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Evaluating The Effectiveness of Cancer Treatment Protocols Across Different Modalities of Treatments on Diagnosed Cancer Cases at The Cancer Research Institute, David Umahi University Teaching Hospital, Uburu, Ebonyi State

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Keywords

Cancer treatment effectiveness; Treatment modalities; Combined therapy; Oncology , outcomes.

Abstract

Background: *Cancer remains a leading cause of morbidity and mortality globally, with treatment outcomes influenced by the choice and combination of therapeutic modalities. In low and middle-income settings, including Nigeria, variability in access to and effectiveness of cancer treatment protocols poses significant challenges to optimal patient outcomes. Evaluating the effectiveness of existing treatment modalities is essential for evidence-based improvements in cancer care.*

Objective: *This study aimed to evaluate the effectiveness of cancer treatment protocols across different treatment modalities among diagnosed cancer patients managed at the Cancer Research Institute, David Umahi Federal University Teaching Hospital (DUFUTH), Uburu.*

Methods: *A retrospective observational study design was employed, involving a review of medical records of patients with histologically confirmed malignancies managed at the Cancer Research Institute, DUFUTH, Uburu, between January 2023 to December 2025. Patients were categorized based on treatment modality, including surgery alone, chemotherapy alone, radiotherapy alone, and combined modality therapy. Treatment effectiveness was assessed using clinical response, treatment outcome, and clinical follow up. Data were analyzed using descriptive and inferential statistics.*

Results: *A total of 253 cancer patient records were analyzed between January 2023 to December 2025, out of which, 145 (57.3%) were males while 108(42.7%) where females. Prostate cancer toping all other malignant condition followed by breast cancer and cervical cancers.*

Combined modality therapy demonstrated superior treatment effectiveness, evidenced by higher rates of treatment completion, treatment follow up and disappearance of symptoms following treatment compared to single-modality treatments. Patients who received surgery combined with adjuvant chemotherapy and/or radiotherapy showed better follow up and clinical outcomes than those managed with chemotherapy or radiotherapy alone. Treatment interruptions and incomplete treatment were associated with poorer outcomes across all modalities. Among all the modalities of treatment, most of the cancer patients received Radiotherapy much more than other treatment modalities and among the single modalities of treatment, radiotherapy was more effective than chemotherapy. However, combination of therapy yielded a more effective treatment with more stable outcome and less treatment failure and follow-up.

Conclusion: *Combined treatment modality protocol for cancer treatment was more effective than single-modality approaches among patients managed at DUFUTH, Uburu. Strengthening multidisciplinary cancer care, improving early diagnosis, and ensuring treatment continuity are critical to enhancing cancer treatment outcomes in this setting.*

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Introduction

Cancer, a malignant neoplastic disease is one of the challenging major cause of morbidity and mortality in Nigeria counting for the 2nd most common cause of mortality after cardiovascular diseases worldwide [1]. Globally, there were about 18.1 million new cancer cases and 9.6 million cancer deaths in 2018[1]. Malignant neoplasms are characterized by progressive growth of tissue with structural and functional alterations with a peculiarity of ability to metastasize via blood and lymph vessel penetration [2]. Cancer therefore, is defined by rapid creation of abnormal cells that grow beyond their usual boundaries, invade adjoining parts of the body and spread to other organs.

Neoplasms which is known as new growth can be classified into benign and malignant conditions. Benign neoplasms unlike the malignant ones appear as localized growths of tissue with predominantly normal minor symptoms which are amenable to surgical therapy. They can become clinically important when they occur in organs of close compartment causing compression and where surgery cannot be easily performed like the brain and when they produce hormones with systemic effects [2]

Knowledge about the causes and preventions of malignant neoplasms has been largely based on the development of cancer epidemiology, novel treatment, prevention and screening modalities [3].

Cancer causation can be genetic or environmental. Several inherited conditions carry a very high risk of one or several cancers genes which are identified through family-based and other linkage studies. These conditions are rare and explain only a small proportion of human cancers. Genetic factors are also likely to play an important role in interacting with non-genetic factors to determine individual susceptibility to cancer, although the observation of changes of incidence in migrant groups after they have moved to a new living environment suggests a major role of non-genetic factors [4].

Cancer has increasingly contribute to premature mortality in Africa [3] as it became the second leading cause of premature mortality (about 9.3 million deaths) in low- and middle-income countries (LMICs), for individual within the ages of 30 to 69 years[4,5]. In 2020, Africa recorded around 1.1 million new cancer cases and 700,000 deaths, accounting for 5.7 % of global cancer incidence. Cancer death rates in Africa are projected to exceed the global average by 30% in the next 20 years [6,7]. Similarly, Nigeria recorded a total of 124,815 new cases of cancer with 51,398 occurring in male (prostate cancer being the commonest at 29.8%) and 73,417 occurring in females (with breast cancer being the commonest, 38.7% followed by cancer of the cervix, 16.47%) [7]. Excluding non-melanoma skin cancer, prostate, colorectal, non-Hodgkin lymphoma, liver, and leukemia remains the top five most frequent cancers in males while breast, cervical, non-Hodgkin lymphoma, ovarian, and colorectal are the top five in females [8], surprisingly, skin cancers like basal and squamous cell carcinoma are gradually finding their way into our environment as Ehidiamhen et al., reported 24.7% for cutaneous SCC and 15.8% for cutaneous BCC in a South Eastern hospital in Nigeria [9].

Cancer control programs that prioritize screening and surveillance for early cancer diagnosis assumes that undiagnosed cancer would have been the underlying causes of death [10,11]. This is far from a universal outcome as careful attention is needed to ensure that the cancer control programs achieve all intended outcomes, balancing benefits to potential harm [10]. Increasing cancer-related mortality experienced by LMICs have been as a result of rising obesity rates, increasing sedentary lifestyles, dietary factors, excess tobacco and alcohol use and persistent carcinogenic infections like Helicobacter pylori, hepatitis B virus, human papilloma virus and other less understood factors [12,13]. Studies have shown that 30% to 50% of all cancers are preventable [14,15] , if appropriate screening and early diagnosis and treatment are taken seriously. In 2008, the population attributable factors (PAF) for infectious agents were 16.1% out of the 12.7 million new cases with LMICs accounting for 22.9% compared to 7.4% in HICs. Although this varied from 3.3% in Australia and New Zealand to 32.7% in sub-Saharan Africa (SSA)[13], yet 15.4% of the 14 million new cancer diagnosis were attributed to infectious agents[12,16] with some SSA countries having 50% PAF compared to 5% in United States and Canada [12].

In Nigeria, some 100 000 new cases of cancer occur every year, with high case fatality ratio [2]. Approximately 20% of the population of Africa and slightly more than half the population of West Africa, Nigeria contributed 15% to the estimated 681,000 new cases of cancer that occurred in Africa in 2008 [1]. Similar to the situation in the rest of the developing world, a significant proportion of the increase in incidence of cancer in Nigeria is due to increasing life expectancy, reduced risk of death from infectious diseases, increasing prevalence of smoking, physical inactivity, obesity as well as changing dietary and lifestyle patterns [17]

In a comprehensive study on cancer epidemiology done in Italy, the cancer- related burden was slightly higher in men than in women (9.6% vs 8.6%) with Leukemia (37%) serving as the highest prevalence followed by brain and nervous system cancers (16%). Lymphomas (13%) was the most prevalent malignant diseases in subjects aged 14 years or younger. In the age range 15–49 years, breast cancer (13%) is the most common malignancy, followed by liver (12%) and lung (9%) cancers. In the age range 50–59 years, lung cancer was the most frequent malignant disease (18%), followed by liver (11%) and breast (9%) cancers, while the most frequent malignancies in subjects aged 60 years or older are lung (21%), colorectal (9%), stomach (9%), and liver cancers (9%) [18].

WHO acknowledges that effective cancer treatment is dependent on early detection, accurate diagnosis, and access to multimodal cancer therapy thus, emphasis is placed on early detection as a lynchpin to cancer control in LMICs [11]. Sagan asserts that population screening should be done within an organized screening programme that includes certain core elements, from identifying target populations, through treatment, to monitoring and evaluation [17,18]. Patient care should be prioritized when deciding to implement a screening programme to protect against the potential for commercially driven vested interests and patient demand that is supplier-induced, thereby identifying barriers to maximizing the effectiveness of programs and setting up measures to overcome them are equally important.

Given the studies undertaken to evaluate the health and economic impact of healthy lifestyle interventions, Cecchini found policies targeting diet, physical activity and obesity (e.g. food advertising regulation and school-based interventions) have the potential to reduce the incidence of lung, colorectal and female breast cancers [19]. Similar conclusions were drawn by Kohler, stating that strict adherence to nutrition and physical activity guidelines is associated with a 10–61% reduction in overall cancer incidence [20,21]. Regarding the abuse of alcohol, a study on the impact of alcohol prevention an interventions concluded that excess taxes were effective in reducing rates of alcohol consumption as 10% rise in alcohol prices, for instance,

could cut alcohol-related cancer rates by 2% [22-25].

The treatment of cancer continues to rest largely on three major modalities: surgery, radiotherapy and systemic therapies, including chemotherapy, immunotherapy, targeted therapy and gene therapy [26] and combinations of therapies. The most prevalent treatment modality known around is chemotherapy. The probability of receiving each treatment modality was 85% for chemotherapy, 62% for surgery, and 31% for radiotherapy in a previous study. Multimodality treatment, including chemotherapy, surgery, and radiation, was administered to 24% of patients [27]. For example, early-stage of breast cancers (stage I and II) can be treated with a combination of breast-conserving surgery and radiation therapy, whereas locally advanced breast cancer (stage III) is treated with chemotherapy followed by either surgery or radiation therapy or both. Patients with stage IV breast cancer (metastatic breast cancer) are treated predominantly with chemotherapy or hormone therapy alongside radiation therapy, to control the spread of tumor [28]. More importantly, the treatment of breast cancer can be effective, especially when the disease is diagnosed early and its prognosis and treatment depend on the type of breast cancer and tumor stage.

The proportion of patients with breast cancer who receive different forms of treatment vary across the continent based on the stage at diagnosis, availability of resources, age at presentation, and the cost involved in treatment [28]. In Africa, nearly 53% of all women with breast cancer are diagnosed with advanced stages and they are treated by surgical removal combined with hormone therapy or chemotherapy, whereas few receive palliative treatment such as radiation therapy because the tumor is at an advanced stage and inoperable. It is a common knowledge that In Sub-Saharan African countries, 60% of patients with breast cancer usually undergo surgery and only 52% receive radiation therapy after surgery, and 19% received chemotherapy [28].

Radiation therapy is one of the most effective approaches for cancer treatment, with more than one-half of patients requiring radiation therapy during their disease course. However, numerous research conducted over the past 20 years has demonstrated the scarcity of radiation oncology resources in LMICs, including Africa. A recent study on the assessment of radiation therapy resource capacity reported a cumulative shortage of 188 megavoltage machines, 85 brachytherapy after loaders, and 3363 trained radiation therapy personnel in developing countries including Africa [28].Radiation is a physical agent, which is used to destroy cancer cells. The radiation used is called ionizing radiation because it forms ions (electrically charged particles) and deposits energy in the cells of the tissues it passes through. This deposited energy can kill cancer cells or cause genetic changes resulting in cancer cell death. Although radiation damages both normal cells as well as cancer cells, the goal of radiation therapy is to maximize the radiation dose to abnormal cancer cells while minimizing exposure to normal cells, which is adjacent to cancer cells or in the path of radiation. Normal cells usually can repair themselves at a faster rate and retain its normal function status than the cancer cells. Cancer cells in general are not as efficient as normal cells in repairing the damage caused by radiation treatment resulting in differential cancer cell killing.

In a previous systematic review on radiation therapy availability in LMICs, it was documented that Africa has the fewest radiation therapy resources worldwide [28] and with the increase in cancer incidence in Africa, the lack of radio-oncological health care resources exacerbates the burden of this disease and accentuates a growing public health challenge in the continent. Data from the International Atomic Energy Agency indicated that as of March 2020, some African countries have access to external beam radiation therapy and brachytherapy, nonetheless, no African country has sufficient radiation therapy resources that meets the treatment requirement with regards to the increasing cancer incidence in the continent. Radiation therapy resources comprising linear accelerators (linacs), brachytherapy equipment, orthovoltage units, computed tomography simulators, computed tomography scanners, and trained radiation oncology personnel are grossly inadequate in Africa [28].The superiority and effectiveness of radiation therapy in cancer management can never been overemphasized. Previous studies in Western countries suggested that radiation therapy may prolong overall survival as well as achieve local control of the disease [28]. The basis of radiation therapy is the use of ionizing radiation to destroy malignant tumor cells while minimizing damage to normal cells. Radiation therapy plays a vital role in the treatment of breast cancer from the early stages to locally advanced stages and most commonly to alleviate the symptoms associated with metastatic breast cancer [28]. Moreover, it is effective in reducing mortality and the risk of recurrence in patients with breast cancer after breast conserving surgery. The discovery of X-rays and radiation by Becquerel and Rontgen in the late 19th century was the first step towards radiation treatment. Marie Curie's work greatly contributed to the development of radiotherapy. The first cancer case cured exclusively by radiation occurred in 1898. After World War II, technological progress allowed charged particles to be propelled through a vacuum tunnel called linac, or linear accelerator [29]. In 1960, Ginzton and Kaplan began to use a rotational linac radiotherapy called "Clinac 6", which was used to concentrate X-rays more deeply thereby preventing skin affectation. The development of modern computers enabled three-dimensional X-ray therapy, such as intensity-modulated radiation therapy (IMRT) using mapping information from Computed Tomography (CT) scans. This provides a three-dimensional reconstruction, which helps avoid toxicity since the contours of the tumor are targeted and separated from healthy tissues. In 2003, a specific type of IMRT was developed called the TomoTherapy® system. This treatment uses CT-guided IMRT technology that directs the radiation source by rotating it around the patient, which makes the morphological limits of a tumor easier to trace with the beam [29].

Another significant trend is the use of charged particle radiotherapy with proton or helium ions for specific types of patients with melanoma of the uveal tract. It is also used as adjuvant therapy for skull base chondroma, chondrosarcoma and spine (usually cervical). In summary, the lines of development have been fractionated dose delivery, technological advances in X-ray production and delivery and improvement of computer-based treatment planning [29]. The latest advance in scanning technology with radiotherapy is four-dimensional (4D) conformal radiotherapy [30], which records a video sequence of tumor movement. This therapy uses dynamic CT images of the body that compensate for any movement by the target, including movements when patients breathe. There are two forms of this therapy: Image-guided radiation therapy (IGRT) and Image-guided adaptive radiation therapy (IGART) [29,30]. Radiotherapy is recommended as the treatment of choice on the basis of published evidence that radiotherapy has a superior clinical outcome compared to alternative treatment modalities

(including no treatment) and where the patient was suitable to undergo radiotherapy based on an assessment of performance status indicators and the presence or absence of comorbidities [31]. The superiority of radiotherapy over other treatment options could be because of better survival, local control, or toxicity profiles [31].

Of all the treatment modalities, radiotherapy is the least accepted, understood and utilized in Africa. In the background of this is a globally inequitable distribution of radiotherapy facilities whereby low- to middle-income countries are disadvantaged through a lack of or inadequate radiotherapy treatment services. In high-income countries, one radiotherapy machine is available for every 120,000 people and in middle-income countries, one machine serves over 1 million people [32-35].Further indications of radiation therapy include combination strategies with other treatment modalities such as surgery, chemotherapy or immunotherapy. If used before surgery (neoadjuvant therapy), radiation will aim to shrink the tumor. If used after surgery (adjuvant therapy), radiation will destroy microscopic tumor cells that may have been left behind. It is well known that tumors differ in their sensitivity to radiation treatment [36]. There are two ways to deliver radiation to the location of the cancer. External beam radiation is the livered from outside the body by aiming high-energy rays (photons, protons or particle radiation) to the location of the tumor. This is the most common approach in the clinical setting. Internal radiation or brachytherapy is delivered from inside the body by radioactive sources, sealed in catheters or seeds directly into the tumor site. This is used particularly in the routine treatment of gynecological and prostate malignancies as well as in situations where retreatment is indicated, based on its short range effects [36].

Cancers curable with radiation therapy in combination with other modalities include breast carcinomas, skin cancers (squamous and basel cell) , prostate carcinomas, lung carcinomas (non-small cell), cervix carcinomas, lymphomas (Hodgkin's and low grade Non-Hodgkin's), head and neck carcinomas, rectal and anal carcinomas, local advanced cervix carcinomas, locally advanced head and neck carcinomas, locally advanced lung carcinomas, advanced lymphomas, bladder carcinomas, endometrial carcinomas , CNS tumors soft tissue sarcomas, pediatric tumors [36].

Chemotherapy, is one of the most popular means of cancer treatment. The history of chemotherapy began in the early 20th century, but its use in treating cancer began in the 1930s. The term "chemotherapy" was coined by the German scientist Paul Ehrlich, who had a particular interest in alkylating agents and who came up with the term to describe the chemical treatment of disease. During the first and second world wars, it was noticed that soldiers exposed to mustard gas experienced decreased levels of leukocytes. This led to the use of nitrogen mustard as the first chemotherapy agent to treat lymphomas, a treatment used by Gilman in 1943 [29]. In the following years, alkylating drugs such as cyclophosphamide and chlorambucil were synthesized to fight cancer [29].Chemotherapy is curative in some types of advanced cancer, including acute lymphoblastic and acute myelogenous leukemia, Hodgkin's and non–Hodgkin's lymphoma, germ cell cancer, small cell lung cancer, ovarian cancer and choriocarcinoma [29]. In pediatric patients, curable cancers include acute leukemia, Burkitt's lymphoma, Wilms' tumor and embryonal rhabdomyosarcoma. Although treatment is not always curative for these cancers, there has been significant improvement in progression-free and overall survival [29]. Another modality of treatment is neoadjuvant therapy, which aims to reduce the size of the primary tumor and prevent micrometastases. This type of treatment improves on more conservative surgical techniques in preserving the functionality of important organs. Neoadjuvant chemotherapy is indicated for anal, breast, lung, gastroesophageal, rectal, bladder and head and neck cancer, as well as some types of sarcoma. There are many cancers for which adjuvant chemotherapy has been established with curative effect, and with the new effective drugs and combinations the curability rates are expected to rise even more [29].

The concept of Immunotherapy in medicine incorporates the use of components of the immune system, including antibodies (Abs), cytokines, and dendritic cells, to treat various illnesses, such as cancer, allergies, and autoimmune and infectious diseases. Immunotherapy also includes the use of vaccines for the prevention of allergies and tumors. Immunotherapy adds new dimensions to clinical practice, offering much more specificity, higher efficacy, directed therapy, less toxicity, lower secondary effects and better tolerance. Although immunotherapy can be used for several illnesses (macular degeneration, autoimmune diseases, etc.), in the case of cancer, the aim of immunotherapy is to kill tumor cells (either directly or indirectly) or to help patients' immune systems destroy tumors [29].

More recent treatments, which are at various stages of development, include angiogenesis inhibitor therapy, biological therapies (including interferons, interleukins, colony-stimulating factors, monoclonal antibodies, vaccines, gene therapy and nonspecific immunomodulating agents), bone marrow and peripheral blood stem cell transplantation, laser therapy, hyperthermia, photodynamic therapy and targeted cancer therapies [29].

Hyperthermia, as an anticancer therapy, consists of heating a tumor to inhibit proliferation of cancer cells with the aim of destroying or rendering them more sensitive to the effects of conventional protocols of radiation and chemotherapy. In fact, hyperthermia is currently used as an adjunct therapy to radiotherapy and/or chemotherapy. When cells are heated beyond their normal temperature they can become sensitized to conventional therapeutic agents such as radiation and chemotherapy. When high temperatures are used, typically above 43 °C, the heat causes irreparable damage and results in tumor cell death in a process known as thermal ablation. The success of local thermal ablation consists of destroying the entire tumor mass without damaging adjacent vital structures. This requirement is particularly important for patients with limited reserves of tissue function [29].

Hyperthermia treatments make use of microwaves, ultrasounds and radiofrequency, which can be focused and used locally to target the tumor. A significant advantage of thermal technology is that it is minimally invasive. Mild heat increases blood flow in the tumor, allowing chemotherapy to exert greater effect on cancer cells. By depressing the metabolic activity of target cells, heat also reduces the oxygen demand in the tumor and tumor tissue oxygenation increases, which makes hyperthermia one of the most potent radio-sensitizers available [29].

Photodynamic therapy (PDT) is a technology that uses a photosensitizer that is activated upon exposure to visible or near infrared (NIR) light, and transfers energy to molecular oxygen, thereby generating reactive oxygen species (e.g., singlet oxygen, free radicals, peroxides). The subsequent oxidation of lipids, amino acids and proteins induces cell death [29].

Nanoparticles are engineered to achieve cell targeting by using selective moieties (e.g., antibodies and their fragments, carbohydrates, peptides, nucleic acids), which binds to its corresponding antigen, cell surface carbohydrate or over-expressed receptor in tumor cells. The rapid cellular proliferation of these cells is also exploited by coupling the nanoparticles with different biological agents, such as folic acid. The rationale for coupling these carriers with folic acid is that the folate receptor is over-expressed in a broad range of tumor cell types, including solid and hematological malignancies [29,30]

Radiotherapy (RT), surgery and chemotherapy play key roles in the curative treatment of cancer, both individually and in combination. It was estimated that RT was the predominant modality involved in the cure of 40% of cancer patients with estimated figures for surgery and chemotherapy [33].

Cancer management has evolved rapidly since the 1980s, with remarkable technical developments in RT and surgery, alongside discoveries of new drugs, especially cell- cycle checkpoint inhibitors and immune response modifiers. Equally important, the increased integration of multi- modality treatments has structurally modified cancer care [33].

Previous studies showed that the addition of bevacizumab in combination with chemotherapy in patients with recurrent, persistent, or metastatic cervical cancer was associated with an improvement in care. Immunotherapy in cervical cancer is a promising option since programmed cell death ligand 1 (PD-L1) has a high expression in this tumour [8,9]. Therefore, the trial of pembrolizumab, a Programmed Cell Death Protein 1 (PD-1) inhibitor, achieved an objective response of 14.3% in patients who had received one or more prior chemotherapy treatments for recurrent or metastatic disease and had PD-L1–positive tumors. Based on this, pembrolizumab was the first immunotherapy to receive accelerated approval from the United States Food and Drug Administration in 2018 as a second-line treatment for patients with metastatic cervical cancer with positive PD-L1 expression [33].Subsequently, a clinical trial explored the addition of pembrolizumab to chemotherapy with or without bevacizumab in patients with recurrent, persistent, or metastatic cervical cancer, this showed a benefit in progression-free survival (PFS) regardless of the expression of PD-L1 [33]. In 2024 data was published that patients with newly diagnosed, high-risk, locally advanced cervical cancer the addition of pembrolizumab to chemo-radiotherapy treatment significantly increased PFS currently, there are multiple clinical trials with combinations of immunotherapy, conjugated antibodies and poly ADP-ribose polymerase inhibitors determining a new era in the treatment and prognosis of this pathology [33].

Treatment options for brain metastasis (BMs) of cancer include surgery, whole-brain radiation therapy (WBRT), WBRT with a simultaneous in targeted boost, stereotactic radiosurgery/ stereotactic body radiotherapy (SRS/HFRT), chemotherapy, targeted therapy and immunotherapy with immune checkpoint inhibitors (ICIs) [32]. These treatments have significantly prolonged the survival of patients with BMs. Local therapies, particularly radiotherapy (RT), play a pivotal role in the treatment of BMs. For patients with 1-3 BMs, SRS has the benefit of local control, reduced delivery time, and reduced cognitive impairment compared to the WBRT [32]. Recent studies agree that WBRT+boost/HFRT and SRS are equivalent in the treatment of single brain metastases. However, SRS may be with more cerebral distant relapse in comparison with WBRT + boost. Owing to economic reasons or considering poor follow-up compliance in China, WBRT + boost/HFRT treatment still remains possible. Although SRS is recommended by guidelines as a standard radiotherapy method for patients with 1-3 BMs [32]. However, several retrospective clinical studies have reported varying prognosis of radiotherapy for solid and cystic BMs. One study showed that solid BMs in NSCLC had significantly better local control rates than cystic BMs [32]. Brigell showed that HFRT results in a higher local control rate compared to WBRT in patients with solid BMs, but the radiotherapy models have a limited effect on the local control rate of cystic BMs. Contrary to the aforementioned studies, Wang reported that there was no difference in prognosis and local control between patients with cystic and solid BMs treated with RT [34].

Currently, reports comparing the prognosis of patients with cystic and solid BMs after radiotherapy are limited and inconsistent. Due to the rarity of cystic BMs, there is still a lack of definitive evidence from large clinical research trials to support the optimal treatment of cystic BMs [32].

Along with surgery and chemotherapy, radiation therapy remains an important modality used in cancer treatment being a highly cost effective single modality treatment accounting about only 5% of the total cost of cancer care [8]. Furthermore, approximately 50% of all cancer patients will receive radiation therapy during their course of illness [9,10] with an estimation that radiation therapy contributes to around 40% towards curative treatment [11]. Rapid progress in this field continues to be boosted by advances in imaging techniques, computerized treatment planning systems, radiation treatment machines (with improved X-ray production and treatment delivery) as well as improved understanding of the radiobiology of radiation therapy [36].

The perception of curability is a crucial factor in the management of advanced cancer. Previous studies have shown that oncologists tend to be more realistic in their assessment of curability, considering relevant clinical and scientific factors, while patients with advanced cancer may have unrealistic hopes and expectations regarding the possibility of a cure. Oncologists rely on their clinical experience and the available scientific evidence to evaluate the potential cure, patients may have higher expectations of a cure, which could have been influenced by non-medical information and success stories of treatment [37]. These differences in expectation can lead to mental and emotional strains, including difficulties in clinician-patient communication, which can cause severe problems in shared decision-making during treatment

Scientific evidence indicates that a significant number of patients in palliative care believe that their therapy aims for a cure but are unaware of their life expectancy. Patients with advanced malignant neoplasms often overestimate the benefits of chemotherapy and hold misconceptions about the therapeutic intent of treatment. Female patients and those with secondary or higher education are more likely to understand their diagnosis. However, patients with lower education levels tend to lack awareness of treatment intent. Additionally, older patients with lower incomes and a lack of social support tend to have misconceptions about treatment goals.

Justification of Study

DUFUTH has a radiotherapy center, equipped with a linear accelerator, brachytherapy and CT for variable cancer treatment, stimulation and guidance. Since onset this center has undertook the treatment of various cancers using different conventional means like radiotherapy, chemotherapy, immunotherapy and

combination alike. There have been a dearth of knowledge on the outcome of these patients following the various treatment modalities as well as comparison to know the most effective method around viz za viz the outcome of the treatment of these cases. More importantly even the incidences and epidemiology as well as the analysis of the various cancer cases in this locality remain unknown.

This retrospective study is to provide the relevant analysis and comparative analysis of the various treatment modalities currently been done at cancer research institute in DUFUTH as well as to provide information of the treatment outcome and survival rates of our patients over the past three years. This will help to provides essential information on possible causes and population trends of these conditions, thus making it possible to establish timely and appropriate health-care interventions aimed at developing efficient policies for prevention, screening, diagnosis and effective treatment method that can enable cancer patient survival in our localities.

Aim

This retrospective study is to evaluate the epidemiology of cancer and to analyse the effectiveness of treatment modalities in Cancer Research Institute, David Umahi University of Teaching hospital Uburu.

Objectives

- To determine the age and sex of cancer patients in DUFUTH
- To analyse cancer treatment modalities in DUFUTH
- To analyse treatment outcome with the treatment modalities in order to determine their effectiveness in bringing cures to cancer patients

Definition of Terms

Referral: The act of directing someone to a more specialize professional for services or assistance

Incomplete treatment: When a patient stops prescribed regimen or fail to finish procedures.

Discharge against medical advice: When a patient leaves a hospital before the medical team recommends discharge

Abscond: To leave secretly and suddenly to avoid detection

Stable outcome: Complete or partial cure with disappearance of symptoms and religious clinical follow up

Cancers: A large group of disease characterize by uncontrolled cell growth that can invade surrounding tissues often caused by genetic mutations from environmental factors.

Carcinoma: Cancers arising from epithelia cells

Sarcomas: Cancers arising from connective tissues (bone, fat, muscle, nerves etc.)

Methodology

Study Design

The retrospective study was carried out amongst patients pathologically confirmed and Oncologically treated cancer cases in Cancer Research Institute, DUFUTH, Uburu, Ebonyi state, South East Nigeria, between January 2023 to December 2025.David Umahi Federal University Teaching Hospital is a 500 bedded tertiary referral hospital in Southast Nigeria, Ebonyi state with a well equipped radiology and radio-oncology department. Equipment present include a linear accelerator, brachytherapy machine which are used for the various cancer treatment that meet the criteria. For diagnostic and simulative purposes, the radiodiagnostic department has a 1.5 tesla MRI, a 64 slides CT scan, a digital and mobile x-ray machine, a mammogram and several 4ds ultra sound scanners.

Study Design

A cross sectional retrospective study on all Cancer cases treated at Cancer research institute in David Umahi Federal University Teaching Hospital, Uburu DUFUTH. Cases were collated and analyzed alongside with their treatment modalities applied.

Description of material

Records used included data from patients' file, registers, summary sheets, doctors' medical and referral notes and electronic medical records.

Data analysis

Data was analyzed using SPSS version 26, IBM Corp Armonk, NY. All continuous variables were summarized using medians with interquartile ranges, while categorical data was recorded as proportions with percentages. Pearson's Chi-square test was used to examine the associations between independent variables and the timing of diagnosis among cancer patients. Prevalence ratios (PRs) was estimated the strength of association between the outcome and indicator variables, and associations was tested at a 95% confidence interval (CI).

Inclusion Criteria

All diagnosed and treated cancer cases were used for this analysis.

Exclusion Criteria

All cases with missing record of treatment and diagnosis were excluded.

Ethical clearance

Clearance was obtained in Research and ethics department of David Umahi Federal University Teaching hospital bothering on patient's confidentiality and protection of data. HREC/20/09/25/002.

Result and Discussion

General Result

DUFUTH received and treated a total of 253 numbers of cancer cases between January 2023 to December 2025, out of which, 145 (57.3%) were males while 108 (42.7%) were females. Prostate cancer served as the major presenting malignant condition among all the patients accounting for, 24.5% (62) followed by breast cancer and cervical cancers 16%(41), 14%(36) respectively. Among all the modalities of treatment, most of the cancer patients received Radiotherapy at a rate of 41.5%, much more than other treatment modalities and among the single modalities of treatment, radiotherapy was more effective than chemotherapy. However, combination of therapy yielded a more effective treatment modality with more stable outcome and less treatment failure and follow-up.

Discussion

Distribution of cancer in most centers in Nigeria are similar to the findings in DUFUTH [3,5,27-29]. Cervical cancer was the commonest cancer, accounting for 55% of 2,420 cancers screened in similar study in Lagos Nigeria followed by breast

(41%), prostate (4%), and colorectal cancers (0.2%). Of the 7,682 cancers treated among Lagos residents, the top five were breast (45%), colorectal (8%), cervical (8%), prostate (5%), and ovarian (4%). The female: male ratio of cancer cases was 3:1 [29]. Similar findings abound in Ilorin, Kano, Benin, southwest Nigeria and even among Africa studies and global studies [1-5,27-29].

Modalities of Cancer Treatments In DUFUTH

The modalities employed to treat cancers in DUFUTH as observed by this research include:

Single methods

1. Radiotherapy
2. Chemotherapy
3. Surgery
4. Palliative care
5. Hormonal therapy

Combine methods

1. Chemotherapy + Radiotherapy
2. Chemotherapy/Hormonal therapy + surgery
3. Radiotherapy+ surgery

Treament Modalities and Their Rate

Greater percentage of cancer patients in DUFUTH received radiotherapy at a rate of 41.5%(105) as a means of treatment. This was followed by palliative care at a rate of 20.4%(52). Chemotherapy combined with surgery was 11.9%(30) while chemotherapy alone stood at 10.3%(26). Surgery alone stood at the least rate of 1.5%(4) while surgery combined with radiotherapy stood at 6.0% (15) and chemotherapy with radiotherapy was 8.3%(21). See table 1

Treatment Outcome in Comparison with Their Modalities

Treatment outcome in this research is compared by those who became cancer symptoms free, with successful completion of their treatment plan/regimen and are currently still on continuous monitoring and clinical follow up. These individuals are termed "stable" treatment outcome.

Individual who absconded from treatment, failed to complete their treatment regimen or plan and leave against medical advice with no monitoring and clinical follow up are termed incomplete" treatment outcome. No knowledge or findings on their status of symptoms or curability. Individual who died from disease progression in the course of treatment are termed "dead" while those who were transferred or referred to other facilities either for additional services or based on request due to proximity are termed "transferred/referred".

Therefore, among the 10.3%(26)cancer patients that received chemotherapy alone as a means of treatment, 26.9%(7) of them had stable outcome while 61.%(27) of them had incomplete treatment outcome.11.5%(3) of them died or transferred during the course of treatment.

On radiotherapy alone, 41.5% (105), 57.1%(60) had stable outcome while 41.8%(45) had incomplete treatment. Surgery alone 1.5%(4) had 100%(4) stable outcome.

Palliative care 20.4%(52) had 38.5%(20) stable outcome and 55.5%(29) incomplete treatment and 5.7%(3) mortality.

In combination of treatment modality, Chemotherapy in combination with radiotherapy 8.3%(21), 33.3%(7) had stable outcome while 66.7%(14) had incomplete treatment.

Chemotherapy in combination with surgery 11.9%(30), 60%(18) had stable outcome while 40%(12) had incomplete treatment. Radiotherapy in combination with surgery 6.0% (15) , 13.3%(2) had stable outcome while 86.7%(13) had incomplete treatment outcome. See table 1

Note that palliative care is given to those with end stage disease and aim is basically for pain relieving and prolongation of life. Treatment given where usually radiotherapy in combination with opioids to relive pains.

Discussion

In contrast, a study done at Illorin revealed most prevalent treatment modality as chemotherapy alone. The probability of receiving each treatment modality was 85% for chemotherapy, 62% for surgery, and 31% for radiotherapy. Multimodality treatment, including chemotherapy, surgery, and radiation, were administered to 24% of patients in Illorin [30]. Similarly in China, support for chemotherapy as the predominant form of cancer treatment, are documented and it was more likely to improve symptom management, cognitive function, hospital readmission, treatment received compliance, and provision of timely treatment for cancer patients with overall equivocal effect on cancer patients' quality of life, self-efficacy, survivor status, and satisfaction[31]. Rare significant effect was reported on cost and length of stay [31]. Surgery was the most common curative treatment, with 80% receiving surgery, alone or in combination

TABLE 1: Showing the different modalities of treatment of neoplastic diseases with treatment outcome in DUFUTH.

TREATMENT	NUMBER	STABLE	INCOMPLETE TTREATMENT	DEAD/TRANSFER
Chemotherapy only	26(10.3%)	7(26.9%)	27(61.5%)	3(11.5%)
Radiotherapy only	105(41.5%)	60(57.1%)	45(41.8%)	-
Surgery only	4(1.5%)	4(100%)	-	-
Chemotherapy+ Radiotherapy	21(8.3%)	7(33.3%)	14(66.7%)	-
Chemotherapy + surgery	30(11.9%)	18(60%)	12(40%)	
Radiotherapy + surgery	15(6.0%)	2(13.3%)	13(86.7%)	
Palliative care	52(20.4%)	20(38.5%)	29(55.58%)	3 (5.7%)
TOTAL	253	118	129	6

in Egypt [32]. Radiotherapy was delivered at a rate of 39% and chemotherapy at 29%; 45% received two and 13% all three modalities as studied in Egypt [32].This study concluded by emphasizing the importance of integrated, resourced, multidisciplinary cancer care. Among the 5 year survived patients, studied in Europe, 40% received radiotherapy with emphasis on the importance of radiotherapy in cancer patient survival [33]. No doubt that radiotherapy (RT), surgery and chemotherapy play key roles in the curative treatment of cancer, both individually and in combination. In 1992, it was estimated that RT was the predominant modality involved in the cure of 40% of cancer patients with estimated figures for surgery and chemotherapy of 49% and 11%, respectively [33].Radiotherapy, although an essential and cost-effective treatment for cancer, has a low uptake on the African continent. Surprisingly, radiotherapy serves and the, main modality of cancer treatment in DUFUTH. This is not surprising as DUFUTH has a functional cancer center and radio-oncology department equipped with linear accelerator and branchytherapy with effective management and consumable supply. Many cancer patients from all walk of life come to DUFUTH for cancer treatment basically for radiotherapy with effective and improved outcome post radiotherapy treatment. Most cancers treated in the region of Africa need radiotherapy as a component at some point in the course of the management either for curative or for palliative [34], unfortunately this is hardly available in most centers in Nigeria. The relatively high cost of setting up radiotherapy services is a major challenge and political efforts and will need to be redirected in healthcare sector concerning cancer care in provision of radiotherapy facility. This will enable a balanced long-term benefits of having a well-proven treatment modality that can be accessible to a large number of cancer patients at reasonable cost [34]. Low healthcare funding in our region is a key hindrance to access to radiotherapy.

In Australia, the proportion of patients with cancer who had external beam radiotherapy is about 52% [35]. Radiotherapy is an essential mode of cancer treatment and contributes to the cure or palliation of many cancer patients. Radiotherapy facilities have high capital costs and their operation is staff and capital intensive [35]. Many components are involved in the effectiveness of management of radiotherapy centers in order to have a deliverable results. These components are interwoven to give a deliverable result in cancer care. See fig.1

Figure 1*: Showing the components for structuring quality radiotherapy service provision. Extracted from radiotherapy treatment in cancer control and its important role in Africa. E cancer 2019 [34].*

Although immunotherapy is not so popular in cancer management in DUFUTH, in recent years, immunotherapy has become an important therapeutic alternative, making first choice in many cases of cancer treatment [36], however, this is also very expensive and unreachable by many indigent patients.

Surgery and radiotherapy were the basis for solid tumor treatment in 1960s in many countries in the world. This led to a plateau in curability rates due to uncontrolled micro metastases [36] and the experience with poly-chemotherapy in hematologic cancer brought to light the fact that different drugs act against tumor cells in different phases of their cellular cycle [36].

In Benue, 77.5% of cancer patients received chemotherapy, 13.5% surgery and 9.1% went for radiative therapy [37] and combination of surgery, chemotherapy and teletherapy were the most common form of treatment in Bangladesh [38] while Surgery was the most common curative treatment, at 80% rate either alone treatment or in combination; radiotherapy was delivered to 39% and chemotherapy to 29%; 45% received two and 13% all three modalities in multicenter study done in Africa [34]. In contrast, cancer patients in New Yolk receiving multimodality therapy survived longer up to 5years. Three-year survival for patients who received chemotherapy, surgery and radiotherapy as combine therapy was 68%. Whereas it was 43% in patients who received chemotherapy and surgery only [39] similarly, findings in Zambia showed that 93% adhere to radiotherapy treatment for cancer while 7% did not adhere to treatment [40] inferring that radiotherapy don't only better cancer treatment outcome,. It also enhance and encourages treatment adherence compared to all other form of treatment. This is similar to findings in this research with adherence rate for radiotherapy of 57.1%, 60 patients out of 105, the highest number of adherence among all other single therapy modality used in this analysis(chemotherapy, 26.7% adherence) . However, among the combine modalities, adherence of chemotherapy in combination with surgery surpassed all other combination at a rate of 60%; 18 patients out 30, when compared with other combination therapy studied in this research (33% for chemotherapy in combination with radiotherapy and 13.3% for radiotherapy in combination with surgery). Although surgery compliance rate is 100%(4), this is not a true reflection of effectiveness comparing the numbers of patient involved and their stage of cancer treatment. Surgery is only a required means of treatment for stage 1 and 11 cancers and only minimal number of patients present at this early stage and those who present are supposed to have 100% compliance and stability due to the stage of the cancer.

Each modality of cancer treatment faces variable challenges despite the world technology advancement. Surgery struggles with complete tumor removal due to heterogeneity, chemotherapy contends with drug resistance and side effects; Radiation therapy grapples with precision issues and limited access in some regions. Hormonal therapy faces resistance development and quality of life impacts [41], however, the success of treatment depends upon the type of cancer, locality of tumor, and its stage of progression. Nevertheless, there is hope that some of the modern modalities include hormone-based therapy, anti-angiogenic modalities, stem cell therapies, and dendritic cell-based immunotherapy and the synergistic effects of combining targeted therapies with immunotherapy and the development of safe and efficient cancer nano-medicines will

proffer better hope and survival outcome for cancer care[42,43]. Stem cell therapy has brought promising efficacy in regenerating and repairing diseased or damaged tissues by targeting both primary and metastatic cancer foci, and nanoparticles brought new diagnostic and therapeutic options [44]. Targeted therapy possessed breakthrough potential inhibiting the growth and spread of specific cancer cells, with less damage to healthy cells. Moreso, ablation therapy has emerged as a minimally invasive procedure that burns or freezes cancers without the need for open surgery. Natural antioxidants demonstrated potential tracking down free radicals and neutralizing their harmful effects thereby treating or preventing cancer [44]; However, most of these modalities are far fetch in our environment making cancer care difficult in our setting.

Treatment modalities have different possibility for cure and this variability depends on the kind, stage, and performance level of the patient, among other factors. For solid malignancies in their early stages, surgery alone may be curative [46]. The palliative care is mostly focused on increasing the quality of life rather than focusing on the cancer cells. In immune-therapy, the immune system of an individual is boosted to fight against cancer. In laser therapy, high intensity beam is used to destroy the tumours cells, this is mostly preferred for the superficial kind of cancers [47].

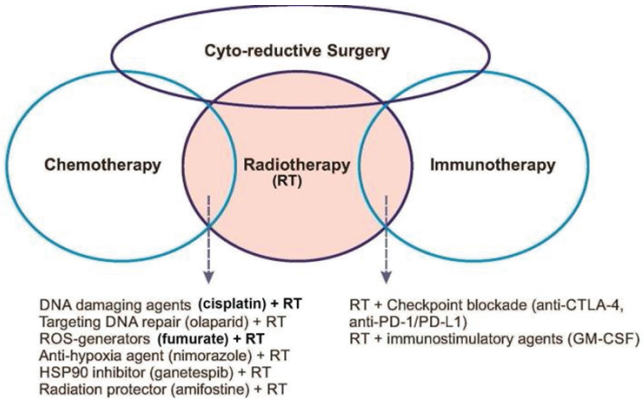

Fig 2: present interrelationships between cancer treatment-cyto-reductive surgery, chemotherapy, radiotherapy, or immunotherapy [45]

Historically, surgery was considered as the only chance treatment for cure of cancer serving as the first line of defense against a tumor; however, the increased use of neo-adjuvant therapies have often shifted surgery to a second or third line of treatment [1,32]. The role of surgery does not confine to a purely therapeutic manner but also included considerations of both palliation (pain, bleeding, obstruction, malnutrition, or infection) and prophylaxis like the use of tamoxifen for the chemoprevention of breast cancer [32,48], and With the knowledge of genetic predisposition to cancer and presence of cancer family gene, the surgeon can remove healthy organs to prevent cancer, therefore, surgery in cancer therapy has multidisciplinary roles to play apart from therapeutic application of established tumors but also towards the prevention of cancer [48].

Nowadays, more advanced techniques for surgery like cryosurgery, lasers, hyperthermia, and photodynamic therapy have been invented to make surgical approach to cancer easier [32]. In cryosurgery the extreme cold produced by liquid nitrogen or argon gas is used to destroy abnormal tissue and this is mainly applicable for early-stage skin cancer, retinoblastoma, and precancerous growths on the skin and cervix [48]. Laser treatment uses powerful beams of light to cut through tissue and it may be used to shrink or destroy tumors or growths that might turn into cancer. It is also used to treat tumors on the surface of the body or on the inside lining of internal organs such as basal cell carcinoma, cervical, vagina, esophageal, and non-small cell lung cancers and premalignant lesions etc. Hyperthermia treatment is carried out by exposing areas of body tissue to high temperatures to damage and kill cancer cells or make them more sensitive to radiation and certain chemotherapy drugs [48]. Radiofrequency ablation is a kind of hyperthermia that uses high-energy radio waves to generate heat and Photodynamic therapy drugs which react to a certain type of light are used to expose the tumor [48]

Hormone therapy can help the cancer patient in the cases of prostate cancer who are not able to have surgery or radiation therapy and it may be used to reduce or prevent symptoms of cancer and it can also be used for breast cancer [35,48]. One of the most encountered clinical situations in hormone replacement therapy is regarding the relief of menopausal symptoms of breast cancer survivors [36] and hormone replacement therapy is advantageous to cancers like endometrial cancer, cervical adenocarcinoma, hematologic malignancies, local cutaneous malignant melanoma, colorectal cancer, hepatocellular cancer, uterine carcinosarcoma and adenosarcoma, certain types of ovarian cancer, cervical, vaginal and vulvar squamous cell carcinoma, prolactinoma, kidney cancer, pancreatic cancer, thyroid cancer; but relatively contraindicated for leiomyosarcoma, certain types of ovarian tumours, brain tumours, advanced metastatic malignant melanoma, lung cancer, gastric cancer and bladder cancers [48].

Radiation therapy is synergistic with chemotherapy, and in susceptible cancers, it can be used before, during, and after chemotherapy and often accompanied with other cancer treatments, such as surgery, chemotherapy, and immunotherapy [48]. This is commonly applied to tumor cells because of its ability to control cell growth. The ionizing radiation works by damaging the DNA of the cancerous cells leading to cell death by necrosis or apoptosis [35,45]. Furthermore, the types of radiation therapy that would apply to cancer cells depends on many factors like the type of cancer, tumor size, tumor location in the body, tumors closeness to normal tissues that are sensitive to radiation, general health, and medical history of the patient, whether other types of cancer treatment would be required, age and other medical conditions [35].

Different cancers respond to radiation therapy in different capacities [35,46,47]. Highly radiosensitive cancer cells such as leukemias, most lymphomas and germ cell tumors are rapidly killed by modest doses of radiation. Majority of epithelial cancers are only moderately radiosensitive, and require a significantly higher dose of radiation (60-70 Gy) to achieve a radical cure [47]. Some types of cancers like renal cell cancer and melanoma are notably radio-resistant, they require much higher doses to produce a radical cure than may be safe in clinical practice, Nevertheless, radiation therapy is still a palliative option for many patients with metastatic melanoma. Combining radiation therapy with molecular targeted therapy and immunotherapy is an active area of investigation and has shown promising results for melanoma and other cancers [48]. The efficacy of the invention of combinations of cytotoxic agents over the years have given disappointing results with significant mortality [53]

but in recent years, cancer treatment with chemotherapy is becoming more advantageous especially in targeting and killing tumor cells without affecting healthy cells [54]. This advantage is further enhanced by combining new targeted therapies with existing chemotherapy. Furthermore, introduction of targeted therapies such as 'imatinib' (a tyrosine kinase inhibitor) for chronic myeloid leukemia and gastrointestinal stromal tumor, or 'erlotinib' (an inhibitor of the epidermal growth factor receptor tyrosine kinase) for lung cancer had provided better outcomes to patients [48]. Immunotherapy detects and destroys abnormal cells and may prevent or curb the growth of many cancers [37,55-59]. For example, immune cells are sometimes found in and around tumors (which are known as tumor-infiltrating lymphocytes or TILs) are signs of immune system responding to the tumor and cancer patients whose tumors contain TILs often do better than those whose tumors do not have TILs [37]. However, cancer cells have ways to avoid destruction by undergoing genetic changes that make them less visible to the immune system, and their surface proteins can turn off immune cells and change the normal cells around them and thereby interfering with the way of immune system responding to the cancer cells [48]. Differentiation therapy is one of the emerging therapies for cancer which uses potentially lesser toxic approaches that can modify cancer cell differentiation. This approach is based on the tacit assumption that many neoplastic cell types exhibit reversible defects in differentiation, which upon appropriate treatment, results in tumor reprogramming and a concomitant loss in proliferative capacity and induction of terminal differentiation or apoptosis [48].Other emerging modalities of equal importance are small molecule targeted agents, antibody-drug conjugates (ADCs), cell-based therapies, and gene therapy. These cutting-edge treatment modalities not only afford personalized and precise tumor targeting, but also provide patients with enhanced therapeutic comfort and the potential to impede disease progression [49,50]. Nonetheless, it is acknowledged that these therapeutic strategies still harbour untapped potential for further advancement. Gaining a comprehensive understanding of the merits and limitations of these treatment modalities holds the promise of offering novel perspectives for clinical practice and foundational research engagement [50].

On treatment compliance, 57.1% of the subjects that received radiotherapy alone as a mode of treatment in DUFUTH completed their treatment with a dedicated follow-up and symptom free, while 41.8% absconded or discharged against medical advice. Treatment with chemotherapy alone was 26.9% complete treatment while 61.5% had incomplete treatment and 11.5% had inter-facility/hospital transfer. Surgery had 100% compliance with treatment modality while chemotherapy combined with radiotherapy had 33.3% treatment compliance and 66.7% non-compliance. Chemotherapy combined with surgery had 60% compliance and 40% non-compliant. Palliative care had 38.5% treatment compliance and 55.5% non-compliance and 5.7% mortality. Radiotherapy combined with surgery had 13.5% complete treatment and 86.5% incomplete treatment. In illorin, Nigeria, available data, stated that nearly half of patients who initiated chemotherapy did not complete the recommended number of doses or received treatments at irregular intervals [30]. The utilization of radiotherapy was five times higher when patients received treatment in centers with radiation facilities [30]. Compliance with surgery and its combination with chemotherapy appeared to yield a good treatment compliance, however, compliance with radiotherapy and in combination with other treatment modalities yielded a good treatment outcome and increase in treatment compliance, in similar comparison with findings in Ilorin and other cancer treatment centers around [30,49]. Findings in Zambia showed that 93% of the participants in a similar research adhered to radiation therapy while 7% did not adhere to treatment [49]. Majority of the patients 77.1% had experienced side effects of radiation therapy with 28% severe psychological distress [49] and statistically, there was significant association between adherence and perceived quality of health care services. The analysis showed that patients who perceived poor quality of health care services were 99.5% times less likely to adhere to radiation therapy [49]. Previously, study done in Ebonyi state Nigeria; among the 50.9% of cancer patients who absconded, discharged against medical advice or have incomplete treatment were similarly found to have length of stay on admission, poverty predominantly among farmers and petty traders, mainly indigenes of Ebonyi, mainly among patients with prostate and breast cancer, absence of psychological support during treatment and mainly among those treated with chemotherapy and male sex [52]. Common Implicating factors in our environment to non-adherence to cancer treatment include inadequate funding for cancer research, poor cancer education or awareness, inadequate screening or diagnostic facilities, lack of a well-organized and effective cancer registry system and access to care, shortage of specialized medical staff, high costs for screening, vaccination, and treatment, lack of technical capacity, poor vaccination response, corruption and misappropriation of funds, and/or late presentation of patients for cancer screening [51].

Limitations in cancer care in Africa have led to reduced survival rates for cancer patients [18]. Even in Europe, the 5-year survival rate for women with breast cancer is 82%, and 46% in Uganda, less than 39% in Algeria, and 12% in the Gambia [19] respectively. These limitations also impose significant socio-economic burdens on the affected population, as governments and families in these countries struggle with the increasing cases of cancer on the continent [51] and possible solution could include awareness, System for early detection, Cancer care through a health insurance scheme and improve Funding for cancer care and research [51,52].

Summary of Cancer Treatment Outcome in DUFUTH

On the over all, out of the 253 malignant cases treated in DUFUTH within the study period, 47%(118) cases completed their treatment regimen with adequate clinic follow up and disappearance/ relieve of symptoms of their cancer diseases, while 51%(129) cases had incomplete treatment or absconded from the treatment regimen with no relieve of symptom and non-clinic follow up. 1%(3) cases were transferred to other facilities

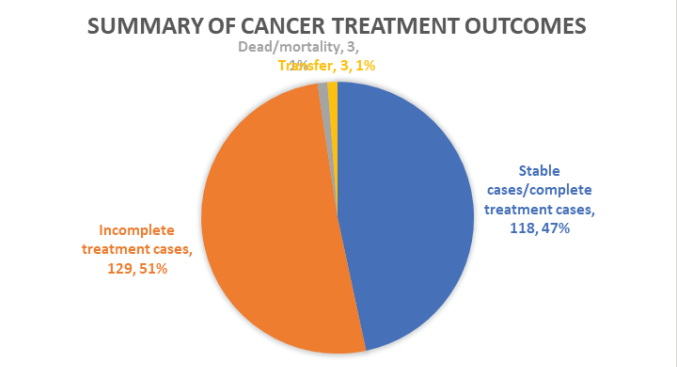

Fig.3: *Showing summary of cancer treatment outcome in DUFUTH.*

while 1%(3) of patient confirmed dead during the study period and these were mainly among prostate cancer cases, the most prevalent cancer in this research.

Epidermiology of Ten Most Common Cancers in DUFUTH

A total number of 253(12.7%) malignant cases were recorded in DUFUTH during the study period against the total number of 2,000 cases admitted and managed during the study period. Out of these the ten most prevalent cancers were prostate cancer 62(24.5%), breast cancer 41(16.0)% , cervical cancer 36(14.0)%, colorectal cancer 18(7.1%), squamous cell carcinoma 15(5.9%), oesophageal cancer 10(4%), urothelial cancers 10(4.3%), renal cancers 10(4%), nasopharyngeal cancers 8(3.2%) and Endometrial cancers 5(2%). The most prevalent cancers in males wan prostate cancer while breast was the most prevalent cancer in Females.

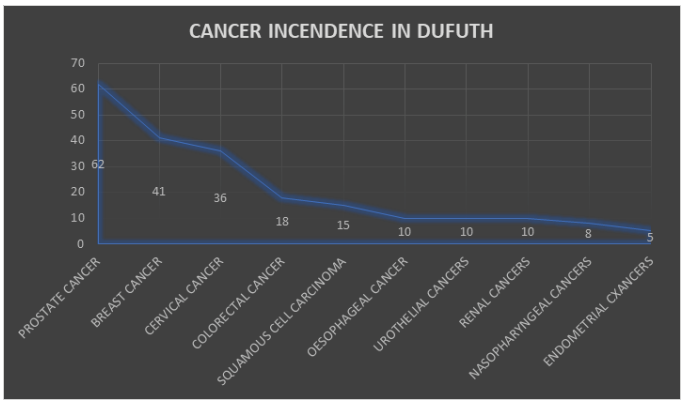

Fig.4: showing the distribution of the ten most prevalent cancers in DUFUTH.

Individual Cancer Treatment And Their Outcome

Cervical cancer cases accounted for 36 number of cases out of which, 27.8%(10) had stable treatment outcome while 72.2%(26) had incomplete treatment. Breast cancer cases (41) had 63.4%(26) incomplete treatment while 35.5%(15) had stable outcome. Renal cancers recorded a total of 10 cases with equal percentage of 50%(5 each) for both stable and incomplete treatment outcome. Endometrial cancers, with a prevalence of 1.9%(5) had 60%(3) incomplete treatment and 40%(2) stable treatment. Oesophageal cancer (10) had equal percentage of 50%(5 each) for both incomplete and complete treatment outcome. Prostate cancer recorded with a prevalence of 24.5%(62) had 61.3%(38) incomplete and 30.6%(19) stable treatment, 3.2 %(2) mortality and 4.8%(3) referrals. Urothelia carcinoma(10) had equal percentage of 50%(5 each) for both stable and incomplete treatment outcome. Gastric cancer(3) recorded 100% stable outcome. With zero incomplete treatment. Colorectal cancer (18) had 61.1 %(11) stable outcome and 33.3% (6)incomplete outcome. Lung cancer (2) had equal percentage of 50%(1 each) for both complete and incomplete outcome. Ovarian cancer (3) and Melanoma (4) had 100% stable outcome with no record of incomplete treatment during the study period. Vagina cancer (1) recorded 100%(1) stable outcome. Lymphomas with a prevalence of 1.2%(3) had 66.7%(2) stable outcome and 33.3%(1) incomplete treatment outcome. Basal cell carcinoma (3) and malignant hemangiopericytoma (3) had 100% (3 each) stable outcome while Nasopharyngeal cancers (8) had 62.5%(5) stable outcome and 37.5%(3) incomplete treatment outcome. Olfactory neuroblastoma (3), Malignant Peripheral Nerve Sheet Tumour (3) and Pituitary carcinoma (3) had 66.7%(2) stable outcome and 33.3%(1) incomplete treatment, 100%(3) stable outcome with no record of incomplete treatment, and 66.7%(2) stable treatment outcome and 33.3% (1) incomplete treatment outcome respectively. Squamous cell carcinoma with a prevalence of 5.9% (15) recorded a treatment outcome of 73.3%(11) stable and 26.7%(4) incomplete. Parotid gland cancers (3) recorded 100%(3) stable treatment outcome with no record of incomplete treatment. Sarcomas(3) and Choroid Meningioma (1) recorded 66.7%(2) stable outcome and 33.3%(1) incomplete treatment and 100%(1) stable treatment outcome respectively. See table 2.

Table 2: showing analysis of treated cancers with treatment outcome

Treated cancers	Number	Incomplete/ Absconded/ DAMA	Stable/discharged/cured
Cervical cancers	36(14.0)%	26(72.2%)	10(27.8%)
Breast cancers	41(16.0)%	26(63.4%)	15(35.5)
Renal cancers	10(4%)	5(50%)	5(50%)
Endometrial cancers	5(2%)	3(60%)	2(40%)
Oesophageal cancers	10(4%)	5(50%)	5(50%)
Prostatic cancers	62(24.5%)	38(61.3%)	19(30.6), 2 (3.2%)dead, , 3 (4.8%) referred.
Urothelia cancers	10(4.3%)	5(50%)	5(50%)
Gastric cancers	3(1.2%)	0	3(100%)
Colorectal cancers	18(7.1%)	6(33.3%)	12(61.1%)
Lung cancers	2(0.8%)	1 (50%)	1 (50%)
Ovarian cancers	3(1.2%)	0	3(100%)
Vagina cancers	1(0.4%)	0	1(100%)
Melanoma	4(1.6%)	0	4(100%)
Lymphomas	3(1.2%)	1(33.3%)	2(66.7%)
Basal cell carcinoma	3(1.2%)	0	3(100%)
Malignant Hemangiopericytoma	3(1.2%)	0	3(100%)
Nasopharyngeal cancers	8(3.2%)	3(37.5%)	5(62.5%)
Olfatory neuroblastoma	3(1.2%)	1(33.3%)	2(66.7%)
MPNST	3(1.2%)	0	3(100%)
Pituitary carcinoma	3(1.2%)	1(33.3%)	2(66.7%)
Squamous cell carcinoma	15(5.9%)	4(26.7%)	11(73.3%)
Parotid glands tumour	3(1.2%)	0	3(100%)
Sarcomas	3(1.2%)	1(33.3%)	2(66.7%)
Choroid meningioma	1(0.4%)	0	1 (100% died).
TOTAL	253	129	118

Discussion

Cancers comprise of 2% of the entire population according to the Australian Institute of Health and Welfare report (27), these cancers include pediatric cancers, sarcomas of soft tissue and bone, cancers of the mediastinum, orbit, peritoneum, retro-peritoneum, penis, and pleura as well as other rare malignancies and they are commonly treated with radiotherapy (such as soft tissue sarcomas), however, peritoneal and pleural tumors rarely respond to radiotherapy hence they are not commonly treated by it in Australia [35]. The optimal radiotherapy utilization rates in Australia for different cancers include: 12 for breast cancers, 13 for lung cancers, 14 for skin (melanoma), 16, for genitourinary, 15 for gastrointestinal, 18 for gynecological cancers, 19 for head and neck cancers, 17 for hematologic malignancies, 20 and 21 for central nervous system cancers and thyroid cancers, and 22 for cancers of unknown primary site tumors [35] with a zero recommended rate for liver cancer patients [35]. Chemotherapy is curative in some types of advanced cancer, including acute lymphoblastic and acute myelogenous leukemia, Hodgkin's and non–Hodgkin's lymphoma, germ cell cancer, small cell lung cancer, ovarian cancer and choriocarcinoma [36]. Among pediatric patients, curable cancers include acute leukemia, Burkitt's lymphoma, Wilms' tumor and embryonal rhabdomyosarcoma do respond to chemotherapy or radiotherapy [36] and if the cancer has not spread surgery may be used to remove the tumor, depending on the pathology of cancer and, the surrounding tissue [56]. For solid malignancies in their early stages, surgery alone may be curative [46], These roles do not confine to a purely therapeutic manner but also included considerations of both palliation (pain, bleeding, obstruction, malnutrition, or infection) and prophylaxis like the use of tamoxifen for the chemoprevention of breast cancer [32,48]. With the knowledge of genetic predisposition to cancer, the surgeon removes healthy organs to prevent malignancy and even with more advanced techniques, surgery can be performed without involving cuts with scalpels which include cryosurgery, lasers, hyperthermia, and photodynamic therapy [48], have revolutionalise surgical approach to cancer management making outcome and compliance satisfactory across hospitals. For breast cancer, both mastectomy with or without rapid reconstruction and breast-conserving surgery (BCS) are proven local treatments [46]. In indian, the 10-year survival rate following radiotherapy has increased to 5% for triple negative breast cancer (TNBC) and 2-4 percent for estrogen receptor (ER) and human epidermal growth factor receptor-2 (HER-2) positive breast cancer [23,46]

Scientists continue to learn more about Cancer's biology as new discoveries are able to refine existing treatments and develop new ones to make individualized treatment [56] for example, radiofrequency ablation(RFA) is an outpatient procedure that utilizes heat or rapid freezing, delivered through a thin needle –like probe inserted into the tumor to kill tumor cells and cryoablation is a similar procedure that uses rapid freezing and thawing to kill the cancer cells [56], these are benefits of continuous research and new discoveries on cancer treatment modalities.

For lung cancers, chemotherapy, chemo-radiotherapy, targeted therapy, immunotherapy, antiangiogenic therapy, and combination therapy are among the treatments modalities and adjuvant therapy and neoadjuvant therapy are also used to treat stage II–IV of lung cancers and surgery for stage 1[46]. For colorectal cancers, Neoadjuvant treatment, which includes chemotherapy and radiation therapy, has been suggested for rectal cancer and has successfully decreased tumor burden for cancers in the intermediate and advanced stages [46]. Similarly for bladder cancer, Chemotherapeutic drugs, often mitomycin-C (MMC), or immunotherapeutic agents, such as BCG, are administered either alone or in different combinations and Intravesical chemotherapy is a procedure that is greatly underutilized [46]. For Hepatocellular carcinoma, Angiogenesis is the target of various medications, including sunitinib, brivanib, linifanib, vatalanib, TSU-68, cediranib, bevacizumab, and ramucirumab. The MEK1/2 competitive inhibitor selumetinib, the mTOR antagonist everolimus, the epidermal growth factor receptor inhibitors erlotinib and lapatinib, and the multikinase inhibitors nintedanib and regorafenib are among the newer treatments evolution in liver cancers [46]. For brain tumors, the safest course of treatment is surgical excision of the tumor followed by chemotherapy and radiation [46] and targeted therapy is mostly used in the treatment of thyroid cancer, prostate cancer, lymphoma, kidney cancer, leukaemia, liver cancer etc [47].

Prostate cancer, the most commonest cancer in male worldwide as well as breast cancers benefit immensely from hormonal therapy because these cancers use hormones to grow and are often used along with other cancer treatment modalities [48] and it also find its usefulness in hormone replacement therapy to relief menopausal symptoms in breast cancer survivors [48]. Based on the available reports , hormone replacement therapy is advantageous to such cancers like endometrial cancer type I, cervical adenocarcinoma, hematologic malignancies, local cutaneous malignant melanoma, colorectal cancers, hepatocellular cancer; and neural with BRCA 1/2 mutation carriers, endometrial cancer, uterine carcinosarcoma and adenosarcoma, certain types of ovarian cancer, cervical, vaginal and vulvar squamous cell carcinoma, prolactinoma, kidney cancer, pancreatic cancer, thyroid cancer [57,58]. However, it is relatively contraindicated in leiomyosarcoma, certain types of ovarian tumours, brain tumours, advanced metastatic malignant melanoma, lung cancer, gastric cancer, bladder cancer; and disadvantageous and contraindicated with breast cancer, endometrial stroma sarcoma, meningioma, glioma, hormone receptor positive gastric and bladder cancer etc [57,58].

Radiation therapy is synergistic with chemotherapy, and in susceptible cancers, it has been used before, during, and after chemotherapy and often accompanied with other cancer treatments, such as surgery, chemotherapy, and immunotherapy [59,60]. Different cancers respond to radiation therapy in different capacities [59-62]. Highly radiosensitive cancer cells such as leukemias, lymphomas and germ cell tumors are rapidly killed by modest doses of radiation. Majority of epithelial cancers are only moderately radiosensitive, and require a significantly higher dose of radiation (60-70 Gy) to achieve a radical cure. Some types of cancers like renal cell cancer and melanoma are notably radioresistant, they require much higher doses to produce a radical cure than may be safe in clinical practice. However, radiation therapy is still a palliative option for many patients with metastatic melanoma. Combining radiation therapy with molecular targeted therapy and immunotherapy is an active area of investigation and has shown promising results for melanoma and other cancers [63-66]. Immunotherapy drugs have been approved to treat many types of cancers; nonetheless, it is not yet used widely like surgery, chemotherapy, or radiation therapy [68,69]. Immunotherapy may be considered as biological therapy as it uses the substances made from living

organisms such as white blood cells, organs, and tissues of the lymph system. It detects and destroys abnormal cells and may prevent or curb the growth of many cancers [68,70]. For example, immune cells are sometimes found in and around tumors (which are known as tumor-infiltrating lymphocytes or TILs) are signs of immune system responding to the tumor. In fact, cancer patients whose tumors contain TILs often do better than those whose tumors do not have TILs [68].

Advent of targeted therapies such as 'imatinib' (a tyrosine kinase inhibitor) for chronic myeloid leukemia and gastrointestinal stromal tumor, or 'erlotinib' (an inhibitor of the epidermal growth factor receptor tyrosine kinase) for lung cancer with other targeted therapies that include antibodies that recognize cell surface markers which trigger an immune response or stop signal cascades, had provided better outcomes to the patients [67]. Targeted therapy, which is also known as molecularly targeted therapy is one of the major modalities of medical treatment for cancer [71,72]. Targeted therapy is devised to target the proteins that control the regulatory system for growth, division and spreading of cancer cells; and it is the foundation of precision medicine [71,72]. Differentiation therapy is one of the emerging therapies for cancer which uses potentially lesser toxic approaches that can modify cancer cell differentiation. This therapy had come to a hallmark success after achieving effective results in the treatment of acute promyelocytic leukemia, neuroblastomas and myeloid leukemias. Cancer stem cells maintain their self-renewal capacity by activating multiple stem cell signaling pathways and inhibiting differentiation signaling pathways during cancer initiation and progression, like the normal adult stem cells involving in various developmental processes and tissue homeostasis [73]. For us in DUFUTH, a lot is required to be done in incorporating some of the advanced and targeted treatment modalities as we are currently far from reach of these new technologies. Employing these technologies will enhance treatment compliance rate as well as better outcome for the curative value for our cancer patients.

Treatment Modalities Of Cancers And Their Outcome In Dufuth

Out of the 41 number of breast cancer patient treated, 51.2% (21) received radiotherapy with 47.7%(10) stable outcome and 52.3% (11) incomplete treatment, while 24.4% (10) received combination of radio and chemotherapy with 50%(5 each) stable and incomplete outcome respectively. 17.1%(7) received palliative care with 100% incomplete treatment outcome while 7.3%(3) received chemotherapy with 100%(3) incomplete treatment outcome. See Table 3 and Fig. 5

For cervical cancer 30.6% (11) received radiotherapy with 45.5%(5) stable outcome and 54.5%(6) incomplete treatment while 36.1%(13) received palliative care with 100% incomplete treatment outcome. 19.4%(7) received combination of radiotherapy and chemotherapy with 71.4%(5) stable outcome and 28.6%(2) incomplete outcome. 13.9%(5) received chemotherapy with 100% incomplete treatment outcome. See table 3 and fig. 6

Prostate cancer with 24.5%(62) prevalence, 83.9%(52) received radiotherapy with 36.5%(19) stable outcome and 57.7%(30) incomplete treatment while 3.8%(2) were transferred to another facility. 14.5%(9) received palliative care with 77.8%(7) incomplete treatment outcome and 22.2%(2) mortality. 1.6% (1) receives chemotherapy and outcome was 100% incomplete treatment outcome. See fig.7 and table 3.

For colorectal cancers with a prevalence of 7.1% (18), 33.3%(6) had radiotherapy with equal 83.3%(5) of stable and 16.7%(1) incomplete treatment outcome. 27.8%(5) had combine radio and chemotherapy with 100% (5) stable outcome. 16.7%(3) had chemotherapy with 66.6%(2) incomplete treatment outcome and 33.4%(1) stable treatment outcome. Out of the 22%(4) that had palliative care in colorectal cancers, 100%(4) had incomplete treatment outcome. See table 3 and Fig. 8

For squamous cell carcinoma of a prevalence of 5.9%(15), 60%(9) had radiation therapy with 66.7%(6) stable outcome and 33.3%(3) incomplete outcome. 33.3%(5) had combination of radiotherapy and chemotherapy with 100%(5) stable outcome. Palliative had 100% incomplete outcome out of the 6.7%(1) that underwent palliative therapy. See table 3 and fig.9

For oesophageal cancers, 30%(3) underwent radiotherapy with 66.7%(2) stable treatment outcome and 33.3% (1) incomplete treatment outcome ; while out of the 30%(3) that took combine therapy, 100%(3) stable outcome was achieved. Palliative had 20% treatment rate with 100% (2) incomplete outcome while chemotherapy of 20%(2) had 100%(1 each) incomplete treatment outcome. See table 3 and figure 10.

For Urothelial carcinoma, with a prevalence of 3.9%(10), 40%(4) had combination therapy with an outcome 75%(3) stable and 25%(1) incomplete treatment. 30%(3) had radiotherapy with 66.7% (2) stable outcome and 33.3%(1) incomplete outcome. 30%(3) had chemotherapy with 100%(3) incomplete treatment.

Table 3: *showing treatment modalities of the ten most prevalent cancers in DUFUTH.*

S/N	Cancers	Total number	Chemotherapy	Radiotherapy	Surgery	Combination	Palliative care
1	Breast cancers	41	3(7.3%)	21(51.2%)	none	10(24.4%)	7(17.1%)
2	Cervical cancer	36	5(13.9%)	11(30.6%)	none	7(19.4%)	13(36.1%)
3	Prostate cancer	62	1(1.6%)	52(87.1%)	none	none	9(14.5%)
4	Colorectal	18	3 (16.7%)	6(33.3%)	none	5(27.8%)	4(22.2%)
5	Squamous cell carcinoma(skin)	15	0	9(60%)	0	5(33.3%)	1(6.7%)
6	Oesophageal cancers	10	2(20%)	3(30%)	none	3(30%)	2(20%)
7	Urothelia	10	3 (30%)	3(30%)	none	4(40%)	none
8	Renal cancers	10	0	0	2(10%)	7(70%)	1(10%)
9	Nasopharyngeal cancers	8	1(12.5%)	3(37.5%)	none	3(37.5%)	1(12.5%)
10	Endometrial cancers	5	1(20%)	1(20%)	1(20%)	1(20%)	1(20%)

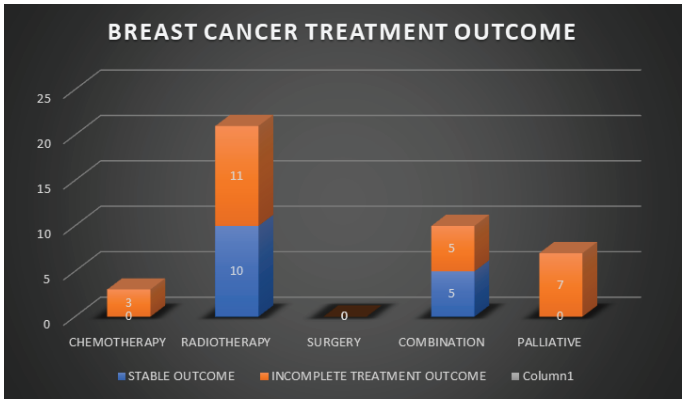

Fig 5: *showing the treatment outcome for breast cancer following modalities of treatment*

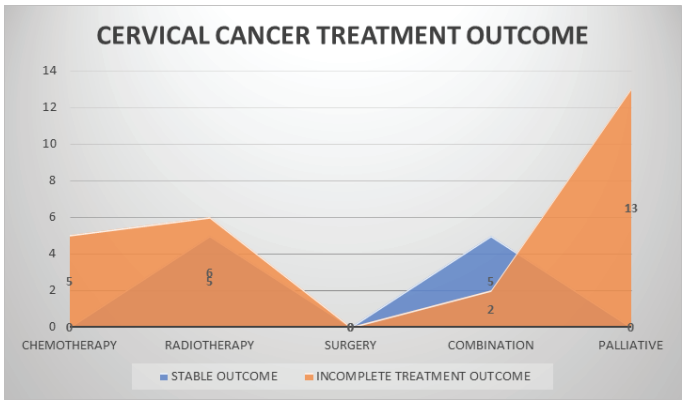

Fig.6 *showing treatmet outcome of cervical cancer*

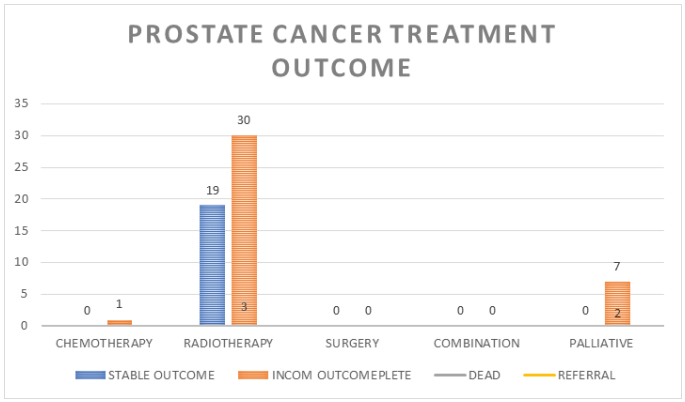

Fig. 7 *showing the treatment outcome of prostate cancers.*

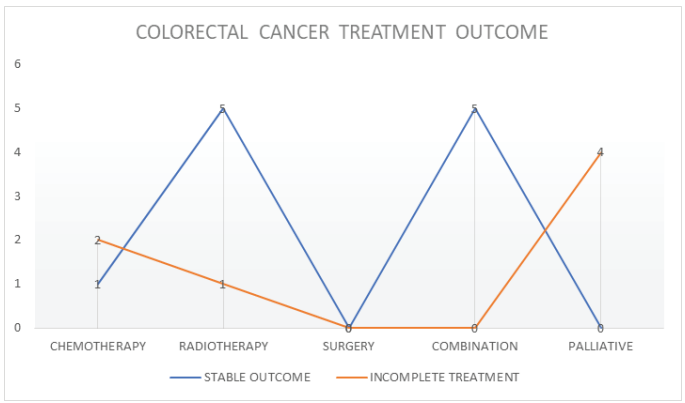

Fig. 8 *showing the treatment outcome of colorectal cancer*

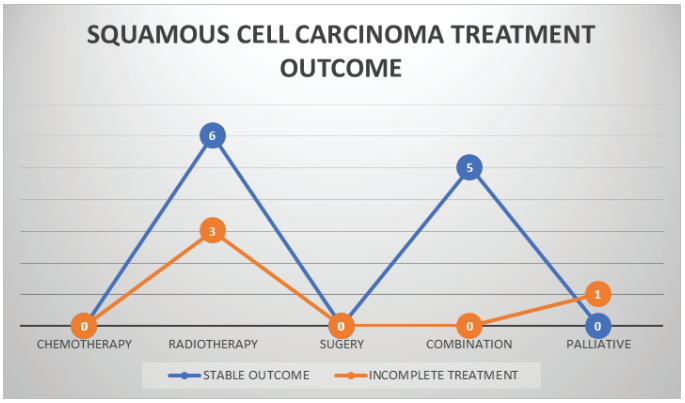

Fig 9: *showing treatyment outcome for squamous cell carcinoma*

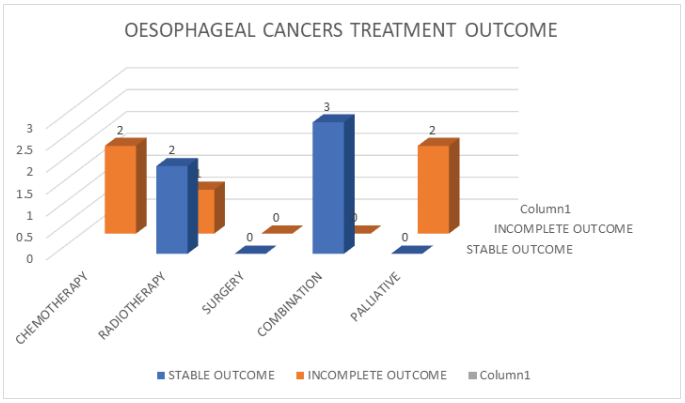

Fig 10: Showing treatment outcome for Oesophageal cancers

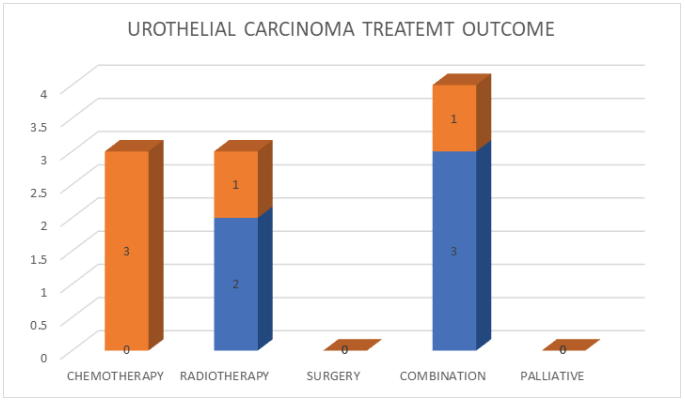

Fig 11: Showing treatment outcome for Urothelial cancers

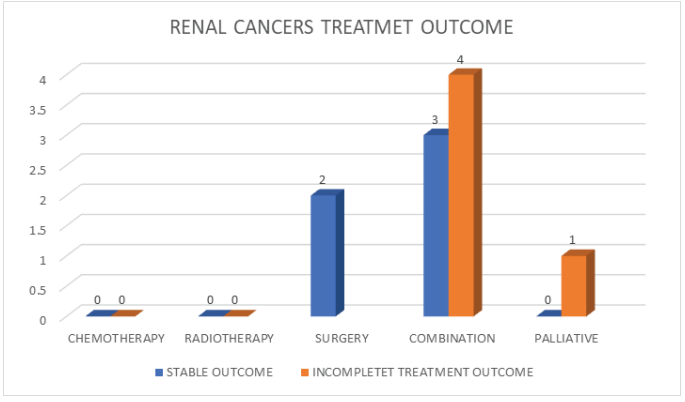

Fig 12: Showing treatment outcome for Renal cancers

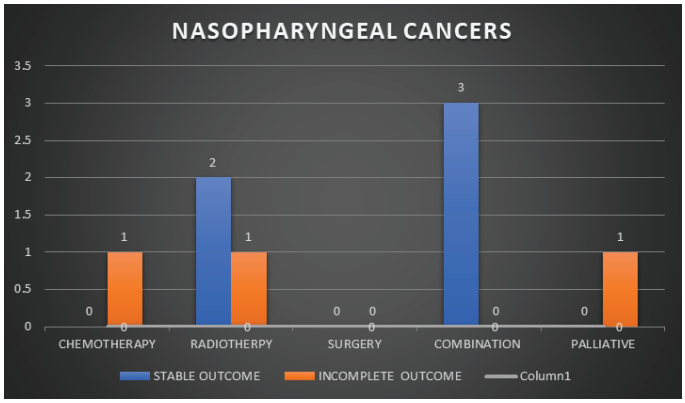

Fig 13: Showing treatment outcome for Nasopharyngeal cancers

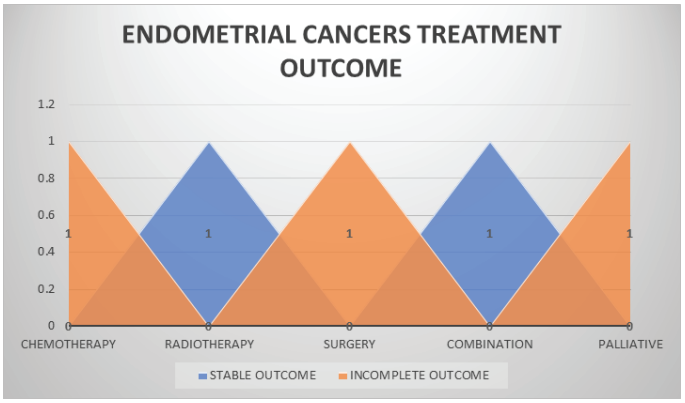

Fig 14: showing treatment outcome for Endometrial cancers.

***Table 4**. Statistical Inferentiasl Analysis of the Modalities of Cancer Treatment in DUFUTH*

Variables	B (regression coefficient)	p value	Odds ratio	95% C.I. for Odds ratio	
				Lower	Upper
Occupation		0.997			
Academic/Education Professional	-1.25	1	0.286	0.000	0.000
Agriculture (Farmer)	-119.23	0.010	1.0670	0.900	1.204
Petty traders	-19.085	0.024	0.990	0.871	1.023
Civil/Public Servant	-0.62	1	0.538	0.000	0.000
Health Worker (Support)	-0.525	1	0.592	0.000	0.000
Media/Communication	-1.703	1	0.182	0.000	0.000
Paramilitary/Uniformed Service	-2.582	1	0.76	0.000	0.000
Professional (Engineering)	-19.808	0.999	0.000	0.000	0.000
Professional (Finance)	-20.57	0.999	0.000	0.000	0.000
Professional (Health)	-19.935	0.999	0.000	0.000	0.000
Religious Leader	-21.94	0.999	0.000	0.000	0.000
Retiree	-55.16	0.999	0.000	0.000	0.000
No records		1			
State of Residence	-16.077	0.999	0.000	0.000	0.000
Abia	-16.616	0.999	0.000	0.000	0.000
Abuja	-14.962	0.999	0.000	0.000	0.000
Akwa-Ibom	-3.504	1	0.03	0.000	0.000
Anambra	1.999	1	7.381	0.000	0.000
Benue	-16.65	0.999	0.000	0.000	0.000
Cross River	-38.1	0.999	0.000	0.000	0.000
Delta	-16.743	0.999	0.000	0.000	0.000
Ebonyi	-14.855	0.041	0.997	0.789	1.980
Enugu	-14.452	1	0.000	0.000	0.000
Imo		0.034			
Rivers	-1.25	1	0.286	0.000	0.000
No records		1			
Treatment reception					
Yes	-19.4	0.998	0.000	0.000	0.000
No		1			
Chemotherapy					
Yes	-17.824	0.998	0.000	0.000	0.000

No		1			
Radiotherapy					
Yes	-18.135	0.023	1.127	0.987	1.461
No		1			
Surgery					
Yes	72.348	0.998	2.63E+31	0.000	0.000
No					
Palliative care					
Yes					
No	-19234	0.0121	0998	0.832	1.222
Length of stay (Days)	0.063	0.057	1.000065	0.000.998	1.137

*Reference category, R2 (coefficient of determination) = 47.8% to 73.3%

See table 3 and figure 11.

For Renal cancers, 70%(7) had combination therapy with 57.1%(4) incomplete treatment outcome and 42.9%(3) stable outcome. 20% (2) underwent surgery and had 100% stable outcome while 10%(1) had palliative care and had 100% incomplete treatment outcome. See table 3 and figure 12.

For Nasopharyngeal cancers with a prevalence of 3.2%(8), 37.5%(3) had combination therapy with an outcome of 100% stable outcome while 37.5%(3) had radiotherapy with 66.6% stable outcome and 33.3%(1) incomplete treatment outcome.12.5%(1) had chemotherapy with 100% incomplete treatment outcome and 12.5%(1) had palliative care with 100% incomplete treatment outcome. See table 3 and figure 13.

For Endometrial cancer with a prevalence of 1.9%(5), 20%(1) had chemotherapy with 100%(1) incomplete treatment outcome, 20% had radiotherapy with 100% stable outcome, 20% had surgery with 100% (1)incomplete treatment outcome , 20%(1) had combination therapy with 100%(1) stable outcome while 20%(1) had palliative care with 100%(1) incomplete outcome. See table 3 and figure 14

The model explained between 47.8% and 73.3% of the variance (R^2) in non-adherence. Across the occupational categories, none of the groups showed statistically significant associations with non-adherence (all p-values ≥ 0.999). Large negative regression coefficients were observed in several occupations (e.g., retirees, religious leaders, and professionals), all with odds ratios of 0.000, reflecting instability in the estimates due to sparse data.

For state of residence, no significant associations were observed with non-adherence. Although Imo State served as the reference group, coefficients for other states ranged widely, but their odds ratios mostly converged to 0.000, again suggesting unstable model estimation from small cell sizes.

In relation to treatment modalities, reception of chemotherapy, radiotherapy, and general treatment did not show significant independent associations with non-adherence, as all yielded p-values ≥ 0.998 and odds ratios of 0.000. Interestingly, surgery had a very large positive regression coefficient (B = 72.348), with a corresponding extremely high odds ratio (2.63E+31), but this was not statistically significant (p = 0.998), further indicating the influence of very small sample representation in that category.

Regarding length of hospital stay, the regression coefficient was positive (B = 0.063) with a borderline p-value (0.057). The odds ratio (approximately 1.065) and 95% confidence interval (0.998–1.137) suggest that longer hospital stay may slightly increase the likelihood of adherence, but this association did not reach conventional statistical significance.

In summary, the regression model did not identify any statistically significant independent predictors of non-adherence. The wide confidence intervals and extreme odds ratio estimates in several categories highlight limitations due to sparse data distribution across subgroups.

Conclusion

Concerted efforts is needed to enhance effective compliance with chemotherapy, surgery, and radiation for cancer patients in Nigeria and many newer therapy modalities with better outcome are far reach in our environment. More importantly, currently, many therapies are available for treating different types of cancer, there is major lack of precision. Cancer ranking at the 6th on rate of deaths globally caused by a disease required both political and academic and research attention. Every research towards finding the best treatments for the cure of cancer should always be strengthened and supported.

Conflict of Interest

Author declare no conflict of interest .

Sponsorship

TETFUND IBR 2025.

Limitation

Retrospective Study Design

The use of retrospective medical record review limited data completeness and accuracy, as some patient records were missing, inconsistent, or poorly documented clinical details.

Single-Center Scope

Findings from the Cancer Research Institute, DUFUTH, Uburu may not be fully generalizable to other tertiary hospitals or oncology centers in Nigeria due to differences in infrastructure, staffing, and treatment availability.

Heterogeneity of Cancer Types

The inclusion of multiple cancer types with varying biological behavior and prognosis affected the comparability of treatment outcomes across modalities.

Late Presentation of Patients

A high proportion of patients presenting with advanced-stage disease confounded treatment effectiveness, making it difficult to isolate the impact of treatment modality alone.

Treatment Interruptions and Non-Adherence

Financial constraints, drug stock-outs, and loss to follow-up lead to incomplete treatment courses, potentially affecting outcome measures.

Limited Survival Data

Incomplete follow-up and poor documentation of long-term outcomes may limit robust survival analysis.

Absence of Randomization

Treatment modalities were determined by clinical indications and resource availability rather than random assignment, introducing potential selection bias

Despite these limitations, the study provides valuable real-world evidence on cancer treatment effectiveness in a resource-limited tertiary healthcare setting and offers insights for improving oncology practice and policy.

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