Pilot study assessing the direct medical cost of treating patients with cancer in Kenya; findings and implications for the future

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Abstract

Background. Currently the majority of cancer deaths occur in low and middle-income countries where there are appreciable funding concerns. In Kenya, most patients currently pay out of pocket for treatment and those who are insured are generally not covered for the full costs of treatment. This places a considerable burden on households if family members develop cancer. However, the actual cost of cancer treatment in Kenya is unknown. Such an analysis is essential to better allocate resources as Kenya strives towards universal healthcare. **Objectives**. Evaluate the economic burden of treating cancer patients. **Method**. Descriptive cross-sectional cost of illness study in the leading teaching and referral hospital in Kenya, with data collected from the hospital files of sampled adult patients for treatment during 2016. **Results:** 412 patient files were reviewed, of which 63.4% (n=261) were female and 36.6% (n=151) male. Cost of cancer care is highly dependent on the modality. Most reviewed patients had surgery, chemotherapy and palliative care. The cost of cancer therapy varied with the type of cancer. Patients on chemotherapy alone cost an average of KES 138,207 (USD 1364.3); while those treated with surgery cost an average of KES 128,207 (1265.6), and those on radiotherapy KES 119,036 (1175.1). Some patients had a combination of all three, costing on average KES 333,462 (3291.8) per patient during the year. **Conclusion**. The cost of cancer treatment in Kenya depends on the type of cancer, the modality, cost of medicines and the type of inpatient admission. The greatest contributors are currently the cost of medicines and inpatient admissions. This pilot study can inform future initiatives among the government as well as private and public insurance companies to increase available resources, and better allocate available resources, to more effectively treat patients with cancer in Kenya. We will be monitoring developments and conducting further research.

1. Introduction

Cancer results in high morbidity and mortality (1). In 2012, it was estimated that approximately 14 million new cases of cancer worldwide were diagnosed, with 8.2 million deaths due to cancer (2, 3). There were 8.8 million deaths due to cancer in 2015, with mortality due to cancer projected to rise to 13 million deaths a year by 2030 due population growth and its ageing, increase in infection rates as well as an increase in unhealthy lifestyles known to cause cancer (3, 4). The majority of cancer deaths are now seen in middle and low-income countries (LMICs) (2, 5), with LMICs currently accounting for approximately 57% of cancer cases worldwide and approximately 65% of cancer deaths (3). Other authors have suggested up to 70% or more of the burden of cancer is now among LMICs (5, 6). Cancer mortality in LMICs is enhanced by late diagnosis as well as a lack of finances to

fund appropriate care (2, 3). Having said this, in higher income countries there appears limited correlation between resources spent and reduced mortality, with issues such as efficiency, patient centred care and timely treatment more important (7).

In sub-Sahara Africa, the most common cancers affecting women are breast and cervical cancers with equal incidence, although cervical cancer leads to more deaths aided by infection; whilst among men, prostate and liver cancer are the most common and cause more deaths (2, 3). Prevalence rates are expected to more than double between 2008 and 2030, with the number of new patients developing cancer expected to rise to 1.6million by 2030 (5). In Kenya in 2012 there were approximately 41,000 new cases of cancer with 28,453 deaths (4, 8), making cancer the third highest cause of mortality after infectious and cardiovascular diseases at approximately 7% (8). Others though have suggested higher incidence rates in Kenya at approximately 82,000 new cancer patients annually, which may be due to improvements in disease detection and characterisation (6).

Among women in Kenya, breast cancer (34 cases per 100,000) and cervical cancer (25 per 100,000) are the leading cancers, with prostate cancer (17 cases per 100,000) and esophageal cancer (9 cases per 100,000) the leading cancers in men (6). There are though appreciable differences in incidence rates among the different ethnic groups in Kenya (9). For children, the most common cancers are leukemia, brain and other central nervous system cancer, and lymphomas. Childhood cancers accounted for 15% of cancer admissions at the leading tertiary hospital in Kenya with currently only 1 in 10 children surviving cancer in Kenya compared with rates of 7 in 10 or higher among developed countries (4, 6). However, these disparities in survival are likely to be multifactorial.

The lack of adequate healthcare personnel and diagnostic equipment in Kenya has impacted on survival rates among diagnosed cancer patients. Currently there are only 4 radiation oncologists, 6 medical oncologists and 4 paediatric oncologists located in the leading hospitals in Kenya, with ongoing concerns when machinery such as radiation equipment breaks down (6, 10). Some authors though have suggested higher figures, with a total of 22 oncologists currently in Kenya (4). These numbers will grow with already 5 new cancer centres being planned in Kenya including those outside Nairobi (4).

There are also issues of affordability with high costs of care including physician visits, medicines, laboratory tests, surgery and other treatment modalities including radiation (11). The cost for one radiotherapy session at US$5 – 10 in the public hospital can be prohibitively expensive for disadvantaged Kenyans, who typically live on US$1 per day or less (10, 12, 13). The current estimated average costs of treating patients with cancer in Kenya at US$1,600 to $5,000 is a major concern as this would be unaffordable for most Kenyans (10), with only the wealthy able to fully afford treatment (10, 14). The type of insurance cover patients have is a major contributor to possible treatment approaches since even if patients can afford insurance, which is a minority, some insurance policies do not cover all cancer medicines and diagnostic tests with some limiting the number of chemotherapy courses a year (4, 14). Overall, treatment costs depend on many factors including the type of cancer, the type of treatment, the length of therapy and even the location of therapy.

The cost of medicines is a major concern in LMICs countries including Kenya and worldwide as typically there are high co-payment levels and low incomes (5, 14-16). Prices of cancer medicines have risen up to ten fold during the past ten years in some countries despite often limited health gain (17-23), although this is not universal (24). Having said this, some pharmaceutical companies are giving up their patents for biological medicines to ease the patient burden as seen in India with trastuzumab (5). However, this is not universal among LMICs with for instance trastuzumab in Botswana currently only benefiting 3% of its cancer patients but consuming 43% of its entire cancer budget (4). Having said this, such practices may grow with estimates suggesting that the cost of production of even some newer cancer medicines may be as low as 1% of the selling price (25). In Kenya, chemotherapy typically costs between KES 6,000 (US$ 60) and KES600,000 (US$600) per treatment course in public hospitals depending on the cancer being treated (13); however, even these costs may be prohibitive to some patients, affecting their subsequent care (26). Costs to patients can be further increased with initial misdiagnosis (13).

Since most patients in Kenya are not insured, and hence pay out-of-pocket for their care, this has important implications on timing when they seek treatment and the type of treatment they choose (27). As mentioned, current costs of cancer care impoverish many Kenyans as they struggle to

acquire the funds for treatment. Consequently, there is an urgent need to improve the knowledge of treatment costs to help guide patients with cancer and the government on potential ways forward as exact costs are currently unknown (28). Such information can better enable the government and donors to allocate more resources to cancer therapy if needed, and to patients to better understand possible costs. We believe such information will also help hospitals in Kenya to improve their waiver systems for selected cancer patients to ensure more accessible and affordable therapy to enhance equity and improve outcomes. This is important whilst Kenya strives towards universal healthcare.

Consequently, the main objective of this pilot study is to start to quantify the cost of treatment of cancer patients in Kenyatta National Hospital (KNH), the leading referral hospital for cancer patients in Kenya. This includes direct medical costs including the costs of medicines, laboratory tests, radiation and surgery.

2. Methodology

2.1 Study Design, Duration and Site

A descriptive cross-sectional study was carried out in the oncology unit at the Kenyatta National Hospital (KNH) between January and March 2017. The cost of illness study involved quantifying the direct medical costs involved in cancer treatment and care. The documented costs were those that the patients incurred during the time they visited the hospital in 2016. The actual time periods for different patients varied depending on the type and cycle of medication (chemotherapy) that they were on.

Kenya National Guidelines on Cancer Management (2013) exist and current treatments are typically based on these guidelines (29). These guidelines have been adapted from the World Health Organisation (WHO) guidelines on cancer management.

2.2 Study site

The study was carried out at KNH, the largest referral and teaching hospital in Kenya. KNH treats various types of cancers affecting Kenyans in both the paediatric and adult settings. Moreover, most cancer patients in Kenya are currently referred to this hospital. The hospital has a specialized oncology unit, with most oncology specialists in Kenya currently working in this hospital.

2.3 Study Population

The study population were adults above 18 years of age being treated for different cancers at KNH in 2016. The patients' files were used to collect the data. Paediatric patients were excluded since patients were consulted in case additional data on resource use were required, and it was believed that it would be unfeasible to collect this information in children as frequently as paediatric patients would not have their parents or guardians present at the hospital at questioning. Consequently, it was predicted that missing cost information would introduce bias and best to avoid this in this pilot study. In addition, the vast majority of cancer cases in Kenya currently occur in adults (8).

The sample size could not be easily calculated for the cross sectional study as there are no prevalence studies that have been undertaken for Nairobi since patients treated at KNH are sourced from across Kenya. However, from the KNH cancer registry of 2014-2016 (30), it was recorded that 4,211 cancer patients were treated in that year. Using this estimate we decided to pick one out of every ten files from the registry, from which we obtained our pilot sample size of 412 patients after excluding those that did not meet the inclusion criteria. Sampling has also been undertaken in other LMIC countries to assess the extent of prescribing of chemotherapy agents for patients with cancer (31).

According to the KNH Cancer registry, which was established in 2014, KNH attends to an average of over 550,000 outpatients annually, and over 80,000 inpatients per year. The registry estimates the total number of cancer patients between this period (2014-2016) at 10,335, with the majority being women at 6,279 and men at 4,056 (30). The most common cancer among females at KNH is cervical cancer (n=1800) followed by breast cancer (n=1500). The most common for men is oesophageal and prostate cancer in equal numbers (n=480 each). The leading cause of hospitalisation in KNH in the years 2015 and 2016 was cancer (30).

2.4 Data Collection

The collection of data was undertaken with the aid of a data collection tool including the patients' treatment history (Appendix A1). The data collected included patient demographics, medicines prescribed and their costs, cost of radiologic tests, costs of laboratory tests, any surgery and associated costs as well as the quantity and costs of any medical devices used.

The information on the costs of medicines used during in-patient care were obtained from the expenditure and revenue collection unit for the oncology department of KNH. The costs of surgery in both the public and private sectors was based on current charges, with typically some subsidisation of costs in the public sector. These data were also collated from the revenue collection documents of the oncology department at KNH. Where information could not be obtained from patient records, for example, the costs of medical devices, patients were contacted and asked about these costs. The costs of radiotherapy and medical devices, as well as other pertinent additional costs, were obtained by history taking from the patients. This is because such costs could not be obtained from the KNH oncology department expenditure and revenue collection records. Where the services and medical devices could not be obtained from KNH, the patients procured these from other private facilities and paid for them out of pocket. This data was also recorded.

We used a conversion rate of USD 1 = KES 101.3 (Central bank of Kenya - www.centralbank.go.ke/forex/).

2.5 Data management and quality assurance

The data were pretested in a pilot study of ten patients to ensure the feasibility of the study and its methodology as well as give a trend on the overall cost of therapy. All the data collected were recorded in a questionnaire. The data were cleaned and any errors or omissions corrected. The data was then transferred onto Excel spreadsheets, only accessed by the investigator and analysts. Backup of the data collected was undertaken every day. A qualified statistician was selected for the data analysis and quality assurance.

Descriptive data analysis was undertaken and the results presented in figures, percentages and proportions. The data obtained was analyzed using STATA v13.0 (Stata Corporation, TX).

2.6 Ethical Considerations

The approval to carry out the study was sought from KNH-UON Ethics and Research Committee. Informed consent was sought from the Kenyatta Hospital Records management before conducting the study. In order to ensure confidentiality, serial numbers were used instead of patient names or in-patient numbers or out-patient numbers so as to ensure the data remains confidential. All data collected was kept secure and could only be accessed by the investigator.

3. Results

Of the 412 patients reviewed, 261(63.4%) were female and the remaining 151 were male. A small percentage of reviewed patients treated for cancer in 2016 (16%) died of their disease; however, the majority of patients were still undergoing treatment at the time of the study.

Of the reviewed patients, most of them were treated in the public wing (89.8%), with only a small percentage treated in the private wing of KNH. This reflects the fact that the public wing of KNH handles a considerable volume of patients versus the private wing. However, patients in the private wing pay more for their treatment.

Surgery (25.4%) was the most frequently used treatment modality, followed by chemotherapy (24.6%) and palliative care (21.7%), with radiotherapy used in only a few cases (6.3%). A combination of any of the three modalities was seen in only a few cases, i.e.: of the 154 patients on chemotherapy:

- 96 had chemotherapy alone
- 36 had chemotherapy and surgery
- 14 had chemotherapy plus radiotherapy
- 8 had chemotherapy plus surgery plus radiotherapy

Among the sampled patients, the most prevalent cancers among men were prostate cancer (9.7%, n=40) and colon cancer (2.9%, n=12). The most prevalent cancers among women were cervical

cancer (23.78%, n=98) and breast cancer (7.28%, n=30). There were also cancers that affected both men and women at approximately the same rate. These included oesophageal cancer, chronic myeloid lymphoma, colorectal cancer, pancreatic cancer and glioblastoma. This is included in figures 1 to 4.

Figure 1: Gender distribution of different types of cancer

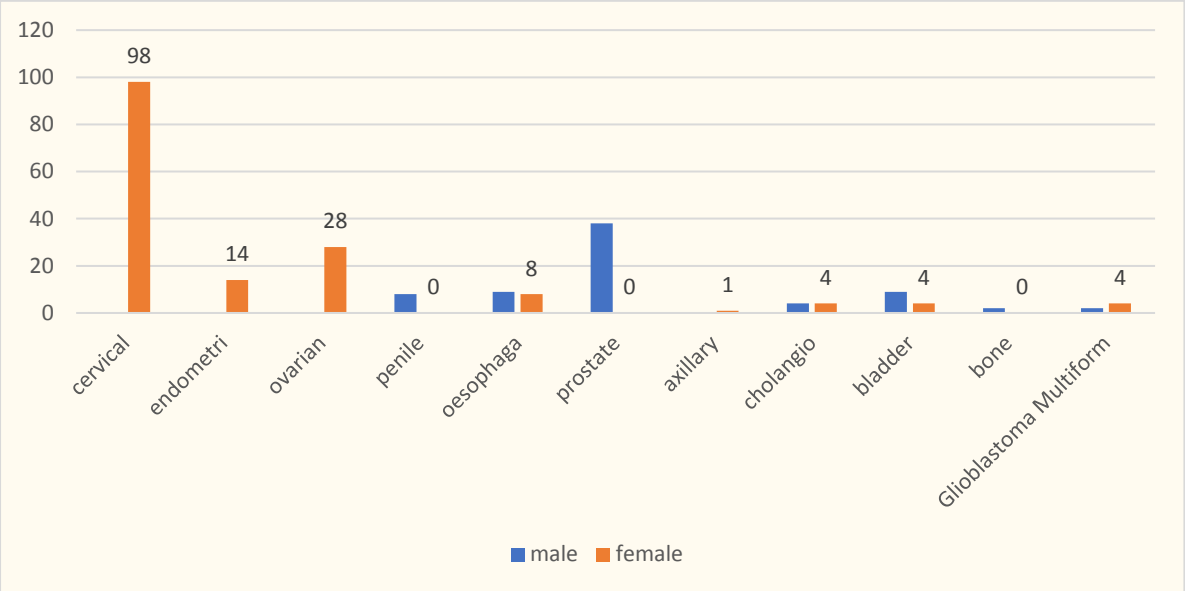


Figure 2: Gender distribution of different types of cancer (cont.)

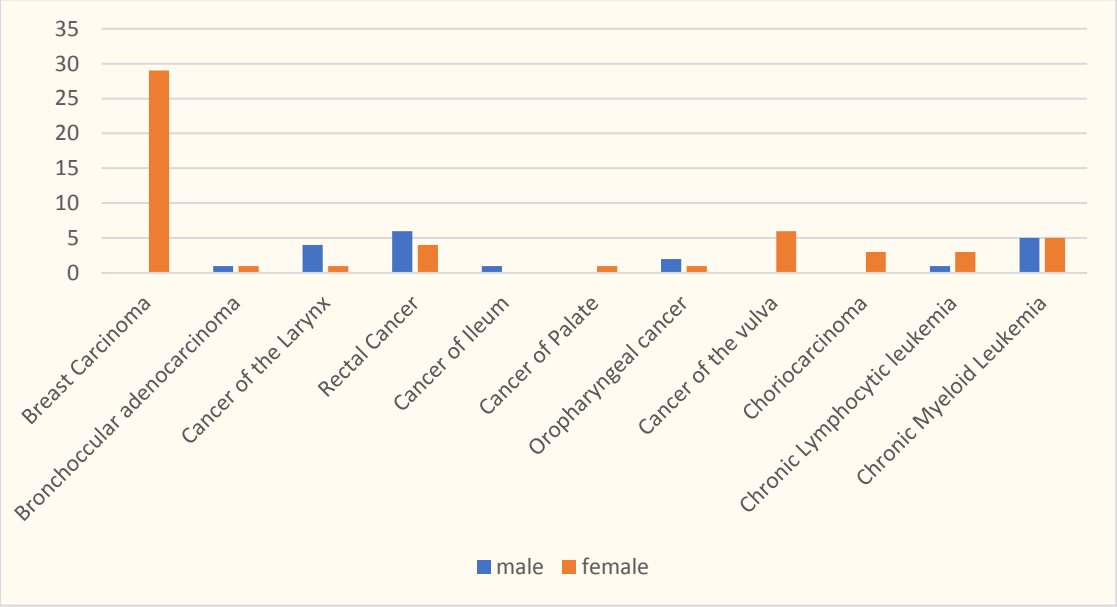


Figure 3: Gender distribution of different types of cancer (cont.)

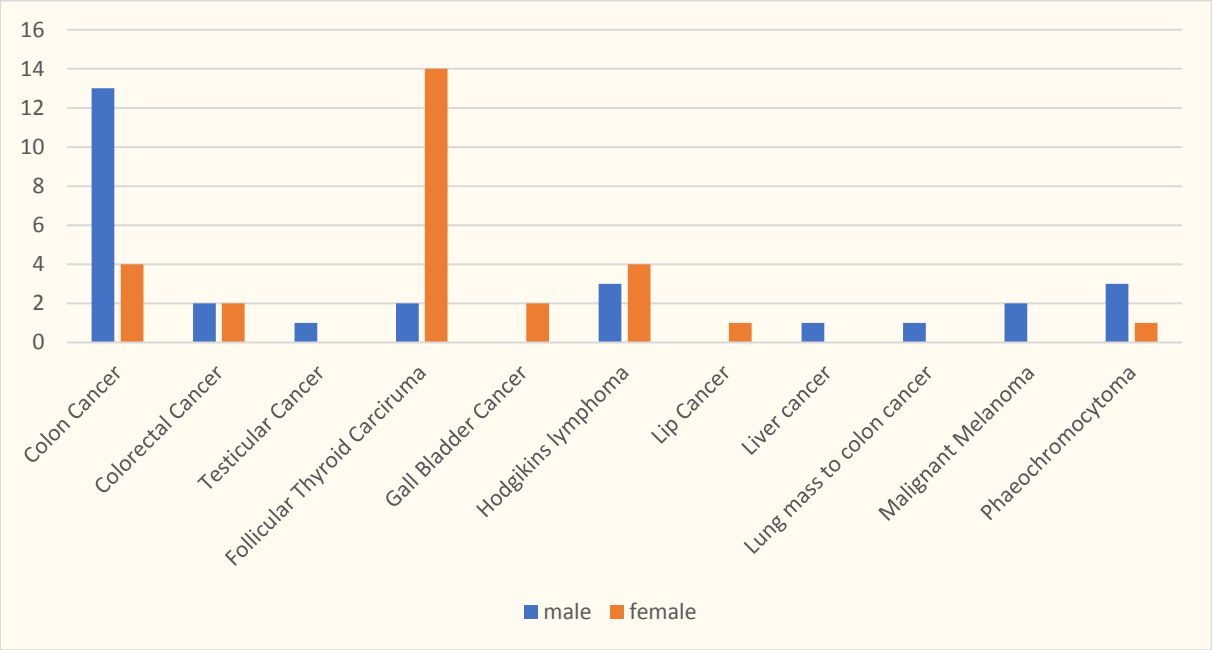
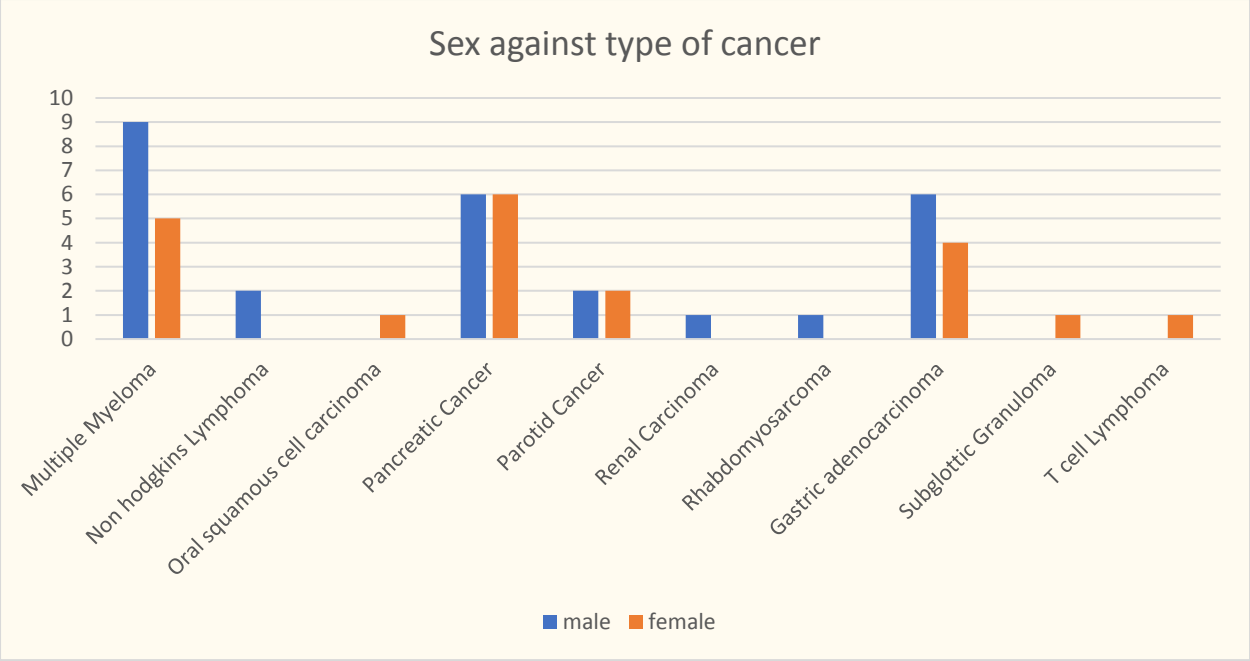


Figure 4: Gender distribution of different types of cancer (cont.)



The average cost of treatment for all the reviewed cases treated was KES 143,132 (1USD =101.3 KES) (Table 1). The highest contributors to the cost of cancer therapy are the cost of medicines and inpatient admissions (Table 1). The cost of medical devices can also be high in view of equipment costs at a minimum of KES 5,500; however, this applied to only relatively few cases. Table 2 documents the average costs incurred for the various modalities in treating patients with cancer in KNH in 2016.

Table 1 – Average cost of cancer care in KNH (2016)

Variable	Observed cases	Mean cost KES (USD)	Std. Dev., KES (USD)	Minimum cost KES (USD)	Maximum cost KES (USD)
Cost of drugs	401	32,311 (318.9)	55,974 (552.5)	25 (0.25)	579,500 (5,720.6)
Surgical procedures cost	174	44,976 (443.9)	26,272 (259.3)	2,630 (26.0)	166,480 (1,643.4)
Radiology procedures cost	298	17,197 (169.7)	24,102 (237.9)	700 (6.9)	131,300 (1,296.1)
Lab test cost	410	14,075 (138.9)	12,916 (127.5)	200 (1.9)	125,000 (1,233.9)
Cost Nursing and Drug Administration	408	9,925 (97.9)	8890 (87.7)	2,174 (21.4)	91,990 (908.1)
Consultation fee	398	3,619 (35.7)	3,579 (35.3)	600 (5.9)	28,200 (278.3)
Inpatient Admission cost	412	27,875 ((275.1)	34,860 (344.1)	1,200 (11.8)	576,000 (5,686.1)
Cost of Medical Devices	8	20,725 (204.5)	20,279 (200.1)	5,500 (54.2)	65,750 (649.1)

Table 2 - Average Cost of Cancer Therapy in 2016 in KNH

Variable	Number of cases	Average Cost in KES (USD)
Chemotherapy alone	96	138,207 (1364.3)
Palliative care	88	98,931 (976.6)
Surgery and radiotherapy	18	178,065 (1757.8)
Surgery alone	96	128,207 (1265.6)
Chemotherapy, radiotherapy and surgery	8	333,463 (3291.8)
Chemotherapy and radiotherapy	14	173,867 (1716.4)
Chemotherapy and surgery	36	285,138 (2814.8)
Radiotherapy	26	119,036 (1175.1)
Diagnostic fees and tests	12	48,273 (476.5)

Surgery is an important mode of treatment of cancer used, with higher costs when combined with other modes of therapy. The only surgical procedures carried out in the selected cohort of patients during the observation period were hysterectomy, radical mastectomy, laparotomy, colectomy and thyroidectomy. For colon cancer patients, a colectomy was performed. No surgery was undertaken for patients with prostate cancer during the observation period. Some cervical cancer patients (n=10) also underwent a laparotomy for diagnostic purposes. Overall, the most expensive procedures were surgery combined with radiotherapy and chemotherapy (Table 2). Table 3 depicts the current costs (charges) for common surgical procedures in both the public and private sectors in Kenya in 2017.

Table 3: Cost of commonly used surgeries during therapy in KNH in 2017

Type of Surgery	Public sector charges KES, (USD)	Private sector charges KES, (USD)
Hysterectomy	50,000 (493.6)	50,000 (493.6)
Radical mastectomy	27,000 (266.5)	40,500 (399.8)
Laparotomy	36,000 (355.4)	54,000 (533.1)
Colectomy	36,500 (360.3)	54,750 (540.5)
Thyroidectomy	27,000 (266.5)	40,500 (399.8)

The cost for using the theatre and consumables during the surgery was charged separately. The theatre charge was KES 2,000, while the theatre consumables vary with the patient.

Radiological procedures vary from those used for diagnosis and monitoring to the use of radiotherapy as part of treatment. Radiotherapy as part of the treatment regimen is the most expensive, costing an average of KES 31,769 per patient, with the cost of radiotherapy appreciably increasing when used with other treatment modalities (Table 3). Table 4 contains the cost of common laboratory tests undertaken during treatment in 2016.

Table 4: Cost of Common Laboratory Tests offered during therapy in 2016

Laboratory Test	Cost per test, KES (USD)
Full Haemogram	500 (4.9)
Liver Function Test	900 (8.9)
Renal Function Test	1,300 (12.8)
Thyroid Function Test	900 (8.9)
Urinalysis	700 (6.9)
Blood biochemistry	700 (6.9)
Lipid profile	900 (8.9)
HER-2 test	900 (8.9)
Histology	1,200 (11.8)

The cost of nursing includes the cost of catheterization, nebulization, wound dressing, drug infusion among others. The cost of such services depends on the type of admission the patient used (public or private ward admission).

A number of drug regimens are used for various cancers based principally on current national guidelines (29). The most expensive drug regimen used during the observational period was fluorouracil and actinomycin D costing KES 2,224,990 per patient (Table 5), while the cheapest was fluorouracil alone which cost KES 30,580.

Table 5 – Average cost of chemotherapy regimens in 2016

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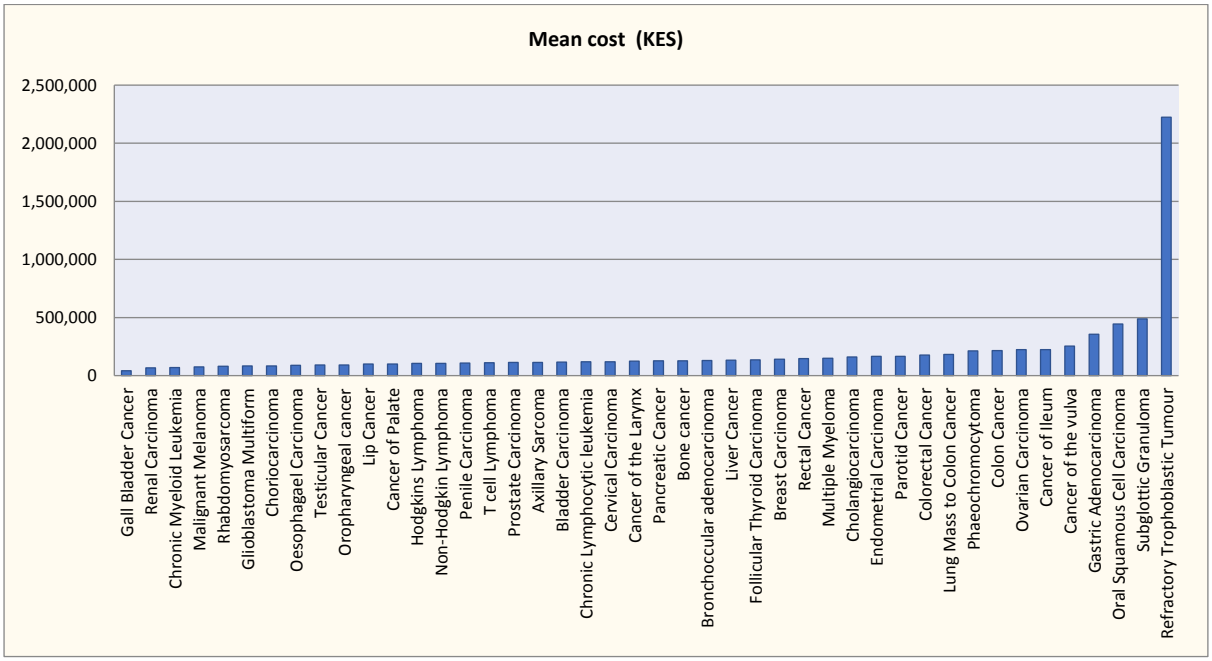
Chemotherapy regimen	No of patients	Mean KES, (USD)
ABVD (Adriamycin, Bleomycin, Vinblastine, Dacarbazine)	8	110,919 (1,094.6)
AC (Adriamycin, Cyclophosphamide)	7	140,255 (1,384.6)
ACH (Adjuvant chemotherapy)	1	861,080 (8,500.3)
ATMZL (Adriamycin, Temozolomide)	2	307,744 (3,037.9)
Bendamustine + Chlorambucil	1	66,260 (654.1)
Bleomycin, Etoposide, Cisplatin	6	435,191 (4,296.1)
Cyclophosphamide, Adriamycin	6	145,897 (1,440.2)
Cyclophosphamide, Adriamycin, Vincristine	1	113,945 (1,124.8)
Cyclophosphamide, Adriamycin, Vincristine, Prednisone	1	111,990 (1,105.5)
Cisplatin, Gemcitabine	1	117,223 (1,157.2)
Chlorambucil	1	59,240 (584.8)
Cisplatin	1	135,945 (1,342.0)
COP (Cyclophosphamide, Vincristine, Prednisone) + Chlorambucil	1	209,760 (2,070.7)
Fluorouracil, Actinomycin D	1	2,224,990 (21964.4)

The cost of treating each type of cancer during 2016 depends on the type of cancer, its stage and treatment approaches. The most expensive cancer treated was a refractory trophoblastic tumour (KES 2,224,990), followed by subglottic granuloma which costed KES 486,876 per patient whilst the cheapest included renal carcinoma which cost KES 68,017 (Figure 5). Table A2 in the Appendix contains more details including the number of patients with the different cancers and the mean cost in USD.

Figure 5: Average cost of treating different types of cancer (KES)



The cost of treating patients with cancer during 2016 was appreciably higher in the private sector than in the public sector for the same mode of therapy, with variations ranging from KES 15,369 to KES 602,991 depending on the treatment involved (Table 6).

Table 6: Cost variations in KES between the private and public sectors (USD in parenthesis)

Variable	Group	Obs.	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]		df	P value
Chemotherapy	Public	89	125685 (1240.7)	8737 (86.2)	82424 (813.7)	108323 (1069.3)	143048 (1412.1)	93	0.0014
	Private	6	337085 (3327.6)	228328 (2254.0)	559287 (5521.1)	-249851 (-2466.4)	924021 (9121.6)		
	Combined	95	139037 (1372.5)	16438 (162.3)	160222 (1581.7)	106398 (1050.3)	171676 (1694.7)		
	Difference		-211400 (-2086.9)	64308 (634.8)		-339103 (-3347.5)	-83697 (-826.2)		
Palliative care	Public	73	94867 (936.5)	13392 (132.2)	114423 (1129.5)	68170 (673.0)	121564 (1200.0)	86	0.4417
	Private	15	118708 (1171.8)	18953 (187.1)	73406 (724.6)	78058 (770.6)	159359 (1573.1)		
	Combined	88	98931 (976.6)	11572 (114.2)	108553 (1071.6)	75931 (749.6)	121931 (1203.7)		
	Difference		-23841 (-235.4)	30845 (304.5)		-85159 (-840.7)	37476 (370.0)		
Surgery and Radiotherapy	Public	17	177211 (1749.4)	23484 (231.8)	96828 (955.9)	127426 (1257.9)	226995 (2240.8)		
	Private	1	192580 (1901.1)						
	Combined	18	178065 (1757.8)						
	Difference		-15369 (-151.7)						
Surgery	Public	84	123721 (1221.3)	9262 (91.4)	84890 (838.0)	105299 (1039.5)	142144 (1403.2)	93	0.1344
	Private	11	164826 (1627.1)	25608 (252.8)	84934 (838.4)	107766 (1063.8)	221885 (2190.4)		
	Combined	95	128481 (1268.3)	8769 (86.6)	85471 (843.7)	111070 (1096.4)	145892 (1440.2)		
	Difference		-41104 (-405.8)	27221 (268.7)		-95160 (-939.4)	12952 (127.9)		
	Public	7	258089 (2547.8)	42036 (415.0)	111216 (1097.9)	155231 (1532.4)	360947 (3563.1)		

Chemotherapy, surgery and radiotherapy	Private	1	861080 (8500.3)						
	Combined	8	333463 (3291.8)						
	Difference		-602991 (-5952.5)						

4. Discussion

Out of the 412 reviewed cancer cases 63% were female and 37% were male. This corresponds to a study by Korir *et al* (32) which reported a higher incidence of cancer in females than males in Kenya. The cancer rate for women is 231 per 100, 000 people while the rate for men is 161 per 100,000 people in an age standardized incidence rate study (32). Our findings also corroborate the data on the Kenyatta National Hospital Registry (2014-2016) which reported that there were more females than males currently being treated for cancer in Kenya (30). In this period, cancer remained the main cause for hospitalisation in KNH. However, different from a middle income country such as Iran where more men than women are receiving chemotherapy (31).

In East Africa, 116,800 men and 170,500 women were diagnosed with cancer in 2012. Of all the cases diagnosed that year, 92,500 men died due to cancer and 116,500 women died as a result of cancer. Statistics therefore suggests that cancer morbidity and mortality effects women more than men (33). This could be attributed to the health seeking behaviour of women, who are more likely to seek treatment than men, as well as perhaps greater prevalence of overweight and obesity as seen for instance in other African countries (34). Women are also more likely to be on hormonal contraceptives, which could be an etiological factor in promoting the growth of hormone dependent cancers, although studies on their role are conflicting (35-38).

The cost of treating cancer in our study depended on the type of cancer, the chemotherapy regimen prescribed, the radiotherapy sessions prescribed as well as the numerous laboratory and radiologic tests that the patients should undergo during diagnosis and treatment. Regarding the chemotherapy regimens used, whilst cyclophosphamide was being administered in a number of patients (Table 5), there appeared to more limited use of capecitabine, cisplatin, docetaxel, doxorubicin, fluorouracil, imatinib, or oxaliplatin compared with other LMIC countries (31, 39). Overall, chemotherapy is the key driver of treatment costs, reflected in other studies (5, 17, 40). Even though laboratory and radiologic investigations are important in the diagnosis and management of various cancers, there are concerns that unnecessary use will increase health care costs and expose patients to unnecessary radiation (41). This is an area we will be researching further in the future along with researching variations in the cost of radiologic and laboratory examinations between sectors to guide future policy. Other authors have also shown that government and teaching hospitals charged less than other hospitals for blood tests (42).

Overall, the cost of treatment of cancer patients is prohibitively high for most patients in Kenya. Kenya is a low income country, where four out of ten people live below the poverty line, according to the World Bank. Currently, the Kenyan healthcare system relies heavily on out of pocket payments for healthcare (14), although there are moves towards universal healthcare (4). For this reason, patients may not be able to afford expensive chemotherapy, surgical and radiotherapy procedures and may default on their treatment, negatively impacting on their outcome. However, The Ministry of Health is currently underfunded and cannot pay for the costs of all patients with cancer although there are ongoing moves to improve the availability of facilities and personnel (4). The National Health Insurance Fund (NHIF) pays for some costs of patients, but only caters for inpatient hospital stay. Some hospitals, including Kenyatta National Hospital, have adopted a waiver system to cover the costs of care for extremely poor patients. This still has challenges though as the hospitals are not able to cover the costs of all patients (43). In addition, there are problems applying the waiver system for cancer patients since the costs of treating these patients can be very high. This calls for a revision in healthcare financing policies in Kenya to meet the WHO standards for equity in healthcare (14) as well as Sustainable Development Goal 3.4 (4). This also calls for initiatives to obtain low prices for cancer medicines in Kenya, building on current access initiatives in other disease areas (44), as many patents for standard cancer medicines are now expired, with increasing availability of biosimilars, although there can be concerns with quality of generics in LMICs (45).

We are aware that we only carried out this pilot study in one hospital (KNH). However, this is the national referral hospital treating an appreciable number of patients with cancer in Kenya. We also only used patients' notes for the analysis with the limitations this imposes on content and accuracy. However, such methods are routinely used to collect costing data in the absence of electronic medical records. In addition, we are aware that there were only a limited number of patients with some cancers making statistical analysis difficult to interpret and we only included costs for one year. We also could not adequately calculate the sample size due to absence of cancer prevalence studies. Despite these limitations, we believe our findings are robust and provide a basis for assessing the costs of cancer care in Kenya in the future, which we and others can build upon this in future research including much larger patient samples and duration for the different cancer types.

5. Conclusion

The cost of cancer treatment in Kenya varies by type of cancer, the modality, cost of medicines and the type of inpatient admission. However, the cost of medicines and inpatient admissions are currently the greatest cost components in the treatment of patients with cancer in Kenya.

It is anticipated that this study will provide a platform to inform future initiatives from the government as well as both private and public insurance companies in Kenya to increase resource availability, and better allocate available resources, to more effectively treat patients with cancer in Kenya given the current high burden for patients. In addition, provide a basis for future research efforts. Greater availability of generic anticancer medicines as well as biosimilars should help in the future as Kenya strives towards universal access.

6. Recommendations

The cost of cancer therapy is currently high in Kenya with respect to average salaries. Consequently, all parties involved should play their role in reducing the prevalence and burden to patients. This includes instigating programmes to reduce behaviours that increase the risk of cancer. In view of this, we believe patients should be encouraged to go for regular check-ups to hasten early diagnosis and monitor progression, as well as be given advice and encouragement to alter their lifestyles to reduce their potential for developing cancer. Lifestyle changes include dietary modifications, exercise, and weight loss where pertinent.

We also believe for those patients with insurance, insurance companies should allocate more resources to cancer therapy to ease the burden for their clients. The National Health Insurance Fund (NHIF), which is public insurance offered by the Kenyan government, should also increase its comprehensive cover for cancer patients in all settings building on current initiatives. Furthermore, we believe hospitals and donor companies should increase their waiver for cancer patients who are struggling to fund their care to improve future care. Lastly, the Ministry of Health should explore potential access schemes for patients with cancer, building on initiatives in other disease areas. We will be monitoring this development.

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There was no external funding for this project and the authors declare they have no relevant conflicts of interest.

Author contributions

OMA and SO developed the concept for the study and undertook the initial analysis including developing the data collection tools. All authors subsequently helped with the analysis and the write-up of the paper. All authors approved the final submission.

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Appendix

Appendix 1 - Data Collection Tool

Section 1: PATIENT DEMOGRAPHICS

Patient Serial Number_____ Age____ Sex_____
Date of Admission_____ Setting: □ In patient □ Out patient
Date of Data Collection_____
Patient area of Residence_____
Diagnosis_____

Section 2: DIRECT HEALTHCARE COSTS

A) Cost of Drugs (KES)

Cancer Chemotherapy		Drugs for Adverse effects		Drugs for Co-morbidities	
Name	Cost (KES)	Name	Cost(KES)	Name	Costs(KES)
1					
2					
3					
4					
5					
6					
7					

B) Cost of Surgical Procedures

Name of Procedure	Cost(KES)
1	
2	
3	
4	
5	

Done in KNH □Yes □No
If no state where_____

C) Cost of Radiology Procedures

Name of Procedure	Cost(KES)
1 Radiotherapy	
2 X-Rays	
3 CT-Scan	
4 MRI	
5 Others	

Done in KNH □Yes □No
If no state where_____

D) Cost of Laboratory tests

Name of Test	Cost(KES)
1	
2	
3	
4	
5	

Done in KNH □Yes □No
If no state where_____

E) Cost of Nursing and Drug Administration

Name	Cost(KES)
1	

2
3
4
5

F) Consultation Fee

Date/ Type of Consult	Cost(KES)
1	
2	
3	
4	
5	

G) Inpatient Admission Costs

Type	Cost (unit/day)	Total Cost (KES)
1		
2		
3		

H) Cost of Medical Devices

Equipment	Cost(KES)
1	
2	
3	
4	
5	

Appendix A2: Average Cost of treating different types of cancer

Type of cancer	Number of patients	Mean cost (KES) (USD in brackets)
Cervical Carcinoma	91	119323 (1177.9)
Endometrial Carcinoma	14	164550 (1624.4)
Ovarian Carcinoma	28	224581 (2217.0)
Penile Carcinoma	9	108408 (1070.2)
Oesophagael Carcinoma	16	87804 (866.8)
Prostate Carcinoma	34	113462 (1120.1)
Axillary Sarcoma	1	113945 (1124.8)
Cholangiocarcinoma	8	159687 (1576.4)
Bladder Carcinoma	13	116380 (1148.9)
Bone cancer	1	128288 (1266.4)
Glioblastoma Multiform	6	82525 (814.7)
Breast Carcinoma	28	141251 (1394.4)
Bronchoccular adenocarcinoma	2	130683 (1290.1)
Cancer of the Larynx	5	125291 (1236.8)
Rectal Cancer	10	145627 (1437.6)
Cancer of Ileum	1	224820 (2219.3)
Cancer of Palate	1	99920 (986.4)
Oropharyngeal cancer	3	91344 (901.7)
Cancer of the vulva	6	254011 (2507.5)
Choriocarcinoma	3	82946 (818.8)
Chronic Lymphocytic leukemia	4	117936 (1164.2)
Chronic Myeloid Leukemia	10	69496 (686.0)
Colon Cancer	15	216395 (2136.2)
Colorectal Cancer	4	176471 (1742.1)
Testicular Cancer	1	91090 (899.2)
Follicular Thyroid Carcinoma	15	136017 (1342.7)
Gall Bladder Cancer	2	41323 (407.9)
Hodgkins Lymphoma	7	103934 (1026.0)
Lip Cancer	1	98952 (976.8)
Liver Cancer	1	132038 (1303.4)
Lung Mass to Colon Cancer	1	182111 (1797.7)
Malignant Melanoma	2	75346 (743.8)
Phaeochromocytoma	4	213564 (2108.2)
Multiple Myeloma	14	149226 (1473.1)
Non-Hodgkin Lymphoma	2	106298 (1049.3)
Oral Squamous Cell Carcinoma	1	444388 (4386.9)
Pancreatic Cancer	10	126012 (1244.0)
Parotid Cancer	4	166130 (1640.0)
Renal Carcinoma	1	68017 (671.4)
Rhabdomyosarcoma	1	80170 (791.4)
Gastric Adenocarcinoma	9	355291 (3507.3)
Subglottic Granuloma	1	486876 (4806.3)
T cell Lymphoma	1	111990 (1105.5)

Refractory Trophoblastic Tumour	1	2224990 (21964.4)