smoking was a risk factor for cancer. More efforts need to be made to bolster public health programs that increasing cancer awareness, particularly within Nigerian communities that have lower educational attainment and socioeconomic status. The median time between symptom onset and medical care seeking was 2 months. Given that 29% of the patients visited traditional healers prior to seeking medical care, efforts to encourage prompt medical care seeking might also include training traditional healers to detect cancer signs and symptoms and to refer patients to hospitals for cancer screening, diagnosis, and treatment. A study conducted at UCH reported that traditional healers are willing to partner with medical professionals to encourage cancer screening [18]. Given the heavy presence of the Christian and Muslim faiths in Nigeria, future studies might also explore how faith-based healing impacts care seeking behaviors of patients in Nigeria [19].

Patients are also experiencing delays between diagnosis and receipt of care. The median time between diagnosis and treatment was 12.2 months, which is 4.88 times the 2.5 month waiting time before radiotherapy in the UK [20]. In addition to some of the facility-level factors that delay receipt of radiotherapy, such as inoperative machines, power failures and strikes, patients are also at greater risk of treatment delay based on their sociodemographic and financial status. Many patients are required to travel long distances to receive care because the closest radiotherapy centers have inoperative radiotherapy equipment. The median distance to UCH was 126 miles and for each unit increase in mile from home to UCH, the time between diagnosis and treatment significantly increased by one day. This finding is consistent with a prior study that shows an inverse relationship between travel time and likelihood of receiving radiotherapy [8]. This underscores the importance of ensuring better geographical access to radiotherapy through increasing the number of radiotherapy facilities. Given that 92% of the sampled patients believe that cancer is a curable disease, providers at UCH are successful in communicating the effectiveness of treatment. However, with a two-month delay before care seeking, coupled with a 12-month delay between diagnosis and treatment, many of these patients present at stages that have no chance for a cure.

In summary, the barriers to care in Nigeria included power outages, health worker strikes, machine breakdown, financial difficulty, and high patient volumes. Factors significantly increasing time to treatment include distance from radiotherapy center and unemployment. Though Nigeria is a country that is rich with natural resources, federal hospitals have insufficient healthcare budgets to improve their radiotherapy delivery capacities due to governmental corruption. However, findings from the Global Task Force on Radiotherapy for Cancer Control show that investment in radiotherapy not only saves lives, but also brings positive economic benefit [2]. These results can and should be used to advocate for the expansion of radiotherapy in Nigeria, and to inform efforts to improve federal radiotherapy sites in Nigeria.

This study is not without its limitations. The sample size was small due to the low patient volume when the radiotherapy equipment was inoperative. However, this small population is still instrumental in identifying major radiotherapy challenges in Nigeria. Moreover, since all of the patients interviewed were seen in the UCH Radiation Oncology Department waiting room, we could not capture those in the community who did not seek treatment, or those attending other radiotherapy centers. In addition, a survivor bias may be introduced if the study did not capture patients who died after experiencing longer treatment delays. Therefore, the sample may not be representative of the general population. Eight percent of the eligible patients approached refused to participate, which may also introduce selection bias. Lastly, self-reported data may be biased due to social desirability which is the tendency of survey respondents to answer questions in a manner that is more socially acceptable.

Conflict of interests statement

The authors have no conflicts of interests to declare.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.ctro.2017.05.003.

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