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Barriers to the Accessibility, Availability and Affordability of Radiotherapy Services in Nigeria

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Abstract: *Background*: Access to healthcare remains a complex notion in developing countries. In 2020, Africa accounted for 5.7% of new cancer. With an estimated 30% of them had no access to any reasonable treatment services. Owing to these limitations, patients in these areas often present with advanced-stage malignancy requiring various treatment modalities, including radiotherapy. It is estimated that approximately 50% of cancer patients would require external beam radiation. 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. This study seeks to identify the existential barriers to accessing radiotherapy services. *Methods*: A cross-sectional questionnaire-based study conducted across the seven functional radiotherapy centers in Nigeria from May 2020 – April 2021. The questionnaire includes sections on socio-demographic characteristics, cancer beliefs and care seeking practices, mapping access to care and barriers to accessing radiotherapy. Descriptive statistics (frequency and proportion) were used to describe patient demographics, cancer beliefs and care-seeking practices, while the Chi-square test was used to find the association between observed barriers and access to radiotherapy services. Access to radiotherapy services was defined as: adequate, accessible, affordable, appropriate and available. Results revealed that in: This study involved 260 patients from seven operational centers. The age of respondents ranged from 18 – 60 years with mean age of 51years (50.15 ± 14.00). About 56% (142) of the patients were between the ages of 41-60years. About 63% (162) attends routine medical check-up and cancer was found among approximately 65% (105). The majority of the patients observed had breast cancer 35.8% (91). Time between symptoms onset and diagnosis was 0-5months and > 5 months respectively. There was a significant association between patient employment status and adequacy of access to cancer screening investigation ($\chi^2 = 0.024$, $p < 0.05$). Health insurance significantly influenced the availability of ($\chi^2 = 0.016$, $p < 0.05$) access to medical devices. The expensive nature of treatment significantly influenced accessibility ($\chi^2 = 5.684$, $p < 0.05$), affordability ($\chi^2 = 4.927$, $p < 0.05$) and appropriateness ($\chi^2 = 5.095$, $p < 0.05$) of access to health practitioners. In Conclusion: The incidence of cancer is on the increase in Nigeria and access to prompt care is essential for a better prognosis. However, access to care especially radiotherapy services face a myriad of challenges from the financial burden of treatment, corruption in the health sector, attitude of attending staff, to waiting time. Access to radiotherapy services can be made more readily available

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and accessible if centers are evenly distributed across the country through a public-private partnership, periodic monitoring and evaluation of available facilities and corruption in the health sector is brought to a minimum.

Key words: Cancer · Radiotherapy services · Nigeria · Periodic monitoring · Available facilities

INTRODUCTION

Cancer is a major public health challenge and ranks as one of the leading causes of premature death in 134 countries of the world. More than 18.1 million cancer cases were reported in 2018 and an estimated 29.4 million new cases by 2040. About 21% of males and 9% of females worldwide will die from cancer [1]. Cancer is estimated to be the leading cause of disease burden in Australia in 2010, accounting for 19% of the total burden [2]. Nigeria with a current population of 206, 139, 590 was reported to have 100, 000 cancer cases in 1991 [3], that number has risen to 124, 815, with mortality of 78, 899 and a 5-year prevalence of 233, 911 according to a 2020 GLOBOCAN report [4] while 50-60% of these patients will require radiotherapy at least once during the course of treatment [5].

The need for establishment of radiotherapy centers in Nigeria arose from the increasing number of people diagnosed with Cancer and radiotherapy serves as one of the ways of managing the disease alongside surgery and administration of Cytotoxic drugs (Chemotherapy) either for curative or palliative purposes [6]. The control of cancer becomes increasingly important because as life expectancy continues to increase; the proportion of elderly people in the population will steadily increase over the next decades [7]. Therefore, it is expected that the number of cancer cases will continue to grow, as the 'baby boomers' ageing population is entering the high incidence period [8].

Aside demographic influences, other factors like socioeconomic status and ethnicity have also influenced cancer incidence [7]. Furthermore, geographical variations influence the rate of treatment and survival from cancer [9]. As the number and diversity of cancer cases increase, the pressure on specialized treatment services will increase as well, calling for better planning and allocation of healthcare resources, particularly at the regional level.

Various studies have examined the effect of geographical accessibility to radiotherapy, based on travel times/distances for patients who are to benefit from radiotherapy services. Studies in France reported lower treatment rates for rural lung cancer patients [10, 11] and concluded that increasing distance to the nearest radiotherapy center was associated with a decreasing likelihood of receiving post-mastectomy radiation therapy. Further studies [12] asserted that lung cancer patients living at a greater straight-line distance from a specialist cancer center, in rural USA, were significantly more likely to undergo surgery but were less likely to receive radiotherapy or chemotherapy than closer patients. Athas *et al*. [13] also found that breast cancer patients living further than 75 miles from a radiotherapy service center were significantly less likely to receive radiotherapy than those living closer. It is possible that the deterring effect of transportation may be even more pronounced in patients who are faced with weeks of daily outpatient treatment, as is common for radiation therapy.

The planning of efficient and accessible RT services for cancer care at regional level requires appropriate estimates of current and future cancer demand based on the spatial distribution and evolution of various socio-demographic groups; spatial accessibility based on transport network and probabilities of re-treatment. This study, therefore, seeks to determine barriers to radiotherapy services' accessibility, availability and affordability.

Access to healthcare is central to the performance of healthcare systems around the world. In fact, the importance of service delivery for people has resulted in measurement of utilization and access having a prominent role in the health policy literature [5, 6]. However, access to health care remains a complex notion as exemplified by the varying interpretations [14]. In 2010, there were 7.5 million new cases of cancer in Low- and Middle-Income Countries (LMIC) less than 30% of whom had access to any reasonable treatment services [15]. With increased population age, due to improvements in primary health care and survival from communicable diseases, as well as the adoption of unhealthy lifestyles, populations in LMIC face an expected rise in annual cancer incidence of nearly 70% by 2030 [15].

Owing to these limitations, patients in these areas often present with advanced-stage malignancy requiring various treatment modalities, including radiotherapy. It is estimated that approximately 50% of cancer patients would require external beam radiation [16, 17]. 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 [18]. More alarmingly, more than 90% of cancer patients in low-income countries lack access to radiotherapy services [18]. Yet this fundamental component of cancer treatment has been absent from global health discussions and has received limited international funding.

Studies among adolescents and young adults revealed that cancer survivors may forgo health care due to cost barriers, potentially inhibiting the early detection of late effects [19]. The financial burden of medical expenses has been increasing for cancer patients. Following the global financial crisis triggered by the collapse of Lehman Brothers in 2008, many developed countries have faced a severe economic recession. A Japanese study on patient income and medical expenses revealed that a high proportion of patients sensed financial burdens as their annual income fell, although their medical expenses did not change [20]. Financial support for patients being treated with expensive drugs remains a major problem globally. According to review research in the United States, annual direct medical costs associated with cervical cancer range from 300 to 400 million USD. A wide range of studies for estimates of the annual direct medical costs associated with carcinoma in-situ (CIN) ranges from 700 million USD to 2.3 billion USD [21].

A recent study in Taiwan reached a similar conclusion that the lifelong health impact and financial burdens are heavier for adenocarcinoma than for squamous cell carcinoma. The cost-effectiveness of prevention programs could be directly compared with that of treatment strategies to improve patient value. And the methodology could be applied to other chronic diseases for resources planning of healthcare services [22].

Nigerians on the other hand, with a minimum wage of N32, 000 especially for patients in the low-wealth quintile, may not be able to afford diagnosis, let alone procure the right medical service to manage the ailment [23]. Business day investigations show that an individual is likely to spend about N67, 000 for breast scans, mammograms, biopsies and other tests. An average surgery cost between N80, 000 and N150, 000 while chemotherapy cost ranges between N100, 000 and N500, 000 [23]. A recent investigation by reporters of The Guardian newspaper revealed that everything about cancer treatment is extremely expensive. Drugs are purchased for as much as N300, 000 monthly, while chemotherapy or radiotherapy goes for N200, 000 or more, which obviously cannot be afforded by the common man [23]. This is an indication that the financial burden of managing the ailment bites hard on the patient, worst if he or she is of a low financial status [22].

MATERIALS AND METHODS

Study Design: A cross-sectional study was adopted to elicit information from various radiotherapy centers in Nigeria from May 2020 – April 2021.

Area of Study: This study was carried out across the six geo-political zones in Nigeria to include the following nine radiotherapy centers; Lagos University Teaching Hospital (LUTH), Lagos, University College Hospital (UCH) Ibadan, Ahmadu Bello University Teaching Hospital (ABUTH), Zaria, National Hospital Abuja (NHA), Abuja, University of Nigeria Teaching Hospital (UNTH), Nsukka, Usman Danfodiyo University Teaching Hospital (UDUTH), Sokoto, University of Benin Teaching Hospital (UBTH), Benin, Federal Teaching Hospital (FTH), Gombe, Eko Hospital, Lagos.

Ethical Consideration: Ethical clearance was obtained from the Ethics Committee of the Institute of Advanced Medical Research and Training (IAMRAT), University of Ibadan/University College Hospital Ibadan (UI/EC/20/0184) and Ethical Committee of Federal Teaching Hospital (FTH), Gombe (NHREC/25/10/2013). The entire study procedure was adequately explained to the participants and their written consent was duly sought and obtained. Information obtained from them were held in strict confidence and used only for the purpose of this study.

Sources of Data Collection: Data used in this study was primarily collected using a hard copy semi-structured questionnaire. The questionnaire includes sections on respondents' demography, cancer beliefs and barriers to accessing radiotherapy services using an interviewer-administered method. The completed questionnaires were retrieved immediately by the researchers, checked for completeness and computed into a spreadsheet for data analysis.

Data Analysis: Data were entered and cleaned using Statistical Package for Social Sciences (SPSS v21), descriptive statistics (frequency and proportion) were used to describe patient demographics, cancer beliefs and care-seeking practices, while the Chi-square test was used to find the association between observed barriers and access to radiotherapy services. Access to radiotherapy services was defined as: adequate, accessible, affordable, appropriate and available. All analysis were carried out at a 5% level of significance.

RESULTS

Socio-Demographic Characteristics: Table 1 depicts the socio-demographic characteristics of patients, the age of respondents ranged from 18 – 60 years with a mean age of 51years (50.15 ± 14.00). About 56% (142) of the patients were between the ages of 41-60years while more than 22% (58) were between 18-40years. Approximately, 66% (171) of the patients were females and married 78% (202) while about 59% (152) of the respondents have attained university/graduate education. About 41% (104) of the patients had either official or professional occupations, while 7.4% (19) were Artisans and 13% (33) were either unemployed or unskilled. About 55% (142) of the patients reportedly used public transport while approximately 43% (111) owned a car. Distance to health facility ranged between 0-722km with a median of 18km (Table 1).

Figure 1 showed that the majority of the patients (47%) were from South-West Nigeria, while approximately 17% and 11% were from South-East and North-East Nigeria respectively. Table 2 presented the cancer beliefs and care-seeking practices of patients. About 63% (162) attend routine medical check-up and cancer was found among approximately 65% (105) of those who attended routine medical check-ups. Less than 25% (72) of the patients remarked they knew about cancer through self-examination, while approximately 17% and 22% reported having gained knowledge of cancer from social media and friend/family respectively. The majority of the patients observed had breast cancer 35.8% (91), 15% (38) Prostate and 15.7% (40) Cervical cancer respectively (Fig. 2). The time between symptoms onset and diagnosis was 0-5months 51.3% (122) and more than 5 months 48.7% (116) respectively.

Access to Cancer Screening Investigations (E.g. Blood Test, Mammogram, PSA Test etc): Table 3 shows the association between barriers to radiotherapy services and access to cancer screening investigations. There was a significant association between patient employment status and adequacy of access to cancer screening investigations (χ^2 = 0.024, p < 0.05). Health insurance significantly influenced the adequacy, (χ^2 = 0.030, p < 0.05) and accessibility (χ^2 = 0.015, p < 0.05) to cancer screening investigation. While corruption significantly influenced the adequacy (χ^2 = 0.042, p < 0.05), accessibility (χ^2 = 0.045, p < 0.05), affordability (χ^2 = 0.000, p < 0.05), appropriateness, (χ^2 = 0.005, p < 0.05) and availability (χ^2 = 0.003, p < 0.05) of cancer screening investigations. Personal health beliefs were significantly associated with the availability (χ^2 = 0.004, p < 0.05) of cancer screening investigations. Restriction on the tasks that can be performed by various health officers was significantly associated with the affordability (χ^2 = 0.024, p < 0.05) of cancer screening investigation. The affordability (χ^2 = 0.009, p < 0.05) of cancer screening investigation was significantly influenced by the expensive nature of treatment.

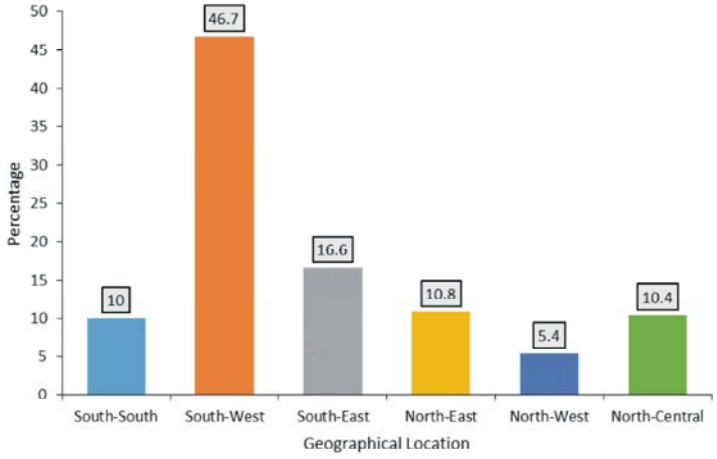

Fig. 1: Geo-political location of patients

Table 1: Socio-demographics Characteristics

Characteristics	Frequency (n)	Percentage(%)
Age groups (years)		
18 – 40	58	23.6
41 – 60	142	56.1
>60	48	20.3
Sex		
Male	89	34.2
Female	171	65.8
Marital Status		
Single	24	9.3
Married	202	78.0
Widowed/Divorced	33	12.7
Highest level of education		
No formal/Primary education	48	18.5
Secondary/Vocational education	59	22.8
University/Graduate education	152	58.7
Occupation		
Office/Professional	104	40.5
Artisans	19	7.4
Unemployed/Unskilled	33	12.8
Others	101	39.3
Mode of Transportation		
Walking	8	3.1
Own a car	111	42.5
Public transport	142	54.4
Distance to Hospital Median (Range)	18.00km (0–722km)	

Table 2: Cancer beliefs and care seeking practices

Characteristics	Frequency (n)	Percentage(%)
Attends routine medical check-up		
Yes	162	62.5
No	97	37.5
Cancer found during routine medical check up		
Yes	105	64.8
No	57	35.2
Knowledge of cancer		
Social media	49	16.6
TV/Radio	63	21.3
Friend/family	64	21.6
Newspaper	18	6.1
Self-examination	72	24.3
Other	30	10.1
Type of cancer		
Breast	91	35.8
Colorectal	21	8.3
Prostate	38	15.0
Cervical	40	15.7
Others	64	25.2
Time between symptoms onset and diagnosis		
0 – 5 months	122	51.3
> 5 months	116	48.7
Time between diagnosis and Radiotherapy treatment		
0 – 6 months	128	51.2
> 6 months	122	48.8
Average waiting time	9.77months ± 13.45	

Access to Medical Devices (e.g. Radiotherapy Machines etc): Table 4 displays the association between barriers to accessing radiotherapy services and access to medical devices. The adequacy (χ^2 = 0.004, p < 0.05) and appropriateness ($\chi^2 = 0.036, p < 0.05$) of access to medical devices were significantly influenced by patients' employment status. Health insurance significantly influenced the availability ($\chi^2 = 0.016, p < 0.05$) of access to medical devices. Corruption in the health sector, significantly influenced the adequacy (χ^2 = 0.036, p < 0.05), appropriateness ($\chi^2 = 0.000, p < 0.05$) and availability ($\chi^2 = 0.328, p < 0.05$) of access to medical devices.

Access to Health Practitioners (e.g. Radiation Oncologists, Therapy Radiographers etc): The association between barriers to radiotherapy services and access to health practitioners is shown below. Corruption in the health sector significantly influenced the adequacy ($\chi^2 = 7.778, p < 0.05$), accessibility ($\chi^2 = 7.884, p < 0.05$) and appropriateness ($\chi^2 = 9.680, p < 0.05$) of access to health practitioners. Accessibility (χ^2 = 0.4.036, p < 0.05) to health practitioners was significantly influenced by personal health beliefs. Meanwhile, affordability of

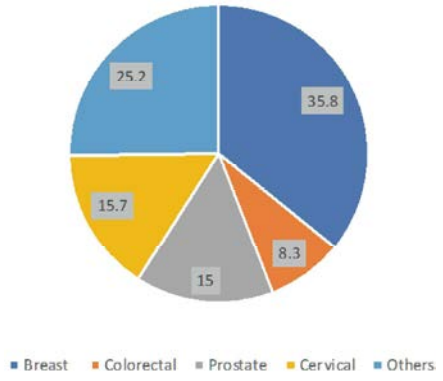

Fig. 2: Cancer Type

(χ^2 = 5.123, p < 0.05) access to health practitioners were influenced by restriction on tasks that can be performed by health officers. The expensive nature of treatment significantly influenced accessibility ($\chi^2 = 5.684, p < 0.05$), affordability (χ^2 = 4.927, p < 0.05) and appropriateness (χ^2 = 5.095, p < 0.05)) of access to health practitioners. Affordability (χ^2 = 5.095, p < 0.05) of access to health practitioners was significantly influenced by distance

Table 3: Chi-square test of association between barriers to accessing radiotherapy services and access to cancer screening investigation

	Access to cancer screening investigation (e.g. blood test, mammogram, PSA test etc)									
	Adequate		Accessible		Affordable		Appropriate		Available	
	No %	Yes %	No %	Yes %	No %	Yes %	No %	Yes %	No %	Yes %
Employment status (χ^2)	0.024		0.138		0.453		0.122		0.099	
Office/professional	27.1	72.9	29.0	71.0	60.2	39.8	30.4	69.6	23.4	72.6
Artisan	5.6	94.1	15.8	84.2	52.6	47.4	11.8	88.2	10.5	89.5
Unemployed/Unskilled	6.7	93.3	13.3	86.7	70.0	30.0	20.0	80.0	23.3	76.7
Others	16.9	83.1	17.6	82.4	54.4	45.6	17.6	82.4	11.0	89.0
Health Insurance (χ^2)	0.030		0.015		0.732		0.805		0.045	
No	15.6	84.4	17.2	82.8	60.3	39.7	22.3	77.7	14.9	85.1
Yes	28.8	71.2	32.7	67.3	57.7	42.3	24.0	76.0	26.9	73.1
Corruption in health sector (χ^2)	0.042		0.045		0.000		0.005		0.003	
No	11.4	88.6	13.8	86.3	40.0	60.0	11.7	88.3	7.4	92.6
Yes	22.3	77.7	25.0	75.0	69.7	30.0	28.2	71.8	23.1	76.9
Personal health belief (χ^2)	0.055		0.015		0.031		0.017		0.004	
No	12.2	87.7	12.9	87.1	51.1	48.9	14.3	85.7	8.6	91.4
Yes	22.2	77.8	26.1	73.9	65.2	34.8	27.7	72.3	23.2	76.8
Restrictions on tasks that can be performed by various health officers (χ^2)	0.608		0.282		0.024		0.704		0.517	
No	19.8	80.2	24.1	75.9	50.9	49.1	21.6	78.4	15.9	84.1
Yes	17.2	82.2	18.3	81.7	65.5	34.5	23.7	76.3	19.2	80.8
Attitude of Attending staff (χ^2)	0.524		0.868		0.054		0.500		0.061	
Negative	16.7	83.3	21.7	78.3	51.6	48.4	20.0	80.0	12.0	88.0
Positive	20.0	80.0	20.8	79.2	64.3	35.7	23.8	76.2	21.5	78.5
Expensive nature of treatment (χ^2)	0.483		0.838		0.009		0.885		0.517	
No	15.1	84.9	20.4	79.6	44.4	55.6	22.2	77.8	14.5	85.5
Yes	19.3	80.7	21.7	78.3	64.2	35.8	23.2	76.8	18.3	81.7
Distance from home to health facility (χ^2)	0.832		0.302		0.097		0.415		0.228	
Short	18.6	81.4	25.0	75.0	64.4	35.6	25.2	74.8	20.2	79.8
Long	19.8	80.2	19.0	81.0	53.0	47.0	20.4	79.6	13.9	86.1
Financial burden (χ^2)	0.802		0.618		0.152		0.445		0.731	
No	20.0	80.0	19.2	80.8	51.0	49.0	26.9	73.1	15.4	84.6
Yes	18.4	81.6	22.5	77.5	62.1	37.9	21.8	78.2	17.4	82.6
Waiting time (χ^2)	0.127		0.340		0.153		0.125		0.083	
Short	13.3	86.7	17.6	82.4	53.3	46.7	17.0	83.0	12.0	88.0
Long	21.2	78.8	22.8	77.2	62.8	37.2	25.7	74.3	20.7	79.3

Table 4: Chi-square test of association between barriers to accessing radiotherapy services and access to medical devices

	Access to medical devices (e.g. Radiotherapy machines etc)									
	Adequate		Accessible		Affordable		Appropriate		Available	
	No %	Yes %	No %	Yes %	No %	Yes %	No %	Yes %	No %	Yes %
Employment status (χ^2)	0.002		0.193		0.173		0.036		0.106	
Office/professional	43.3	56.7	41.7	58.3	69.5	30.5	38.5	61.5	38.3	61.7
Artisan	21.1	78.9	21.1	78.9	52.6	47.4	5.3	94.7	16.7	83.3
Unemployed/Unskilled	25.8	74.2	32.3	67.7	71.0	29.0	38.7	61.3	22.6	77.4
Others	18.9	81.1	29.7	70.3	56.7	43.3	31.1	68.9	26.1	73.9
Health Insurance (χ^2)	0.135		0.168		0.870		0.622		0.016	
No	27.6	72.4	32.4	67.6	64.2	35.8	32.8	67.2	25.6	74.4
Yes	38.2	61.8	42.6	57.4	65.5	34.5	36.4	63.6	42.6	57.4
Corruption in health sector (χ^2)	0.036		0.564		0.550		0.000		0.328	
No	21.3	78.8	32.1	67.9	61.3	38.8	16.0	84.0	25.3	74.7
Yes	34.4	65.6	35.8	64.2	65.2	34.8	42.4	57.6	31.4	68.6
Personal health belief (χ^2)										
No	28.0	72.0	33.0	67.0	61.7	38.3	21.5	78.5	23.7	76.3
Yes	30.8	69.2	35.4	64.6	65.0	35.0	41.0	59.0	32.6	67.4
Restrictions on tasks that can be performed by various health officers (χ^2)	0.637		0.699		0.602		0.002		0.137	
No	31.6	68.4	33.0	67.0	64.9	35.1	33.3	66.7	29.5	70.5
Yes	27.9	72.1	33.9	66.1	61.7	38.3	32.2	67.8	27.9	72.1
Attitude of Attending staff (χ^2)	0.533		0.891		0.607		0.857		0.787	
Negative	27.7	72.3	34.0	66.0	63.8	36.2	26.6	73.4	31.9	68.1
Positive	32.2	67.8	34.5	65.5	63.9	36.1	37.9	62.1	27.8	72.2
Expensive nature of treatment (χ^2)	0.203		0.000		1.496		3.280		0.119	
No	27.8	72.2	34.5	65.5	57.4	42.6	23.6	76.4	27.8	72.2
Yes	31.0	69.0	34.4	65.6	66.5	33.5	36.8	63.2	30.2	69.8
Distance from home to health facility (χ^2)	1.422		0.195		1.444		0.355		0.582	
Short	33.0	67.0	31.7	68.3	66.3	33.7	33.7	66.3	27.2	72.8
Long	25.5	74.5	34.6	65.4	58.3	41.7	29.8	70.2	32.0	68.0
Financial burden (χ^2)	1.305		0.063		3.390		0.016		0.550	
No	24.1	75.9	33.3	66.7	53.7	46.3	33.3	66.7	33.3	66.7
Yes	32.2	67.8	35.2	64.8	67.4	32.6	34.3	65.7	28.1	71.9
Waiting time (χ^2)	0.165		1.393		0.357		1.553		0.592	
Short	31.5	68.5	38.7	61.3	66.7	33.3	28.3	71.7	31.9	68.1
Long	29.1	70.9	31.3	68.7	62.8	37.2	36.1	63.9	27.2	72.8

Statistically significant (P-value <0.05)

Table 5: Chi-square test of association between barriers to accessing radiotherapy services and access to health practitioners

	Access to health practitioners (e.g. Radiation oncologist, therapy radiographers etc)									
	Adequate		Accessible		Affordable		Appropriate		Available	
	No %	Yes %	No %	Yes %	No %	Yes %	No %	Yes %	No %	Yes %
Employment status (χ^2)	3.039		1.617		2.477		1.443		2.245	
Office/professional	28.7	71.3	30.2	69.8	36.2	63.8	25.5	74.5	20.2	79.8
Artisan	16.7	83.3	27.8	72.2	33.3	66.7	22.2	77.8	22.2	77.8
Unemployed/Unskilled	25.8	74.2	29.0	71.0	45.2	54.8	30.0	70.0	29.0	71.0
Others	18.9	81.1	22.2	77.8	30.0	70.0	20.2	79.8	16.7	83.3
Health Insurance (χ^2)	0.277		3.650		3.639		0.585		0.798	
No	22.5	77.5	23.9	76.1	38.2	61.8	23.2	76.8	18.5	81.5
Yes	25.9	74.1	37.0	63.0	24.1	75.9	28.3	71.7	24.1	75.9
Corruption in health sector (χ^2)	7.778		7.884		0.634		9.680		2.183	
No	13.0	87.0	15.6	84.4	31.6	68.4	12.0	88.0	14.7	85.3
Yes	29.6	70.4	32.9	67.1	36.9	63.1	30.8	69.2	23.0	77.0
Personal health belief (χ^2)	1.242		4.036		0.774		3.385		0.161	
No	20.0	80.0	19.8	80.2	31.9	68.1	18.0	82.0	18.7	81.3
Yes	26.4	73.6	31.7	68.3	37.5	62.5	28.7	71.3	20.8	79.2
Restrictions on tasks that can be performed by various health officers (χ^2)	0.390		0.002		5.123		3.163		1.964	
No	22.3	77.7	26.8	73.2	27.9	72.1	19.1	80.9	16.4	83.6
Yes	25.8	74.2	27.0	73.0	42.1	57.9	29.2	70.8	23.8	76.2
Attitude of Attending staff (χ^2)	2.703		3.611		4.188		13.631		3.706	
Negative	18.0	82.0	20.0	80.0	26.7	73.3	11.4	88.6	13.5	86.5
Positive	27.4	72.6	31.3	68.7	39.7	60.3	32.9	67.1	23.8	76.2
Expensive nature of treatment (χ^2)	3.192		5.684		4.927		5.095		2.243	
No	15.1	84.9	14.8	85.2	22.6	77.4	13.2	86.8	13.2	86.8
Yes	27.1	72.9	31.3	68.7	39.2	60.8	28.5	71.5	22.7	77.3
Distance from home to health facility (χ^2)	1.505		0.777		6.420		1.268		2.757	
Short	26.0	74.0	27.9	72.1	43.7	56.3	26.5	73.5	25.2	74.8
Long	18.8	81.2	22.5	77.5	26.7	73.3	19.8	80.2	15.8	84.2
Financial burden (χ^2)	10.232		7.218		11.768		1.240		1.986	
No	7.7	92.3	13.2	86.8	15.1	84.9	19.2	80.8	13.2	86.8
Yes	29.4	70.6	32.0	68.0	40.7	59.3	26.9	73.1	22.0	78.0
Waiting time (χ^2)	0.017		0.225		3.838		0.240		1.873	
Short	24.7	75.3	25.6	74.4	27.3	72.7	23.0	77.0	15.7	84.3
Long	24.0	76.0	28.4	71.6	39.9	60.1	25.9	74.1	23.1	76.9

Statistically significant (P-value <0.05)

from home to health facility. Similarly, financial burden of cancer significantly influenced adequacy ($\chi^2 = 10.232$, $p < 0.05$), accessibility ($\chi^2 = 7.218$, $p < 0.05$) and affordability ($\chi^2 = 11.768$, $p < 0.05$) of access to health practitioners; while waiting time significantly influenced the affordability ($\chi^2 = 3.838$, $p < 0.05$) of access to health practitioners (Table 5).

DISCUSSION

This study is an effort to access the availability and accessibility of radiotherapy services in Nigeria. Nine radiotherapy centers were enumerated of which seven were functional as at the time of this study. Two hundred and sixty-two patients were enumerated from the seven functional centers, while one hundred and forty staff were recruited across the nine radiotherapy centers in Nigeria that participated in the study. One hundred and seventy-one patients were females and eighty-nine were males. The patients ages were between 18 and 60 years and above. Patients between the ages of 41-60 years were in the majority.

This study shows the continuous increase in the incidence of cancer in Nigeria across all age groups and genders [24]. Breast cancer 91(35.8%) was one of the most prevalent cancers among Nigeria patients. This type of cancer has been known to inflict economic and psychosocial burden on the patients and relatives this is congruent with studies in Indonesia [25]. Geographical variation exists in the throughput of cancer patients. This study showed that about half of the patients were located within South-western Nigeria (46.7%) or permanently residing in South-west Nigeria this might be as a result of availability, accessibility and functionality of radiotherapy facilities in the South-western region of Nigeria compared to other regions and also home to the oldest health facility in the country. However, this may not be exhaustive, giving some patient's residency status maybe temporary.

It was observed that majority of the patients (77.2%) had no health insurance. This may be due to the procedures involved in getting health insurance and the perceived cost intensive nature of being medically insured. Health insurance is mostly reserved for civil

servants and private individuals and establishments who can afford it. Median distance from home to health centers was 18km. This is a shorter distance in comparison to a study in France [26] and could be due to availability and functionality of radiotherapy centers within patient location especially patients in south-west Nigeria.

The average waiting time between diagnosis and radiotherapy treatment was more than nine months and higher than reported in studies by Stoker *et al*. [27]. This could be due to a number of factors such as staff industrial action, breakdown of radiotherapy machines, or too many patients in need of radiotherapy treatment in comparison to functional machines. This view was also shared by researchers in Morocco [28]. Furthermore, Parkin *et al*., 2006, Kothari *et al*., 2003 and Caplan 2014 reported longer waiting times usually occurred prior to diagnosis and initiation of therapy which is likely to result in advanced disease and low survival [29-31].

More than half of the patients (53.1%) reportedly sought a second opinion in the form of none orthodox (64.5%) care before treatment. This could be due to a lack of awareness about the early signs and symptoms of cancer, fanatical or personal health beliefs that forbid medical therapy for cancer, or financial constraints [32]. Additionally, motivation in seeking a second opinion may be influenced by fear of treatment side effects, costs and the availability and accessibility of health services especially in patients with nasopharyngeal and breast cancer [25, 32, 33].

There are presently twenty-eight radiation oncologists and thirty-four radiation therapists in Nigeria, based on the current cancer incidence in Nigeria, that is about one radiation oncologist for >4 thousand persons and one radiation therapist for >3 thousand persons. Furthermore, there are thirty-one medical physicists, three psycho-oncologist and sixteen resident doctors in Nigeria. According to the IAEA International Basic Safety Standards a radiotherapy center should have at least four-to-five radiation oncologist, three medical physicists, seven radiation therapist, three radiation oncology nurses and one maintenance technician/engineer [34, 35]. This study showed that only a handful of centers meet the requirement, consequently resulting in a massive shortage in the availability of specialist personnel to contend with the menace of cancer in Nigeria [36].

This shortfall could be attributed to a lack of investment in radiotherapy service delivery, especially personnel empowerment. In addition, perceived negligence of radiotherapy services by major stakeholders could also contribute to the shortfall in staff strength, coupled with the fact that most personnel will prefer to offer their services where facility and financial incentives are not only available, but sustainable as well.

Cancer-related mortalities are now common and on the increase. Although screening is a known cost-effective strategy used in reducing the burden of cancer worldwide, its uptake particularly in developing countries is still abysmal. Our study showed that the availability and accessibility of access to cancer-related health services such as cancer screening and investigations were more than 100% accessible for patients who had health insurance. This could be due to the high cost of screening services [37]. Besides, in a country like Nigeria with a myriad of multi-dimensional challenges and a high percentage living below the poverty line. Coupled with a healthcare system that is predominantly dependent on out-of-pocket expenditure, uptake of such services could be prohibitive.

A major barrier to availability and accessibility of radiotherapy services such as screening investigations, medical devices, health professionals, was corruption. Our study showed that the absence of corruption in the health sector increased the availability, affordability, accessibility and appropriateness of radiotherapy services by almost 120%. The reverse however, is prevalent in Nigeria's healthcare sector. Corruption disrupts the efficacy of government institutions and hinders the equal distribution of resources and income across the population.

Africa and indeed Nigeria is confronted with a high burden of diseases. Adequate investment in the healthcare sector, could substantially prevent the loss of income from the African population and stimulate economic growth and development. This study is also in agreement with studies in Uganda [38] and in agreement with that of Mostert *et al.* [39]. Which report that patients are the prime recipients of the impact of corruption on the health sector as access to necessary cancer care especially in (LMICs), is disrupted by longer waiting queues, delayed diagnosis and late or intermittent cancer treatment, resulting in recurrence or poor cancer survival or prognosis [39].

CONCLUSION

In conclusion, this study has been able to identify the throughput of cancer patients and their cancer beliefs as well as barriers to the availability and accessibility of radiotherapy centers in Nigeria. It was observed that a large percentage of radiotherapy centers in Nigeria lack

the equipment and manpower to function optimally. The majority of functional centers and patients are located within the South West geo-political zone of Nigeria. The barriers to availability and accessibility of care were corruption in the health sector, the financial burden of cancer, the attitude of attending staffs and lack of health insurance. Access to radiotherapy services can be made more readily available and accessible if centers are evenly distributed across the country through public-private partnership, periodic monitoring and evaluation of available facilities and corruption in the health sector is brought to a minimum.

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