RISK FACTORS ASSOCIATED WITH COLORECTAL CANCER MORBIDITY AND MORTALITY AT KENYATTA NATIONAL HOSPITAL, KENYA

University of Nairobi- Institute of Tropical and Infectious diseases

PGDRM student: Haduli Eric Omukhulu

Registration: W61/6880/2017

Email: ehaduli20@gmail.com

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University of Nairobi

2020

DECLARATION

I declare that this is my original work and hasn't been submitted by any other person for research purposes, the award of a degree or any other purpose.
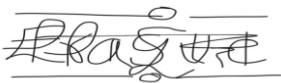
Haduli Eric Omukhulu, MRSB
W61/6880/2017
Postgraduate Diploma in Biomedical Research Methodology
University of Nairobi
Institute of Tropical and Infectious Diseases

Signature ....   Date 25th November 2020

APPROVALS

This dissertation has been submitted with our approvals as supervisors.

SUPERVISORS:

Prof. Oyugi Julius, MSc, PhD
Department of Medical Microbiology,
College of Health Science, University of Nairobi.

Signature…………………..   Date………………………

Dr. Fredrick Okinyi, MBChB, MMed (Path)
Department of Human Pathology,
College of Health Science, University of Nairobi.

Signature…………………..   Date………………………

DEDICATION

This work is dedicated to my family, relatives, and friends whose love and support have been my strength all through and UNITID department.

ABSTRACT

Background;

Colorectal cancer (CRC) is a malignant tumor arising from the inner walls of the large intestine (the colon). Some of risk factors including high tobacco intake and alcohol consumption are associated with the development of this cancer. Globally it is estimated that about 6.1% of the adult population develop CRC annually. In Kenya, the annual cancer incidence is estimated to be 7.6% for males and 4.8% for females.

Objective;

To determine colorectal cancer prevalence, risk factors, morbidity and mortality at Kenyatta National Hospital (KNH) Kenya.

Study Methodology;

This is a retrospective cross-sectional study. Secondary data of adult CRC patients were collected and analyzed, the data included the following variables: gender, age, ethnicity, residence, marital status, alcohol consumption and tobacco intake from study participants' clinical records which were obtained from KNH cancer registry. The data were entered into Microsoft Excel and coded using a standard coding system. The data were processed and analyzed with IBM SPSS Statistical software. Statistical tests were performed to test for association between the variables. The prevalence rate, morbidity rate, and mortality rate were estimated.

Results;

CRC constituted a prevalence proportion of 15% and prevalence by gender in both males and females was 15% of the proportion. There were 53% males in the study in which 5% died of colorectal cancer and 47% of females of which 8% died of the cancer. The majority of the patients were married, 7% died from CRC. The majority of the patients were also between the ages of 41 to 60 years and no deaths due to colorectal cancer was observed in this age group. Patients who live out of Nairobi were 92% less likely to die of CRC. Among the patients, 77% reported having never smoked of which 4% died due to cancer. With alcohol consumption, 14% were alcoholics and 12% of the alcoholics died due to CRC. Alcohol consumption and smoking had no association with CRC morbidity and mortality.

Conclusion;

Colorectal cancer had the lowest deaths among colon and rectal cancers but with a prevalence proportion of 15%, there is an urgent need of the Government of Kenya to allocate funds for cancer research and the public need do have regular cancer screening.

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ABBREVIATIONS

PGDRM---------------- Post Graduate Diploma in Biomedical Research Methodology.

UoN -------------------- University of Nairobi.

KNH-------------------- Kenyatta National Hospital.

CRC -------------------- Colorectal Cancer.

KEMRI---------------- Kenya Medical Research Institute.

ISO -------------------- International Organization for Standards.

RGs ---------------------Research Gaps.

HRQOL----------------Health-Related Quality of Life.

KEMRI---------------- Kenya Medical Research Institute.

NHIF ------------------ National hospital insurance fund.

ERC ------------------- Ethics and Review Committee.

NCD --------------------Non-communicable disease.

WHO --------------------World health organization.

CRC ------------------- Colorectal cancer.

TNM------------------- Tumor-node-metastasis.

MMP ------------------ Mitochondrial membrane potential.

CCL5 ------------------ C-C chemokine ligand 5.

SBRT------------------- Stereotactic body radiotherapy.

SAFs-------------------- Smoke attributable fractions.

BMI--------------------- Body mass index.

DALYs----------------- Disability Adjusted Life Years.

YLD --------------------Years lost due to disability.

WCRF----------------- World Cancer Research Fund.

AICR --------------------American Institute of Cancer Research.

HIC ---------------------High-income countries.

LMICs------------------ Low- and Middle-income countries.

BMI--------------------- Body Mass Index.

SAH ------------------- S-adenosyl-homocysteine.

SAM-------------------- S-adenosylmethionine.

GSH ------------------- Antioxidant glutathione.

ROS ------------------- Reactive oxygen species.

DNA------------------- Deoxyribonucleic acid.

AMPK---------------- 5' AMP-activated protein kinase

CHAPTER 1: INTRODUCTION

Colorectal cancer (CRC) is a malignant tumor arising from the inner walls of the large intestine (the colon). Some risk factors such as high tobacco intake, high alcohol consumption, and westernized dietary habits are associated with the development of this cancer.
Smoking and chronic alcohol drinking were both independently associated with a high risk of CRC and colon cancer alone. Colorectal cancer is a global burden with rising new cases annually. In Kenya, the annual cancer incidence is estimated to be 7.6% for male and 4.8% for females In Kenya alone 7% of deaths per year is cancer-related, it's estimated out of 39,000 new malignancy cases and over 27,000 deaths every year. Younger Kenyans who happen to be less than 70 years old are affected by cancer which contributes to 60**%**(1,2)**.**

Global cancer statistics 2018 assessments of malignant growth incidence and mortality statistics conveyed with the International Agency for Research on Cancer, with an accentuation on geographic vacillation over more than 20 world regions. There will be an expected 18.1 million new malignancy cases in 2018. Both two sexes combined, CRC (6.1%) for incidence and colorectal malignant growth (9.2%) for mortality. Lung malignancy is typically progressive malignancy also the major cause of deaths in males, trailed by prostate and colorectal malignancy (for incidence) and liver and stomach malignancy (for mortality). Among females, bosom malignancy is usually ordinarily analyzed cancer and the main source of malignancy deaths, trailed by colorectal and lung malignant growth. It is critical that malignant growth registry information and proper malignancy control programs, are not accessible in LMICs (3).

CRC is the third most overwhelming new and abnormal malignant growth worldwide and fourth most unending reason for cancer-related deaths all through the world. About 70% of malignant tumors are identified with the way of life and natural or environmental factors. Economic development and urbanization have brought stationary ways of life with progressively westernized dietary propensities, and increments in smoking rates, alcohol utilization, and environmental pollution. Excessive alcohol consumption, smoking and lack of physical activities are considered essential CRC risk factors (4,5).

Colorectal cancer (CRC) leads to significant morbidity and mortality worldwide. Fifteen critical Research gaps (RGs) are summarized below: RG1: Lack of realistic models that recapitulate tumor micro or macroenvironment; RG2: Insufficient evidence on precise contributions of genetic or environmental or lifestyle factors to CRC risk; RG3: Pressing need for prevention trials; RG4: Lack of integration of different prevention approaches; RG5: Lack of optimal strategies for CRC screening; RG6: Lack of effective triage systems for invasive investigations; RG7: Imprecise pathological assessment of CRC; RG8: Lack of qualified personnel in genomics, data sciences and digital pathology; RG9: Inadequate assessment or communication of risk, benefit and uncertainty of treatment choices; RG10: Need for novel technologies or interventions to improve curative outcomes; RG11: Lack of approaches that recognize molecular interplay between metastasizing tumors and their microenvironment; RG12: Lack of reliable biomarkers to guide stage IV treatment; RG13: Need to increase understanding of health related quality of life (HRQOL) and promote residual symptom resolution; RG14: Lack of coordination of CRC research or funding; RG15: Lack of effective communication between relevant stakeholders (6). High variations, in both malignant growth incidence and mortality, were observed. The transcendence of lung, stomach, colorectal, prostate, female breast and cervical malignancies makes cancer control strategy progressively agreeable. Upcoming insights on malignancy events and the results are fundamental for the arranging and assessment of cancer control programs. There is a need for populace based malignant growth enrollment, risk reduction, tobacco utilization control, and primary health administration-based enhancement of health care systems for diagnosis and viable cancer screening in low- and middle-income nations (7,8).

In Africa, cancer is a rising general public health issue. New cases of about 715,000 which leads to 542,000 cancer deaths in 2008. With high anticipation of such numbers increasing more than twice in the following 20 years to come. The majority of African nations have control programs for cancer and the arrangement of early diagnosis also treatment administrations are restricted in spite of this increasing burden. In Kenya, all types of malignancy are evaluated as the third driving cause of deaths following infectious and cardio-vascular diseases. Among the NCD related deaths, the second driving cause of accounts for 7% of an expansive national death succeeding cardiovascular diseases (WHO 2014 NCD country pro le 2014). Yearly events of cancer are near to 37,000 new cases with yearly mortality of more than 28,000. Colorectal the malignant growth in Kenya is transcendently a left-sided disease (9–11).

CHAPTER 2: LITERATURE REVIEW

2.1 Cancer Situation in Kenya

In Kenya, malignant growth positions third for death succeeding irresistible infections and cardiovascular diseases, every year causing 7% of aggregate national deaths. Populace-based Information doesn't exist in the nation. Yearly its assessed that malignancy rate is around 28,000 cases and the deaths to be more than 22,000. Below the age of 70 years old over 60% are affected. In Kenya, the risk of getting malignant growth before the age of 75 years is 14% while the danger of kicking the bucket from the disease is reviewed at 12%. In many developing nations, the quick rising in malignant growths has come about because of expanded introduction to chance components that incorporate tobacco use, high alcohol intake and exposure to natural cancer-causing agents.

In spite of the fact, there is a rise in noncommunicable diseases, which would include; chronic respiratory infection, cardiovascular diseases, cancer and diabetes, the Kenyan health frameworks have generally concentrated on the control and prevention of communicable diseases. In this manner, health and development plans have not adequately placed assets into the prevention and control of these diseases. The noncommunicable disease which is a silent epidemic currently imposes a 'twofold weight of diseases' to the nation with the event that it would overwhelm the country within the near future. This inclination in the system has achieved deficiency in a project that should address noncommunicable infections and their hazard factors in the nation, in accordance to the regional cancer registry at KEMRI, about 80% of detailed instances of malignancy are examined at advanced stages when almost nothing can be accomplished as far as remedial treatment. This is generally because of the low familiarity with malignant growth signs and side effects, lacking screening services, deficient diagnostic facilities and ineffectively organized referral facilities.

The nation has few cancer specialists who are amassed in a couple of health facilities in Nairobi. This makes it troublesome for an extraordinary dominant part of the populace to access malignancy treatment services bringing about long waiting times making some beforehand reparable tumors advancement to hopeless stages(12–15).

2.2 Risk Factors Associated with Colorectal Cancer Occurrence

CRC is a standout amongst the most well-known malignancies and a standout amongst the most preventable tumors, with ground-breaking yet emphatically missed potential for essential, optional and tertiary counteractive action. High CRC incidences have customarily been associated in Western nations. However, it is currently expanding with economic advancement in numerous different regions of the world. CRC shares risk factors, for example, smoking, excessive alcohol intake, lack of physical activity and high BMI index, with other common ailments. Consequently, primary anticipation that attempts to decrease these risk factors are relied upon numerous advantageous impacts that stretch out past CRC prevention, and ought to have high public wellbeing sway. Nations with right on time and high take-up rates of viable screening have displayed significant decreases in CRC occurrence and deaths, rather than other nations(16).

Two vast scale master reports; From 2007 report, which includes consistent project update of the World Cancer Research Fund (WCRF)/American Institute of Cancer Research (AICR) and the International Agency for Research of Cancer (IARC) monograph from 2012 have widely looked into that there is an association between alcohol intake and the danger of creating malignant growth in the most recent decade. Alcohol intake is unequivocally connected to the danger of creating malignant growths of men's CRC. As alcohol consumption changes to a great extent around the world, likewise the Population Attributable Fractions (17).

Most elevated occurrence rates recorded have kept on expanding in High-income countries (HICs), colorectal malignancy appeared differently in relation to some LMIC presently consider as a real part of those with the most amazing rates. Death rates from colorectal cancer is reducing in various HICs while they are growing in LMICs. Despite the fact that rates stay high in HICs, they are leveling or diminishing for the most well-known malignant growths because of declines in early screening and recognition, risk factors and improved treatment. Conversely, rates in a few LMICs are expanding for these tumors because of increments in tobacco use, high BMI rate, and absence of physical activity. Productive malignant growth control measures are required to decrease rates in HICs and capture the

developing weight in LMICs. Colorectal malignant growth (CRC) occurrence and mortality among people more youthful than 50 years (early beginning CRC) are expanding(18,19).

Recent evidence from expansive prospective United States of America and European cohort studies and from meta-analysis of epidemiological examinations shows that the long-haul utilization of expanding measures of red meat and especially of processed meat is related with colorectal malignant growth of both male and female sexes. The affiliation holds on after consideration of known cofounding factors, for example, age, race, BMI, smoking, history of blood pressure, lipids and lack of physical activity(20).

There is a reasonable association between consumption of alcohol with colorectal malignancy (CRC) advancement. Alcohol consumption expanded dangers of tumor-node metastasis (TNM), organ metastasis and poorer prognosis. Ethanol builds CCL5 secretion, CCL5 activates autophagy through AMPK pathway, and autophagy increased migration was affirmed by experiments with autophagy or AMPK inhibitors. In conclusion, the investigation shows that chronic alcohol intake may advance metastasis of CRC through CCL5-induced autophagy(21).

The elevated inescapability of smokers in Indonesia and augment of the amount of people as used smokers. Malignant growth and other various medical issues are caused by used smoke. In Indonesia, to choose the amount of used smoke inferable divisions (SAFs) of six threatening malignant growths (pancreas, lung, colorectal, larynx, stomach, and bladder) and also loads of diseases caused by used smoking using Disability Adjusted Life Years (DALYs) indicator. In light of SAFs extent, inconvenience requirements for Indonesian male and female were lung infection (110,491), colorectal (68,131), and bladder malignant growth (39,140). The SAFs is controlled by merging the two data of used smoking commonness and relative hazard and the DALY indicator is resolved as the aggregate of extended lengths of lost life as a result of untimely mortality (YLL) and the proportionate sound years lost on account of handicap (YLD). Altogether, DALYs 6 malignant growth sicknesses because of used smoke broke down in this examination were 283,360 DALYs (22).

Chronic, overwhelming alcohol intake is connected with veritable negative prosperity impacts, involves the progression of a few kinds of malignant growth. One-carbon metabolism is a one of the pathways influenced by alcohol poison quality. The alcohol-

triggered impedance of this metabolic pathway results in epigenetic changes related with malignant growth advancement. These epigenetic changes are initiated by lack of folate and also by ethanol metabolism. The movements induced by long haul overpowering ethanol intake result in high heights of homocysteine and S-adenosyl-homocysteine (SAH) and decreases in antioxidant glutathione (GSH) and S-adenosylmethionine (SAM) levels, provoking bizarre sponsor advertiser promoter gene hypermethylation, global hypomethylation, and metabolic deficiency of antioxidant defense mechanisms. In like manner, reactive oxygen species (ROS) delivered amid the ethanol metabolism induce alterations in DNA methylation designs that assume an important role in malignant growth advancement(23).

CHAPTER 3: RESEARCH DEFINITION

3.1 Problem statement

With the recent studies, there is an increase in cancer incidence in Kenya with high adult risk factors for instance, tobacco intake, alcohol abuse, physical inactivity leading to obesity, dietary changes with cancer being less researched in Kenya, the government should create cancer awareness not only with breast and cervical cancer but all types of cancer hence reducing cancer mortality. However, Lack of funding in cancer research and discovery, high alcohol consumption and tobacco intake from previous studies shown among youths and adults are alarming.

3.2 Justification of Study

The study focusses on colorectal cancer information and data obtained from the oldest, popular and most preferable public referral hospital in Kenya on risk factors associated with colorectal cancer with possible measures to prevalence, morbidity and mortality.
The fast increment in noncommunicable diseases is credited to social and demographic factors that incorporate economic advancement, globalization of business sectors and urbanization. These factors lead to the extended prologue to the modifiable way of life chance risk factors for cancer. Most developing nations, for example, Kenya are experiencing fast growth in urbanization and economic advancement. (13–15,24)

In East Africa, few studies have been done to ascertain the reasons for delay in treatment due to delayed or late diagnosis of cancer, some of the cancer facilities are out of reach for the patients, cost could be a factor to consider and lack of cancer expertise in the county level in Kenya also contributes to delayed treatment. Inadequate coordination of colorectal cancer research, insufficient integration of different prevention approaches and optimal planning for colorectal cancer screening, inadequate understanding of health- related quality of life and insufficient proof that lifestyle factors contribute to colorectal cancer risk.
This study aims to provide CRC data on risk factors (behavioral, social demographic) prevalence, morbidity and mortality of colorectal malignancy. There is insufficient effective

communication between the relevant stakeholders, this information gathered is important for the Government of Kenya, Ministry of health, NHIF, Research institutes, donors and sponsors for budget and funding allocation, health care planning and policy implementation and formulation.

3.3 Research Questions

1. What is the prevalence among adult colorectal cancer patients attending Kenyatta National Hospital?
2. What is the risk factor among adult colorectal cancer attending Kenyatta National Hospital?
3. What is the risk factor among adult colorectal cancer attending Kenyatta National Hospital?

3.4 Objectives of Study

3.4.1 Broad Objective

To determine colorectal cancer prevalence, risk factors, morbidity and mortality at Kenyatta National Hospital.

3.4.2 Specific Objectives

1. To estimate the prevalence of adult colorectal cancer patients at KNH.
2. To determine the risk factors of adult colorectal cancer patient's mortality at KNH.
3. To estimate morbidity and mortality rates of adult colorectal cancer patients at KNH.

CHAPTER 4: MATERIALS AND METHODS

4.1 Study Site

The study took place at Kenyatta National Hospital, Department of Health Information, Cancer registry. Kenyatta National Hospital is situated in Nairobi County. Nairobi county is composed of seventeen constituencies. Nairobi is the largest capital city in Kenya. The city had a population of 3,138,369 in 2009 census while the metropolitan area had a population of 6,547,547. Its geographic, social and economic challenges mirror the majority of the rest of the country.

KNH is ISO (International Organization for Standards) certified, the oldest government referral hospital and the biggest of the national referral hospitals in Kenya providing affordable cancer treatment to the public. KNH is the most popular and accessible national referral hospital in Kenya offering affordable cancer diagnosis and cancer treatment to the public. Kenyatta National Hospital receives quite a number of colorectal cancer patients annually. KNH is a tertiary learning institution and it also serves as the teaching hospital for the University of Nairobi and Kenya Medical Training College.

Kenyatta National Hospital - Health Information Department, previously known as Medical Records Department, has the best modern medical filling system of a public hospital. The KNH Medical Records Department is organized to manage health information data by ensuring its quality, accuracy, accessibility and security in both paper and electronic system. They have various classification systems used to code patient's information. The department has a database and registry that is used to maintain patients' medical histories as well as treatment histories. The KNH Medical Record Department has a cancer registry that was established in 2014, with a modern filling system of high-level of accuracy and security.

4.2 Study Population

The study included adult male and female patients who were diagnosed with colorectal cancer at KNH and opted for treatment at KNH voluntarily. In either cancer stages during diagnosis.

4.3 Inclusion Criteria

1. Adult patients with colorectal cancer at KNH.
2. Patients with complete medical files, inclusive of independent and dependent variables.

4.4 Exclusion Criteria

1. Patients with other conditions other than colorectal cancer at KNH.
2. Study participants aged less than 18 years with and without colorectal cancer at KNH.
3. Colorectal cancer patients with incomplete medical records and invalid information in their medical files at KNH.

4.5 Study Design

This is a retrospective cross-sectional study. Secondary data was used in the study to determine colorectal cancer prevalence, risk factors, morbidity and mortality at Kenyatta National Hospital from the Department of Medical Records, Cancer Registry.

4.6 Sample Size Calculation

A study on the Cancer incidence in Nairobi, Kenya (2004-2008) shows that the prevalence of colon, rectal and anal cancer in Kenya is = 7.6% (25).

The sample size was calculated with prevalence estimation, level of confidence, a margin of error in consideration to bias (Selection, Information and confounding bias) using the following formula: $n = Z^2 *P (1-P)/e^2$

n = Calculated sample size

Z = Critical value for the corresponding level of confidence, usually 1.96 for 95%

P = Estimated prevalence

e = Margin of error, usually 5%

Z = 1.96

P = 7.6%

e = 5%

$n = Z^2 * P (1-P)/e^2$

$n = 1.96^2 * 0.076(1-0.076)/0.05^2$

n = 108

4.7 Sampling Method

The samples were collected through a probability sample method, giving an equal probability of selection. The clinical records and data of the study participants were obtained through a simple random sampling method with an inclusion and exclusion criteria of the study to attain the required sample size.

4.8 Variable

Sociodemographic variable	Gender, Age, Ethnicity, Residence and Marital status.
Behavioral variable	Alcohol consumption and tobacco intake.

4.9 Ethical Consideration

4.9.1 Ethical and administrative approval
The project proposal was submitted to KNH-UoN Research Ethics and Research Committee for review of study approval, the permission granted by KNH-UoN-ERC enabled secondary data collection and data analysis of colorectal cancer patients at KNH.

4.9.2 Informed consent
Since secondary data was used in the study, a request for a waiver of informed consent from the study participant from KNH-UoN-ERC was obtained. The aim and purpose of the study, procedure, storage of data, benefits and risks and assurance of confidentiality were explained during request for a waiver of informed consent.

4.9.3 Risks and benefits of study

There was no physical harm or injury during the secondary data collection and analysis with potential disclosure of patients' identity. Patients' identity was anonymous, and patients' record were kept confidential to avoid disclosure. There were no monetary benefits for participants in the study.

Knowing colorectal cancer; risk factors, prevalence morbidity and mortality trends in Kenya, is significant for the Government of Kenya, Ministry of Health, Ministry of Finance, NHIF, Research institutes i.e. KEMRI, donors and sponsors for budget and funding allocation, health care planning and policy implementation and formulation.

The finding shall be submitted in partial fulfillment of the Post Graduate Diploma in Biomedical Research Methodology from the University of Nairobi, furthermore, the information can be used as a reference for cancer future research and studies.

4.10 Data Collection methods

Data was collected and analyzed with the principal investigator from the KNH cancer registry, Department of Medical Records. The data collected included the following;

1. Socio-demographical factors; Gender, Age, Ethnicity, Residence, and Marital status.
2. Behavioral factors; Alcohol consumption and smoking/ tobacco intake.

4.11 Data Collection Procedure

Acquisition of adult male and female CRC clinical records and data from the KNH cancer registry with study participants who have met the eligibility criteria of the study was done effectively. The secondary data were entered into Microsoft Excel. The data was coded using the standard coding system and was processed and analyzed with IBM SPSS V 17.0 Statistical software by the principal investigator. Prevalence and risk factors influencing colorectal cancer morbidity and mortality rates were evaluated. The information was kept on a password-protected computer.

4.12 Study Limitation

One of the main study limitations was the lack of recent CRC medical data and incomplete patients' information in the clinical records at the KNH Cancer Registry. Data collected met the eligibility criteria and were collected and analyzed by the principal investigator.

4.13 Data Management and Analysis

The data collected were coded using standard coding instructions. Double entry was conducted for verification using a file structure to ensure the validity of the data. Data cleaning was performed after which the quantitative data from Excel was analyzed with IBM SPSS Statistical software. Back-up copies of the data sets were stored in a password-protected external hard disk, which is in the sole custody of the principal investigator. The information was stored again online cloud storage for reference to the study in future due to cases of hardware breakdown or theft, which is highly encrypted. The computer used by the principal investigator was password encrypted.

Simple random sampling method was used in the study hence association between risk factors, prevalence rate, morbidity rate and mortality rate were determined. Patient's socio-demographical variables; Gender, Age, Ethnicity, Residence and Marital status.) are categorical variables except Age. Age is a continuous variable. Behavioral variables; Alcohol consumption and smoking/ tobacco intake are categorical variables. Statistical test was performed to test for association between the variables. Using IBM SPSS Statistical software for statistical analysis, frequencies were generated and the results where be presented pie charts and tables in the results section.

CHAPTER 5: RESULTS

In this study, we were able to analyze data from 80 study participants although the sample size was 108. We were not able to get the total number of the sample size because KNH Cancer Registry only had 81 CRC medical data from 2014 to 2017 of which one of the study participants didn't meet the study eligibility criteria. And therefore, the data presented in this study is based on the 80 adult colorectal cancer patients of which 53% were male and 47% were females. A total of number 3 figures and 7 tables were reviewed in this chapter.

5.1 Demographics of colorectal cancer morbidity and mortality

The table below gives a summary of demographics of adult colorectal cancer patients at KNH. The risk factors included in the analysis were age, sex, marital status, residence and tribe. The dependent variable in this case was the patients' status classified as either alive or dead.

Table 1: Demographics of colorectal cancer morbidity and mortality

Demographic Factors	Total n(%)	Alive n(%)	Dead n(%)	P-value	Statistic
Age group					
<=40 yrs	19(24)	16(84)	3(16)	0.075	Chi=5.189,df=2
41-60 yrs	33(41)	33(100)	0(0)		
>=61 yrs	28(35)	26(93)	2(7)		
Sex					
Male	42(53)	40(95)	2(5)	0.664	Chi=0.334,df=1
Female	38(47)	35(92)	3(8)		
Marital Status					
Single	5(9)	5(100)	0(0)	0.454	Chi=1.578,df=2
Married	44(82)	41(93)	3(7)		
Divorced/Widowed/Separated	5(9)	4(80)	1(20)		

Tribe					
Kikuyu	*41(52)*	*39(95)*	*2(5)*	*0.638*	*Chi=0.900,df=2*
Kamba	*20(25)*	*19(95)*	*1(5)*		
Other tribes	*18(23)*	*16(89)*	*2(11)*		
Residence					
Nairobi	*23(29)*	*19(83)*	*4(17)*	*0.022**	*Chi=6.839,df=1*
Out of Nairobi	*57(71)*	*56(98)*	*1(2)*		

Age

The age variable was classified into three categories: <=40 years old, 41-60 years old and >=61 years old. Results from the analysis showed that majority of the patients with colorectal cancer were between the ages 41 and 60 years (41%) followed by individuals above the age of sixty (35%) and those below the age of 41 years constituted 24% of the total sample. From the results, no death from colorectal cancer had been recorded within the age group 41-60 years. 16% of patients within the age group below 41 years had died from colorectal cancer, and 7% of the patients in the age group >=61 had died from colorectal cancer. Further analysis to determine the association between age and life status of the colorectal cancer patients did not yield statistically significant results.

Sex

Results from this study shows that 53% of the patients included in the study were male and 47% were female patients. Among the male patients, 5% died of colorectal cancer whereas among female 8% died of the cancer. A further analysis to assess the association between patient sex and life status did not reveal a statistically significant association.

Marital Status

Majority of the colorectal cancer patients seeking health services at KNH were married (82%), those who were single constituted 9% of the total sample and similarly those who were either divorced or widowed or separated constituted another 9%. No death from colorectal cancer had been observed among the single patients while among the married patients, 7% were reported to have died from colorectal cancer. An analysis to determine the association between marital status and patients' life status did not reveal any statistically significant result (p>0.0

Patients' Tribe

The patients included in this study were from various tribes, however based on the frequencies observed, the tribe variable was recorded into three main categories: Kikuyu (52%), Kamba (25%) and other tribes (23%). Among patients from the kikuyu tribe, 5% died due to colorectal cancer , among patients from the Kamba tribe 5% died and lastly, 11% among other tribes died due to colorectal cancer. Patients' tribe was found to have no statistically significant association with mortality due to colorectal cancer.

Residence

Results show that among patients living within Nairobi constituted 29% of the total sample while those living without Nairobi constituted a greater percentage of 71%. Among those living within Nairobi, 17% died of colorectal cancer while only 2% of the people who live without Nairobi. The analysis further showed that there was a significant relationship between place of residence and mortality due to colorectal cancer p=0.022 (chi square= 6.839, df=1).

5.2 Prevalence of colorectal cancer among patients in KNH

From the figure below, colorectal cancer constituted a proportion of 15% of the colorectal, colon and rectal cancer. Colon cancer was the most common type of cancer at KNH with a proportion of 52% and rectal cancer constituted 33%.

Figure 1: Proportion of colorectal cancer among patients with rectal, colon and colorectal cancer at KNH
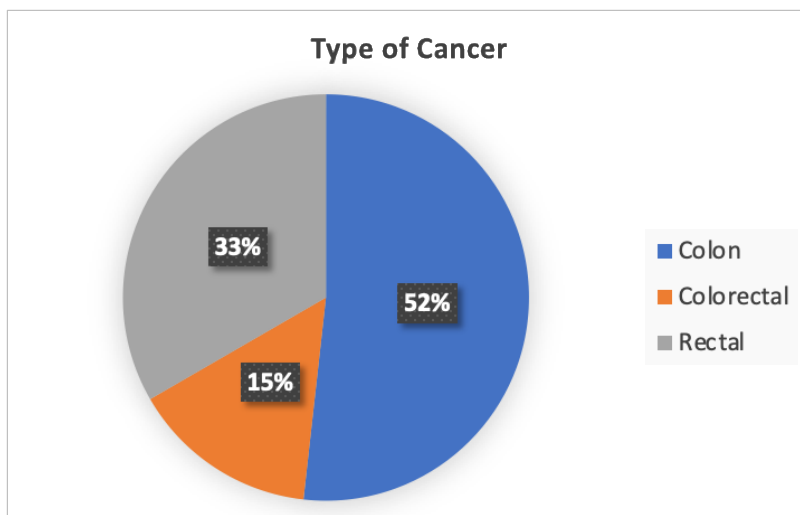
The following figures below gives summary of the prevalence of colorectal cancer among the three different types of cancer by sex at KNH. The prevalence of colorectal cancer among the females and males was the same at 15% however, prevalence of colon cancer was slightly higher among females than in males.

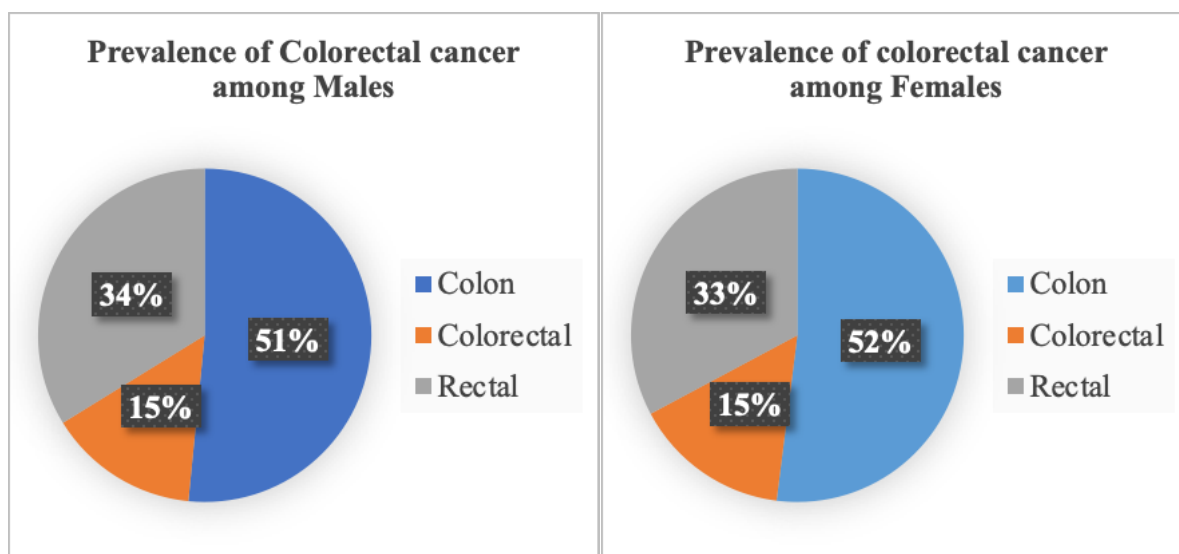**Figure 2: Prevalence of colorectal cancer among colon, colorectal and rectal cancer by sex at KNH.**

5.3 Risk factors associated with colorectal cancer mortality

The table below gives a summary of the risk factors for adult colorectal cancer patients mortality at KNH. The risk factors included in the analysis were smoking and drinking statuses. The dependent variable in this case was the patients' status classified as either alive or dead.

Table 2: Risk factors for adult colorectal cancer patient's mortality at KNH

Risk Factors	Total n(%)	Alive n(%)	Dead n(%)	P-value	Statistic
Smoking Status					
Never	46(77)	44(96)	2(4)	0.140	Chi=3.936,df=2
Smoker	10(17)	10(100)	0(0)		

Ex-Smoker	*4(6)*	*3(75)*	*1(25)*		
Drinking Status					
Never	*44(77)*	*43(98)*	*1(2)*	*0.149*	*Chi=3.807,df=2*
Alcoholics	*8(14)*	*7(88)*	*1(12)*		
Ex-Alcoholics	*5(9)*	*4(80)*	*1(20)*		

Smoking status

Report shows that 77% of the colorectal cancer patients reported having never smoked, 17% were smokers and 6% were ex-smokers. Among people who had never smoked before, 4% died due to the disease while among smokers, no colorectal cancer associated death had been reported. The Pearson's chi-square test did not reveal any statistically significant association between smoking status and mortality due to colorectal cancer.

Alcohol consumption

As show in the results table above, 77% of the patients reported having never consumed alcohol, 14% were alcoholic and 9% were ex-alcoholics. 12% of the alcoholics died due to colorectal cancer while 2% of the patients who had never consumed alcohol lost died due to colorectal cancer. A test of association between alcohol consumption and mortality due to colorectal cancer did not reveal any statistically significant result.

Binary logistic regression

A simple binary logistic regression was fitted to examine factors associated with mortality due to colorectal cancer. Only the variable that was significant with the chi square test of association was included in the model, residence. The dependent variable was mortality (life status coded as 0= dead and 1= alive.

The model is given as follows.

$Ln\ (Yi\ /\ [1-\ Yi]) = \beta0 + \beta1$residence

The table below gives a summary of results from the simple binary logistic regression

Table 3: Simple binary logistic regression

Factor	OR	Lower Limit	Upper Limit	p-value
Residence				
Nairobi	*ref*			
Out of Nairobi	*0.085*	*0.009*	*0.807*	*0.032*

Results from the analysis show that patients who live out of Nairobi were 92% (OR=0.085; 95% CI [0.009;0.807]) less likely to die of colorectal cancer than patients who live within Nairobi.

5.4 Morbidity of colorectal cancer among patients in KNH1

The table below gives a summary of morbidity of adult colorectal cancer patients at KNH. The risk factors included in the analysis are age, sex, marital status, residence and tribe. The dependent variable in this case was the patients' status classified as alive .

Table 4: Demographics of colorectal cancer morbidity

Demographic Factors	Morbidity cases
Age group	
<=40 yrs	*16*
41-60 yrs	*33*
>=61 yrs	*26*
Sex	
Male	*40*
Female	*35*
Marital Status	
Single	*5*
Married	*41*
Divorced/Widowed/Separated	*4*
Tribe	
Kikuyu	*39*

Kamba	*19*
Other tribes	*16*
Residence	
Nairobi	*19*
Out of Nairobi	*56*

Age

The age variable was classified into three categories: <=40 years old, 41-60 years old and >=61 years old. Out of the 80 study participants who were categorized into three age groups 24% were <=40 years in which 84% were alive and living with the disease, 41% were between 41-60 years of which 100 were living with the disease and 35% were over 61 years in which 93% were living with the disease.

Sex

Results from this study shows that 53% of the patients included in the study were male and 47% were female patients. Gender CRC morbidity analysis indicated that out 53% of the male and 47% of the female study participants, 95% and 97% respectively were living with the disease.

Marital Status

Majority of the colorectal cancer patients seeking health services at KNH were married (82%), those who were single constituted 9% of the total sample and similarly those who were either divorced or widowed or separated constituted another 9% of which 100% of the 9% single patient and 80% of the 9% of divorced/widowed/separated were living with disease, while 93% / 41 married patients were living with the disease.

Patients' Tribe

The patients included in this study were from various tribes, however based on the frequencies observed, the tribe variable was recorded into three main categories: Kikuyu (52%), Kamba (25%) and other tribes (23%). Among patients from the kikuyu tribe, while 39 patients that made up 95% were living with the disease , among patients from the Kamba tribe 19 patients/ 95% were living with the disease and enduring with the burden of the disease and lastly, 11% among other tribes 89%/ 16 patients were living with the disease.

Residence

Out of the 23 Nairobi residents 19 patients were living with the disease while 56 patients out of the 57 living out of Nairobi were also living with the diseas

5.5 Mortality Rates due to Colorectal Cancer among Patients at KNH

A sample size of eighty patients with confirmed cases of colorectal cancer at KNH were included in the analysis to estimate the mortality and morbidity due to colorectal cancer. The following table gives a summary of age specific mortality due to colorectal cancer;

Table 5: Age-specific death rate

Age group	Pop n	Alive n	Dead n	Death rate	Death Rate '000
<=40 yrs	19	16	3	0.158	158
41-60 yrs	33	33	0	0	0
>=61 yrs	28	26	2	0.071	71
Total	80	75	5	0.063	63

The estimated death rate due to colorectal cancer among patients at KNH were 158 per 1000 persons among people aged forty years and below and 71 per 1000 persons among people aged over sixty years. There were no deaths due to colorectal cancer observed among patients in age group 41-60 years and hence no reliable estimate for mortality rate for this age group. The crude mortality for colorectal cancer rate was estimated at 63 persons per 1000 individuals

Table 6: Gender-specific death rate

| Gender	Pop n	Alive n	Dead n	Death rate	Death Rate '000
Male	42	40	2	0.048	48
Female	38	35	3	0.079	79
Total	80	75	5	0.063	63

The table above shows the estimated death rates based on gender due to colorectal cancer patients at KNH were 48 per 1000 persons among people males and 79 per 1000 persons among females. The crude mortality for colorectal cancer rate was estimated at 63 persons per 1000 individuals.

Table 7: Mortality by Type of Cancer

Type of Cancer	Total n(%)	Alive n(%)	Dead n(%)	P-value	Statistic
Colon	278(52)	244(88)	34(12)	0.297	Chi=2.430,df=2
Colorectal	80(15)	75(94)	5(6)		
Rectal	179(33)	161(90)	18(10)		

The table above gives a summary of type of cancer and mortality. The proportion of death among patients with colon cancer was the highest among the three types of cancer (12%), followed by deaths among patients with rectal cancer at 10% and the proportion of deaths among patients with colorectal cancer was 6%. Analysis of association between the type of cancer and mortality did not reveal statistically significant results.

Figure 3: Overall proportions of deaths by colon, colorectal and rectal cancer
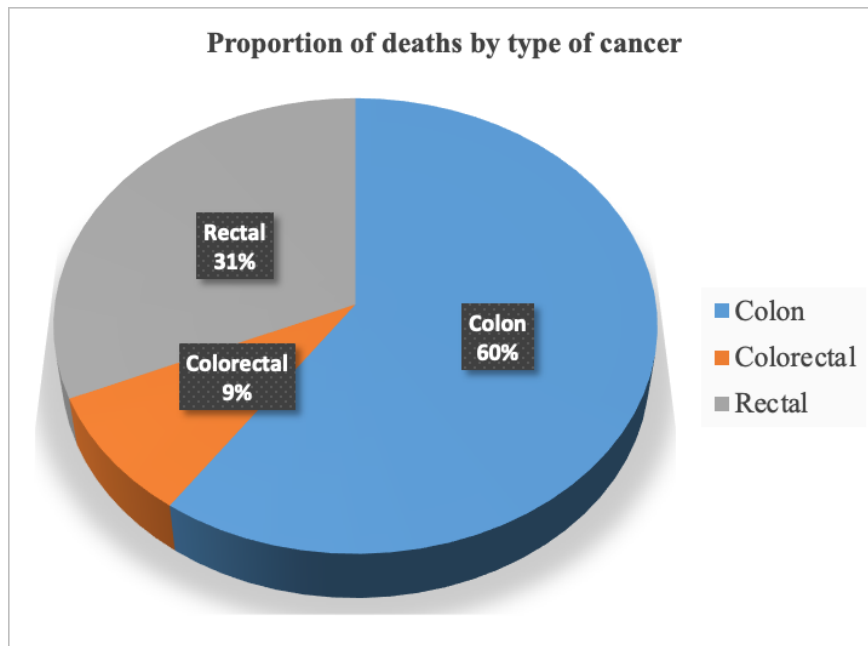
The figure above summarizes the overall proportions of deaths by type of cancer, colon cancer contributed to the highest proportion of total deaths by 60%, 31% of the deaths were due to rectal cancer whereas a small proportion of 9% was due to colorectal cancer.

CHAPTER 6: DISCUSSION

The study aimed to determine colorectal cancer prevalence, morbidity, mortality and risk factors which include; age, sex, ethnicity, residence, marital status, alcohol consumption and smoking at Kenyatta National Hospital.

In the study colorectal cancer constituted a proportion of 15% among colon and rectal cancer. Colon cancer was the most common type of cancer at KNH with a proportion of 52% and rectal cancer constituted 33%. These findings were quite similar when compared to prevalence by gender in male and female, colorectal cancer constituted 15% of the proportion while colon cancer maintained a proportion of 51% and 52% in male and female respectively. These findings contradict a study on the Cancer incidence in Nairobi, Kenya (2004-2008) that shows prevalence of colon, rectal and anal cancer in Kenya being = 7.6% (25).

The estimated death rate due to colorectal cancer among patients at KNH were; 158 per 1000 persons among people aged forty years and below and 71 per 1000 persons among people aged over sixty years. There were no deaths due to colorectal cancer observed among patients in age group 41-60 years and hence no reliable estimate for mortality rate for this age group. Both gender and age specific crude mortality for colorectal cancer rate was estimated at 63 persons per 1000 individuals. These findings are line with National cancer control strategy, Cancer situation in Kenya - 2012. Cancer ranks third as a cause of death. It causes 7% of total national morality every year. It is estimated that the annual incidence of cancer is about 28,000 cases and the annual mortality to be over 22,000. Over 60% of those affected are below the age of 70 years. In Kenya, the risk of getting cancer before the age of 75 years is 14% while the risk of dying of cancer is estimated at 12% (12–15).

Analysis of association between colon, rectal and colorectal cancer and mortality did not reveal statistically significant results.

Majority of the colorectal cancer patients seeking health services at KNH were married (82%), those who were single constituted 9% of the total sample and similarly those who were either divorced or widowed or separated constituted another 9%. No death from colorectal cancer had been observed among the single patients while among the 7% of married patients were reported to have died from colorectal cancer.

From the study it shows that 53% of the patients included in the study were male and 47% were female patients. Among the male patients, 5% died of colorectal cancer whereas among female 8% died of the cancer.

The age variable was classified into three categories: <=40 years old, 41-60 years old and >=61 years old. Results from the analysis showed that majority of the patients with colorectal cancer were between the ages 41 and 60 years (41%) followed by individuals above the age of sixty (35%) and those below the age of 41 years constituted 24% of the total sample. From the results, no death from colorectal cancer had been recorded within the age group 41-60 years. 16% of patients within the age group below 41 years had died from colorectal cancer, and 7% of the patients in the age group >=61 had died from colorectal cancer.

The patients included in this study were from various tribes, however based on the frequencies observed, the tribe variable was recorded into three main categories: Kikuyu (52%), Kamba (25%) and other tribes (23%). Among patients from the kikuyu tribe, 5% died due to colorectal cancer, among patients from the Kamba tribe 5% died and 11% among other tribes died due to colorectal cancer.

Results show that among patients living within Nairobi constituted 29% of the total sample while those living without Nairobi constituted a greater percentage of 71%. Among those living within Nairobi, 17% died of colorectal cancer while only 2% of the people who live without Nairobi.

Among the sociodemographic variables in the study; age, marital status, sex and ethnicity have no statistically significant association with colorectal cancer mortality. Its only place of residence that was of significant relationship between place of residence and mortality due to colorectal cancer p=0.022 (chi square= 6.839, df=1). According to the Ministry of health of Kenya, National Cancer Control strategy 2017, The fast increment in noncommunicable diseases is credited to social and demographic factors which incorporate economic advancement, globalization of business sectors and urbanization. These factors lead to extended prologue to modifiable way of life chance risk factors for cancer for most developing nations like Kenya, which is experiencing fast growth in urbanization and economic advancement(2,13–15).

In the study 77% of the colorectal cancer patients reported having never smoked, 17% were smokers and 6% were ex-smokers. Among people who had never smoked before, 4% died due to the disease while among smokers, no colorectal cancer associated death had been reported. The Pearson's chi-square test did not reveal any statistically significant association between smoking status and mortality due to colorectal cancer.

In the study I found out that 77% of the patients reported having never consumed alcohol, 14% were alcoholic and 9% were ex-alcoholics. 12% of the alcoholics died due to colorectal cancer while 2% of the patients who had never consumed alcohol lost died due to colorectal cancer.

A test of association between alcohol consumption and mortality due to colorectal cancer did not reveal any statistically significant result. The Pearson's chi-square test did not reveal any statistically significant association between smoking status and mortality due to colorectal cancer. These findings contradict with a study that was conducted in Italy, where both smoking and alcohol drinking were both independently associated with high risk of CRC(1)

Same applies to a study in Indonesia, where there was elevated inescapability of smokers in which other various medical issues and malignant growth, including CRC were caused by smokers. Using (DALYs) Disability Adjusted Life Years, smoking in Indonesia was linked to CRC(22)

Chapter 7: Conclusion and Recommendation

7.1 Conclusion

The research questions and objectives of the study were achieved. The response is based on the core objectives of the study. Secondary data was collected and analyzed. The broad objective was to determine colorectal cancer prevalence, risk factors, morbidity and mortality at Kenyatta National Hospital.

The following conclusions were drawn:

1. The prevalence of colorectal cancer among patients at Kenyatta National Hospital constituted a proportion of 15% of the colorectal, rectal and colon cancer. Colorectal cancer had the lowest proportion among the three cancers. The same applied to prevalence by sex in which both male and female had a prevalence of 15%. This is high considering previous studies have shown colorectal cancer having prevalence lower than 15%.

2. Among morbidity demographics such as age group between 41-60 years patients, male patients, married patients, among the kikuyu tribe, and patients who were residing out of Nairobi were living with colorectal cancer and suffered the burden of the disease.

3. Among the risk factors analyzed in the study, Analysis showed that there was a significance association of residence and mortality cases. Further statistical tests showed colorectal cancer patients who live out of Nairobi were 92% less likely to die of colorectal cancer that patients who live within Nairobi.

4. With age specific death rates, there were no deaths among patients in the age group 41 − 60 years. And with gender specific death rate, female colorectal cancer patients had the highest death rate with 0.079.

5. Mortality among colon, rectal and colorectal cancers. Colorectal cancer had 6% which was the lowest proportion of deaths when compared to 12% of colon cancer and 10% of rectal cancer.

7.2 Recommendation

Based on the findings of the study, the Government of Kenya through the Ministry of Health and Ministry of Finance ought to increase budgetary allocation to fund cancer research, since there is inadequate reliable information regarding colorectal cancer research in Kenya and subsidized cancer treatment in the country.

Lastly, with the high prevalence of colorectal cancer, the Ministry of Health needs to educates the public of lifestyle factors that contribute to colorectal cancer risks and encourage the public to have regular cancer screening.

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Appendices

Appendix 1a: Budget

COMPONENT	UNIT OF MEASURE	UNIT COST	TOTAL COST
1. PROPOSAL DEVELOPMENT			
Internet charges	30 Days		Ksh1,000.00
Printing papers	2 Reams	Ksh600	Ksh1,200.00
Printing	50 pages	Ksh5	Ksh250.00
Photocopy	2 Copies	Ksh3	Ksh300.00
Binding	2 Binding	Ksh100	Ksh200.00
Software Installment i.e Microsoft Office, EndNote			Ksh5,000.00
ERC fees			Ksh2,000.00
2. DATA COLLECTION			
Software Installment i.e IBM SPSS			Ksh10,000.00
3. DATA ANALYSIS			
Internet charges	15 Days		Ksh500
Data storage i.e Online cloud storage			Ksh5,000
FINAL REPORT			
Photocopy	2 Copies		Ksh2,000.00
Publication costs			Ksh7,000.00
TOTAL			Ksh34,450.00

Appendix 1b: Justification of The Budget

The budget shows the cost of materials that were and will be used during the study, the price reflects the current market prices, but due recent market infliction prices may change. I choose to use genuine software due to security issues, software failures and hardware failure. Genuine computer software packages can be password encrypted to avoid malicious act when it comes to handlining of human data. The high level of privacy of the data, demands high level of security.