

**SERVICE DELIVERY COST OF IMAGE-GUIDED
PERCUTANEOUS NEPHROSTOMY AMONG CERVICAL
CANCER PATIENTS AT MUHIMBILI NATIONAL HOSPITAL**

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**“A Dissertation Submitted in Partial Fulfillment of the Requirement for the
Degree of Masters of project management monitoring and evaluation of the
Muhimbili University of Health and Allied Sciences”**

October, 2021

CERTIFICATION

The undersigned certify that he has read and hereby recommend for acceptance of dissertation entitled “Service delivery cost of image-guided percutaneous nephrostomy among cervical cancer patients at Muhimbili National Hospital”, in fulfillment of the requirements for the degree of Master of project management monitoring and evaluation Science of Muhimbili University of Health and Allied Sciences.

Prof.Amani Thomas Mori
(Supervisor)

Date

DECLARATION AND COPYRIGHT

I, **Cecilia James Nyabakari**, declare that this dissertation is my own original work and that it has not been presented and will not be presented to any other university for a similar or any other degree award.

Signature: Date:

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DEDICATION

This work is dedicated to my family members for their love, care and encouragements that empowered me to accomplish this work.

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ABBREVIATIONS

CPL	Central Pathology Laboratory
CT	Computed Tomography
ECG	Electrocardiogram
FBP	Full blood picture
GBV	Gender Based Violence
Govt	Government
HMIS	Health Management Information System
HPV	Human papilloma virus
IPPM	Intramural Private Practice
IR	Interventional Radiology
IRB	Institutional Review Board
MNH	Muhimbili National Hospital
MUHAS	Muhimbili University of Health and Allied Sciences
MUHAS	Muhimbili University of Health and allied sciences
NCCP	National Cancer Control Program
NHIF	National Health Insurance Funds
ORCI	Ocean Road Cancer Institute
PCN	Percutaneous Nephrostomy
PCS	Pelvis Calyceal System
SIR	Society of Interventional Radiology
USD	United States Dollars
USG	Ultrasonography

DEFINITION OF TERMS

Capital Costs	The cost to purchase the major capital assets required by the programme (for example equipment, buildings and land).
Cost	Monetary valuation of all efforts, materials, resources, time and utilities consumed, risk incurred and opportunities forgone in production and delivery of goods and services [1]
Cost drivers	The factor or unit which causes or produces a change at the cost level [2].
Personnel costs	The total remuneration, in cash or in kind, payable by an employer to an employee in return for work done [3].
Recurrent costs	Are costs for those resources that are expected to be consumed (replaced) within one year.
Unit costs	A cost chosen as a standard in terms of which other costs may be expressed [4].

ABSTRACT

Introduction

Cervical cancer is among the leading cause of morbidity and mortality among women globally. Most cervical cancer patients present in health facilities with an advanced stage of the disease, with obstructive uropathy as the main complications. Management of obstructive uropathy can be done by image-guided percutaneous nephrostomy, which is only available at Muhimbili National Hospital, with no evidence of its cost and cost-effectiveness.

Objective

To estimate service delivery cost of image-guided percutaneous nephrostomy among cervical cancer patients with obstructive uropathy at Muhimbili National Hospital

Methods

This is a cross-sectional study, which was conducted at Muhimbili National Hospital between February and June 2021. The study was conducted from the provider perspective using a micro-costing approach, which entails identification, quantification and valuation of all resource items consumed. Costs items were classified into two categories i.e., capital (buildings, equipment and furniture) and recurrent (personnel, materials and supplies and utilities). A detailed financial analysis was performed in Excel spreadsheet (Microsoft Excel®, Microsoft Corporation). Cost data were collected in Tanzania shillings and converted to USD using the prevailing exchange rate. Capital costs were annuitized with 3% discount rate.

Results

The estimated cost of performing percutaneous nephrotomy procedure at Muhimbili National Hospital was 358.56 USD per patient. One-way sensitivity analysis indicated that the unit cost was very sensitive to variation in personnel cost. The estimated cost per patient is higher than the reference price of 237.35 USD from the National Health Insurance Fund (NHIF), 259.40 USD charged to the private patients and 172.94 USD charged to the general public patients.

Conclusion

The cost of performing percutaneous nephrostomy among cervical patients with obstructive uropathy at Muhimbili National Hospital is estimated at 358.6 USD/ patients. The estimated cost is higher than the NHIF reimbursement cost and the fee charged to private and public patients. This study underscores the importance of conducting costing studies to inform pricing decisions.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Cervical cancer is an important public health problem in both developed and developing countries. Each year about 570,000 cases are diagnosed with cervical cancer worldwide, of which 311,000 die, making it the fourth most frequently diagnosed cancer and cause of death among women globally[5]. Cervical cancer constitute about 12% of new cancer cases in low-income countries but only about 1% of new cases in high-income countries[6]. Africa has the highest incidence and mortality rate of cervical cancer [5]. In Tanzania, cervical cancer is the most common of female cancers with a striking 9,772 new cases and 6,695 deaths each year [7]. Most cervical cancer patients present in health facilities with an advanced stage of the disease, which is associated with complications such as obstructive uropathy. Prognosis among patients with advanced cervical cancer is usually very poor with very high case-fatality rates.

The burden of cervical cancer has social and economic implications such as loss of productive lives as well as depriving families of their loved ones. According to the Global Economic Burden of Non-communicable Diseases, the estimated medical, non-medical and income losses costs of new cervical cancer cases in 2010 was 2,664 million US\$ and predictions shows it will increase to 4,651 million US\$ by 2030. Medical costs account for the largest share of cancer costs [6].

1.1.1 Pathophysiology, diagnosis and management

Obstructive uropathy is a pathological condition caused by benign tumors or malignancies especially at advanced stages and is associated with blocked urine flow, which results into uremia, urinary tract infections, electrolyte imbalance as well as loss of renal function[8]. It is among the most frequent complication in patients with advanced cervical cancer and associated with notable morbidity[9]. Management of obstructive uropathy can be done by retrograde stenting, open drainage of kidneys and percutaneous nephrostomy. However, retrograde stenting may be difficult to perform in

some patients with advanced cancer; hence percutaneous nephrostomy becomes an ideal procedure[10].

Cervical cancer patients in Tanzania are mostly diagnosed at late stage when the disease has already developed obstructive uropathy, hence the need of percutaneous nephrostomy [11]. Obstructive uropathy complication is a result of the cervical mass compressing the external part of the ureters causing blockage of urine, leading to uremia, urinary tract infections, electrolyte imbalance, loss of renal function, decrease in quality of life and shortened survival[8][12].

Percutaneous nephrostomy is an image-guided placement of a catheter through a calyx into the renal collecting system due to obstructed uropathy. The procedure is done under the indication of urinary drainage, urinary diversion and provision of access to collecting system[13]. Modalities such as computed tomography (CT) scan, Ultrasound and a Fluoroscopy machine are used during the procedure. This treatment has been shown to alleviate pain and prolong life among cervical cancer patients with obstructive uropathy [14].It is expected to enable patients to receive palliative treatment for the tumor and die of their natural death rather than secondary complication. The prevalence of obstructive uropathy among cervical cancer patients is about 43% which worsens the disease profile [15][14]. Tanzanian population need to access these services within their catchment areas to reduce the disease burden and the associated healthcare-seeking economic cost. Clinicians also needs to be aware of procedure costs so as to opt for the most affordable option [16]. The procedure being minimally invasive and cost-effective will prove integral to the growth and future of interventional radiology[17].

1.1.2 Percutaneous nephrostomy in Tanzania

Percutaneous nephrostomy is a relatively new intervention in Tanzania, which is currently performed at Muhimbili National Hospital (MNH) only since October 2018 following the establishment of an Interventional Radiology clinic. The clinic was designed and initiated, as a training program by Yale School of Medicine, which relies on US-based volunteer teams of IR physicians, nurses, and technologists to locally train radiology residents, nurses, and technologists[18]. Apart from other procedures

conducted, Percutaneous nephrostomy is done with an aim of treating obstruction uropathy among patients with advanced malignancies. Most of the obstructive uropathy cases due to cervical cancer at Ocean Road Cancer Institute (ORCI) and other hospitals are sent to Muhimbili National Hospital for further management. Treatment especially chemotherapy cannot be given to these patients, so the percutaneous nephrostomy is an optimal treatment option. The study will estimate the health service delivery cost of percutaneous nephrostomy among cervical cancer patients at Muhimbili National Hospital.

1.2 Problem statement

Cervical cancer is the most common female cancer in Tanzania and other developing countries. Over 70% of cervical cancer patients present in advanced stages of the disease characterized with obstructive uropathy with uremia. Obstructive uropathy increases the risk of irreversible renal damage, which is associated with poor prognosis and high mortality rates[19]. Percutaneous nephrostomy is an effective procedure for management of obstructive uropathy among cervical cancer patients as it improves renal function and allow definitive treatment[20].

Percutaneous nephrostomy is a new procedure in Tanzania, which is only available at Muhimbili National Hospital (MNH). To date no study has been conducted to estimate resource use for provision of percutaneous nephrostomy in Tanzania. As a result, MNH and the National Health Fund (NHIF) have set the price for this newly introduced procedure without conducting costing studies to estimate actual resource use, which may overcharge or undercharge their patients. Therefore, lack of cost evidence for this intervention in Tanzania, makes it difficult to make evidence-based pricing decisions.

1.3 Conceptual framework

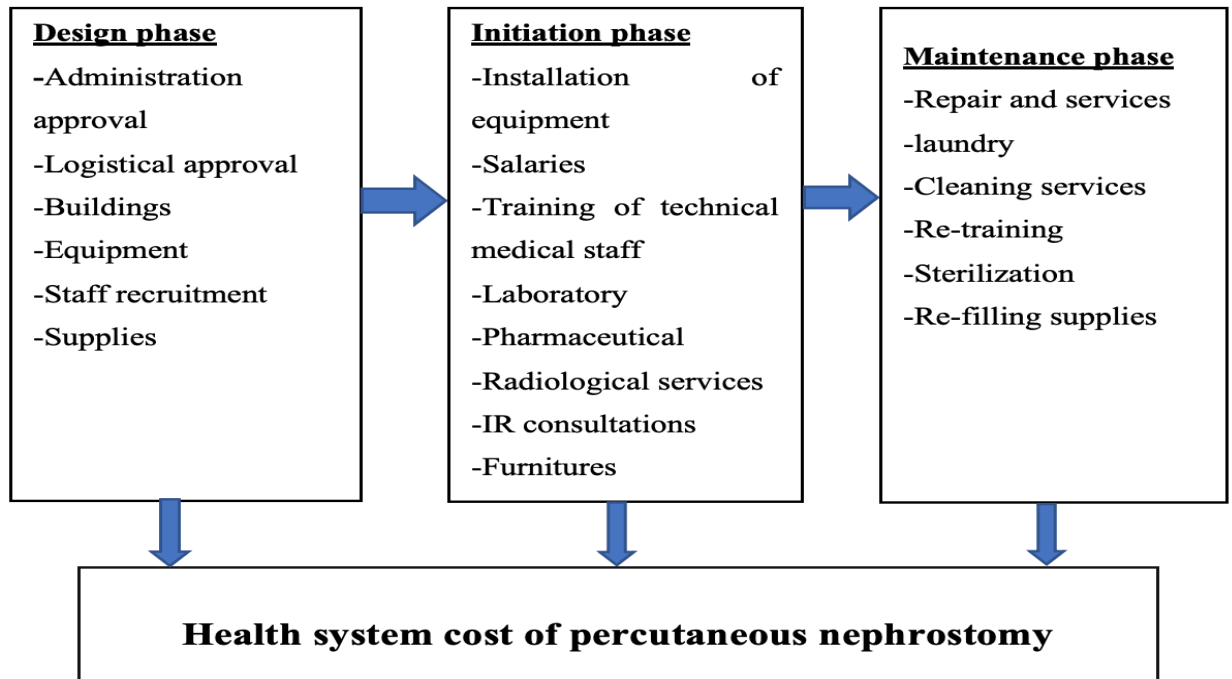


Figure 1: Costing the implementation of percutaneous nephrostomy

Figure 1 illustrates the stages of setting-up an interventional radiology program and the associated activities and resource requirement. The Interventional Radiology included each phase in consideration of activities, resources classification and the costs related. The Interventional Radiology was firstly designed considering the procedures including Percutaneous Nephrostomy had to be adopted, the process involved some costs. Initiation phase includes the costs incurred up-front on the launching of procedure. Maintenance phase involves the costs for ongoing upkeep or quality assurance.

1.4 Rationale

Cost of performing percutaneous nephrostomy to cervical cancer patients due to obstructive uropathy is one of the key aspects to be considered in the process of evaluating the feasibility of scaling-up the procedure to the regional and district hospitals in the country. The findings from this study will be used in policy formulation for improving cervical cancer patients' services and scale up of these procedures throughout the country. The findings of the study will as well assist Muhimbili National Hospital and NHIF to revise the cost charged and the reimbursement costs, respectively. The findings will also be used to inform economic evaluation studies in Tanzania and in other related contexts.

1.5 Research questions

1.5.1 Main research question

What is the service delivery cost of image-guided percutaneous nephrostomy among cervical cancer patients at Muhimbili National Hospital?

1.5.2 Specific research questions

- I. How much does it cost to perform percutaneous nephrostomy procedure on cervical cancer patients?
- II. What are the cost-drivers for percutaneous nephrostomy procedure on cervical cancer patients?
- III. To what extent does the estimated cost for percutaneous nephrostomy differ from references prices charged to NHIF, IPPM and Public patients?

1.6 Research objectives

1.6.1 Broad objectives

To estimate service delivery/provider cost of performing percutaneous nephrostomy to cervical cancer patients with obstructive uropathy at Muhimbili National Hospital.

1.6.2 Specific objectives

- I. To estimate the unit cost of performing percutaneous nephrostomy procedure on cervical cancer patients.
- II. To identify the cost-drivers for percutaneous nephrostomy procedure performed on cervical cancer patients.
- III. To compare the estimated service delivery cost and the charged fee for NHIF, IPPM and public percutaneous nephrostomy patients.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Cost of Percutaneous nephrostomy to cervical cancer patients

Cervical cancer is a preventable disease. Early diagnosis and effective treatment are possible, thanks to various screening strategies. Obstructive uropathy is encountered in 14 to 44 percent of the cases with cervical cancer, and is a common cause of cervical cancer related mortality. Failure to implement early treatment also may lead to decreased survival[21]. Obstructive uropathy results in pain, infection, sepsis and ultimately loss of renal function. It is a potentially life-threatening condition and sometimes it is desirable to provide immediate temporary relief of the obstruction, until definitive treatment can be undertaken[22].

Percutaneous Nephrostomy (PCN) provides a significant improvement in renal function parameters in majority of the patients with advanced cervical cancer presenting with obstructive uropathy. There is no procedure-related mortality, with minimal morbidity. The quality of life is improved significantly at 1 week and 1 month which is not sustained at the third month. Patients who underwent nephrostomy have better survival than patients who did not undergo nephrostomy[23].

2.1. 1Alternative procedure

Cystoscopy with retrograde catheterization and operative nephrostomy, are two valid options with their own disadvantages. Sometimes it may be impossible to pass the ureteric catheter above the obstructing lesion and even when passed, it is uncomfortable and often becomes dislodged into the urinary bladder.

Operative nephrostomy is a major surgical procedure requiring general anesthesia for, what may be a transitory obstruction and already impaired renal function may make it hazardous. On the other hand, percutaneous nephrostomy is a very simple procedure of temporary drainage of an obstructed kidney by establishing a drainage tract into the pelvicalyceal.

2.1.2 Performing percutaneous nephrostomy

Patients are referred to the Interventional Radiology (IR) clinic from outpatient or inpatient from the department of oncology, urology, obstetrics and gynecology. Patients are consulted by IR physician or trainee. On consultation proper history, image confirmation for hydronephrosis and lab investigations relevant to procedures are conducted.

The procedure for percutaneous nephrostomy is shown in **Figure 2**. First the patient must consent for the procedure to be performed and scheduled. On the day of procedure nursing assessment is done and intravenous access is achieved and prophylactic antibiotics administered as per protocol. Image guidance was provided by ultrasonography and fluoroscopy. Patient is then placed in the prone position, cleaning and draping of the region is done. Moderate sedation is initiated and skin infiltration with 2% lidocaine is done. Following an incision with surgical blade (no 11) puncture needle (18/21 gauge) is introduced into the dilated pelvicalyceal system (PCS) under real time USG guidance using a trans abdominal convex probe of 4-9MHz. Urine/pus is aspirated on PCS access for culture and sensitivity.

Precise point of entry is confirmed by performing a nephrostogram and once the access into target calyx is confirmed the needle was exchanged over 0.035inch guide wire. The tract was serially dilated, catheter introduced and guide removed after confirming correct placement of catheter tip. The nephrostomy tube is secured and urobag attached. Post procedure nephrostogram is performed.

Percutaneous nephrostomy

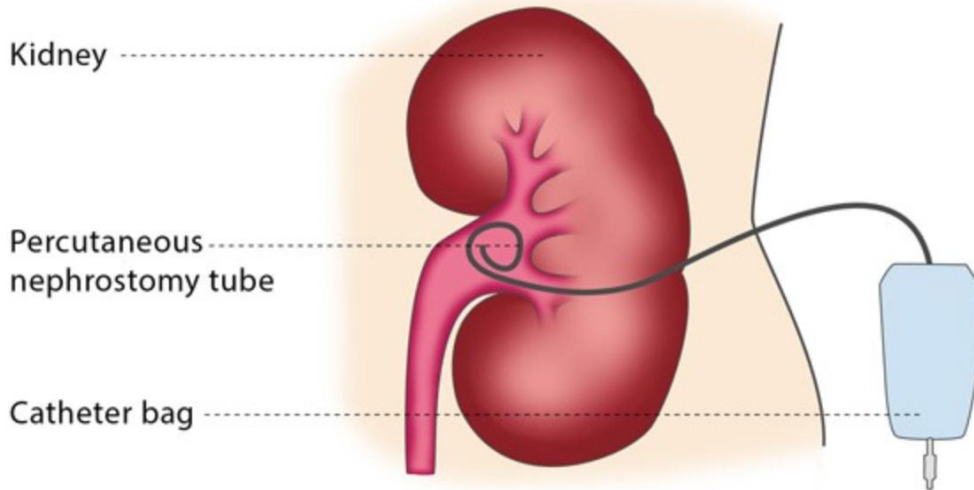


Figure 2: Percutaneous nephrostomy illustration

Physiological monitoring of heart rate by ECG, blood pressure and oxygen saturation is done during and after the procedure and patient observed 24hours. Nephrostomy tube care is advised to the patient and asked to report back if hematuria persisted for more than 48hours. Follow up with blood urea, serum creatinine, and renal ultrasound as done after 2weeks and 1month of the percutaneous nephrostomy. Patients is advice to return to the clinic after 3 months for routine nephrostomy tube exchange[24].

2.1.3 Coverage of percutaneous nephrostomy

Percutaneous nephrostomy is a well-established procedure dating back to the early 20th century. The membership of the Society of Interventional Radiology (SIR) Standards of Practice Committee represents experts in a broad spectrum of interventional procedures from both the private and the academic sectors of medicine[13].

2.1.4 Service delivery cost and cost-drivers of percutaneous nephrostomy

The cost of managing cervical cancer depends on the stage of diagnosis. However, according to a study done in Italy to assess the incidence of invasive cervical cancer and

direct costs associated with its management, the mean cost of cervical cancer management was estimated to be €9,569 per patient in a year[25]. In Spain, a population-based retrospective epidemiological study was conducted to estimate the burden of hospitalizations by cervical cancer. The mean cost of a hospitalization by cervical cancer and carcinoma in situ were €3,098 and €2,192, respectively. The estimated annual cost of hospitalizations or cervical cancer and carcinoma in situ in Spain was 19 million €[26].

The cost of one case of cervical cancer depends on stage of diagnosis as it has been addressed in a study conducted at Morocco. The total cost of cervical cancer care for one year after diagnosis is estimated at \$13,589,360. The cost components are respectively \$435,694 for annual follow-up activity and \$126,057 for diagnosis and preclinical staging[27]. According to a study conducted in Ethiopia, the mean outpatient cost per patient for cervical cancer was \$407.2 (Median = \$206.9). Direct outpatient cost (Mean = \$334.2) takes the largest share compared with the indirect counterpart (\$150). The outpatient cost for half of the respondent falls in a range between \$93.7 and \$478. The mean inpatient cost for hospitalized patients was \$404.4. The average direct inpatient cost was \$329 (74% medical costs and 26% non-medical costs). The mean value for total inpatient cost for half of the respondents was in the range of \$133.5 and \$493.9. For every additional day of inpatient hospital stay, there is a daily incremental inpatient cost of \$4.2[28].

In Tanzania, a cost-effectiveness study that evaluated the cost of Screening and Treatment for Cervical Cancer found that the average screening and treatment cost for patients receiving cancer screening (\$2526) was higher than that for unscreened patients (\$2482). The calculated incremental cost-effectiveness ratio of \$219 per life-year gained from receiving cervical cancer screening compared with not being screened[29].

The guideline on quality improvement for percutaneous nephrostomy reexamining technical success rates and adverse effects based on literature and consensus is available. It addresses the indications, success and complications of the procedure. That is for quality improvement that will result to better patient outcome as approved by the membership of the Society of Interventional Radiology (SIR) Standards of Practice Committee[13]. A study conducted on long-term management of percutaneous

nephrostomy to estimate the financial impact of patient compliance. It suggests percutaneous related complications after discharge are costly for the patients with malignant urinary obstruction. The changes in patients compliance level had a markable effect on the annual charges associated with cost of any routine exchange frequency[30].

Many literatures have been written about the clinical aspects of percutaneous nephrostomy and its significance however, there are no published papers estimating the cost of percutaneous nephrostomy among cervical cancer patients in Tanzania.

2.2. The cost-drivers for percutaneous nephropathy

The study on Cost and cost drivers associated with setting-up a prime vendor system to complement the national medicines supply chain in Tanzania study provides useful information on the cost and cost drivers for setting-up a complementary pharmaceutical supply system to complement an existing system in low-income settings. The study showed the main cost drivers were costs for short-term experts, training of staff and healthcare workers and the Jazia PVS technical and board management activities[31].

Reliable cost information on GBV service delivery is critical for the GoT, funding partners, and program managers as they design and plan the scale-up of the national response to GBV. This study provides new cost information on GBV services delivered within the healthcare setting—a major strategy of the national response. Although the study was not designed to be representative of all health facilities in Tanzania, the study team collected data from three different types of facilities (hospital, health center, and dispensary) located in all four regions of the first phase of GBV health services rollout, thus providing a broad first look at the costs of delivering GBV services under the new national GBV management guidelines. The study indicated cost of drugs and supplies was clearly driving the total cost per GBV client encounter[32].

The study on Cost and Cost-Effectiveness of a Demand Creation Intervention to Increase Uptake of Voluntary Medical Male Circumcision in Tanzania: Spending More to Spend Less showed recurrent costs to be the high influence of the costs. Staff costs made up the largest proportion of costs in both arms of the trial, followed by supplies. Although this is consistent with other studies, staff costs as a percentage of total cost were higher in our study than in others. Cost on consumable surgery supplies were considered

variable costs (i.e., costs that vary with output), and they accounted for 4% to 6% of the total costs in Njombe and 12% to 13% in Tabora.

2.3 Comparison between estimated cost and NHIF, IPPM and Public payment modes.

Public hospitals across the third world countries, particularly in sub Saharan Africa serves over three quarter of the patients in need of health services[33]. In Tanzania, health care is a mixture of public and private practice, with the public practice taking care of more than ninety percent of the clients.

Muhimbili National Hospital (MNH) is the largest of four referral hospitals in Tanzania. It is positioned to serve patients from different parts of the country and is in effect, the apex of the public health in Tanzania [34]. MNH has the highest number of highly qualified health services personnel, who provide the widest range of services, and is equipped to provide the highest quality services in the country. Until very recently, it has been the site that has provided training for medical and health professionals, including a wide range of allied health personnel. Tanzania has generally four means of funding health care systems:

- 1) Government tax-based funding.
- 2) Health insurance schemes
- 3) Out-of-pocket payments
- 4) Donor/development partner funding [35]

2.3.1 IPPM

Public practice is state owned and the financial support is provided for by the Government funds and the donor community. In the past decade, this financial support of public hospitals has significantly declined with hospitals receiving less than twenty percent of the allocated budget. Muhimbili National Hospital, in an attempt to be self-sustaining public hospital, started the intramural private practice (IPPM) services. In early 2000s, Muhimbili National Hospital responded to the government directive to public institutions to be self-sustain and reducing the dependence on government funding, by opening doors to IPPM services within the hospitals.

2.3.2 Government (revenue/tax) funding/ public payments

These payments consider the system that funds the Government owned hospitals from the construction, human resources and supplies. The system follows the pattern of government structures of leadership in the form of hierarchy. There are different levels of services. The system complies with a system of a pyramid on top of which there are central hospitals (for example 4 consultant hospitals), which are expensive as they are oriented to the international standards[35].

2.3.3 NHIF

The National Health Insurance Fund was established by Act of Parliament No. 8 of 1999. The Fund is administered by a Board of Directors which is autonomous but reports to the Minister responsible for Health matters. Payment to providers is through fee for service whereby providers submit their claims. The NHIF offers both inpatient and outpatient care as part of its benefits package. Hospitals claim expenses monthly according to an agreed fee schedule based on actual costs plus a mark-up[36].

NHIF has specific limits of spending granted to the beneficiaries. Any In Tanzania, health care is a mixture of public and private practice, with the public practice taking care of more than ninety percent of the clients. Amount in excess of the fixed expenditure will be paid by the beneficiary in an attempt to counter consumer moral hazard. The main source of NHIF revenue is members' contributions[37].

The main objectives for the establishment of the Health Insurance Scheme are: -

- a) To institute a permanent and reliable system for the provision of health services to formal sector employees and later on to other groups as the scheme gets experience
- b) To improve the accessibility and quality of health services by introducing competition among health care providers from the Government, and Private Health Providers
- c) To establish a reliable method this will enable formal sector employees to contribute towards their own health and those of their families
- d) To reduce the financing gap by supplementing the Government allocation to the health sector
- e) To invest in economically viable projects in the health sector.

On the three modes of payment, the IPPM is expected to pay more since the payments are designed to support the financial system of the hospital. The NHIF payments should be affordable and should reflect the actual payment of the service. The public payments should be cheaper considering the mode of payment is under government support on the nature of funding. The costing theory and principles of charged fees at MNH were not documented.

As we have shown above the body of knowledge doesn't seem to have much written-information on costing of Percutaneous Nephrostomy. There is no costing study that has been conducted in Tanzania to estimate the resource required to provide such a service, and thus it remains to be established what would be the costing-drivers as well. It is also important to estimate price differences since the service is already provided at MNH for both public and IPPM patients and is also reimbursed by NHIF, which will enable both MNH and NHIF to revise their current price charged and reimbursed, respectively.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study area

The study was conducted at Muhimbili National Hospital (MNH) in Ilala district the region of Dar es Salaam. Dar es salaam is the largest city and business capital of Tanzania with over 6 million people. It is made up of 5 districts of Ilala, Kigamboni, Kinondoni, Ubungo and Temeke. MNH is a National Referral Hospital, Research Center and University teaching hospital with 1,500 bed capacity and attending 2,000 outpatients per day. The hospital is made up of different units and departments that serves referral and non-referral patients from all over Tanzania. Muhimbili National Hospital has been operating since 1897. The hospital has many units however this study involved Emergency department, Sewahaji block, Radiology department and Central Pathology Laboratory. The procedure was being conducted at MNH and no other hospitals in the country.

3.2 Study design

A cross-sectional study that involved data collection from the provider's perspective was conducted. A cross-sectional study is a type of observational study that analyzes data of variables collected at one given point in time across the pre-defined subset.

3.3 Target population

Cervical cancer patients with obstructive uropathy

3.4 Study population

Cervical cancer patients with obstructive uropathy attended at MNH

3.5 Study variables

The study will not employ regression analysis, hence identifying the dependent and independent variables may not be necessary. Otherwise, in the computation of unit costs, the total cost was a dependent variable, while independent variables were the capital and

recurrent cost items including personnel, materials and supplies, utilities, buildings, equipment's and implements also furniture's used.

3.6 Data collection

Costing method

The study used a micro-costing approach to estimate the health system costs of providing percutaneous nephrostomy service. Also known as bottom-up approach, it records resource utilization at the patient service level, and aggregates service level utilization data to identify the type of resources used and to measure resource utilization in order to calculate the costs of specific services[38]. This method entailed the identification of cost items, quantification, and valuation of cost items[39]. The obtained data was from March 2019 to September 2020 through hospital records with assistance of department officials (eg, stores, procurement, accounts, care givers, hospital engineering and others). The reports and registers for cost information on consumables and other recurrent hospital supplies (eg, utility fees) were searched and the capital expenditures, including equipment and other non-consumables expected to last for more than 1 year was searched.

Cost centers

Costs were aggregated across cost centers which were identified by considering the patient pathways. The pathway was noted considering the patients data on the HMIS (Jeeva) and a little observation on the new and inpatients. The patients were first attended at the Emergency department then referred to ward 21 in Sewahaji block for admission. After admission consultation is done by Interventional Radiology (IR) specialists to schedule the patient for the procedure at the IR clinic. Laboratory tests and some medications from the pharmacy were involved. On admission, the patient barely spent a week for the procedure when everything was available. Therefore, there were 5 cost centers namely the Emergency department, Sewahaji block, IR clinic, Laboratory, and Pharmacy.

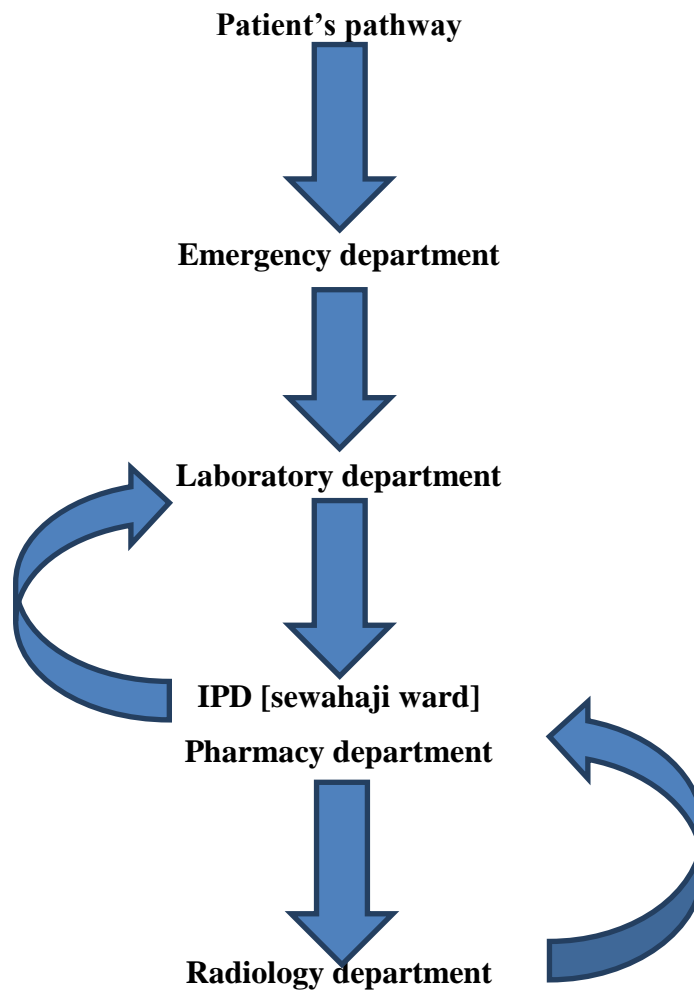


Figure 3: Cost centers for Percutaneous Nephrostomy.

Emergency department

The Emergency Department was attached with the administration block. The whole department attends about 4,500 patients in a month's 4 being the cervical cancer patients with obstructive uropathy.

Laboratory

The annually attended patients in the laboratory unit sum up to 240,000 samples per month from the whole hospital. The samples don't have labels on the patient's conditions, hence hard to distinct an exact number of patients having obstructive uropathy. The samples taken are to be analyzed for FBP, serum creatinine, urea, urine analysis, potassium, sodium and calcium electrolytes. The blood sample is drawn from the patient, on arrival at the emergency department, the day after admission, before the procedure and after the procedure. The laboratory receives 4 samples from a single patient. The obstructive uropathy patients sum up to 48 annually that means 192 samples in the lab. The machines used for processing are the chemistry analyzer and the cell-dyne Ruby.

Sewahaji ward (In patient)

The sewahaji block has 8 wards within. Ward 21 is the main unit attending patients with cervical cancer. The whole ward attends about 80 patients in a month. About 3-4 patients with obstructive uropathy among the cervical cancer cases are attended in a month.

Pharmacy

There is no actual building for a pharmacy store, an attached pharmacy building in sewahaji ward was measured. Sewahaji block pharmacy attends about 62,151 patients according to June 2020- 2- June 2021 records.

Interventional radiology

The Interventional radiology (IR) unit is within the radiology building, it attends an average of 7 patients a day summing up to 210 patients a year. Among them, 4 obstructive uropathy patients' due cervical cancer patients in a month as noted in the record book.

Categories for each cost center

Costs were categorized into two groups i.e., capital and recurrent costs. Capital costs were those incurred on items that last longer than one year and recurrent if incurred on items that were used up in the year or for all items that cost less than 100 USD [21]. The recurrent cost items included staff salaries, medicines, and medical supplies, consumables and other recurrent equipment items which were categorized into

personnel, utilities and materials, and supplies. The capital cost **included buildings**, equipment and implements, and furniture. The annual capital cost was obtained from the depreciation of the item for the relevant year by the annualization factor. The annualization factor was defined based on the discount rate and the total life of the asset.

Buildings costs

The buildings were measured using the tape measure to get the square meters occupied. The original purchase value of the building was used to get the amount of the square meter being used for the obstructive uropathy patients having cervical cancer. The capital costs were depreciated considering the straight-line depreciation. The accumulated buildings costs were depreciated by the rate of 4% since the last valuation done/ baseline data in 2012/2013. Total life was set as 50 years for buildings and other capital assets from the available literature[40].

Equipment's and implements

Mostly were fixed assets with the original purchase price and year of purchase. These lists were used where available; otherwise, procurement rates in recent for purchasing equipment, instruments, and furniture were used. Fluoroscopy C-arm machine, Ultrasound machine, Vitals monitor, Suction machine, Refrigerator.

Furniture

The furniture list includes beds, cabinets, tables, chairs, lockers, and patient trolleys. The useful life of buildings and structure was considered 20 years; the useful life of other capital items was assumed to be 5 years [19]. A 3 percent discount rate was used to calculate the cost of depreciable assets and the opportunity cost of land

Personnel cost

The average time spent by healthcare personnel was determined by using the payroll for each rank of staff. The actual patient-facing hours were determined from time- and motion surveys. Direct continuous observation was conducted on the patients and staff. The providers work 8 hours per day, 260 days a year. Vacations and meetings time, evenings on call, or weekend responsibilities were not included due to lack of most data on them. The medical specialist spends 30% of their time in the Sewahaji ward.

Materials and supplies

The material and supplies were counted based on standard norms i.e., the type and amount of each item consumed by the individual patient. Other relevant hospital records were used to collect data on the number of patients and visits, laboratory tests done and drugs dispensed during the costing period. The costs of materials and supplies were calculated according to the price list of each source of supply. The materials and supplies included Micro puncture set [Neph set], Amplatz wire 80cm, 8F dilators, 10F dilators, Catheter nephrostomy drainage 10FR-25cm, Bag drainage 600mls, Probe cover, Iodinated contrast, C-arm cover, 3way stopcock, Nylon suture 2-0, Povidone 100mls, Lidocaine 2% 50mls, Disposable mask, IV Canula 18G/20, Disposable cap, surgical gloves, Ultrasound gel, Spirit, Special X-ray tray, 20CC syringes, 2CC syringes, Normal saline 500ml, Plaster 7.5cm x 5m, gauze, Surgical blade (No. 11). The drugs included Midazolam, Fentanyl 100ml, IV paracetamol, Ceftriaxone inj and Flagyl inj.

Utilities

Water, Electricity, telephone, security and cleaning costs were obtained from the record of the administrative department and each unit.

Both capital and recurrent costs were calculated from the hospital records. The finance and accounting department was consulted on getting the payroll list of involved personnel. The procurement department was consulted to obtain the valid costs of supplies and materials.

3.7 Investigation tools and validity and reliability Issues

The standard tool for collecting cost data was developed. The tool capture information on the type and quantities of capital and recurrent cost items consumed and their unit price/ replacement price, source and useful life years. The data collection tool was pretested before the actual collection of data so as to make sure all the necessities are included. All items were clearly defined to avoid the inappropriate collection of data. The research assistant was trained and pre-tested to use the tool so as to note the pitfalls and correct errors associated with the process.

3.8 Data analysis

Cost data was managed and analyzed in Excel spreadsheet (Microsoft Corporation). First, all the costs were collected and allocated considering the number of obstructive uropathy patients attended in the unit over the total number of patients attended in the center monthly or annually. The cost centers were identified based on patient's path route on getting the service at the hospital. The costs were presented into USD using an exchange rate of 2300 Tzs to 1 USD and then summarized to get the total cost. The equipment's life years came from the available literature when information could not be obtained from the hospital records. Straight-line depreciation of buildings and equipment from the original purchase price of fixed assets was done. Total cost was the sum of capital and recurrent variables costs annually. Final results were subjected to one-way sensitivity analysis by adjusting unit cost for each category of cost items by 10% and 20 % upward and downward to identify the most influential cost items on the overall unit cost. The estimated total cost as compared to the charged fee for the public and IPPM patients as well as the NHIF reference price. Total cost was based on the financial year 2019/2020.

Assumptions: A number of assumptions were made such as:

- i. Utilities were allocated based on experience of the units on functionality, number of machines and surface area.
- ii. Vacations and meetings time, evening on call or weekend responsibilities were not included.

3.9 Ethical issues

Ethical clearance with Ref No. DA.282/298/01.C/was obtained from Institutional Review Board (IRB) of Muhimbili University of Health and Allied Sciences (MUHAS).

CHAPTER FOUR

4.0 RESULTS

4.1 Service delivery cost of performing percutaneous nephrostomy

4.1.2 Service delivery cost

The total service delivery cost of conducting the percutaneous nephrostomy procedure at MNH annually was estimated to be 17,076.29 USD for all cervical patients with obstructive uropathy attended at MNH for June 2019-2020 Muhimbili National Hospital. The cost per patient was estimated to be 358.56 USD shown in **Table 1**.

Table 1: Cost of performing percutaneous nephrostomy

	IR	Pharmacy	Sewahaji	Emergency	CPL	Total	Unit cost
Recurrent costs(USD)							
Personnel costs	613.76	0.88	122.35	42.22	0.85	780.06	16.25
Materials and supplies cost	14,366.68	541.36	47.61	468.51	-	15,424.14	321.34
Utilities	40.15	0.18	554.76	73.93	1.08	670.1	13.96
Capital costs (USD)							
Building	26.16	0.06	83.74	21.25	1.05	132.26	2.76
Equipment and implements	190.2	0.02	0.7	0.01	0.05	190.98	3.98
Furnitures	2.37	0.13	8.37	0.11	0.02	11	0.27
Total cost	15,239.32	542.63	817.53	606.03	3.05	17,076.29	358.56

Key: IR- Interventional Radiology, CPL-Central Pathology Laboratory

4.2 The cost-drivers for percutaneous nephrostomy

The recurrent cost accounted for 351.55 \$USD which is equivalent to 98.04% of the total cost, while capital cost accounted for 7.01\$ that is 1.96% of the total cost.

One-way sensitivity analysis

The analysis varied the total unit cost **358.56\$** to note the most sensitive or influential unit cost on increase and decrease of the unit cost driver by 10% and 20% upwards and downwards.

Personnel cost

Increase unit personnel cost by 10% i.e., from 16.25 to 17.88 USD led to an increase of total unit cost from 358.51\$to 360.14\$, which is equivalent to 0.45%. An increase of 20% increased total unit cost to 361.76 (0.91%). (**Figure 4**).

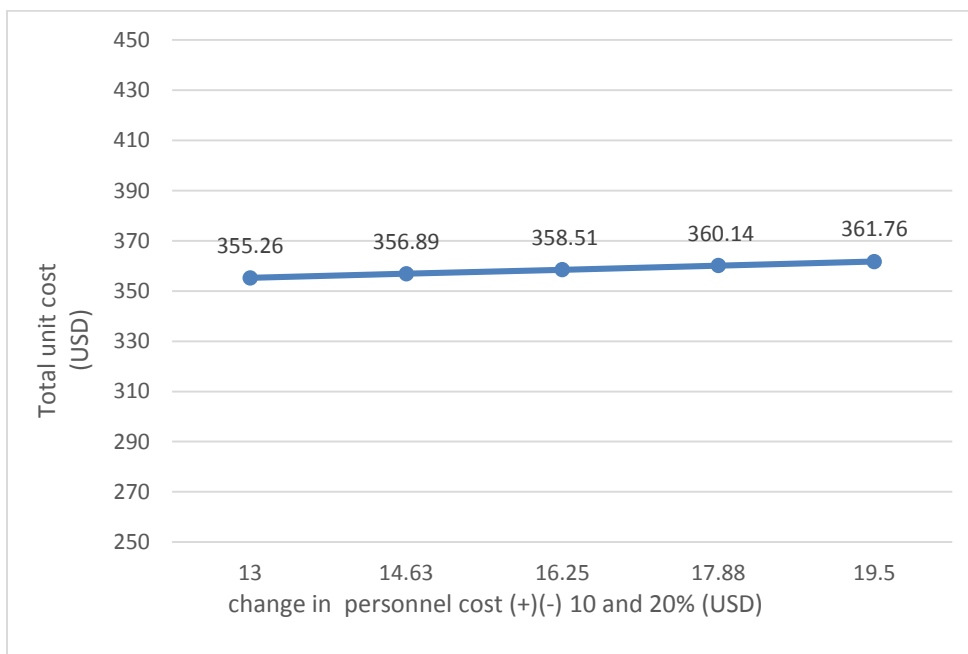


Figure 4: Influence of changing personnel cost on total unit cost

I. Materials and supplies

Increase unit materials and supplies cost by 10% i.e., from 321.34 to 353.47 USD led to an increase of total unit cost from 358.51\$ to 390.65\$, which is equivalent to 8.96%. An increase of 20% increased total unit cost to 385.60 (17.93%). **(Figure 5).**

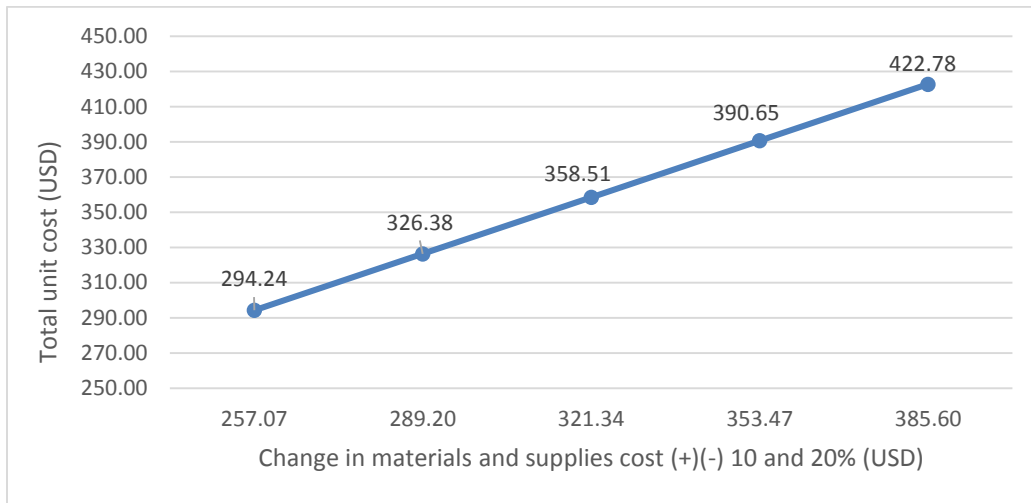


Figure 5: How changes in the unit material and supplies cost affect the total unit cost

The materials and supplies used during the procedure at the IR contributed to major cost than other cost centers. The cost of materials and supplies were most influenced by the IR than others. The costs were 34810851.3 TZS in IR, 1245120 TZS in pharmacy and in sewahaji 2384.2 TZS.

II. Utilities

Increase unit utilities cost by 10% i.e., from 13.96 to 16.75 USD led to an increase of total unit cost from 358.51\$ to 359.91\$, which is equivalent to 0.39%. An increase of 20% increased total unit cost to 361.3 (0.78%). **Figure7).**

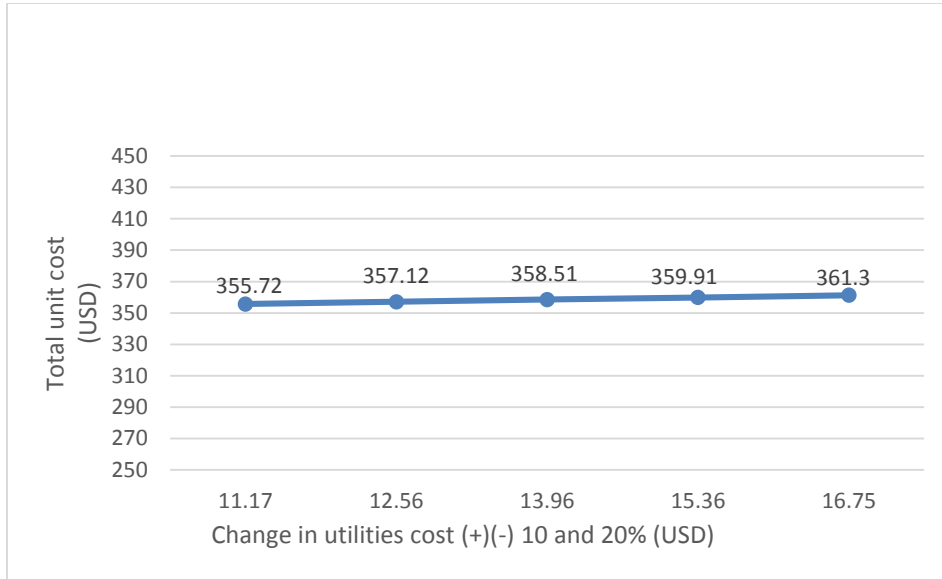


Figure 6: Influence of utilities cost on total unit cost

4.3 Comparison of estimated cost with NHIF, IPPM and Public cost

The estimated cost of percutaneous nephrostomy among cervical patients with obstructive uropathy was higher (358.51\$) than existing mode of payment registered to the patients such as (National Health Insurance Funds (NHIF), Intramural Private Practice Management (IPPM) and public mode. The existing payment charges have been drafted and put in place by the administration (**Figure 8**). The NHIF charges usually involve carrying out actuarial assessment and valuation however the cost of this procedure has identified to be differ from what has been estimated by the NHIF.

The estimated price differs higher by 99.1\$ to the IPPM, 121.16\$ to the NHIF and 185.57\$ Public charged costs. The percentages have shown to vary by 34.87% on the estimated charges, 25.23% on the IPPM charges, on the NHIF 23.08% and on the Public 16.82%.

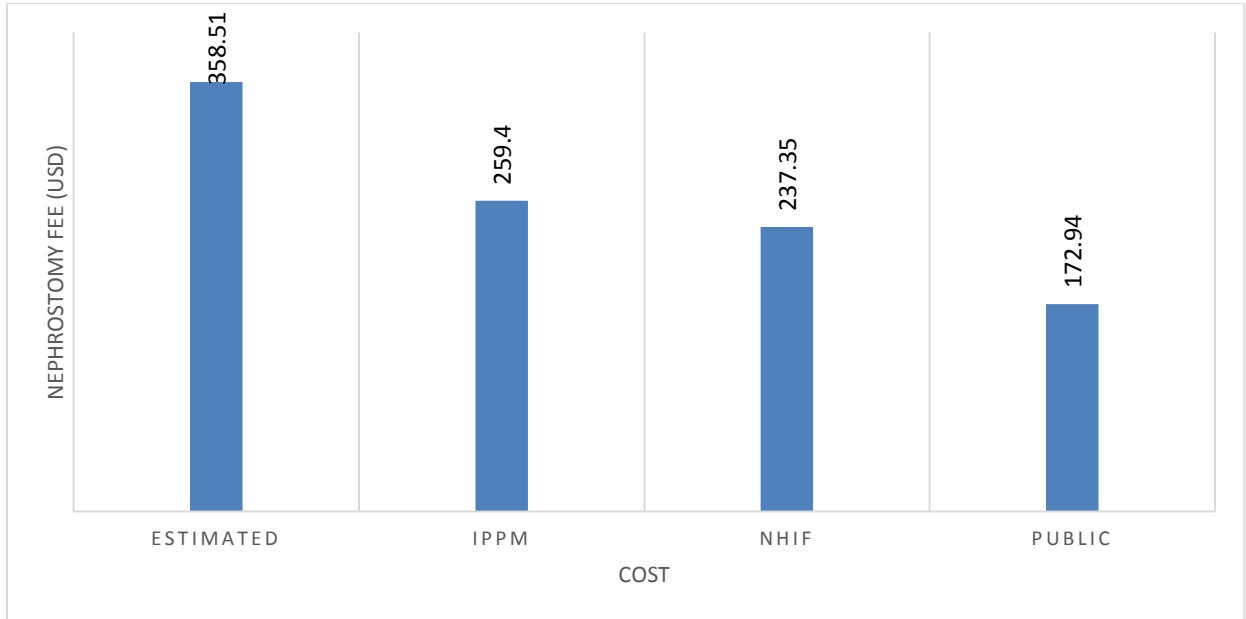


Figure 7: Comparison estimated cost, NHIF reimbursement rate, and fees charged to the IPPM and public patients for percutaneous nephrostomy

The unit cost of performing percutaneous nephrostomy at MNH has been estimated to be 358.56 USD per patient. The most influential cost items were the materials and supplies compared to any other cost categories. The estimated cost was found to vary higher than the current charged fee for the procedure in the hospital.

CHAPTER FIVE

5.0 DISCUSSION STUDY STRENGTH AND LIMITATIONS

5.1 Discussion

This study shows the cost of performing the percutaneous nephrostomy for cervical cancer patients with obstructive uropathy at Muhimbili National Hospital was 358.56 USD per patient. Literature review done could not find a related published studies in Tanzania or any other sub-Saharan Africa countries. Most of the cost studies concerning cervical cancer in sub-Saharan Africa did not report on percutaneous nephrostomy[41][28].The estimated cost has shown to be relatively cheaper than other percutaneous procedures such as nephrolithotomy in other settings[31] and other treatments for cervical patients at late stages [27]. This may be due to several factors such as economic state and organization of the health care system.

The other parts of the world have note on the percutaneous nephrostomy-related complications after discharge are costly for the patients with malignant urinary obstruction[30]. The changes in patients' compliance level make a markable effect on the annual charges associated with cost of any routine exchange frequency. This study did not asses the costs according to other underlying conditions however it is known that, the cost of long-term management of percutaneous nephrostomy depends on patient compliance to the procedure .The exchange of the percutaneous nephrostomy is mostly done considering to minimize the long-term costs, patients with malignant obstruction undergoes exchange at approximately 60 days and improvement in patient compliance results in cost savings by reduction in complication-related Percutaneous Nephrostomy exchanges[30]. The estimated charge may cover the procedure but not the maintenance, with maintenance the costs will be higher.

Muhimbili National hospital being the only facility offering the services on a long run will be burdened with a pile of workload to attend such patients[42]. The demand will mark the need of having the percutaneous nephrostomy services at the lower levels so as to serve the

population demand when the primary preventions programs are not in place. The study identified 5 cost centers on provision of the percutaneous procedure, the emergency, ward, pharmacy, radiology unit and the pharmacy. The centers identified are the basic units inclusive in any hospital. Any hospital with availability of such centers may be considered eligible to conduct the procedure in consideration with availability of the resources. An analysis of population-based surveys indicates that coverage of cervical cancer screening in developing countries is 19% compared to 63% in developed countries[43]. The majority of women in developing countries still do not have access to cervical cancer prevention programmes which is resulting in increased cervical cancer disease burden[44]. The Human papilloma virus (HPV) vaccine and cervical cancer screening programs not being accessible with the increase in population signifies the chances of having more cases diagnosed at late stages having developed obstructive uropathy necessary.

This study has not analyzed the societal burden of the procedure, it based on the provider's perspective on analyzing the cost. To know the actual burden of the procedure patient's perspective should have been involved. Thus, the direct and indirect costs of the procedure would be assessed and generalized to know the general implication of the procedure.

According to this study, recurrent costs accounted for 98% of the total costs. It includes the costs of personnel who are paid every month and the utilities, materials and supplies which are single use items and they are expensive as result annually they are need more and contribute mainly in the unit cost. Few studies conducted on the same setting noted the recurrent costs to be major contributor of the provider costs [31][32]. For the case of this study Muhimbili National Hospital being a national hospital with multiple departments and many patients from different regions might have overestimated the actual costs of capital items on allocation.

This cost analysis has been conducted on financial basis not the economic basis. On sensitivity analysis, the total unit cost was most sensitive to changes in recurrent costs related to personnel cost, materials and supplies cost, and utilities. The sensitivity of changes was mostly noted on the materials and supplies (consumables) which made up the largest

share of the total cost of the percutaneous nephrostomy. [45]. The materials and supplies analyzed were mostly not re-usable and some are rarely available thus causing a delay of the procedure sometimes. The study conducted in Vietnam on medical costs for the treatment of cervical cancer found the facilities and medical equipment to have the largest share of the total cost for treatment unlike this study[45]. The differences may be due to the nature of study areas and the health financing systems of the different countries. Equipment's at MNH are used up in large scale thus causing insignificant changes on sensitivity analysis. Delay of the procedure causes increased patient stay time at the hospital hence increased patient cost and provider's cost.

The estimated cost was higher than the existing forms of payments such as NHIF, IPPM, and public fees. The implication of MNH charging less than the actual resource use is that MNH is operating under loss. The cost percutaneous nephrostomy procedure among cervical patients with obstructive nephropathy is clearly contributed by other sources to undergo the procedure and not what has been paid by the patient. The charged prices are not sufficient to sustain the procedure.

This study is in contrast with a study conducted to determine costs of health care services for cost-effectiveness analyses which found the charged estimates are higher than the cost-based studies [46].The cost analyzed can be subjective depending on availability of the materials used and considering the patient's condition. The financing system of MNH may be different from other hospitals considering it is a national level and top in hierarchical order of referral system. Other mode of payments at MNH includes full or semi exemption of charges considering the hospital policy. The cost analyzed has shown to be more expensive compared to the actual fee being charged by the hospital. This ignites the provider on the possible mistakes made on drafting the charges that are not correlating with the actual resources being used. In considering the cost estimated the provider can take to account for further decision making and so.

5.2 Strengths

First, this study is the first study to estimate cost of percutaneous nephrostomy procedure in Tanzania and sub-Saharan African. This is so considering the scarce literature regarding percutaneous nephrostomy. Second, the study has used a micro-costing approach which offers the advantages on accuracy, generalizability and transparency however difficult to implement. The estimate analyzed is surely having the so characters.

5.3 Study limitations

Despite the strengths listed the study is not short of limitations. Firstly, the study was conducted in a large hospital were no specific utilities for units, the number of samples per patient, So the assumptions were applied to solve thus might result in either overestimate or underestimate the findings. The bottom-up approach could be more suitable for non-homogenous hospital services/ set up. Being a referral hospital-based study, some information obtained from the study cannot be generalized into the population.

Secondly, the study didn't consider indirect costs such as training, supervision, and overhead costs. Vacations and meetings time, evening on-call, or weekend responsibilities were also not included in personnel unit costing. This was mostly due to missing and lack of these information.

Thirdly, Unit costs of cost centers might have been calculated as an average cost per unit of output (which could over or underestimate the real costs of resource consumption).

Fourthly, this study did not apply a patient perspective thus the estimated total economic burden of the procedure was not stated.

CHAPTER SIX

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Accurate unit cost of medical service is critical to improve efficiency and transparency in the hospital. The unit cost of conducting the percutaneous nephrostomy procedure among cervical cancer patients at Muhimbili National Hospital was estimated at 358.6 USD. The estimated cost was higher than the cost charged to the private and public patients and NHIF reimbursement cost. Total unit cost was most sensitive to variation of the cost of material and supplies.

6.2 Recommendations

- Muhimbili National Hospital need to revise the cost charged to the private and public patients while NHIF need to revise the reimbursement cost for percutaneous nephrostomy to reflect actual resource use
- Percutaneous Nephrostomy procedure to be scaled up in other hospitals, the listed units, and influential cost driver should be considered. More cost studies should be considered in health systems so as to have actual charges of the services provided in order inform pricing decisions.
- The future study may consider provider and patient perspectives to assess the societal financial or economic burden of the procedure.
- The health system and government in general needs to have available prevention that is early screening, and a vaccine for cervical cancer especially at grassroots health facilities to avoid the costs associated with late treatment.

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<i>iii. Utilities</i>						
1.	Water					
2.	Electricity					
3.	Gas					
4.	Fuel					
5.	Air-time					

B: Capital costs							
<i>i. Buildings</i>							
	Name	Floor area	Purchase/replacement cost		Life years	Annualized costs	
			Financial	Economic		Financial	Economic
1.	Managers office						
2.	Accounts office						
3.	Medical records						
<i>ii. Equipment and implements</i>							
No	Type	Quantities	Unit costs		Life years	Total costs	
			Financial	Economic		Financial	Economic
1.	Desktops						
2.	Printers						
3.	Cars						
	Other						
<i>iii. Furniture</i>							

No	Type	Quantities	Unit costs			Total costs	
			Financial	Economic	Life years	Financial	Economic
1.	Chairs						
2.	Tables						
3.	Cabinets						
	other						

RADIOLOGY DEPARTMENT							
A: Recurrent costs							
<i>i. Personnel costs</i>							
No.	Personnel	Full Time Equivalent	Monthly gross salary		Monthly allowances		Total salary (yearly)
			Financial	Economic	Financial	Economic	
1.	Radiologist						
2.	Senior technician						
3.	Technician 1						
4.	Technician 2						
5.	Nurse						
6.	Nurse attendant						
7.	Anesthetist						
<i>ii. Materials and supplies cost</i>							
No.	Type	Quantity	Unit cost		Total cost		
			Financial	Economic	Financial	Economic	
1.	Micro puncture set [Neph set]						

2.	Amplatz wire 80cm					
3.	8F dilators					
4.	10F dilators					
5.	Catheter nephrostomy drainage 10FR,25cm					
6.	Bag drainage 600mls					
7.	Probe cover					
8.	Iodinated contrast					
9.	C-arm cover					
10.	Nephroureteric stent					
11.	3way stopcock					
12.	Ultrasound gel					
13.	Special x-ray tray					
14.	Others					
<i>iii. Utilities</i>						
1.	Water					
2.	Electricity					
3.	Other					
B: Capital costs						
<i>i. Buildings</i>						

	Name	Floor area	Purchase/replacement cost		Life years	Annualized costs	
			Financial	Economic		Financial	Economic
1.	Radiology building						
<i>ii. Equipment and implements</i>							
No	Type	Quantities	Financial	Economic	Life years	Financial	Economic
1.	Fluoroscopy machine						
2.	Ultrasound machine						
3.	Vitals monitor						
4.	Suction machine						
5.	Others						
<i>iii. Furniture</i>							
1.	Chairs						
2.	Tables						
3.	Cabinets						
<i>iv. Training</i>							
1.	Pre implementation						
2.	During implementation						
3.	Others						

PHARMACY							
A: Recurrent costs							
<i>i. Personnel costs</i>							
No	Personnel	Full Time Equivalent	Monthly gross salary		Monthly allowances		Total salary (yearly)
			Financial	Economic	Financial	Economic	
1.	Pharmacist1						
	Pharmacist 2 etc.						
2.	Pharmacy technician/assistant						
3.	Others						
<i>ii. Materials and supplies cost</i>							
			Unit cost		Total cost		
No	Type	Quantities	Financial	Economic	Financial	Economic	
1.	Normal saline 500ml						
2.	Midazolam						
3.	Fentanyl						
4.	IV paracetamol						
5.	Ceftriaxone inj						
6.	Spirit 100mls						

7.	Surgical blade [no. 11]						
8.	20cc syringes						
9.	Flagyl inj						
10.	Examination gloves						
11.	Disposable cap						
12.	Disposable masks						
13.	Lidocaine						
14.	Povidone						
15.	Nylon sutures 2-0						
16.	Others						
<i>iii. Utilities</i>							
1.	Water						
2.	Electricity						
3.	Oxygen gas						
4.	Other						
B: Capital costs							
<i>i. Buildings</i>							
	Name	Floor area	Purchase/replacement cost		Life years	Annualized costs	
			Financial	Economic		Financial	Economic
1.	Pharmacy store						
<i>ii. Equipment and implements</i>							

No	Type	Quantities	Financial	Economic	Life years	Financial	Economic
1.	Refrigerator						
2.	Other						
<i>iii. Furniture</i>							
1.	Shelves						
2.	Tables						
3.	Chairs						
4.	others						

LABORATORY							
A: Recurrent costs							
<i>iv. Personnel costs</i>							
No	Personnel	Full Time Equivalent	Monthly gross salary		Monthly allowances		Total salary (yearly)
			Financial	Economic	Financial	Economic	
1.	Specialist 1						
2.	Technician						
3.	Nurse						
<i>v. Materials and supplies cost</i>							
			Unit cost		Total cost		
No	Type	Quantities	Financial	Economic	Financial	Economic	
1.	Cotton wools						

2.	Gauze						
3.	Syringes						
4.	WCB						
5.	Serum Urea						
6.	Creatinine						
7.	Serum potassium						
8.	PT						
9.	PTT						
10.	INR						
11.	Other						
<i>vi. Utilities</i>							
1.	Water						
2.	Electricity						
3.	Oxygen gas						
4.	Other						
B: Capital costs							
<i>iv. Buildings</i>							
	Name	Floor area	Purchase/replacement cost		Life years	Annualized costs	
			Financial	Economic		Financial	Economic
1.	Laboratory						
<i>v. Equipment and implements</i>							
No	Type	Quantities	Financial	Economic	Life years	Financial	Economic
1.	Hemoglobinometer						

2.	Chemistry Analyzer						
3.	Others						
<i>vi. Furniture</i>							
1.	Chairs						
2.	Tables						
3.	File cabinets						

SEWAHAJI WARD							
A: Recurrent costs							
<i>i. Personnel costs</i>							
No.	Personnel	Full Time Equivalent	Monthly gross salary		Monthly allowances		Total salary (yearly)
1.	Specialist 1		Financial	Economic	Financial	Economic	
2.	Medical Officer						
3.	Nurse						
<i>ii. Materials and supplies cost</i>							
			Unit costs		Total costs		
No.	Type	Quantities	Financial	Economic	Financial	Economic	
1.	Cotton wools						

2.	Gauze						
3.	Syringes						
4.	Normal saline						
5.	Others						
<i>iii. Utilities</i>							
1.	Water						
2.	Electricity						
3.	Water						
4.	Other						
B: Capital costs							
<i>vii. Buildings</i>							
	Name	Floor area	Purchase/replacement cost		Life years	Annualized costs	
			Financial	Economic		Financial	Economic
1.	Sewahaji ward						
<i>viii. Equipment and implements</i>							
No	Type	Quantities	Financial	Economic	Life years	Financial	Economic
1.	Bp machine						
2.	Thermometers						
3.	Others						
<i>ix. Furniture</i>							

1.	Beds						
2.	Tables						
3.	File cabinets						
4.	Chairs						
5.							

Appendix II: Consent form (English version and Swahili versions)

INFORMED CONSENT FORM (ENGLISH VERSION).

Introduction.

Greetings,

I am **CECILIA J NYABAKARI**, a master's student from Muhimbili University of Health and Allied Sciences pursuing Master of Science in project management monitoring and evaluation in health (MSc.PMMEH). I am conducting a study on the service delivery cost of image-guided percutaneous nephrostomy among cervical cancer patients at Muhimbili National Hospital in Tanzania. I, therefore, request you to participate and cooperate in my study. My research assistant and I are looking forward to your cooperation as we conduct this study. Please ask anything about this study for any further clarification when you feel you do not have a clear understanding.

Purpose of the study

This study aims analyzing the service delivery cost of image-guided percutaneous nephrostomy among cervical cancer patients at Muhimbili National Hospital. Therefore, you will be requested to provide information on the costs of the items associated. I would ask you to let me and my research assistants to note down the information as needful.

What participation involves

If you agree to participate in this study, you will be required to sign this consent form and respond to some questions that you will be asked in relation to this study.

Confidentiality

I would like to assure you that all the information collected will be confidential. Only researchers working in this study will have access to the information. We will use study identification code to record and access the information you provide.

Risks

There are no any invasive procedures expected in this study, therefore, no harm is anticipated to occur by your participation in this study.

Rights to withdrawal and alternatives

Taking part in this study is completely at your will. You can stop participating in this study at any time, even if you have already given your consent. Refusal to participate or withdraw from the study will not involve penalty or loss of any benefits to which you are otherwise entitled.

Benefits

The information you share will be used as a basis to assist in inform decision making regarding service delivery cost of image-guided percutaneous nephrostomy among cervical cancer patients at Muhimbili National Hospital

Agreement

Do you agree to participate in this study?

YES

I have read and understood the contents in this form. I agree to participate in this study.

Signature of Participant _____

Date _____

Signature of the Researcher

Date

Contact Information.

In case of any inquiry please contact the principal investigator:

Cecilia James Nyabakari, Principal researcher,

Muhimbili University of Health and Allied Sciences (MUHAS),

P.O. Box 65001, Dar es Salaam,

Mobile No: +255786592334.

Email: cnyabakari2@gmail.com

If you have questions about this study you may call, the Chairperson of the (Research and Publications Committee, MUHAS. P.O. Box 65001, Dar es Salaam-Tanzania, Tel +2552150302-6)

Appendix III: Consent form (Swahili versions)

Utangulizi

Jina langu ni **CECILIA J NYABAKARI**, ni mwanafunzi wa shahada ya uzamili na mtafiti kutoka Chuo Kikuu cha Afya na Sayansi Shirikishi cha Muhimbili. Ninafanya uchunguzi juu ya gharama ya huduma ya Percutaneous nephrostomy baina ya wagonjwa wa kansa ya shingo ya kizazi katika hospitali ya Muhimbili. Kwahiyo, naomba ushiriki wako kwenye huu utafiti na kama una swali lolote kuhusiana na huu utafiti pengine hujaelewa, waweza uliza bila tatizo.

Dhumuni la utafiti

Lengo la utafiti huu ni kutambua gharama zinazohusika na huduma hiyo kwa ajili ya kufanya maamuzi. Hivyo unaombwa kushiriki katika hii tafiti kwani naamini utakuwa na majibu sahihi yanayo hitajika katika hii tafiti. Nakuomba pia kuniruhusu mimi na wasaidizi wangu kuandika taarifa husika ilikusaidia wakati wa kuandikia taarifa ya utafiti huu.

Kinachohusikakwenyehiitafiti

Kama utakubali kushiriki kwenye hii tafiti, mtafiti atauliza maswali kuhusiana na gharama ya huduma ya Percutaneous nephrostomy ya wagonjwa wa kansa ya shingo ya kizazi katika hospitali ya Muhimbili Mahojiano haya yanaweza chukua dakika 10 mpaka dakika 30.

Usiri

Napenda kukuhakikishia kuwa taarifa zote zitakazopatikana zitakuwani za siri, zitatumika kwa madhumuni ya tafiti tu.

Madhara

Sitegemei kutakuwa na kitu chochote kitakachotokea kwako kwa kushiriki katika utafiti huu, wala hakuna madhara yeyote yatakayotokea kwako katika kushiriki kwenye huu utafiti.

Faida

Taarifa utakazotoa zitasaidia kupata gharama ya huduma ya Percutaneous nephrostomy baina ya wagonjwa wa kansa ya shingo ya kizazi katika hospitali ya Muhimbili na hivyo kutumia tafiti hizi katika ufanya maamuzi na kuboresha huduma. Hakuna faida ya moja kwa moja ambayo utaipata.

Haki yakushiriki

Kushiriki kwenye hii tafiti ni ridhaa yako mwenyewe. Unaweza kuamua kuacha kushiriki mda wowote. Hakuna tozo yoyote itakayo kuwepo kama ukikataa kushiriki. Kama umekubali kuhojiwa, tafadhali saini hapa:

Makubaliano.

Saini yako hapa chini ina maana kwamba umesoma habari hapo juu, umelewa na uko tayari kushiriki kwenye utafiti huu kwa hiari.

Mimi..... nimesoma na kuelewa kilichoelezwa kwenye fomu hii na maswali yangu yamejibiwa kiufasaha. Hivyo ninakubali kujibu maswali yatakayoulizwa.

Sahihi ya mhojiwaTarehe

Sahihi ya mkusanya taarifa.....Tarehe.....

Mawasiliano

Ikiwa kuna changamoto yoyote tafadhali wasiliana na Mtafiti mkuu:

Cecilia James Nyabakari, Mtafiti mkuu

Chuo Kikuu cha Afya na Sayansi Shirikishi Muhimbili (MUHAS),

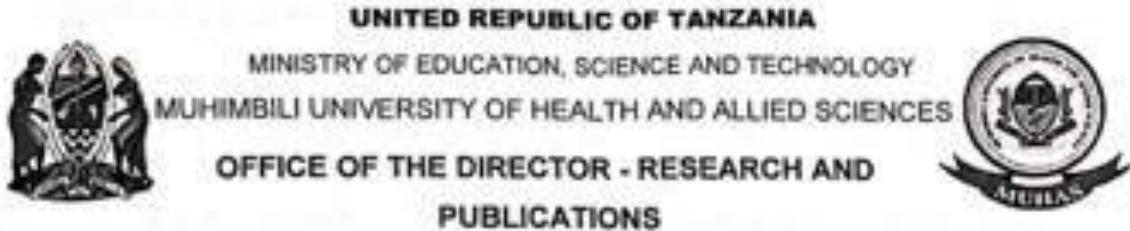
P.O. Box 65001, Dar es Salaam,

Nambari ya simu: +255786592334

Barua pepe: cnyabakari2@gmail.com

Ikiwa una maswali juu ya utafiti huu unaweza kupiga simu, Mwenyekiti wa (Kamati ya Utafitina Machapisho, MUHAS. P.O. Box 65001, Dar es Salaam-Tanzania, Simu + 2552150302-6)

Appendix III: Ethical clearance



Ref. No. DA.282/298/01.C/

Date: 15/04/2021

MUHAS-REC-04-2021-556

Cecilia J Nyabakaris,
MSc, PMMEH,
School of Public Health and Social Sciences,
MUHAS

**RE: APPROVAL FOR ETHICAL CLEARANCE FOR A STUDY TITLED:
SERVICE DELIVERY COST OF IMAGE-GUIDED PERCUTANEOUS
NEPHROSTOMY AMONG CERVICAL CANCER PATIENTS AT MUHIMBILI
NATIONAL HOSPITAL**

Reference is made to the above heading.

I am pleased to inform you that the Chairman has on behalf of the University Senate, approved ethical clearance of the above-mentioned study, on recommendations of the Senate Research and Publications Committee meeting accordance with MUHAS research policy and Tanzania regulations governing human and animal subjects research.

APPROVAL DATE: 15/04/2021

EXPIRATION DATE OF APPROVAL: 14/04/2022

STUDY DESCRIPTION:**Purpose:**

The purpose of this retrospective cross-sectional study is to estimate service delivery/provider cost of performing percutaneous nephrostomy to cervical cancer patients with obstructive uropathy at Muhimbili National Hospital.

The approved protocol and procedures for this study is attached and stamped with this letter, and can be found in the link provided: <https://rb.muhas.ac.tz/storage/Certificates/Certificate%20-%20526.pdf> and in the MUHAS archives.

The PI is required to:

1. Submit bi-annual progress reports and final report upon completion of the study.
2. Report to the IRB any unanticipated problem involving risks to subjects or others including adverse events where applicable.
3. Apply for renewal of approval of ethical clearance one (1) month prior its expiration if the study is not completed at the end of this ethical approval. You may not continue with any research activity beyond the expiration date without the approval of the IRB. Failure to receive approval for continuation before the expiration date will result in automatic termination of the approval for this study on the expiration date.
4. Obtain IRB amendment (s) approval for any changes to any aspect of this study before they can be implemented.
5. Data security is ultimately the responsibility of the investigator.
6. Apply for and obtain data transfer agreement (DTA) from NIMR if data will be transferred to a foreign country.
7. Apply for and obtain material transfer agreement (MTA) from NIMR, if research materials (samples) will be shipped to a foreign country.
8. Any researcher, who contravenes or fail to comply with these conditions, shall be guilty of an offence and shall be liable on conviction to a fine as per NIMR Act No. 23 of 1979, PART III section 10 (2)
9. The PI is required to ensure that the findings of the study are disseminated to relevant stake holders.
10. PI is required to be versed with necessary laws and regulatory policies that govern research in Tanzania. Some guidance is available on our website <https://drp.muhas.ac.tz/>.

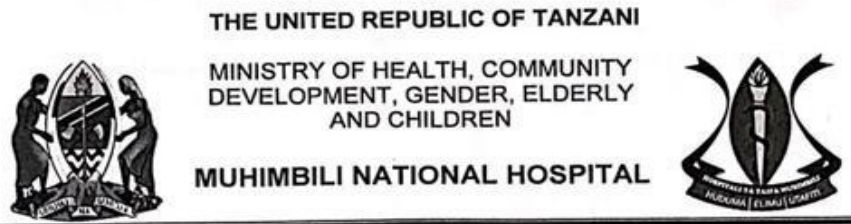


Dr. Bruno Sunguya
Chairman, MUHAS Research and Ethics Committee



Cc: Director of Postgraduate Studies, MUHAS

Appendix IV: Introduction Letter



In reply please quote;

Ref. No.: MNH/TRCU/Perm/2021/118

Date: 12th May, 2021

Head of Department
Radiology
Muhimbili National Hospital

RE: PERMISSION TO COLLECT DATA AT MNH.

Name of Student	Cecilia J. Nyabakaris
Title	"Service Delivery Cost of Image-Guided Percutaneous Nephrostomy Among Patients at Muhimbili National Hospital".
Institution	Muhimbili University of Health and Allied Sciences
Supervisor	Prof. Amani Thomas Mori
Period	12 th May 2021, to 11 th June, 2021

Approval has been granted to the above mentioned student to collect data at MNH.

Kindly ensure that the student abide to the ethical principles and other conditions of the research approval.

Sincerely,

Reid B. Mchome

Coordinator –Teaching, Research and Consultancy Unit



c.c DCSS
c.c Cecilia J. Nyabakaris