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Patient-Centered Perspectives on Radiation Therapy: Knowledge, Attitudes, and Perceived Barriers Among Cancer Patients at Merowe medical city , northern state , Sudan , 2026

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1. Introduction

1.1 Background

Cancer is a complex global health challenge fundamentally characterized by the uncontrolled proliferation of abnormal cells that invade and destroy bodily tissues.The global burden of the disease is profound , with the Global Cancer Observatory recording over 4 million new cases in 2018 alone .[1,2] This crisis is particularly acute in Sub Saharan Africa (SSA), where incidence rates are projected to more than double by 2040 due to demographic shifts and limited resources . [3,4] Despite advancements in oncology , significant disparities in mortality persist between high income and low income countries , driven largely by severe gaps in access to standard treatment protocols . [5,6]

There many methods to its treatment , including immunotherapy , chemotherapy, surgery, and radiation therapy (RT) [7] RT remains an important modality in the management of cancer because approximately half of all newly diagnosed patients with cancer require RT at some point during the course of their disease.[8.9] RT is a highly cost-effective treatment modality, accounting for only 5% of the total cost of cancer care [10]. Radiotherapy as a treatment modality, employs high doses of radiation to precisely target and eliminate cancer cells while minimizing damage to adjacent healthy tissues .[11] It can be administered either only or compound with other interventions such as surgery and chemotherapy . [12] While RT is highly effective , a substantial utilization gap exists in low resource settings . Evidence based estimates suggest that optimal RT utilization should range between 47% and 56% [13,14], however actual use in low and middle income countries (LMIC) often languishes between 9 % and 46 % . [15] This discrepancy is frequently termed a silent crisis in global health , compounded by the fact that only about 40 % of LMIC possess the necessary infrastructure for radiation oncology .[16 , 17]

The clinical effectiveness of RT is often undermined by low health literacy and unmet information needs among patients. Many patients arrive at their first consultation with

little to no knowledge about the procedure, which fosters heightened anxiety and deep-seated misconceptions . [18,19]

Common myth such as the belief that radiation is inherently "dangerous," that it reduces lifespan, or that the patient becomes "radioactive" are major drivers of treatment non-adherence and may lead patients to seek alternative medicines instead of conventional care. Improving patient education is therefore essential, as informed patients feel more empowered and experience less treatment-related distress.[20,21,22]

When evaluating access through the 5-As framework (Availability, Accessibility, Affordability, Accommodation, and Acceptability), research identifies a complex web of obstacles in SSA .Dominant barriers include the high cost of treatment, logistical transportation difficulties, and the financial strain of being away from home. In many African contexts, the fear of the treatment itself remains a primary deterrent, often surpassing demographic or socioeconomic factors in its impact on treatment uptake[23].

In the specific context of Sudan and the Northern State, these challenges are intensified by the centralization of oncology services at specialized facilities like Merowe Medical City. This geographic concentration imposes a severe travel and financial burden on patients from remote rural communities, who must often travel hundreds of kilometers and arrange for temporary housing. [24] Such logistical demands give rise to "time toxicity," [25]where the cumulative time spent traveling and waiting for daily fractionated treatments over several weeks exhausts the patient's resources and support networks.[24]

Despite the growing cancer burden in northern Sudan, there is a notable paucity of research investigating how Sudanese patients in the Northern State perceive and navigate these barriers [18,19] . Since many of these obstacles ranging from transport logistics to psychological fears are potentially surmountable through targeted education and improved clinical communication, this study aims to bridge the local knowledge gap. By assessing Knowledge, Attitudes, and Perceived Barriers at Merowe Medical City, this research will provide the necessary evidence to improve healthcare delivery and patient outcomes in the region [26,27] .

1.2 Proplem statement

Conferment previous studies established that RT patients suffers from information's needs incomplete remarkably, [18] One study in breast cancer patients found that the majority had little or no knowledge about radiotherapy [19]. Another study in head and neck cancer patients also found a low level of knowledge of radiotherapy [28] The effect lack sufficient knowledge lead to anxiety , and promote understanding false about safety radiation and non-adherence with protocol or not completely [29]Although awareness of risk and benefit of radiotherapy that help patients to make informed decisions [30] However , there is lake of studies about knowledge and attitude on this side . In addition that while some studies focused on environmental factors , but there severe shortage in the studies which investigated what the patients themselves perceive as barriers that prevent them from completing of treatment . [26] This problem is more pronounced in the environment merowe medical city in Sudan , Where the region lacks scientific studies that clarify the perspectives and perceptions of local patients regarding this type of treatment .

1.3 Justification :

This study is based on the premise that patient knowledge directly shapes attitudes and treatment behaviors [31] A thorough understanding of the treatment plan is essential for an accurate perception of their medical condition and options . . Despite the widespread use of radiotherapy in cancer management , significant , knowledge gaps persist among patients regarding its nature and safety . This lack of awareness reinforces negative misconceptions and elevating patient anxiety , which frequently leads to treatment non adherence or incomplete protocols. Therefore , elevating patients knowledge serves as a critical determinant in shifting attitude and minimizing these psychological and behavioral barriers to ensure optimal treatment outcomes [29]

Consequently assessing knowledge and attitudes among patients of radiation therapy in Merowe Medical City is an essential approach to evaluating health information acceptance and identifying specific educational barriers [28,32] . This study aims to investigate these parameters to help clinicians target key clinical discussions and guide decision makers in

developing tailored intervention strategies , ultimately improving healthcare quality and treatment outcomes in the region .

2. Objectives

2.1 general objectives

To assess cancer patients knowledge, attitudes, and perceived barriers regarding radiation therapy at Merowe Medical City , Northern state , Sudan , 2026 .

2.2 Specific objectives

1. To assess patients' knowledge about radiation therapy, including its purpose, safety, procedures, and side effects.
2. To evaluate patients' attitudes, fears, trust, and acceptance toward radiation therapy.
3. To identify perceived barriers to accessing and completing radiotherapy using the 5-A access framework.
4. To explore patients' experiences and suggestions regarding radiotherapy services.
5. To examine the association between patients' knowledge, attitudes, perceived barriers, and selected Sociodemographic and clinical characteristics.

3. Materials and methods

3.1 Study design : this study will employ a descriptive analytical cross sectional study design .

3.2 Study setting and area :

this study will take in Merowe Medical City , oncology center , merowe , northern State. As a leading referral center for oncology services in the region .

3.3 Study population |:

This study include all of adult cancer patients referred to the Radio therapy Department at Merowe Medical City .

The Inclusion criteria :

- age 18 years or older
- currently receiving , having previously completed , or have been referred for radiotherapy during the study period. This also include patients whose treatment was discontinued by medical decision. Patients who have been referred but have yet started radiotherapy are intentionally included , as their experiences and perceptions of barriers differ fundamentally from those of patients who have successfully completed treatment and already overcome those challenges. Additionally , participants must be able to communicate clearly and understand the questionnaire to ensure the accuracy and reliability of the collected data .

Exclusion criteria :

- Voluntary refusal to participate or failure to provide informed consent .
- Congestive or mental impairment due to brain metastasis or other conditions that prevent understanding and clear response .
- Presence of communication barriers that prevent interaction with the research team or comprehension of the questionnaire .
- Severe illness , physical frailty or general health deterioration that prevents the completion of the interview .
- Diagnosed psychiatric or a cute emotional distress that may compromise the patients focus or the accuracy of the data .

3.4 Sample size :

Because the number of eligible radiotherapy patients during the study period is limited, all eligible patients attending the oncology/radiotherapy unit during the study period will be invited to participate. The expected sample is approximately 160 patients.

3.5 Sample technique :

A consecutive sampling technique will be used to minimize selection bias and ensure proper inclusion of all eligible patients during the study period will be included in the study .

3.6 Variables

1. dependent variable : These are the main areas and effects by other factors :

a) Knowledge factors : misconceptions , understanding of side effects and any questions related to general understanding of radiotherapy

b) Attitudes factors : fear of radiation , acceptance or refusal of treatment , trust in the treatment or medical staff , any positive or negative perceptions

c) Perceived barriers : challenges reported by patients , categorized into five dimensions :

- Availability : presence of treatment facilities .
- Accessibility :transposition and travel distance .
- Affordability : costs of treatment and being away from home or family support .
- Accommodation : waiting times , logistics, treatment interruption and communication with medical staff .
- Acceptability : fear of treatment and lack of information

2. Independent variables : (Sociodemographic factors)

These variables are used to understand the background of the patients

- Gender : male or female
- Age : patients age in years or divided into specific age groups
- Education level : ranging from primary school to college or higher education .
- Residence : whether the patients lives in a rural , urban , or suburban area .
- Employment status : including unemployed , employed , retired , self-employed , homemaker, others .
- Monthly income : to assess the patients financial capability .
- Marital status : married , single , divorced , or widowed .

Independent Variables (clinical factors)

These factors describe the medical condition of the patients :

- Type of cancer : the specific diagnosis , such as Breast , Prostate , Head and Neck Gastrointestinal , Cervical , Lung ,Other
- Cancer stage : whether the disease is in a stage I , stage II , stage III , stage IV .
- Previous treatment history (Surgery / Chemotherapy / Hormonal therapy) .

3.7 Data collection tools

Data will be collected by using five parts of structured questionnaire include :

- Sociodemographic characteristics :

1. including gender , age, residence, education , work status , monthly income, marital status, smoking, drinking, medical insurance, radiation therapy available for tumors, diagnosis duration of tumor (less than 1 year, 1–3 y ears, more than 3 years), underlying diseases (multiple choice : hypertension, heart disease , respiratory disease , diabetic , none), history of tumor surgery.[23]

- The knowledge dimension includes 12 items assessing the patients perceived familiarly with radiotherapy . Response are recorded using a 3-point scale : (2) well known , (1) Heard of , (0) Unknown . This scoring method differentiates between comprehensive understanding , superficial awareness , and a lack of information . The total possible score ranges from 0 to 24 points . Knowledge levels are categorized as follows :

0 to 8 points indicate poor perceived knowledge , 9 to 16 points indicate moderate knowledge , 17 to 24 points (representing > 70 % of the maximum score) indicate good perceived knowledge .

- The attitude dimension includes 10 items evaluating the patients perspectives and emotional responses toward radiotherapy . Responses are measured using a 5-point Likert scale with following options : Strongly Agree (5 points) , Agree (4 points) Neutral (3 points) , Disagree (2 points) , and Strongly Disagree (1 points) . The total possible score ranging from 10 to 50 . To maintain consistency in data analysis reverse scoring will be applied to items phrased negatively(example :items reflecting , fear or resistance) ensuring that higher total scores consistently represent a more positive attitude toward treatment . Attitude levels are categorized as follows : 10 ~ 35 points as negative attitude and 36–50 points as positive attitude .[23]

- Barriers : Perceived barriers to treatment will be assessed using the 5-A access to care framework , which identifies five central dimensions :availability , accessibility , affordability , accommodation and acceptability . to identify these barriers . a 4-point Likert scale will be employed ranging from (0) No problem to (3) Sever problem for purpose of data analysis a factor will be operationally classified as an impeding barrier

if the patient selects any category from minor to sever problem (scores 1-3) either the intermediate or severely problematic category .[33]

Patient voice : In this section of the questionnaire, open-ended questions will be used to allow participants to describe their experiences, opinions, concerns, and suggestions regarding radiotherapy in their own words, without being restricted to predefined response options. [34]

3.8 Data collection and Quality control :

Data collection will be collection by the investigators through bedside interviews at Merowe Medical City .Content validity will be established by an expert panel (oncology / radiology , community medicine supervisor and research methodology specialist) , To ensure the reliability of the tool a pilot study will be conducted on 5-10% of the sample size.with internal consistency will be measured by Cronbach's alpha coefficient with a target value (≤ 0.70) for multi item scales (knowledge and attitude) . The barriers to ensure statistical stability and internal consistency .

3.9 Data analysis :

Data analysis will be conducted using SPSS v26.0 . Categorical variables will be presented as frequencies and percentages such as : gender , education , cancer type , and barrier categories , while Knowledge, Attitude, and barriers scores will be reported as mean ± standard deviation [35] or median with inter quartile range (IQR) depending on the distributions normality . The Chi square tests will be employed to assess associations between categorized outcomes and demographic or clinical variables . Differences in mean scores across groups will be compered using the Independent t-tests or one way ANOVA . Spearman's correlation will assess the relationship between knowledge and attitudes scores [36]. Additionally simple Logistic regression will be used to identify independent factors for defined binary outcomes such as high versus low barrier levels . [37] Qualitative “patient voice” responses will undergo thematic analysis to Analyze open-ended patient voice responses into themes and sub themes. [38]. Statistical significance will be set at $p < 0.05$ [39]

4.1Ethical approval :

This study will adhere to established research ethics principles and internationally accepted standards for studies involving human participants, in line with the World Health Organization (WHO) guidelines. Ethical approval will be obtained from the Research Ethics Committee (REC) and the administration of the Oncology Department at Merowe Medical City before data collection begins.

Informed consent will be obtained from all participants after the study objectives and procedures have been clearly explained to them. Participation will be entirely voluntary, and participants have the right to skip any question or stop the interview at any time without providing a reason and without any impact on their medical care . Depending on the participants' literacy level and preference, consent may be obtained either verbally or in writing.

To ensure the highest ethical standards patient well being the following measures will be implemented :

- No interference with care : interviews will be scheduled at the patients convenience or clinical routines .
- Privacy and respect : all interviews will be conducted in a private and respectful setting to maintain patient dignity and confidentiality .
- Anonymity and coding : to protect patient identify no name will recorded on the questionnaires ; instead a coding system will be used for participant identification during data entry and analysis .
- Data security : all collected data will be stored securely in password protected files accessible only to the research team .
- Distressed protocol : if a patients becomes distressed or experiences emotional difficulty during the interview , the investigator will immediately stop the session and refer the patient to the treating clinical team or psycho-social support services for appropriate care .

The confidentiality and privacy of participants will be protected by avoiding the collection of identifying information and storing all data securely. Access to the data will be limited to the research team and the information collected will be used solely for scientific purposes.

As the study involves cancer patients, interviews and questionnaires will be conducted with sensitivity and respect for participants' comfort and feelings. Participants will be free to

decline answering any question they do not wish to answer, and appropriate support will be provided if any participant experiences discomfort during the study.This version is concise, natural, and suitable for inclusion in the Ethical Considerations section of an academic research proposal.

4.2 Timetable

Stage	Deadline
Proposal revision	Jun 2026
Ethical approval	Jul
Data collection	Jul
Data entring and cleaning	Aug , Sep
Data analysis	Sep
Report writing	Sep , Oct
Final submission	Oct , Nov

4.3 Budget slide

Budget category	Examples	Estimated amounts	Unit cost (SDG)	Total (SDG)
Printing and stationery	Questionnaires, consent forms, pens, folders	200 copies	300	60000
Transport	Data collection visits, local movement	16 trips	5000	80000
Communication	Phone calls, internet, coordination	1 bundle	30000	30000
Data entry and analysis	Data entry support, software if needed	Lump sum	170000	170000
Report production	Printing, binding, and presentation materials.	4 copies	10000	40000
Direct costs subtotal			380000	380000
Contingency	Approximately 10% of total direct costs.	10٪	_	38000
Total	Sum all categories			418000

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