CANCER MORBIDITY AND MORTALITY RATES BETWEEN THE YEARS 2013-2017 AT THIKA LEVEL FIVE TEACHING AND REFERRAL HOSPITAL, KIAMBU COUNTY, KENYA

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DECLARATION AND APPROVAL

The thesis is my original work and has not been presented for a degree in any other university or any other award.

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DEDICATION

This work is dedicated to my family for their reliable support and continuous encouragement. This accomplishment would not have been possible without them.

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ABSTRACT

Non-communicable diseases are the leading cause of morbidity as well as mortality. In 2020 about 19.3 million newly cases diagnosed and 10.0 million people die of cancer annually worldwide. In Kenya cancer come second cause of mortality besides cardiovascular diseases accounting for 7% of total mortality thus making it a public health concern. In the 2020 GLOBOCAN report, National cancer estimates stand at 42,116 new cancer cases diagnosed and a mortality of 27,092. In Thika level five Hospital cancer cases are unknown. The main objective of this study was to assess cancer morbidity and mortality between the years 2013-2017 at Thika level five Hospital, Kiambu County, Kenya. The primary target for this study was all cancer patients attending Thika hospital. A descriptive, cross-sectional design was employed to gather data presented in all cancer patients. A sum of 261 cancer patients' records observed from patients treated between January 2013 and December 2017. An interview was done using a structured questionnaire with 98 patients from the department of cancer pain management in the hospital. Data on independent variables including age, sex, primary anatomical sites of cancer origin. Data were analyzed, and summarized into frequencies and proportions, because of a small number of cancer cases only the top five were considered. The proportionate cancer frequency for incidence rate, and prevalence, as well as mortality, were calculated. The frequency recorded was absolute, and the proportions were in percentages. Data were presented in graphs and tables. The questionnaire interviews were analyzed using SPSS version 21. Proportionate cancer morbidity for five years and proportionate mortality rate since 2017 was analyzed Approval acquired from Mount Kenya Institutional Research Ethics Committee and a license was obtained from the National Commission of Science, Technology, and Innovation (NACOSTI). Permission to collect data obtained at Thika level five Teaching and Referral Hospital. The data were abstracted from 261 records out of which 179 (69%) female while 82 (31%) males. Primary data were obtained from a questionnaire for 98 cancer patients out of which 79 (77.6%) were alive while 22 (22.4%) die in combined gender. The top five cancer by sites were cervix 59 (22.6%), breast 40 (15.3%), esophagus 37 (14.2%), stomach 31 (11.9%), and prostate 13 (5 %). The proportionate cancer morbidity for five years for all ages was 73.9 per 100, population. The proportionate mortality rate for 2017 is 8.4 per 100 populations. In conclusion, major cancer in females and males were cervical and prostate, respectively. Recommendation, there is a need to emphasize provider-initiated cervical and prostate cancer screening during triage at the health facility as this may facilitate documentation of unseen cases.

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LIST OF ABBREVIATIONS AND ACRONYMS

ACSM	American Cancer Society Medical
ACS	America Cancer Society
AICR	America Institute for Cancer Research
CR	Cancer Registry
CT	Cancer Type
CF	Case Fatality Rate
CIDP	County Integrated Development Plan
CE	Clean Energy
ECIG	Electronic Cigarette
IP	Incidence proportion
ICO	Information Centre on
IARC	International Agency for research on Cancer
ILCC	International lung cancer consortium
IP	Incidence proportion
KEMRI	Kenya Medical Research Institute
LF	Lifestyle factors
MKU	Mount Kenya University
MPHS	Ministry of Public Health and Sanitation
NACOSTI	National Commission of Science, Technology and Innovation
NHL	(Non-Hodgkin Lymphoma)
NCI	National Cancer Institute
NIH	(National Institute of Health) (National Institute of Health)
NCDs	Non communicable diseases
PP	Period prevalence

PBCR	Population based cancer registry
PM	Proportionate morbidity
SEER	(Surveillance Epidemiology and End Results)
UK	(United Kingdom) – United Kingdom
UE`	Unclean Energy
USA	(United State of America)
WCRFI	World cancer research fund international
WHO	World Health Organization

OPERATIONAL KEY TERMS

A cancer registry gathers data about a person diagnosed with cancer storage, management of cancer information, and analysis of cancer in hospitals (National Institute of Health, 2019)

Age-adjusted is the adjustment of individual age to fit a certain category/group (NIH, 2019).

Cancer the growth of abnormal cells that multiply without controlled others spread to various tissues or organs (National Institute of Health, 2019 and NC I, 2019).

Cancer type anatomical cancer is associated with e.g., lung cancer, colon cancer, etc (National Cancer Institute, 2019).

Gender either male or female (WHO, 2016).

Incidence newly cases in a population (Globocan, 2018).

Incidence proportion a newly part originally disease-free from infection that develops disease through time (WHO, 2018).

Lifestyle factors are factor-like drinking alcohol, tobacco smoking, diet, and fuel ((Globocan, 2020).).

Morbidity is the number of persons who are ill (Globocan, 2020).

Mortality is the number of persons who are dead (WHO, 2019).

Non-communicable diseases are diseases that cannot be transmitted from one person to another (WHO, 2018).

Proportionate morbidity the population that is ill in time (Bray *et al*, 2018).

Pesticides: Pesticides are chemicals synthetic used to deter insects, rodents, fungi weed (WHO, 2017).

Prevalence are newly infected together with previously infected in a particular population (IARC, 2018).

Period prevalence sum total of newly infected and those with disease measured in a given time frame (Globocan, 2020).

Population-based cancer registry methodically gathers information on happening in a define area either from a single sources or multiple sources (WHO, 2017).

The case fatality rate part of a person who died from that condition (Ferlay *et al*, 2017).

The population at risk apparently healthy group of persons likely to contact some illness or condition (Ferlay *et al*, 2018).

Clean energy is the sustainable renewable that meets the present needs without compromising the needs of future generation. E.g., gas (Oxford dictionary)

Unclean energy is the unsustainable renewable that meets the present needs but compromising the needs of future generation. E.g., charcoal. (Oxford dictionary)

CHAPTER ONE: INTRODUCTION

1.1: Background of the Study

Non-communicable diseases are the leading course of mortality globally (WHO, 2020). Cancer is a non-communicable disease. A cancer is a combination of more than 100 diseases in which cells grow out of control (NCI, 2019). Cancer remains second cause of mortality, and it threatens to reduce the lifetime anticipated in each nation in the 21st era (WHO, 2015). Malignancy can be caused by many factors ranging from environmental factors to unhealthy diets and poor lifestyles (Li gibel *et al*, 2014.). Environmental factors can cause cancer in small or massive quantities when they encounter the human body (Ligibel *et al.*, 2014). Anticipated nineteen million newly diagnosed, with ten million people deceased from cancer annually globally in 2020. The top five cancer cases were rated as follows: Lung (18.0%), liver (8.3%), Breast 626,679 (6.9%), Stomach 782,685(7.7%) and Colon 551,269 (5.8) deaths, respectively. (GLOBOCAN, 2020). The incidence rate globally for lung cancer is (11.4%), breast cancer (11.7%), prostate (7.3%), colon (6.0%), throat (3.1%), bladder (3.0%), non-Hodgkin lymphoma (NHL) (2.8%), others (46.3%) (WHO, 2020). In females, Endometrial cancer being the fourth cancer in women (Cohn, BA et *al.*, 2015) due to obesity and mutation (Mo rice *et al.*, 2016.) an estimated 38.4% obesity among women with the cancer disease (Ogder *et al*, 2014)

Develop countries pointed out one in two persons was more likely to develop cancer (American Cancer Society (ACS) 2019). In 2018, half of the incidence and mortality cases were attributed to cancer in Asia and that is estimated that 60% of the worldwide population lives in the Asian continent.

In developed countries, the newly cancer rates approximated 50% in both gender. In France, cancer incidence was about 382,000 in 2018 (Defossez *et al.,* 2019.) The women's mortality rate in East Africa is high at about 24.6% compared to Europe at 16.7%, and America at 18.7% respectively in developing countries (GLOBOCAN, 2020). Also in developing countries, liver, stomach, cervical, and prostate cancer remain quite common. Further, an estimate of 70% cancer mortality arose in those countries (WHO, 2014). Approximately 30% of these cancer deaths can be prevented (WHO, 2014).

In Africa, the newly diagnosed cancer cases stand at (1,109 209) 5.7%, Egypt leading with 12.1%, Nigeria with 11.3%, South Africa with 9.8%, Ethiopia with 7%, and Kenya are included others. The prevalence is (2,166 740) 4.3% Egypt leading with 12.8%, South Africa 12.1%, Nigeria 10.8%, Ethiopia 6%, and Kenya 3.8%. And the mortality rate estimates are 7.1% Egypt leading with 12.5%, Nigeria 11.1%, South Africa 8%, Ethiopia 7.3%, and Kenya included in others 46.7% (GLOBOCAN, 2020)

Nationally cancer data has not been exhaustively collected; however, the annual incidence is approximately 42,116 cases and the mortality rate 27,092 death yearly (GLOBOCAN, 2020), which is a slight decrease compared with the 2018 WHO report estimates 42,887 incidences and 32,987 deaths. Kenya has two cancer registries, Nairobi Cancer Registry together with Moi Teaching and Referral Hospital (MTRH) Cancer Registry. Nairobi Cancer Registry is limited to cancer cases that live in Nairobi County only. Referrals from upcountry like Thika are not captured adequately, and therefore there is a need for the counties to develop their cancer registries. In Kiambu County, there is no cancer registry, and there is an urgent need to establish one to aid in documenting the cancer morbidity and mortality rate. Thus, while lack of a cancer

registry to record cancer morbidity and mortality cases, cancer morbidity and mortality are not fully documented.

1.2 Statement of the Problem

Internationally malignancy remains the succeeding cause of fatality (WHO, 2018). A predictable 9.6 million people perish from cancer, and about one in six deaths are due to cancer (WHO, 2018). According to World Health Organization, 2013 report, an estimated 70% of cancer fatalities occurred in third world countries. An estimated 30% of these deaths were preventable (WHO, 2014). 61.1% of cancer are a result of infection (ICO, 2013). The facilities need to equip with both qualified human sources and equipment to reduce the cancer cases referrals to India (WHO, 2013). Nationally, cancer data has not been captured, exhaustively collected, and documented; exact morbidity and mortality rate remain unknown because the cancer data per county is not available. KEMRI besides MTRH are the only cancer registries in Kenya reporting to WHO.

Thika Level Five Teaching and Referral Hospital has no cancer registry where all cancer morbidity and mortality cases can be determined. This makes it challenging to establish the true morbidity as well as mortality rates of cancer cases in the Hospital. Cancer morbidity plus mortality rates are not well documented due to over and or underestimating cancer cases at the facility. Therefore, there was a need to develop a hospital-based cancer registry that would contribute to developing the hospital cancer registry.

1.3 Justification

The justification of this study was to acknowledge the immense contribution in the national and county managements in their political good will in supporting cancer as a

diseases which affect the entire population. Nationally, cancer data has not been captured, exhaustively collected, and documented; exact morbidity and mortality rate remain unknown because the cancer data per county is not available. KEMRI besides MTRH are the only two cancer registries found in Kenya reporting directly to WHO. This study bridged the gap by identifying the true cancer cases in Thika level five teaching and referral hospital. Also, the cancer patients sought early treatment and reduce the mortality cases among the population.

1.4 Objectives of the Study

1.4.1 Broad Objective

Research main objective was to assess cancer morbidity and mortality between the years 2013-2017 at Thika level five Teaching and Referral Hospital, Kiambu County, Kenya.

1.4.2 Specific Objectives

The research sought to meet the following specific objectives:

1. To determine the morbidity rate of cancer between 2013-2017 at Thika level five teaching and Referral Hospital, Kiambu County, Kenya
2. To determine the mortality rate of cancer between 2013-2017 at Thika level five teaching and Referral Hospital, Kiambu County, Kenya
3. To show the association between cancer mortality and morbidity rate and socio-economic factors between 2013-2017 at Thika level five teaching and referral Hospital Kiambu County, Kenya
4. To determine the lifestyle risk factors associated with cancer in between 2013-2017 at Thika level five Teaching and Referral Hospital, Kiambu County, Kenya?

1.5 Research Question

1. What was the morbidity rate of cancer in between 2013-2017 at Thika level five Teaching and Referral Hospital, Kiambu County, Kenya?
2. What was the mortality rate of cancer between the years 2013-2017 at Thika level five teaching and Referral Hospital, Kiambu County, kenya?
3. What was the association between cancer mortality and morbidity and socio-economic factors in between 2013-2017 at Thika level five Teaching and Referral Hospital, Kiambu County, Kenya?
4. What were the lifestyle risk factors associated with cancer in between 2013-2017 at Thika level five Teaching and Referral Hospital, Kiambu County, Kenya?

1.6 Significance of the Study

Research offered baseline data for the cancer registry in Thika level five Teaching and Referral Hospital. The prevalence, occurrence, and death of the cancer cases amid populace in Thika level five and Thika sub-county at large were set up. The study also showed the cancer burden to the facility and the people at the Thika sub-county. The actual results of cancer found, and the data derived from this study were used to improve medical care and put control measures for the sub-county. Besides, the findings might use to make informed decisions by the county health management team.

1.7: Scope of the Study

Studied research choice was to estimate cancer morbidity and mortality of cancer in between 2013 all the way up to 2017 at Thika level fiveTeaching and Referral Hospital, Kiambu County, Kenya. Nationally cancer data has not been exhaustively collected; however, the annual incidence is approximated to be about 42,116 cases and the

mortality rate 27,092 death yearly (GLOBOCAN, 2020), which is a slight decrease as compared with 2018 WHO report estimates 42,887 incidences and 32,987 deaths (WHO, 2018).

Thika Level Five Teaching and Referral Hospital in Kenya also has no cancer registry where all cancer morbidity and mortality cases are determined. This marks it tough in determine the genuine number of cancer Hospital.

Scope was to approximate newly as well as prevalence of cancer cases at Thika level five Teaching and Referral Hospital between the years 2013-2017. The study's main objective was to estimate both morbidity mortality of cancer between the years 2013-2017 at thika level five Teaching and Referral Hospital, Kiambu County, Kenya. The scope was to sought to estimate the morbidity rate of cancer, determine the mortality of cancer, show the relationship among cancer mortality as well as morbidity rate and socio-economic factors, and determine the lifestyle risk factors associated with cancer between the years 2013-2017 at Thika level five.

1.8 Study Limitations

The abstract forms were incomplete, and there were gaps in records. There was incomplete data entry of the patients' vital medical data. Further, the medical history of some patients was either partially filled or not captured at all.

1.9 Study Delimitations

The excellent record keeping, and complete abstract forms enabled the researcher to collect quality and reliable data.

1.10: Assumption of the Study

The study had an assumption that the diagnosis was made by a qualified doctor and was accurate for 261 cancer patient's files. Also, the cancer patient's files were available to abstract the data associated with research.

CHAPTER TWO: LITERATURE REVIEW

2.1: Introduction

Cancer result from combination be it more than 100 diseases or less in which cells grow out of control (NCI, 2019). It can be traced back to the 15th century during the Renaissance by scientist Galileo *et al.,* 2016. Harvey did the first autopsy in 1628, and followed by 1761, Famous scientist being pioneer of scientific oncology, the study of cancer (ACS medical, 2014). The growth may be either rapid or slow (Rachel *et al.*, 2018.).

2.2 General Literature Review

This general literature review presents the types of cancers, causes, prevention of cancers, and role of cancer registries.

2.2.1 Types of cancers

Cancers are categorized as benign and malignant. Benign tumors are not cancer as well as they do metastasized (National Cancer Institute, 2019). A malignant tumor does metastasize (AC AM, 2014). Cancers are defined according to the size or type of cell they start to grow. The most common cancer is carcinoma which grows in the epithelial tissue, lymphomas, melanoma, and sarcomas (NIH, 2019). These may take a few to many years to develop, and if diagnosed early, they can be treatable. For instance, the common cancers are the stomach, lungs, breast, liver, colorectal, prostate, throat, cervix uteri, and bladder cancer. (ACSM, 2014).

2.2.2 Cause of cancers

2.2.3 Infections and Acute Inflammation

Viral infection: (HPV) and (EBV) is an infectious agent causing cervical cancer, head cancer, neck cancer as well as anal cancer (Bornstein *et al.,* 2018.). Sexually active

women during their younger age, of 16 years or below, may be at danger of both hepatitis B and C liable for liver cancer (Mera *et al.*, 2018). HIV predisposes, Kaposi's melanoma, squamous cell carcinomas among others (Goedert, 2015).

Bacterial infection: Helicobacter pylori are a bacterial infection responsible for digestive ulcers, which result in stomach cancer (Mera *et al.,* 2018.). Pneumonia presumed to be lung cancer elevated the risk factor together with other elements like raised volatile oxygen (Sogaard *et al.,* 2015.) also, research done by ILCC shown that 57% intensified threat (Brenner *et al.*, 2012.). Chlamydia pneumonia is the one accountable for causing pneumonia (Blasi *et al.*, 1998.) might proliferation the possibility of the lung cancer (Litman *et al.*, 2005). Tuberculosis (TB) may lead to gene mutations through chronic inflammation, which causes a threat to cancer of the lungs (Keikha *et al.,* 2018). ILCC (International Lung Cancer Consortium) further wrote down that TB rises threats to cancer of the lungs from 48% all the way to 76% (Brenner *et al.,* 2011 and Brenner *et al.,* 2012)

Fungi infection: Aflatoxins from various research shows contribute to liver cancer (Alam *et al.*, 2012).

Acute inflammation: Inflammation is the process by which the body fight against things that harm it, for instance, toxins, infections, and injuries, in trying to heal itself (Andrienne, 2018). When the body is injured, the cells release chemicals that trigger a response from the body (Brian *et al.*, 2016). Chronic inflammation occurs when this response lingers, leaving the in-alert state of alert constantly (Scrivo *et al.*, 2016). Scrivo and Adrienne suggested that chronic inflammation could play a role in conditions ranging from cancer to asthma (Scrivo *et al.*, 2016). Chronic inflammation can cause DNA damage and lead to various cancers (Choi *et al.,* 2015). For instance,

colon cancer because of ulcerative colitis and Crohn`s disease (Oncology Training International). Furthermore, EBV) was related with B- cell which link to lymphoma (Co pie *et al.*, 2017).

2.2.4 Noninfectious causes

Pesticides: Pesticides are chemicals synthetic used to deter insects, rodents, fungi weed, according to World Health Organization (WHO, 2017). Pesticides are any substances of the biological or chemical ingredient used for destroying, repelling any pest, and regulating plant growth (FAO, 2014). Insecticides are categorized into pesticides, herbicides, and fungicides (Barros *et al.*, 2016). An estimated 20 active ingredients found in pesticides are found to be carcinogenic in animals, and most of them have been banned in the United States terms as group one (arsenic and arsenic compounds, Ethylene oxides, TCDD, and Lindane) are carcinogenic in humans (IARC, 2013). Contact with high pesticides by farmers caused cancer, for instance, lung, stomach, brain, lips, prostate, skin, and NHL (Andreotti *et al.*, 2018). Glyphosate is an herbicide commonly used globally in agricultural and residential shows associations for NHL (Andreotti *et al.*, 2018). Also, drinking water contaminated with pesticides was connected to cancer (Tarla *et al, 2015*). According to Bahadar *et al* report of 2015, various pesticides' actions disrupt the endocrine, resulting in carcinogens (Bahadar *et al.*, 2015). Exposures to pesticides holding organophosphates was related to developing neurodevelopment (Munoz-Quezada *et al.*, 2013). Also, low exposure organophosphates are related to visual memory and decreased psychomotor, a risk factor to cancer of the endocrine (Ross *et al, 2013*). Moreover, disclosure to pesticides is allied to carcinogens, resulting to cancer of the endocrine system (Petrakis *et al.*, 2017).

Medical drugs: During cancer treatment, some medications could escalation the second malignancy, and estrogens used increase the incidence of endometrial cancer (Cohn, BA, et *al.*, 2015). Further, the use tamoxifen is a group of drugs that acts like estrogen; using these drugs may lead to malignancy (PDQ, 2019). The resistance of chemotherapy by lung cancer patients and its toxicity were related to various gene trails that may result in a substantial risk of developing liver cancer (Lee *et al*, 2013) due to the chemotherapy response in platinum-based drugs (Chen *et al.*, 2014). Moreover, chemotherapy and radiotherapy have been linked to urologic and gastrointestinal cancer (Kier *et al.*, 2017) and Hauptmann *et al.*, 2016.

Solvents: Many benzene solvents were being used until about 12 years ago, its use in pesticides was banned, but in other sectors such as the petrochemical, pharmaceutical, cigarette making, rubber, gasoline, and leather industries, Benzene is presently used. (Bahadar *et al.* 2014). Employees working in these industries are often exposed to benzene. Moreover, Benzene is known to cause leukemia (Bahadar *et al.*, 2014). Bisphenol A solvents are linked with the intoxication of the female reproductive system (Caserta *et al.*, 2014). High bisphenol levels in plasma fluid or urine interconnected with a considerable threat to developing prostate and ovarian malignancy (Souter *et al*, .2013). Pre- and post-natal exposure to toxic solvents is associated with childhood cancer (Weselak *et al.*, 2014).

Silicon: Silicon element (Si) found in group 14 has atomic number 14, has a mass of 28.085, and in the periodic table categorizes as p-block elements. Primarily available as crystalline silica and allotrope. Jon's Jacob Berzelius discovered it in 1824 (W. M. Haynes, 2015). It is a hazardous substance (Lacourt *et al.*, 2015). This element is airborne silica is found in soil as well as sand. In Canada, workers working in

construction sites are more exposed to a higher recommended limit level of 0.05mg/m^3 (Lacourt *et al.*, 2015 and Verma *et al.*, 2003).

2.2.5 Cancer Registries

A cancer registry shows a systematic way of collecting information about a person diagnosed with cancer storage, management of cancer information, and analysis of cancer (National Institute of Health, 2019). The Cancer Registry holds details of the patient identifiers, basic demographic information, and cancer information. It is used to calculate the incidence and prevalence of cancer (Zuo-Ferng *et al.*, 2008). There are three types of registries, namely, pathological or (specialty) as well as population-based cancer registry (National Institute of Health, 2019) and (Menck *et al.*, 1994).

Hospital-based cancer registries collect information on patients with cancer treated in hospital (National Institute of Health, 2019). It is used for administrative purposes as well as reviewing clinical performance according to the (NIH) and (SEER) Training Modules (NCI SEERTM, 2019). A hospital-based registry is further sub-classified into a single hospital registry and collective registry, according to NIH 2019. Also, it is used to improve patient care, clinical research, and administrative information about cancer and for professional education (NIH, 2019). Secondly, a pathological-based cancer registry collects data on laboratory procedures, including histological and immunohistochemistry diagnosis of cancer, for instance, the Gilda Radner Familial Ovarian Cancer Registry. Furthermore, the data serve as a quick snapshot of the cancer profile (NIC, 2019).

The third (PBCR) steadily gathers data that happening in a physically well-defined populace on various sources. (NIC, 2019) The information is used to associate and interpret cancer incidences, guide forecasting including assessment of cancer efforts,

watch trends over a period, and determine the cancer patterns (National Cancer Registrar Association, 2011) (NIC 2019).

The cancer registry from America was proven way back 1973 to offer quality data to over 96% population of the USA (Have ner *et al.*, 2008). In North America, 95% of the population has a quality cancer registry, eighteen percent in western countries, in Asia and Africa six and two percent respectively (Jemal *et al.*, 2014).

Europeans nation, registry of the cancer was founded in 1971 called National registry cancer and Service (NCRAS) (International Journal of Epidemiology, 2019). In 2013 England introduced the Cancer Outcome and Services Dataset (COSD) for reporting cancers (NCRAS, 2018). England had a robust automated quality assurance of cancer registration of data and a manual one for checks and balance; all these assists to assessed cancer incompleteness, validity, comparability, and relevance (Bray *et al.*, 2009).

In sub-Sahara Africa, according to the Africa Cancer Registry Network (AFCRN) report of 2019, there are about 25 population-based cancer registry registries in 20 countries. AFCRN succeeded the East African Cancer Network (EARN) was formed in 2011 as funding source in USA Charitable organization (Doris Duke Charitable Foundation, 2019).

In South Africa, NCR-SA (National Cancer Registry of South Africa) was set up and routine report started in 1990 (Africa Cancer Registry Network, 2019). Besides, NCR-SA has twelve cancer registries fully operational, and in 2014 they reached a lag time of routine reporting of two years in cancer cases from the Africa Cancer Registry Network report of 2019. NCR (Nairobi Cancer Registry) has been used to report cancer such as prostate, skin, and oral cancer (Norval *et al.*, 2014) and (Babb *et al.*, 2014).

South Africa's cancer registry serves about 84% population and smaller private health totaling up to 16% (Green paper, 2014). Also, they were able to report incidence rates by demography using the pathological reports from both civic and non-civil health institutions (Cancer Full Report coming from South Africa, 2014).

Trendy Kenya, they are two cancer registry centers, (ECR) being one of them, according to the AFCRN (Africa Cancer Registry Network) report of 2019. ECR came into being in 1999, situated in Eldoret. The main goal was to be Population-based for Uasin Gishu County, with three registrars working on per time on registry work. Also, the report further finds that they use Hospital records, death certificates, and pathology. Moreover, in 2013 16000 people were the residence in that County (Tenge *et al.*, 2009). Nairobi Cancer Registry is the second cancer centre in the country began in 2001 to serve residence only from its environs (ACRN, 2019). NCR being part of EARN 2011(ACRN, 2019). In 2006 60% of the 3000 cases were residents of Nairobi (AFCRN, 2019). The report further showed the health institution from; government and private Hospital, medical laboratories, radiotherapy treatment centres Nairobi Hospice and vital statistics which was set up in 2006 by NCR (Korir *et al.*, 2015)

2.3 Empirical Literature Review

2.3.1 Morbidity rate of cancer between the years 2013-2017

According to global cancer statistics 2018, which involved 185 countries and 36 malignances, the occurrence of the cases was projected as 18.1 million, lung cancer prostate tailed in men, whereas breast malignancy was highly spotted second was colorectal cancer, lung cancer and cervical cancer (Bray *et al*, 2018). More than one, and a half mortality cases was from Asia. Second in the position Europe, which is believed to contribute to about 23.4% of morbidity, contributing about 9% of the

worldwide population. The third is the United States of America which had total morbidity of 21%. Forth is Africa, which contributed a total of 5.8% morbidity, and lastly, Oceania had 1.4% (Bray *et al.*, 2018).

A worldwide analysis which involves an estimate of 160 nations indicated more than 560,000 incidence cases of women's cancer from population-based cancer registries were recorded in 2018 (Arbyn et al, 2020), malignant in women was recorded fourth position behind breast cancer, colorectal cancer, and lung cancer among women. About 84% of cervical cancer occurred in the Human Development Index (HDI) of less than 0.80. (Arbyn *et al.*, 2020)

A similar study done which involve twenty-nine different groups to ascertain, the global burden of cancer disease worldwide; analyzed the morbidity of breast and liver cancer years 1990 to 2017 established that laryngeal, esophageal, bladder, morbidity rates more in men as compared with women (Lin *et al.*, 2019) she further stated that another study done during the same period indicated that there were 5.90 new cases in 2017(Fan *et al.*, 2020). A different study (Fitzmaurice *et al.*, 2017) reported that prostate, tracheal bronchus, and lung cancers (TBL) were reported highest among males contributing to a 42% morbidity rate; among females' breast, colorectal, and TBL cancer accounted for 46% morbidity in 2015.

A similar study conducted in the US approximated the new cancer cases in 2020 indicated to be about 1,806,590 cancer cases, ductal carcinoma 48,530, and melanoma 95,710 cases occurred in 2020. (Siegel *et al.*, 2020). More so, developed countries point out the high possibilities of increasing malignancy in the third countries (American Cancer Society (ACS), 2019). Further in Brazil, the incidence rate of breast, pancreas, , among others increased in both genders; a study was done between the years 1996 -

2016 (Bigoni *et al.*, 2019). Also, a similar survey conducted in England between 1981 and 2016 on cancer morbidity trends indicated that the four common types of cancers were increasing in both genders (Arik *et al.*, 2020). Furthermore, the morbidity of lung cancer increased to 14.05% in older women in urban as compared with 4.01% in rural areas (Sliwczynski *et al.*, 2019).

2.3.2 Mortality rate of cancer between 2013 and 2017

According to global statistics of the year 2018 an estimated, 9.6 million people died. Lung cancer 11.6% was the most diagnosed in both sexes combined as well as the most cancer that cause mortality 18.4%, (Bray *et al.*, 2018).men's, were in front, followed by women (Bray et al, 2018)

Worldwide cervical cancer mortality was about 7.5% (311000) deaths in 2018, and rated 4th position mortality besides, lungs, colon and rectum among women. Furthermore, 88% of cervical cancer deaths occurred in low-income countries where 1.3% succumbed before 75 years out of 1.8% of women diagnosed with cervical cancer (Arbyn *et al.*, 2018).

The GBD was a similar study conducted which involved 29 cancers indicated that the mortality of males was 618,529 and females 391,976 in 2017 globally and accounting to 23.9% death in females, stomach 15.19, liver 15.10, colorectal 13.79, and prostate cancer 13.11(Lin *et al.*, 2019). A similar study in Uruguay between the year 1997 to 2014 indicated high mortality of 63.7% in oral and oropharyngeal cancer (Cosetti-Olivera *et al.*, 2020). Another study done in Australia between 1982 to 2013 showed that there was high mortality in five cancers, breast cancer 0.6%, prostate cancer 2.5%, colorectal 0.7%, skin cancer 0.4%, and lung cancer 1.8% for both gender in 2013 (Bech *et al.*, 2020). Further, a study in Brazil, years between 1996 and 2016, showed that all

cancer mortality was 16.4% (3,219,245) (Bigoni *et al.*, 2019). Another different study showed, liver, stomach cancer being mutual causes of mortality in males 2015, while the vice versa was the cause of mortality in women in 2015 (Fitzmaurice *et al.*, 2017).

A similar study done indicated that for both sexes combined, Asia had more than one and a half deaths 57.3% since it was contributing about 60% of the worldwide population, Europe, 20.3% deaths, were the second, Americas 14.4% deaths was third, Africa, 7.3% deaths, was forth, and Oceania, 0.7% deaths, was in the last position with a total of 9.6 million deaths globally (Bray *et al.*, 2018). Further, research done in the US between the years 1930 to 2017 indicated a decline in mortality by 29% if the peak rate persisted, which was realized in four cancers: lung, colorectal, breast, and prostate (Siegel *et al.*, 2020). The decrease was lower in females as compared with males; however, in males, the decline was higher in lung cancer 3% per year in 2008 to 5% in 2013-2017 while in females 2-4% was realized, prompting the high ever annual decrease cancer deaths of 2.2% between the years 2016-2017 (Siegel *et al.*, 2020). Siegel further estimated the crude deaths in 2020 to be about 606,520 from the prostate, lungs, colorectal and breast cancer in male and female one and a quarter of it was from lung cancer.

A different study done between 1975 to 2014 indicated that the mortality of cancer reduced by 1.8% overall between 2010 to 2014; lung 3.5%, prostate 3.4%, and colorectal cancer 2.5% yearly and increased in liver 2.5 %, pancreas 0.3%, and brain cancer 0.5% annually in males, while in female's lung 2.0%, breast 1.6%, colorectal cancer 2.8% yearly and an increased in uterus 2.0%, and liver 3.0% yearly (Jemal *et al.*, 2017). Further, a study in Iran between 2001 -2030 indicated that gastrointestinal cancer 3.9% and 3.7% in men and woman respectively per 100,000 populations

(Shadmani *et al.,* 2020). Furthermore, a study between the years 1990-2017 indicated that the mortality rate of esophageal was estimated to be 5.48% (Fan *et al.*, 2020).

2.3.3 Association between cancer mortality and morbidity rate and socio-economic factors

Socio-economic factors are factors that determine the health of specific individuals. These factors include education, occupation, income, and social support.

Globally cancer morbidity and mortality are associated with cancer, a study that involve 27 cancer type in 175 countries (|Globocan, 2020). A study in Spain between the years 2011-2013 showed an association between socio-economic factors with colorectal cancer (26.9%) mortality and survival (Luque-Fernandez *et al.*, 2020). Further, a study in Italy between the years 1990 to 2016 among women with breast cancer showed associations between the socio-economic factors that led to the reduction of breast cancer from 1990 4.2 to 2016 3.2 per 100 000 populations (Rossi *et al.*, 2020). Moreover, a study done in European countries between the years 1990 to 2015 indicated an association between the mortality and morbidity of various cancers, especially with those who had low socio-economic status (Mackenbach *et al.*, 2019). Also, Sweden indicated relationship among socio-economic factors as well as mortality, where 1.7 million died (Kitikireddi *et al.*, 2020). A similar study done in Germany between the years 2000 to 2015 among 38,130 patients who had colorectal cancer showed an association between colorectal cancer mortality and morbidity, where 50% enduring died (Jansen *et al,*. 2020). A scholar in Botswana in 2021 shows the similar relationship among socioeconomic as well as disease and death of cancer. A similar study was done in Kenya which shows the socioeconomic factors associated with cancer indicated that indeed education and occupation ted to make person

vulnerable to cervical and prostate cancer (Lehmann *et al.*, 2020). Even though this was contrary to the study result.

2.3.4 Lifestyle risk factors associated with cancer

Overview: Threat factors are things that increase one chance of getting cancer (CDC, 2019). These factors can either increase or lower the risk of one getting cancer (WCRF, 2018 (WCRF) and (IARC, 2019). Varies threat influences remain behaviors non-varied threats factors are factors that cannot be altered (Ontario, 2014). Lifestyle factors (such as tobacco use (IARC, 2019 and National Cancer Institute (NIC), 2019), alcohol use, being overweight, and obesity, poor diet, and lack of physical activity) (Ontario, 2014, NHI, 2019). The Ligibel reported that the rising incidence of tumors is attributed to essential environmental and lifestyle risk factors. Besides, about 6% of all cancer is believed to cause by genetic predisposition, 90-95% caused by unhealthy lifestyle and environmental condition (Ligibel *et al.*, 2014). An unhealthy lifestyle can be considered unbalanced diet consuming excess alcohols, tobacco smoking and lack of physical exercise (Anand et *al.*, 2013).

Age: Globally age was rated the root cause of demise following the age of seventy year glob can, 2020. According to the report published in April 2015, an average time was 66 years for diagnosis. Age is a peril aspect and most individual (NCI, 2019). Furthermore, in Africa the report confirmed that for most of the cancer types, the median age varies with the type of cancer once have (NCI, 2015). Also, cancer may occur at any age. For instance, at twenty the most frequently identified malignancy is bone cancer. Under 20 years of age, leukaemia, neuroblastoma is common in children and adolescents than in adults in east Africa countries including Kenya (NCI, 2015). The risk of prostate cancer is genetic factors, ethnic group especially among black and

family history (Price *et al*., 2017). In Thika age was a factor that may have contributed to cancer.

Obesity: Worldwide, presence heaviness or overweight (WHO, 2019) linked to elevated risk of emerging several cancers by twenty-six in grownups with BMI of about 30 (Ontario, 2014 and WCRF, 2018). Also, adults who consume vegetables and fruits less than five times per day had high chances of increasing development of tumor (Azevedo *et al.*, 2016). The high body mass index may increase one's risk of lung cancer (Forouzanfar *et al.*, 2015) and consumption of red meat (Park *et al.*, 2016). Being overweight escalates threats of one having pancreatic tumor by an estimate of 20% (WCRFA and ICR, 2018). Assorted scholars indicated that being overweight in premenopausal women may be attributed to minimal risk because of reduced hormonal levels in increased anovulation (Schoemaker *et al.*, 2018). Being overweight surges the colon and rectal cancer (Kyrgiou *et al*, 2017). In East Africa and Kenya Processed meat is carcinogenic to human beings and red meat that has not been processed (IARC, 2015, Bouvard *et al.*, 2015 and Schwingshackl *et al.*, 2018). Isoflavones are linked to increased prostate cancer, especially in Japan (Perez-Cornago *et al.*, 2018). During the study diet was noted to contribute to certain cancer type not limited to prostate cancer.

Tobacco: Globally, tobacco smoking contribute to about (25%) 2.4 million deaths and 20 different cancer types (WHO, 2020). Currently, 80% of 1 billion tobacco users are from undeveloped nations (WHO Tobacco, 2016). Tobacco cigarette smoking causes cancer and other health effects for instance pulmonary, cardiovascular disease (Unites state health and Human Services, 2014). In the United States, ciggy was main the principal source for preventable death (U.S A DHHS, 2014). Smokeless tobacco besides cigar smoking use contribute to the enlarged possibility of mouth melanoma

(Chrcanovic *et al*, 2015). Carcinogens present trendy tobacco products account for approximately one-third of cancer mortality annually reported by Anand in 2013. Besides, tobacco smokers and passive smokers developed countless malignancies, such as mouth, lungs, liver, colon, throat, stomach, and others (Anand *et al.*, 2013). Adults who smoke daily or occasionally increase the risk of developing cancer y 18.7% (Ontario, 2014). The tobacco smoke may have led to an increase in water pipe tobacco (WTS) smoking, particularly among the youth (Jawad *et al.*, 2013), which might have led to the rise of malignant among the youth (Haddad *et al.*, 2015). The nicotine concentration in both WTS and tobacco cigarettes involves the same plasma peak (St Helen *et al.*, 2014). However, because of dependence, participants of WTS will receive one point seven more carcinogens in a sole when related with the sole roll-up (Eissenbeng *et al.*, 2009) even though the longer in use may result in less nicotine delivery through WTS as compared with the cigarette (Jacob *et al.*, 2014). WTS hold spray, which is carcinogenic and toxic, leading to substantial cancer risk (Shihadeh *et al.*, 2011). A single dose of WTS may result in up to 40 litres of smoke within 30-60 minutes, but the single cigarette may result in up to 1 litre of smoke (Primack *et al.*, 2016); hence WTS produces more toxicants (Shidadeh *et al.*, 2015) and some users may need medical attention due to heavy intoxication exposure especially the carbon monoxide (Wang *et al.*, 2015). WTS is related to systemic conditions because of tobacco smoking and lung cancer (Aoun *et al.*, 2013). WTS causes vascular changes making a person limited to physical activities, which successfully may lead to cancer (Alomari *et al.*, 2015) and (Layoun *et al.*, 2014). WTS causes pulmonary abnormalities in the healthy person, leading to blood cancer (Strulovici-Barel et *al.*, 2016). It also causes cancer of the mouth (Al-Amed *et al.*, 2014). Furthermore, WTS causes short-

and long-term loss of memory (Alzoubi *et al.*, 2015), increases the inflammation of the lungs (Khabour *et al.*, 2015), cardiac syndrome (Rammah *et al*, 2013), a genotoxic effect especially leukocytes as well as the buccal cell (Al-Amrah *et al*, 2014).

The routine automated cigarette (ECIG) involves aerosolizing liquid that consists of a mixture of glycerin and glycol, especially propylene and nicotine, through electric heating (Breland *et al.*, 2016). They are over seven hundred flavours in the market today that can refill (Zhu *et al.*, 2014) with the ingredients ranging from zero to about 36mg/ml nicotine (Etter, 2016) ECIG liquids comes from the tobacco plants and regulated by United State food and drugs administration (Food and Drugs Administration, 2016). U.S. is the leading in using ECIG among its citizens (Bunnell *et al.*, 2015). The latest research indicated that youths are the majority in ECID use without knowing the long-term health impacts (Rennie *et al.*, 2016). However, some believe that it may lead to introductions of the cigarette in their adulthood (Primack *et al.*, 2015) while youth may be using EICD because of peer pressure and out of curiosity (Barrington *et al.*, 2016) but for the EICD in adults uses just because of cigarette cessation (Li *et at; 2015* and Grana *et al.*, 2014).

Some EICG holds some toxicants such as aldehydes (Tob Control, 2014) and formaldehyde (Jessen *et al.*, 2015) which may lead to lung cancer or throat cancer (Ann, 2017). Aldehydes found in EICG as flavours and furans may result in pulmonary discomfort when inhaled (Schubert et al., 2012); also, they are depressants to the central nervous system (Elsayed *et al.*, 2016). Pyrrolidine and hexanol in EICG were reported to be a health hazard to liver cancer (Wall Rubenstein *et al.*, 2015). Furthermore, phenol in cresols may result in hepatic and vascular endothelial problems (Chang *et al.*, 2014). EICG flavours have some emissions, such as diacetyl which are

carcinogenic (Farsalinos *et al*, 2015) and (Allen *et al*, 2016). Thika hospital and relationship among cigarette cancers was not significant. However there has to be other factors that may have contributed to cancer which was not limited to asbestos.

Alcohol: Globall**y** Excessive alcohol intake increases threat to liver tumor by 8.2%, excess of the recommended of alcohol intake per day per person (Ontario, 2014 and US Department, 2017). Cancer-associated with excessive alcohol consumption includes liver, throat, and mouth cancer (Bag nard V. *et al.*, 2015). Heavy alcohol use may cause liver cirrhosis, a risk factor for developing liver cancer (national Institute of Health, 2019). Lung cancer is eased by drinking alcohol (Park *et al.*, 2016). Consumption of alcohol in small quantities rate to reasonable may result in the breast cancer threats together with. Intake of the same by adult women is 54%, and between 13-18% are overdoing drinks. Preceding researchers wrote that about eight point two to about twelve point three percent of women tumors were because of menopause contributed by the history of the family (Engmann *et al*, 2017) in addition to more consumptions of alcohol (Ekwueme *et al*, 2017). In the US, the connection amid alcohol intake besides all tumors sites was low (Scheideler and Klein, 2018); in contrast that 30% of the respondents knew the relationship between breast cancer with that of alcohol drinking (Merten *et al*, 2017).

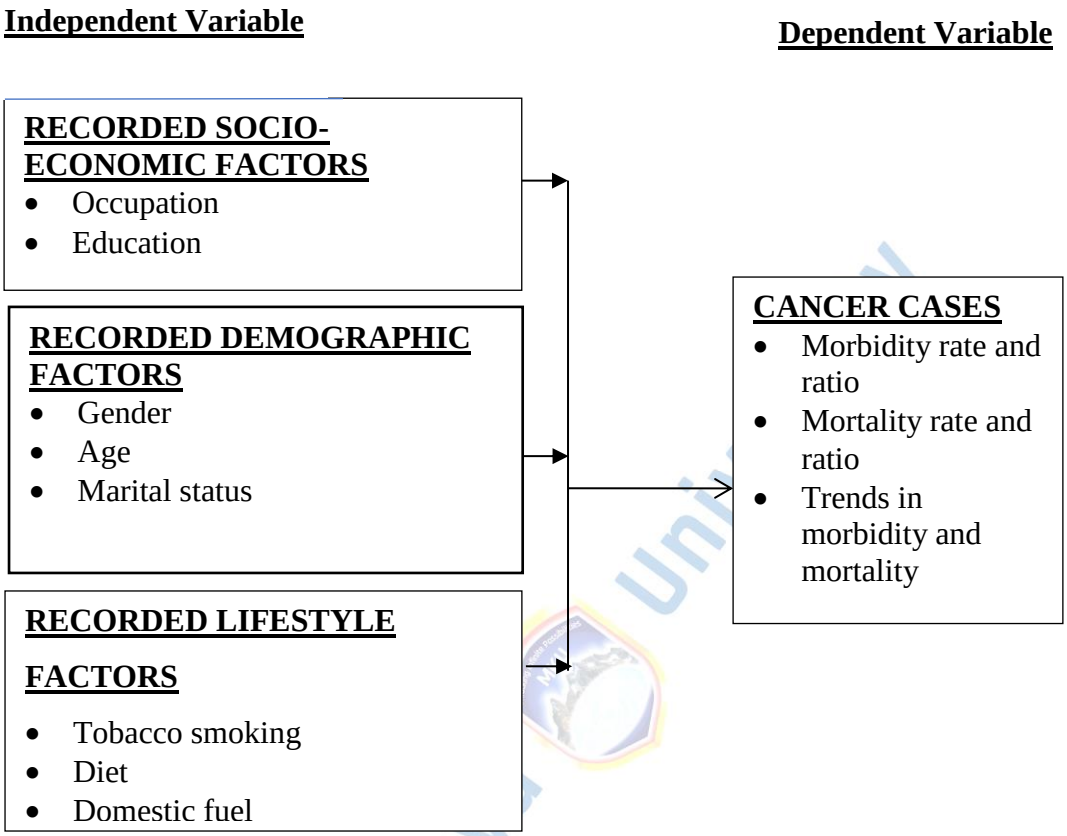
2.4 Theoretical frame work

The study embraced a healthcare-seeking behaviour (HSB) theory to explain why individual cancer patients went to health facilities to seek medication. HSB defines as having any action or inaction takes persons who distinguish themselves as having a problematic/ill and aimed for proper medication. This action is started by the issues defined as symptoms that eventually lead to treatment planning. He further revealed

that many patients who use biomedical treatment as another form of treatment had a negative consequence (Agbokey *et al.*, 2019).

As per the previous researchers, HSB had been predisposed several influences, perception of the disease by the individual, accessibility, and availability of health services. The abovementioned factors and their interactions show that HSB from the community level, family, and individual made it a complex outcome (Habtu *et al.*, 2018).

2.5 Conceptual Framework



Source: Adapted from Literature

Figure 2. 1: Conceptual framework of records used to assess cancer morbidity and mortality between the years 2013-2017 at Thika level fiveTeaching and Referral Hospital, Kiambu County Kenya, April – July 2019

CHAPTER THREE: METHODS AND MATERIALS

3.1: Introduction

The researcher systematically showed how the data collection was carried out. Twelve different subtopics were captured in this chapter, from the introduction up to the approvals.

3.2: Research Design

Researcher used a hospital-based study, where a census of all records from 2013 to 2017 were reviewed. Disease frequency was achieved by analyzing the information from both the cancer registry abstract form and questionnaire. Bivariate analysis was done to a certain the association multiple triangulation was not done since the study was majorly quantitative.

3.3 Location of the Study

This research was carried out at Thika level five Teaching and Referral Hospital Kiambu County, Kenya. Kiambu County has a population of 2,417,735 with an area of 2,449 square Kilometers (KNBS, 2019).

The county is well represented with all the hospital levels (County integrated development plan, 2013-2017).

3.4 Target Population

Researcher targets all cancer patient files at cancer management (palliative care) registry at Thika level five teaching and referral Hospital. A total of 628 cancer patients' files was retrieved. Three hundred sixty-seven were excluded because they had no laboratory reports. Those outside the defined study period were also excluded. The final study population was 261 cancer patient files collected within the study period.

3.5: Sampling procedures and techniques

A census of all cancer patient files attending Thika level five Teaching and Referral Hospital for five years (2013 to 2017) was carried out.

Inclusion criteria: This study included all files of cancer patients who had visited Thika level five Teaching and Referral Hospital in Kiambu County for the last five years (2013-2017) and had laboratory reports.

Exclusion criteria: This study excluded all cancer patients who had no laboratory report within the study period were excluded. Also those who had incomplete records were excluded.

3.6: Sample Population

The study applied the purposive technique method to find Thika level five Hospital, a public Hospital in Kiambu County. A census of all files of cancer patients attending Thika level five Teaching and Referral Hospital within five years was done. A sample of 261 cancer patients' files was sampled.

3.7: Data collection tools

Cancer patients' files were obtained from Thika level five Teaching and Referral Hospital between the years 2013 to 2017. The relevant data from the patient file were abstracted from the clinical history. The following variables were collected, demographic variables for instance age, gender, marital status, primary cancer sites, lifestyle characteristics for example, the tobacco smoking status, consumptions of alcohol status, food type, including source of domestic fuel, socio-economic risk aspects not limited to education and employment, the status about patients either alive or dead and county of origin. Follow-up telephone interviews were conducted of which, the socio-demographic variables, lifestyle risk-related factors, socio-economic risk

factors, status of the patients were collected. The data were transported and entered in Microsoft Excel, coded, cleaned, analyzed, and stored under password protection. The frequency data were presented through tables.

3.8: construction of data tools

This study instrument adopted the validated KEMRI cancer registry form. The tool was designed for a larger sister project which this study was part of it. The cancer abstract form was used to collect quantitative data, and the variables were Age, gender, marital status, primary cancer sites, and where available lifestyle on smoking, alcohol education, and occupation.

3.9: Validity and Reliability

The study utilized a standard validated tool CanReg 5, an open source used, and crisscross and evaluate cancer registry statistics. The tool is widely used, and it is reliable.

3.10: Data collection methods and procedures

The researched identifies questionnaire as a tool in collect quantitative data by abstracting data from cancer patient's files. The researcher went through each of the patient's file critically extracting crucial data about, age, gender, marital status, county, primary cancer sites, and occupation.

3.11: Data analysis techniques and procedures

Quantitative data coded, move in, prepared, and scrutinized with SPSS version 21. In describing the categorical data percentages as well as frequencies used. For inferential analysis logistic regression was used, the nominal data analyzed by grouping them according to their gender, from each, the disease frequency was determined by analyzing the information from both the cancer registry abstract form and

questionnaire. The morbidity of cancer was calculated using period prevalence rate and incidence rate. They were expressed as cases per 100 percent or 100,000 of the population observed. The period prevalence proportionate of cancer was calculated by taking the population of patients who went to the hospital during the five years over the total population who are threat and multiplied by 100 or 1000

$$P = \frac{The\ population\ of\ patient\ who\ went\ to\ the\ hospital\ during\ the\ five\ years}{The\ population\ who\ areat\ risk} X\ 10^5$$

The incidence (I) was premeditated using numerator as the figure of new cases during defined five years over all of persons unprotected to risk throughout the entire five years.

$$I = \frac{The\ incidence\ of\ new\ cases\ of\ cancer\ in\ five\ years\ period}{The\ number\ of\ exposed\ to\ risk\ of\ cancer\ for\ five\ years\ period} X\ 10^5$$

The cumulative incidence (CI) of cancer for the five years was calculated per 1000.

$$CI = \frac{The\ number\ of\ cancer\ patient\ who\ get\ the\ disease\ for\ five\ years\ period}{The\ number\ of\ free\ cancer\ patient\ at\ the\ beginning\ of\ the\ year} X\ 10^3$$

The proportion was calculated using the formula,

$$\frac{Number\ of\ persons\ with\ a\ particular\ characteristic}{Total\ number\ of\ persons\ or\ events,of\ which\ the\ numerator\ is\ \ subset} X\ 10^n$$

The chi-square checked significance in categorical data. Rate and ratio analyzed using descriptive statistics. The categorical data: gender, tobacco smoking presented using tables. After cleaning, frequencies from the Cancer registry abstract form for instance masculinity, age, marital status, cancer sites, occupations, learning, tobacco smoking, the county were analyzed. The proportions of cancer mortality and morbidity, case fatality, and proportional prevalence were calculated using the formulas mentioned above.

3.12: Ethical consideration

Mount Kenya University Ethics Review Committee approved the study. The study permit was acquired from (NACOSTI). The NACOSTI license was used to obtain approval from Thika Level five Teaching and Referral Hospital. Highly confidential patient data were kept in that any identifiable individual features were not published. Personal data was available only to the researcher and the hospital staff. Electronic patient information abstracted from hospital records was password protected while the hard copies were safely stored under key and lock office cabinets only accessible to the principal investigator.

CHAPTER FOUR RESULTS AND DISCUSSION

4.1 Objective One: Morbidity rate of cancer between the years 2013-2017

4.1.1 Social-demographical, and economic characteristics of patients

Gender: The relative distribution of cancer respondents by gender indicated 69 were female, and 31 males as shown in table 4.1.

Age combined: The study shows that those aged 65 years and above reported 44.4% morbidity of all cancer sites of and between 25-34 years old. The study also shows that between the ages of 35-44 years old had low morbidity of 0.4% of all cancer sites. The means age among patients sampled was 58.5. The illustration as shown in table 4.1.

Marital Status: From the records abstracted, 57.9% were married, 20.3% were widowed, and 11.1% were single. The unknown accounted for 6.1%, while 2.7% and 1.9% were recorded as separated and divorced, respectively, as summarized in table 4.1. **Occupation:** The occupation status of the respondents indicated that the majority were self-employed, 14.3% were unemployed, and only 4.1% were formally employed.

Table 4. 1: Relative frequency distribution of cancer cases by Social-demographical, and economic characteristics of patients reported between the year 2013 – 2017 at Thika level five Teaching and Referral Hospital in Kiambu County, Kenya, April-July 2019

Distribution of cancer by Gender	Relative Frequency
Male	31
Female	69
Distribution of cancer by Age	
1- 4 years	0
5-14 years	0
15-24 years	5.4
25-34 years	17.2
35-44 years	0.4
45-49 years	9.2
50-54 years	10.3
55-64 years	13
Over 65 years	44.4
Distribution of cancer by Marital Status	
Married	57.9
Widowed	20.3
Single	11.1
Separated	2.7
Divorce	1.9
Unknown	6.1
Distribution of cancer by Occupation Status	
Unemployed	14
Self-Employed	79.9
Employed	4

4.1.2 County of residence

Kiambu County, the host county, had the highest proportion, 42.5%, of cancer cases. Muranga County reported 39.8%, Machakos County 3.4% was the third. The Other counties represented 14.3%, respectively, as presented in table 4.2.

Table 4. 2: Distribution of patients with cancer between 2013-2017 at Thika Level five Teaching and Referral Hospital in Kiambu County, Kenya, April-July 2019

County	Number	Frequency
Kiambu	111	42.5
Muranga	104	39.8
Machakos	9	3.4
Others	37	14.3
Total	**261**	**100.0**

4.1.3: Proportion of Cancer by primary site as abstracted from Hospital records **between the Year 2013-2017**

Table 4.3 presents information on the type of cancer cases abstracted from hospital records. Cervical cancer represented the highest proportion of cancer cases, 23% recorded; Breast 15%, esophagus 14%, stomach 12%, prostate 5%, liver 5%, and pancreatic cancers 4%, were the other highest recorded types of cancers.

Table 4. 3: proportion of cancer type by primary site between the years 2013-2017

Primary sites	Number	Frequency	Mean Age
Cervix	59	23%	52
Breast	40	15%	52.5
Esophagus	37	14%	71.8
Stomach	31	12%	60.8
Prostate	13	5%	74
Liver	12	5%	49.8
pancreas	10	4%	70
Skin	6	2%	55.3
Gall Bladder	5	2%	61.5
Gastric	5	2%	64.2
Tongue	5	2%	60.8
Nose	5	2%	37.8
Rectum	4	2%	61
Throat	3	1%	63
Bone	3	1%	72.3
Lung	3	1%	52.3

Ovary	3	1%	55
Blood	2	1%	56
Colon	2	1%	63
Thyroid	2	1%	36.5
Uterus	2	1%	70.5
Vulva	2	1%	80
Jaw	1	0%	58
Mouth	1	0%	54
Oral pharyngeal	1	0%	73
Pelvic	1	0%	42
Penis	1	0%	42
Shoulder	1	0%	55
Brain	1	0%	30

4.1.4: The proportion of cancer type per 100,000 population

Table 4.4 summarizes the proportion of cancers per 100,000 population per year from 2013 through 2017. In 2013, the population at risk was ten persons representing an incidence of 6.3 per 100,000 population. In 2014 incidence proportion was 23.5 per 100,000 population per year. In 2015, the cancer incidence proportion recorded was 58.9 per 100,000 population per year. Also, in 2016 the population at risk was 53 persons, and the total population was 199937, representing 26.5 per 100,000 population per year. In 2017 an incidence proportion of 35.9 per 100 000 population per year was recorded

Table 4. 4: Primary site distribution per year from 2013 to 2017

Year	Population with cancer (N)	Total population (in and outpatient at Thika level five)	Proportionate cancer
2013	10	158878	6.3
2014	41	174385	23.5
2015	111	188488	58.9
2016	53	199937	26.5
2017	46	128099	35.9
Total	**261**	**849787**	**151.1**

4.1.5: Age-Adjusted cancer proportionate prevalence for 2013

Age-adjusted cancer proportionate for 2013 shows that the population aged 50-54 years had a high cancer proportionate prevalence of 124%, followed by those aged over 65 years reporting 93.7%, 55-64 years 72.2%, 45-49 years 63.0%, 35-44 years 62.3 %, 25-34 years 20.1%, 15-24 years 12.3%. The result is summarized in figure 4.1.

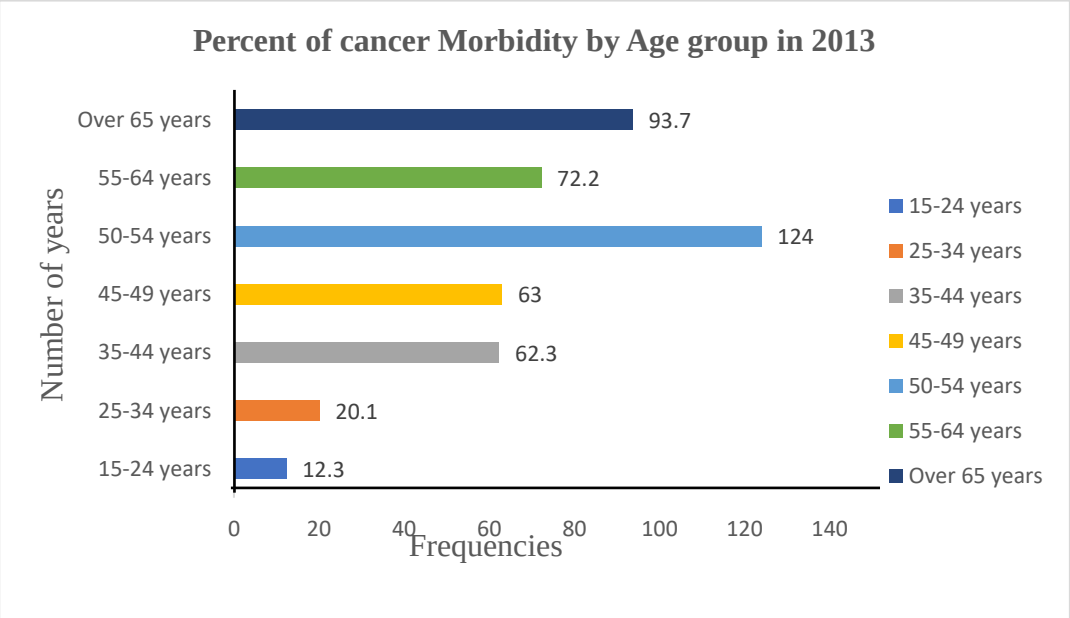


Figure 4. 1: Age-adjusted cancer morbidity for the year 2013

4.1.6: Age-Adjusted cancer proportionate prevalence for 2014

The Age-Adjusted cancer proportionate prevalence for 2014 was calculated, and the results illustrated in figure 4.6 show that those age 35-44 years had reported the highest rate at 111.2%.

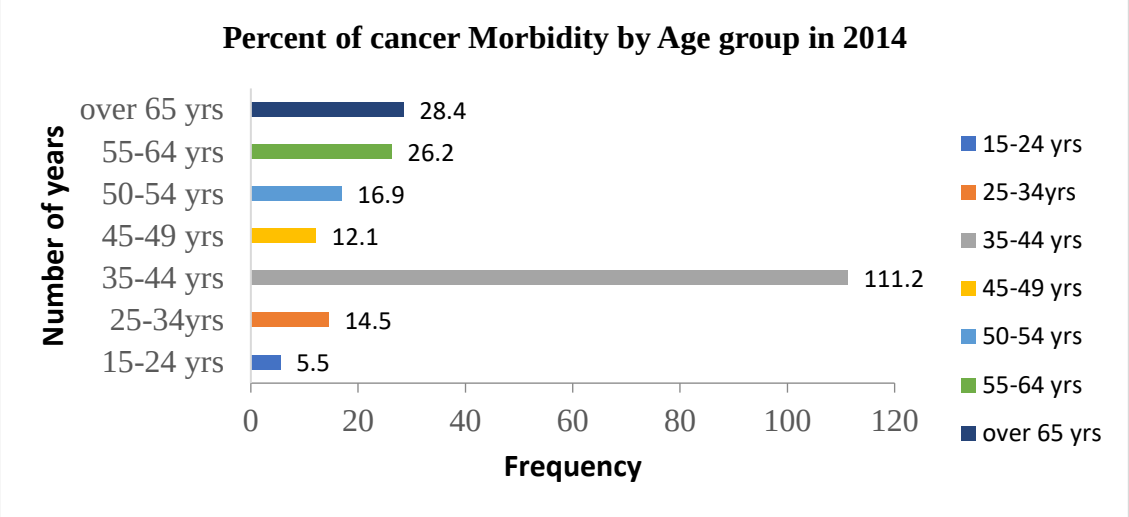


Figure 4. 2: Relative frequency distribution by age-adjusted cancer proportionate prevalence for 2014

4.1.7: Age-Adjusted cancer proportionate prevalence for 2015

The Age-Adjusted cancer proportionate prevalence for the year 2015 results showed that the age group 35-44 years had the highest prevalence 114.5 % those age 65 years and above had a proportion of 63.7% while the15-24-year-old had the lowest age-adjusted prevalence as shown in figure 4.2.

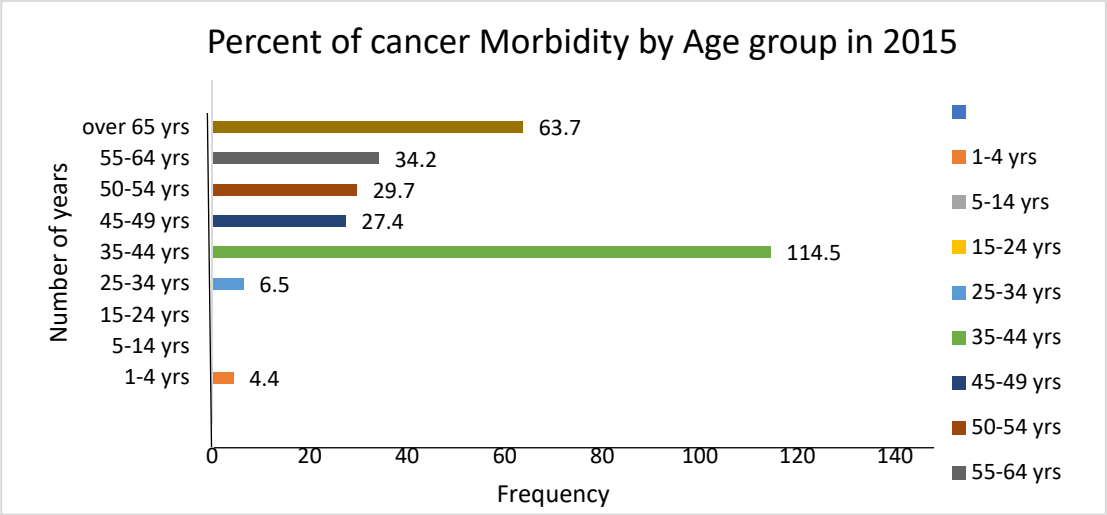


Figure 4. 3: Relative frequency distribution by age-adjusted cancer proportionate prevalence for 2015

4.1.8: Age-Adjusted cancer proportionate prevalence for 2016

For the year 2016, results in Figure 8 show that the over 65-year-olds reported the highest prevalence 411.4% followed by 35-44 years 109.7% had the lowest

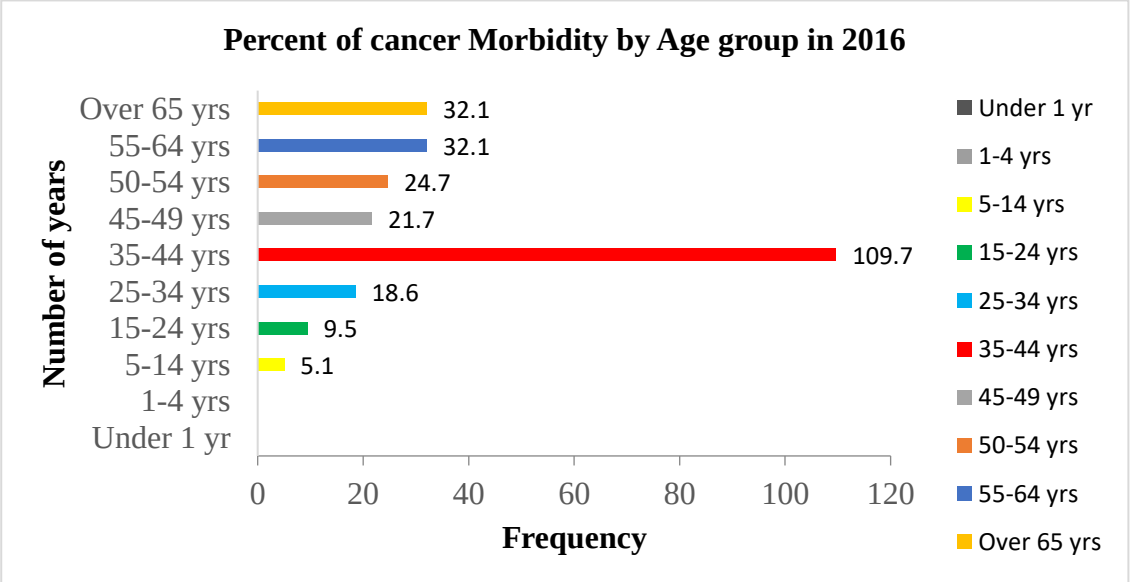


Figure 4. 4: Relative frequency distribution by age-adjusted cancer proportionate prevalence for 2016.

4.1.9: Age-Adjusted cancer proportionate prevalence for 2017

The age-adjusted cancer proportionate prevalence for the year 2017 results showed that 55-64 years 44.6% had the highest followed by over 65 years 34.5%, 45-49 years 31.8%, 50-54 years 25.1% 25-34 years 12.6%, 35-44 years 2.5%, 15-24 years 1.7% as shown in figure 4.4.

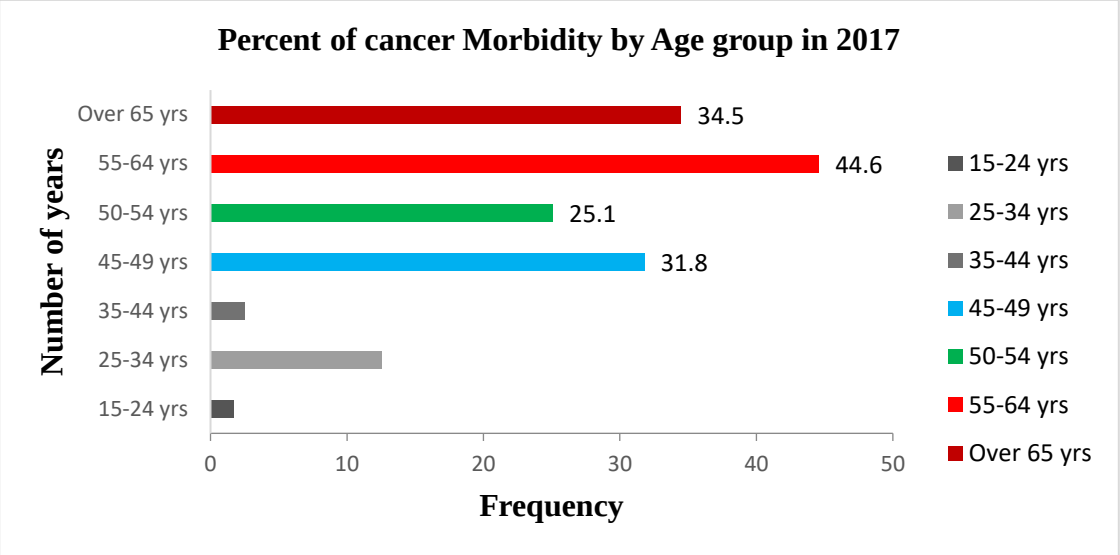


Figure 4. 5: Relative frequency distribution by age-adjusted cancer proportionate prevalence for 2017

Incidence: The incidence rate (density) measured in a population of 849787 age combined free cancer. A total of 261 cancer cases were recorded in five years, as shown in table 4.5. General newly occurrence rate calculated was 73.9 for every 100000persons per year.

4.1.10: Cumulative incidence

The cumulative cancer incidences for the five years were calculated per 1000; from 261 cancer cases, the total population of 849787, and ages combined, the cumulative incidence for cancer was 0.31 per 1000 (table 4.5)

Table 4. 5: Cumulative Incidence and Incidence Rate of cancer for five years

Years	Number of Cancer Patients	Total population	Cumulative Incidence per 1000
2013	10	158878	0.06
2014	41	174385	0.24
2015	111	188488	0.56
2016	53	199937	0.27
2017	46	128099	0.6
Total	261	849787	0.31
Incidence Rate			Rate per 10^5 per year
2013	37	158878	23
2014	78	174385	45
2015	139	188488	74
2016	132	199937	66
2017	77	128099	60
Total	261	1157142	54

Follow-up Socio-demographics survey based on Hospital records

4.2: Objective two: Mortality rate of cancer between the years 2013-2017

4.2.1: Mortality status by Socio-demographic characteristics

In the study, the cancer mortality for all cancer cases was 22% in 2017. The morbidity rate was 78% for all cancer cases. The death rate by gender shows that females had the highest with 72.7% (16) than males 27.3% (6) respectively. The mortality rate by marital status shows that the married had the highest rate of cancer deaths, 45.5%. The singles and the widowed accounted for 36.4% and 18.2%, respectively; regarding occupation, the highest mortality cases, 68.2%, were reported highest among the self-employed. Concerning the Education level, 50% had a college level of education, 27.3% had a secondary level of education, and only 22.7% had a primary level of education.

Table 4. 6: Mortality of patients with cancer for the year 2017 in Thika Level Five Teaching and Referral Hospital

	Gender		
status	**male**	**female**	**Total**
Alive	22(29%)	54(71%)	76(78%
Dead	6(27.3%)	16(72.7%)	22(22%)
Total	28(28.6%)	70(71.4%)	98
	Marital status		
status	**single**	**married**	**widowed**
Alive	6(7.9%)	66(86.8%)	4(5.3%)
Dead	8(36.4%)	10(45.5%)	4(18.2%)
Total	14(14.3%)	76(77.6%)	8(8.2%)
	Occupation		
status	**Unemployed**	**Self-Employed**	**Employed**
Alive	8(10.5%)	65(85.5%)	3(4%)
Dead	6(27.3%)	15(68.2%)	1(4.6%)
Total	14(14.3%)	80(81.6%)	4(4.1%)
status	**Primary**	**Secondary**	**College**
Alive	13(17.1%)	42(55.3%)	21(27.6)
Dead	5(22.7%)	6(27.3%)	11(50%)
Total	18(18.4%)	48(50%)	32.6

4.2.2: Age-specific death rates

The age-specific death rates show that those aged 45-49 years old had the highest death rate of 36.4%, the over 65 years had the second-highest rate of 27.3%, while those aged 15-24 years recorded the least death rate of 9.1% (table 4.6).

Table 4.6 Age-specific death rate

Age-specific death rate	Number	Frequency
15-24 years	2	9.1
25-34 years	3	13.6
45-49 years	8	36.4
55-64 years	3	13.6
Over 65 years	6	27.3

4.2.3: Mortality rate

Table 4.7 shows that of the total population of patients diagnosed with cancer, 261, and the number of deaths diagnosed with cancer was 22 in 2017; the mortality rate in 2017 was 8.4 deaths per 1000 population.

Table 4. 7: Case fatality rate of the cancer patient in the year 2017

Case fatality rate	Number	Mortality rate (%)
The number of cancer cases	261	8.4
The number of deaths from cancer cases	22	

4.3 Objective three: Association between cancer mortality and morbidity rate and socio-economic factors between the years 2013-2017

Chi-square test of independence was used to illustrate the associations of cancer mortality and morbidity rates and the socio-economic factors of respondents. Results show that the socioeconomic statuses were not statistically significant; education level (*df =2*) *p= 0.060*), Occupation (*df =2, p=0.136)* table 4.8. Logistic regression analysis also showed no statistical association between cancer morbidity, mortality, and socioeconomic factors (table 4.9).

Table 4. 8: Test of association: Cancer mortality and morbidity and socio-economic status

Education level					
Status	**Collage/University**	**Primary**	**Secondary**	***df***	***p- value***
Alive	21 (27.6%)	13 (17.1%)	42 (55.3%)	2	*0.060*
Dead	11 (50.0%)	5 (22.7%)	6 (27.3%)		
Total	32 (32.7%)	18 (18.4%)	48 (49.0%)		
		Occupation			
status	**Self-Employed**	**Employed**	**Unemployed**	***df***	***p-value***
Alive	65 (85.5%)	3 (3.9%)	8 (10.5%)		
Dead	15 (68.2%)	1 (4.5%)	6 (27.3%)	2	*0.136*
Total	80 (81.6%)	4 (4.1%)	14 (14.3%)		

Table 4. 9: Logistic Regression analysis

Status	**.**		**[95% Conf**	**Interval**
Education level	**Coef**	**p-value**	**Lower**	**Upper**
Primary	**Ref**			
Secondary	0.317	*0.115*	0.076	1.323
Collage/university	1.191	*0.804*	0.299	4.755
Occupation				
Unemployed	**Ref**			
Self employed	0.253	*0.061*	0.06	1.064
Employed	0.211	*0.265*	0.014	3.255

4.4: Lifestyle risk factors associated with cancer between the years 2013-2017

The study analyzed the lifestyle risk factors associated with cancer between 2013-2017 as follows. Tables 4.8 and 4.9 show no statistical association between respondent Smoking status, spouse smoking status *(p=0.795),* type of food (*p= 0.279),* domestic household fuel *(p= 0.684),* and socioeconomic status *(p=0.924*)

Table 4. 10: bivariate Analysis of lifestyle risk factors and associated cancer morbidity and mortality.

	Cancer morbidity and mortality		
Smoking status	**Alive**	**Dead**	**Pearson Chi-Square**
Never smoke	22 (28.9%)	7 (31.8%)	
Smoking	54 (71.1%)	15 (68.2%)	
Total	76(100.0%)	22 (100.0%)	*p=0.795*
Smoking status of the spouse			
Never	34 (44.7%)	7 (31.8%)	
Smoking	42 (55.3%)	15 (68.2%)	*p= 0.279*
Total	76 (100.0%)	22 (100.0%)	
Type of food			
Balance diet	68 (89.5%)	19 (86.4%)	
Unbalanced Diet	8 (10.5%)	3 (13.6%)	*p= 0.684*
Total	76 (100.0%)	22 (100.0%)	
House-Hold Domestic fuel			
Clean energy	25 (32.9%)	7 (31.8%)	
Unclean energy	51 (67.1%)	15 (68.2%)	*p=0.924*
Total	76 (100.0%)	22 (100.0%)	

Table 4. 11: Logistic Regression analysis

Lifestyle risk factor variables	**Coef.**	***p-value***	**[95% Conf**	**Interval**
Smoking status of the respondent				
Nonsmoker	**Ref**			
Smoker	0.8	*0.701*	0.255	2.504
Smoking status of the spouse				
Nonsmoker	**Ref**			
Smoker	1.603	*0.398*	0.537	4.782
Type of food				
Unbalanced diet	**Ref**			
Balance diet	1.493	*0.651*	0.264	8.457
Household domestic fuel				
Clean energy	**Ref**			
Unclean energy	0.704	*0.562*	0.215	2.305
Constant	0.926	*0.948*	0.092	9.288

CHAPTER FIVE: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1: Morbidity rate of cancer between the years 2013-2017

The study sought to assess the cancer morbidity and mortality in Thika level five Teaching and Referral Hospital for five years (2013-2017) by examining demographic factors and social-economic factors of morbidity and mortality. Women had a high cancer incidence rate of 68.6%, compared to males, 31.4%. The study findings were five-fold and two folds higher than that of Kenya National Statistics, in which it is estimated to be 12.3% for males and 13.0% for females (GLOBOCAN, 2020). Also, when compared to results in East Africa, the outcome was high in both males (10.3%) and females (43.8%). Overall, in Africa, the trend was lower by 8.2% and 26.7% in males and females, respectively, compared to this study's findings.

Further, this proportion perceived research being greater than those stated in Asia and Europe among males, in Asia by 18.5% (GLOBOCAN, 2020). Compared to the global statistics, wherein the reported cancer incidence in males was 52.2 % and female 47.8%, this study's findings on cancer incidence were lower by 20.8% among males and females. (GLOBOCAN, 2020). The small sample size and use of one health institution as a sentinel site could be the apparent difference in the statistics.

Data in this study illustrates that those over 65 years (44%) and those aged 25-34 years (17.2%) recorded the highest morbidity of all cancer. (Lee *et al.*, 2016) deposes that cancer survivorship among youths has been understudied. Cancer incidences among youths observed being advanced by 21.5% as those described in East Africa and 1.1% lower in North Africa (GLOBOCAN, 2020). Also, this study findings compared differently to those of Europe and Africa, which reported a lower incidence of cancer

sites among those aged over 65 years. Moreover, the study findings were like that of the USA (United States of America) and, Asia who had a high incidence of 89% and 49.2%; however, they were higher by 44.6%.and, 4.8% respectively than that of the study findings (WHO, 2020).

Married respondent 151 (57.9%) were the majority, windowed 53 (20.3%) second, single 29 (11. %) third, unknown 16 (6.1%) fourth, separated 7 (2.7%) fifth and the sixth being divorce 5 (1.9%) respectively., When we compared our findings with those of other studies, it revealed that marital status plays a crucial role in forecast various carcinoma (lung, stomach (Shi *et al.,* 2016), colorectal (Wang *et al.*, 2011), and prostate where cancer patients show much improvement in Married cancer patients showed high survival compared with single, divorced, and separated (Adekolujo *et al,* 2017 and Hinyard *et al,* 2017). It has been distinguished those single, divorced, and separated patients tend to be unenthusiastic in seeking health services (Tatangelo *et al.,* 2017). The survival of single cancer patients had been substantiated to have a considerable significance of various cancer types (Martinez *et al.,* 2016 and Costa *et al.,* 2016). Being a single patient may contribute to high mortality risk, especially with gastrointestinal Moreover, when single malignancy patients compared with married cancer patients showed that at first diagnosis tend to progress towards a worse stage and even nonadherence to the medication has turned up (Murota *et al.*, 2015). Furthermore, single cancer patients, separated cancer patients, windowed cancer patients, and divorce cancer patients are more likely to have a mental problem than married cancer patients (Scott *et al.*, 2010). Single cancer patients are at risk of cardiovascular diseases (Wong e*t al.*, 2018). Preceding research has shown that early diagnosis and preliminary treatment of married cancer patients tend to be effective

compared with single, separated, and divorced cancer patients (Aizer *et al.*, 2013). As from various researchers' studies, the findings can explain why married cancer patients the majority had, 57.9% (151), compared with joint results for widowed, single separated, and divorced cancers patients 36% (97). Married cancer patients were proactive in seeking health care services compared with a later group, as from the study results. More so, married cancer patients might be receiving moral support from their partners, unlike their counterparts which receive little or none. The marital status of the respondents plays a pivoted role in non-communicable diseases, especially cancer. The married couple received much moral support as associated with others including widowed.

Most malignancy patients reported were unknown 57.1% followed by farmers 18.0%, self-employed 12.3%, housewife 5.7%, employed 5.4%, civil servant 1.1%, and student 0.4%. In Kenya, occupation contributes about 9% of lung cancer and 2% of leukemia because of poor working conditions, which contribute about 50 to 100% of employees exposed to hazards that surpass the minimum contact limits (Kipkirui Rotich, 2020). The findings were compared with that of other researched from western environs, where frequent scholar done in ascertained syndicate socioeconomic status as well as the incidence of malignance as well as mortality because of occupation (Kroenke *et al.*, 2019, Jung-Choi *et al.*, 2011, Kim *et al.*, 2015 and Lee *et al.*, *2016*). A case-control study in Japan showed a significant relationship between the socioeconomic status of higher and lower to have high chances of developing lung, breast as well as stomach cancer, and Occupational exposure to various hazards, especially carcinogens had been estimated to contribute about five to ten percent of lung cancer (Alberg *et al.*, 2013

The IARC classified human carcinogens group I (IARC, 2019) that causes lung cancer through various occupation exposure (Field *et al.*, 2012).

Furthermore, occupational cancer has shown a substantial number of deaths in Europe (Takala *et al.*, 2014); in other nations, the population attribute faction of about 3-10% depending on their exposures (Rushton, 2017 and Purdue e*t al.*, 2015). Population attribute fraction explains the probability component causing the cancer cases with or without exposure (McClure *et al.*, 2019 and Rosen, 2013); notwithstanding, various countries lack the conclusive evidence to affirm that indeed there is a link between occupational cancer (Kieffer, 2018 and Labreche *et al.*, 2014). Moreover, an estimated $10 million was used to manage occupational cancer in European nations in 2015 (Vencovsky *et al.*, 2017). An estimated 86% in Great Britain are associated with occupational cancer (Hutchings *et al.*, 2012). A report from various researchers proclaims that working in different fields poses different likelihood elements to occupational cancer since positive syndicate with environmental exposures (IARC, 2019).

The research finding was different from other researchers due to the one facility sampled, and the information abstracted from the cancer patient file was limited as opposed to other researchers. Also, most cancer patients' file had not shared their employment status. This might be because of the missing cancer registry unit to capture all the identifiable variables.

Study findings indicate that cervical and breast were among the first top cancer cases in women. Study findings were consistent to study done in Meru and Machakos County (Kipkirui Rotich, 2020). Further, the study findings were consistent with those from KNH and MTRH (Macharia *et al.*, 2019). The study findings indicate that women's

cancer incidence cases were 69% higher than in Kenya, which stands at 54% (GLOBOCAN, 2018). The study findings were consistent to that of the Globocan report of 2018, where breast cancer (12.5%) and cervical cancer (11.1%) were leading cancer in women. The study findings indicate that prostate cancer being in top in men, esophagus tailed. This study was consistent with that of Kenya, where male cancer incidence cases stand at (45.9%) The findings are comparable with that of other researchers where prostate cancer is the leading among men (Bray *et al.*, 2018). There were also similarities between cancer sites reported in Thika level five and other health facilities in Kenya. The differences were noted in the top five cancers reported in Meru (Kobia *et al.*, 2020) and (Kipkirui Rotich, 2020). Also, the study findings were consistent with that of the Globocan report of 2018 where prostate cancer was the leading cancer in males (Globocan, 2018) and global statistics (Ruto *et al.*, 2020).

The study findings were consistent with that of other researchers. Although there was a substantial observed difference in sample sizes and the duration of the study, the outcome of the findings still depicts an accurate picture of the trend of cancers in both males and females. Even though esophageal cancer is reported to be in eight position worldwide, about 80% esophageal deaths are reported in Kenya and other developing countries (Kipkirui Rotich, 2020). The study findings are consistent with that of other researchers in Kenya, where esophageal cancer cases had been raised (K *et al.,* 2013), the factor being the age at the onset where about 70% of cases are being diagnosed at an advanced stage (Cheng *et al.*, 2015). A study finding was consistent with the USA study, which indicates that about zero point two esophageal age projected at 30 years (SEER, 2020). In contrast, a study done in China indicates a high incidence case of

esophageal cancer; however, those under 30 years are estimated to be one percent (Zhang *et al.*, 2012).

Proportionate of cancer: Study findings show an increase in proportionate of cancer trend from 2013 to 2015 then decreased in the last two years. The study was consistent with the study done in the US, where a high proportion of the population had cancer of different primary sites such as breast, colorectal prostate, among others (Siegel *et al.*, 2020); cancer proportions has been increasing to about (14.05%) in women in urban as compared with (40.1%) in rural areas (Sliwczynski *et al.*, 2019). The study findings are consistent with the study done where cancer morbidity has risen (Fitzmaurice et al, 2018) and the same sediments were captured (Ruto *et al.*, 2020). A study done in Kenya by the urban private hospital was consistent with the study findings (Maranga, 2013). Further, our study's prevalence of cancer was consistent with other counties in Kenya, particularly Machakos County, where the number of cases per sub-county recorded was high (Kipkirui Rotich, 2020). In 2020, Globocan reported that the prevalence of cancer globally stands at 19.1 million (Globocan, 2020). Age-adjusted proportionate prevalence indicated that between the ages of 55-64 years had a high-risk factor of developing cancer. As the age increase, one has a higher chance of developing cancer (White *et al.*, 2014) as in the case of cervical cancer (Muitta *et al.,* 2019). Other researchers had a contrary opinion of the study where about 9.7% of women were diagnosed at 45 years with breast cancer (CDC, 2018), while others believed 66 years was the median age (NIH, 2020). Cancer among children has been ascending by 2.4% per year from 1999-2011 (Ju *et al.*, 2018), which the study also concurs.

Our study was not far and wide from that of the renowned researcher. Even though the age difference was noticed, more research needed to be done to find other factors that might be coursing the disparities patterns of malignancy.

Result per county designated Kiambu County had most of the cancer patients. This could have been contributed by the presence of Mount Kenya University, where lecturers participated by providing health services at the hospital. Also, Thika Sub-County's cosmopolitan nature may have contributed a lot where people seek health services at the hospital. Moreover, Murang'a County was the second to have cancer patients because of its strategic position of being a neighborhood where most residents may have sought better services from Thika Level five Hospital. Further, workers and students might have indicated their county when seeking health services; this may have contributed to the extensive list of counties mentioned. Also, we had an unknown; they were responded to indicate their County of origin when they were seeking health services. Those which were recoded as others were Nyeri, Kirinyaga, Meru, Nairobi, and Kitui County, respectively

5.2 Mortality rate of cancer between the years 2013-2017

By 2030, an estimated 70% being 65 years and above will develop cancer globally (White *et al.*, 2013). Other studies indicated that 66 years is the median age for cancer diagnosis (CDC, 2018). Age between 45-49 years had the highest death rate. The study done in Meru indicated that the mean age for both sexes was 58 years, and for men, 61 years, and women, 56 years (Kobia *et al.*, 2020) was in contrast from that of the study. Also, possibility of mortality rate was about (12%) according to the Ministry of health 2018 report. In women, cervical and breast cancer are the most common cancer types with higher burden (Kipkirui Rotich, 2020), which is consistent with the study findings.

Furthermore, the study findings are consistent with KNH and MTRH (Macharia *et al.*, 2019).

In Africa, the mortality rate for females (9.0%) while males (5.9%) (Bray *et al.*, 2018) is consistent with the study findings. Most of the cancer death occurred among married who practice farming. The study findings are consistent with other researchers where socioeconomic contribute to a high mortality rate among married (Alotaibi *et al.*, 2018). In addition, a study done in Iran was consistent with the study findings where death in women was greater from those of men (Shadmani *et al.*, 2020).

In contrast, a study done in Australia shows high mortality in the top five cancers (Bech *et al.*, 2020). Also, another study done in Brazil estimated that mortality of all cancers stands at 16.4% (Bigoni *et al.*, 2019), in Asia estimated to be 57.3% (Bray *et al.*, 2018).

Globally, the cancer mortality rate stands at 9.6 million, and the chances of developing cancer in both genders are one in four females and one in three males (Fitzmaurice *et al.*, 2018). As per the findings, females had the highest mortality rate of (72.7%) as compared with males (27.3%); this was inconsistent with other studies where the mortality rate is higher than that of males (Arik *et al.*, 2020). In males, lung cancer was on top followed with prostate (Bray *et al.*, 2018), which contrasts the study findings. Further, a report from Globocan, 2020 shows that esophageal cancer was the leading (Globocan, 2020) which is consistent with the study findings. In contrast, the mortality among males is higher than that of females (Siegel *et al.*, 2020) as opposed to that of study findings. In addition, the study findings are consistent with the report from WHO, 2018 which shows that cervical cancer had a mortality rate of (7.5%) about (88%) of

the deaths occurred in low-income countries 1.3% die before 75 years out of 1.8% of women diagnosed with cervical cancer (Arbyn *et al.*, 2018).

The study findings contrasted with that of other researchers because data was abstracted from one health institution. Also, the institution had no Cancer Registry where all cancer patients' details were captured, and as such, there was no available mortality data for previous years, which might have contributed to the low mortality rate observed in this study. In the future, Cancer Registry should be made available so that vital data may be captured, and actual mortality rate will be captured

5.3: Association between cancer mortality and morbidity rate and socioeconomic factors between the years 2013-2017

A study finding was compared with the study done by various researchers that involved adults shown an association between colorectal cancer mortality and incidence cases (Warren *et al.,* 2019) was in contrast with the study since p-value 0.804, 95% CI for education level and occupation p-0.211, CI 95%. Also, another study indicates the association between the socio-economic factors' cancer mortality and survival (Luque-Fernandez *et al.,* 2020). A similar study in Italy among women with breast cancer showed a connotation amongst socio-economic factors morbidity and transience breast cancer, which resulted in a decrease in cancer among women (Rossi *et al.,* 2020). Further, Europe indicated a relationship among mortality and morbidity of various cancer and socio-economic factors (Mackenbach *et al.,* 2019). Moreover, the study findings were consistent with the study done in Sweden, which shows that there is an association between socioeconomic factors and mortality (Kitikireddi *et al.*, 2020)

The study findings were consistent with those of other researchers done retrospectively for the last five years. Even though the study findings had small (n), a significant

association was noted, unlike the other findings. In the future large sample and from more than one health institution will bring about much significance to the study.

5.4 lifestyle risk factors associated with cancer between the years 2013- 2017.

Logistic regression showed no statistical association between respondents' smoking status (*p=0.701*) and cancer morbidity and mortality. Globally an estimated high use of tobacco (WHO Tobacco, 2016). The study findings were consistent with other researcher's where tobacco smoking contributes to various cancer (Haddad *et al.*, 2015). Also, the study findings are consistent with other researchers where daily smokers amplified threat in developing tumor almost 19% (Ontario, 2014), increased the threat to mouth tumor (Chrcanovic *et al, 2015*), and may lead to blood cancer (Strulovici-Barel *et al.,* 2016). Throat and mouth cancer (Ann, 2017) increase of malignant among the youth as well as cancer of the cavity (Haddad *et all.,* 2015 and Al-Amed *et al.*, 2014) diacetyl which are carcinogenic (Allen *et al.*, 2016).and water pipe tobacco smoking causes vascular changes making a person limited to physical activities which successfully may lead to cancer (Alomari *et al.*, 2015).

The study findings indicated that most cancer patients took a balanced diet though it was not statistically associated (Islamic *et al.*, 2018). The study findings were consistent with other researchers that consuming red meat, either processed or unprocessed red meat, increases the risk of various cancer, including lung cancer (Park *et al.*, 2016 and Bouvard *et al.*, 2015). Also, being overweight is associated with colorectal cancer (Kyrgiou *et al.*, 2017 and WHO, 2019). Further, consuming vegetables and fruits not more than five times a day is a risk for developing cancer (Azevedo *et al.*, 2016. Moreover, being overweight (Kyrgiou *et al.*, 2017). In developing counties, an estimated 60% of cancer types are associated with a lack of

macronutrients (Key *et al.*, n.d). Further logistic regression showed that domestic household sources fuel had no significant relationship with cancer during the study period. The study findings also indicated no relationship between lifestyle risk factors and cancer; perhaps more data and other variables are needed to achieve better data and advanced analytical tools for better results.

5.5: Conclusion

Females reported high morbidity and mortality rates of cancer cases as compared with a male. Those cancer patients who had fifty years and above might be having a higher risk of developing cancer at one point in time than those cancer patients below the age of fifty years. Married cancer patients had the highest frequency as compared to divorced cancer patients. As per the study findings, self-employed develop advanced threat in developing tumor as associated to employed. Cervical cancer was recorded as the primary cancer type in women and prostate cancer in men, and the minor cancer was cancer of the tongue.

The proportionate of cancer for the five years was 73.9 per 100,000 population. The year 2015 had the highest proportionate of cancer, and 2013 had the lowest as per the study findings. The number may be because of cancer patients getting more information and better health services at the facility. Newly tumor frequency in five year was 54 per 100,000 population, and the cumulative incidence was 0.03 per 1000 population. The results indicated that in every ten persons, three had cancer. The mortality rate in 2017 for all cancer cases was 8.4 per 100 populations. The trend may be higher or lower in the other periods. Age-specific Mortality frequency were higher in 45-49 years and lower in 15- 24 years.

5.6: Recommendation

5.6.1: Recommendations for implementation

1. The County Government of Kiambu needs Thika level five hospitals to have an electronic cancer registry to document cancer cases.
2. There is a need to emphasize provider-initiated cervical and prostate cancer screening during triage at the health facility as this may facilitate documentation of unseen cases

5.6.2: Recommendation for Further study

Implementation research needs to be conducted in other facilities in the county to determine the true prevalence and incidence of cancer cases.

REFERENCE

Aizer, Chen MH, McCarthy EP, Mend ML, Koo S, Wilhite TJ, Graham PL, Choueiri TK, Hoffman KE, Martin NE (Nuclear Energy), et al. Marital status, and survival in patients with cancer. J Clin Oncol. 2013; 31:3869–3876. Doi: 10.1200/JCO.2013.49.6489. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

Alam, S. (2012). The Effect of Substrate, Season and Agroecological Zone on Mycoflora and Aflatoxin Contamination of Poultry Figure 4.3.3.4 1Feed from Khyber Pakhtunkhwa, Pakistan, Mycopathologia. 174:341–349

Alomari MA, Khabour OF, Alzoubi KH, Shqair DM, Stoner L. Acute vascular effects of waterpipe smoking: Importance of physical activity and fitness status. Atherosclerosis. 2015; 240:472–476. [PubMed] [Google Scholar]

American Society of Clinical Oncology. Mesothelioma: Risk Factors. 07/2017. Accessed at www.cancer.net/cancer-types/mesothelioma/risk-factors on October 17, 2018.

Anand P. 2013. Cancer [PMC free article] [PubMed] [Cross Ref]

Andreotti, G. 2018. Glyphosate Use and Cancer Incidence in the Agricultural Health Study. JNCI, 110(5):509-516. Epub 2017 Nov 9.

Aoun J, Saleh N, Waked M, Salame J, Salameh P. Lung cancer correlates in Lebanese adults: a pilot case-control study. J Epidemiol Glob Health. 2013; 3:235–244. [PubMed] [Google Scholar]

Bag nard V., Rota M., Botteri E., Tramacere I., Islamic F., Fedirko V., Scotti L., Jenab M., Turati F., Pasquali E., et al 2015. Alcohol consumption and site-specific cancer risk: A comprehensive dose-response meta-analysis. Br. J. Cancer. 112:580–593. Doi: 10.1038/bjc.2014.579. [PMC free article] [PubMed] [Cross Ref]

Bahadar, H.; Mostafalou, S.; Abdollahi, M. 2014. Current understandings and perspectives on non-cancer health effects of benzene: A global concern. Toxicology. Appl. Pharmacology. 276, 83–94. [Crossruff] [PubMed]

Barriers to Cervical Cancer Screening in Rural Kenya: Perspectives from a Provider Survey | SpringerLink. (n.d.). Retrieved July 16, 2020, from https://link.springer.com/article/10.1007/s10900-015-9996-1

Barrington-Trimis JL, Urman R, Berhane K, Unger JB, Cruz TB, Pentz MA, Samet JM, Leventhal AM, McConnell R. E-Cigarettes, and Future Cigarette Use. Pediatrics. 2016:138. [PMC free article] [PubMed] [Google Scholar]

Bornstein J, Rah at MA, Abramovich H: Etiology of cervical cancer: Current concepts. Obstetrics Gynecology Surv 50:146-154, 2018.

Bouvard V., Loomis D., Guyton K.Z., Grosse Y., Ghissassi Fossil Energy, Benbrahim-Tallaa L., Guha N., Mattock H., Streiff K. 2015. International Agency for Research on Cancer Monograph Working Group Carcinogenicity of consumption of red and processed meat. Lancet Oncol. 16:1599–1600. Doi: 10.1016/S1470-2045(15)00444-1. [PubMed] [Cross Ref]

Bray F, Parkin DM. Evaluation of data quality in the cancer registry: principles and methods. Part I: comparability, validity, and timelines. Eur J Cancer 2009; 45:747–55.

Bray, F., Ferlay, J., Soerjomataram, I., Siegel, R. L., Torre, L. A., & Jemal, A. (2018). Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA*: A Cancer Journal for Clinicians, 68(6), 394–424. https://doi.org/10.3322/caac.21492

Breland A, Soule E, Lopez A, Ramos C, El-Hellani A, and Eissenberg T. Electronic cigarettes: what are they and what do they do? Ann N Y Accad Sci. 2016 [PMC free article] [PubMed]

Cancer Trends Progress Report: Sun Protection, 2017

Cheng, M., Zhang, L., Brook, M., Chokunonga, E., Dzamamala, C., Korir, A., Wabinga, H. R., Hiatt, R. A., Parkin, D. M., & Loon, K. Van. (2015). The incidence of esophageal cancer in Eastern Africa: Identification of a new geographic hot spot?

Chen J., Yin J.Y., Li X.P. Clin. Lung Cancer. 2014. Submitted for publication. [Ref list]

Cheng T. Chemical evaluation of electronic cigarettes. Tob Control. 2014

Cohn BA, Merrill ML, Krigbaum NY, Yeh G, Park J-S, Zimmermann L, et al. 2015. DDT Exposure in Utero and Breast Cancer. The Journal of Clinical Endocrinology & Metabolism. 2015; 100(8):2865–72. Doi: 10.1210/JC.2015-1841. [PMC free article] [PubMed]

Contributing Factors for Acute Illness/Injury from Childhood Pesticide Exposure in North Carolina, USA, 2007-2013. Barros N, Langley R, Buhler W, Brantham K Toxics. 2016 Feb 2; 4(1). [PubMed] [Ref list]

Cosetti-Olivera, M. L., da Cunha, A. R., Prass, T. S., Martins, M. A. T., Hugo, F. N., & Martins, M. D. (2020). Mortality due to oral and oropharyngeal cancer in Uruguay from 1997 to 2014. Journal of Applied Oral Science, 28. https://doi.org/10.1590/1678-7757-2019-0166

County integrated development plan (cidp) 2013-2017

Darby S, Hill D, Doll R. Radon: a chemical at all exposures. Annals of Oncology 2001; 12(10):1341–1351. [PubMed Abstract]

Defining Cancer" *National Cancer Institute. Retrieved 28 March 2018.*

Defossez G., Le Guyader-Peyrou S., Uhry Z., Grosclaude P., Colonna M., Dan tony E., Delafosse P., Molinié F., Woronoff A.-S., Bouvier A.-M., et al. Estimations Nationales de L'incidence et de la Mort alite par Cancer France Metropolitan Entre 1990 et 2018. Synthèse. Saint-Maurice: Santé Publique France. [(Accessed on 1 October 2019)]; 2019 Availabl online: http://www.santepubliquefrance.fr/https://geodes.santepubliquefrance.fr/#c=homehttp://lesdonnees.e-cancer.fr/https://www.e-cancer.fr/

Di Sebastiano KM, Mourtzakis M. 2014. The role of dietary fat throughout the prostate cancer trajectory. Nutrients. 6(12):6095–6109. Doi: 10.3390/nu6126095. [PMC free article] [PubMed] [Cross Ref] Doris Duke Charitable Foundation, 2019

Eissenberg T, Shihadeh A. Waterpipe tobacco and cigarette smoking: direct comparison of toxicant exposure. Am J Prev Med. 2009; 37:518–523 [PMC free article] [PubMed] [Google Scholar]

Ekwueme D.U., Allaire B.T., Parish W.J. Estimation of breast cancer incident cases and medical care costs attributable to alcohol consumption among insured women aged <45 years in the US. Am. J. Prev. Med. 2017; 53(3): S47–S54. [PMC free article] [PubMed] [Google Scholar]

Elsayed Y, Dali Balta S, Abu-Farha N. Chemical analysis, and potential health risks of hookah charcoal. Sci. Total Environ. 2016; 569–570:262–268. Doi: 10.1016/j.scitotenv.2016.06.108. [PubMed] [CrossRef] [Google Scholar]

Engel C.L., Sharma Rasanayagam M., Gray J.M., Rizzo J. Work and Female Breast Cancer: The State of the Evidence, 2002-2017. New. Solute. 2018; 28:55–78. Doi: 10.1177/1048291118758460. [PubMed] [CrossRef] [Google Scholar]

Engmann N.J., Golmakani M.K., Miglioretti D.L., Sprague B.L., Kerlikowske K. Population-attributable risk proportion of clinical risk factors for breast cancer. JAMA Oncol. 2017; 3(9):1228–1236. [PMC free article] [PubMed]

Etter JF. A longitudinal study of cotinine in long-term daily users of e-cigarettes. Drug Alcohol Depend. 2016; 160:218–221. [PubMed] [Google Scholar]

FAO and WHO (2014): The International Code of Conduct on Pesticide Management. [(Accessed on 23 April 2016)]; E-ISBN 978-92-5-108549-3. Available online: http://www.fao.org/fileadmin/templates/agphome/documents/Pests_Pesticides/Code/CODE_2014Sep_ENG.pdf.

Fan, J., Liu, Z., Mao, X., Tong, X., Zhang, T., Suo, C., & Chen, X. (2020). Global

trends in the incidence and mortality of esophageal cancer from 1990 to 2017. Cancer Medicine, *9*(18), 6875–6887. https://doi.org/10.1002/cam4.3338

Farsalinos KE, Kistler KA, Gillman G, Voudris V. Evaluation of electronic cigarette liquids and spray for the presence of selected inhalation toxins. Nicotine Tob Res. 2015; 17:168–174. [PMC free article] [PubMed] [Google Scholar]

Ferlay J, Soerjomataram I, Ervik M, Dikshit R, Eser S, Mathers C et al. GLOBOCAN 2012. Cancer Incidence and Mortality Worldwide: IARC CancerBase No. 11 Lyon, France: International Agency for Research on Cancer; 2013.

Fitzmaurice, C., Allen, C., Barber, R. M., Barregard, L., Bhutta, Z. A., Brenner, H., Dicker, D. J., Chimed-Orchid, O., Dandona, R., Dandona, L., Fleming, T., Forouzanfar, M. H., Hancock, J., Hay, R. J., Hunter-Merrill, R., Huynh, C., Hosgood, H. D., Johnson, C. O., Jonas, J. B., … Naghavi, M. (2017). Global, regional, and national cancer incidence, mortality, years of life lost, years lived with disability, and disability-adjusted life-years for 32 cancer groups, 1990 to 2015: A Systematic Analysis for the Global Burden of Disease Study Global American Medical Association

Green Paper: National Health Insurance in South Africa. A Policy Paper. [(Accessed 25 April 2014)]; National Department of Health, Republic of South Africa. http://www.hst.org.za/publications/green-paper-national-health-insurance-south-africa. [Google Scholar] [Ref list]

Havener L, Thornton M, eds. Standards for Cancer Registries Volume II: Data Standards and Data Dictionary, Thirteenth Edition, Version 11.3. Springfield, IL: North American Association of Central Cancer Registries, April 2008. [Google Scholar] [Ref list]

Heller M.C., Keoleian G.A., Willett W.C. 2013. Toward a lifecycle-based, diet-level framework for food environmental impact and nutritional quality assessment: A critical review. Environ. Sci. Technol. 47:12632–12647. Doi: 10.1021/es4025113. [PubMed] [Cross Ref]

International Journal of Epidemiology, 2019, 1–9 DOI: 10.1093/ije/dyz076 Data Resource Profile

Jansen, L., Behrens, G., Finke, I., Maier, W., Gerken, M., Pritzkuleit, R., Holleczek, B., & Brenner, H. (2020). Area-Based Socioeconomic Inequalities in Colorectal Cancer Survival in Germany: Investigation Based on Population-Based Clinical Cancer Registration.

Jemal, A., Ward, E. M., Johnson, C. J., Cronin, K. A., Ma, J., Ryerson, A. B., Mariotto, A., Lake, A. J., Wilson, R., Sherman, R. L., Anderson, R. N., Henley, S. J., Kohler, B. A., Penberthy, L., Feuer, E. J., & Weir, H. K. (2017). Annual Report to the Nation on the Status of Cancer, 1975-2014, Featuring Survival. In Journal of the National Cancer Institute (Vol. 109, Issue 9). [PubMed] [CrossRef] [Google

Scholar]

Jung-Choi K., Khang Y.H., Cho H.J. Changes in the contribution of causes of death to socioeconomic mortality inequalities in Korean adults. J Prep Med Public Health. 2011 Nov; 44(6):249–259. [PMC free article] [PubMed] [Google Scholar]

Katikireddi, S. V., Niedzwiedz, C. L., Dundas, R., Kondo, N., Leyland, A. H., & Rostila, M. (2020). Inequalities in all-cause and cause-specific mortality across the life course by wealth and income in Sweden: a register-based cohort study. International Journal of Epidemiology, 49(3), 917–925. https://doi.org/10.1093/ije/dyaa053

Kieffer C. Incidence and Detection of Occupational Cancers in Nine European Countries. Groupement de institution Prevention de la Sécurité Sociale pour d'Europa (EUROGIP); Paris, France: 2018. Eurogip-141/E. [Google Scholar]

Kier MG, Lauritsen J, Mortensen MS, et al. Prognostic factors and treatment results after bleomycin, etoposide, and cisplatin in germ cell cancer: a population-based study. Eur Urol. 2017; 71:290-298. [PubMed] [Google Scholar]

Kipkirui Rotich, K. (2020). OCCUPATIONAL RISKS AND THEIR POTENTIAL IMPACT ON EMPLOYEES' HEALTH IN KENYA TEA DEVELOPMENT AGENCY'S MANAGED FACTORIES A Research Project Report submitted in partial fulfillment of the requirement for the Award of a Master of Arts in Environmental Planning and Management in the.Kim M.H., Y.M

K, P., J, W., S, M., A, M., & R, P. (2013). Esophageal Cancer, the Topmost Cancer at MTRH in the Rift Valley, Kenya, and Its Potential Risk Factors. ISRN Oncology, 2013

Kobia, F., Gitaka, J., Makokha, F., Kamita, M., Kibera, J., Mwenda, C., Mucee, G., & Kilingo, B. (2020). The state of cancer in Meru, Kenya: a retrospective study [version 1; peer review: 1 approved with reservations, 1 not approved]. 1–19.

Korir A, Okerosi N, Ronoh V, Mutuma G, Parkin M. Incidence of cancer in Nairobi, Kenya (2004-2008). Int J Cancer. 2015 Nov 1; 137(9):2053-9. DOI: 10.1002/ijc.29674. PubMed PMID: 26139540

Kroenke C., Kawachi I. vol. 1. Oxford University Press; 2017. http://www.oxfordscholarship.com/view/10.1093/oso/9780190238667.001.0001/oso-9780190238667-chapter-9 (Socioeconomic disparities in cancer incidence and mortality). Internet. [Cited 2019 Mar 14]. Available from: [Google Scholar]

Kyrgiou M, Kalliala I, Markozannes G, et al. Adiposity and cancer at major anatomical sites: umbrella review of the literature. BMJ 2017; 356: j477. 10.1136/BMJ.j477 [PMC free article] [PubMed] [CrossRef] [Google Scholar]

Labreche F., Duguay P., Boucher A., Arcand R. Estimating the Number of Cases of Occupational Cancer in Quebec. Institute de Recherche Robert-Sauvé en Santé et en Sécurité du Travail (IRSST); Quebec, QC, Canada: 2014. Special Projects; Studies and Research Projects; R-836. [Google Scholar]

Lacourt A, Pintos J, Lavoué J, Richardson L, Siemiatycki J. Lung cancer risk among workers in the construction industry: results from two case-control studies in Montreal. BMC Public Health. 2015; 15:1. DOI: 10.1186/s12889-015-2237-9. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

Lagarde F, Falk R, Almrén K, et al. Glass-based radon-exposure assessment and lung cancer risk. Journal of Exposure Analysis and Environmental Epidemiology 2002; 12(5):344–354. [PubMed Abstract]

Lagergren J, Andersson G, Tailback M, et al. Marital status, education, and income concerning the risk of esophageal and gastrointestinal cancer by histological type /cancer. [PubMed] [CrossRef]

Lee H.-E., Kim H.-R., Chung Y.K., Kang S.-K., Kim E.-A. Mortality rates by occupation in Korea: a nationwide, 13-year follow-up study. Occupy Environ Med. 2016; 73(5):329–335. [PMC free article] [PubMed] [Google Scholar]

Li J, Newcombe R, Walton D. The prevalence, correlates, and reasons for using electronic cigarettes among New Zealand adults. Addict Behave. 2015; 45:245–251. [PubMed]

Lin, L., Yan, L., Liu, Y., Yuan, F., Li, H., & Ni, J. (2019). Incidence and death in 29 cancer groups in 2017 and trend analysis from 1990 to 2017 from the Global Burden of Disease Study. Journal of Hematology & Oncology, 12(1), 96. https://doi.org/10.1186/s13045-019-0783-9 [Cross Ref]

Littman AJ, Jackson LA, Vaughan TL. Chlamydia pneumoniae and lung cancer: epidemiologic evidence. Cancer Epidemiol Biomarkers Prep 2005; 14:773–778. [PubMed] [Google Scholar]

Loconte N.K., Brewster A.M., Kaur J.S., Merrill J.K., Alberg A.J. Alcohol and cancer: a statement of the American society of clinical oncology. J. Clin. Oncol. 2017; 36 JCO.2017.76.115. [Google Scholar]

Luque-Fernandez, M. A., Redondo-Sánchez, D., Rodríguez-Barranco, M., Chang-Chan, Y. L., Salamanca-Fernández, E., Núñez, O., Fernandez-Navarro, P., Pollán, M., & Sánchez, M. J. (2020). Socioeconomic inequalities in colorectal cancer survival in Southern Spain: A multilevel population-based cohort study. Clinical Epidemiology, 12, 797–806. https://doi.org/10.2147/CLEP.S261355

Macharia, L. W., Mureithi, M. W., & Anzala, O. (2019). Cancer in Kenya: types and infection-attributable. Data from the adult population of two National referral hospitals (2008-2012). *AAS Open Research*, *1*, 25.

https://doi.org/10.12688/aasopenres.12910.5

Mackenbach, J. P., Rubio Valverde, J., Bopp, M., Brønnum-Hansen, H., Costa, G., Deboosere, P., Kalediene, R., Kovács, K., Leinsalu, M., Martikainen, P., Menvielle, G., Rodriguez-Sanz, M., & Nusselder, W. J. (2019). Progress against inequalities in mortality: a register-based study of 15 European countries between 1990 and 2015. European Journal of Epidemiology, 34(12), 1131–1142. https://doi.org/10.1007/s10654-019-00580-9

Martinez ME, Anderson K, Murphy JD, et al. Differences in marital status and mortality by race/ethnicity and nativity among California cancer patients. *Cancer*. 2016; 122(10):1570–1578. doi:10.1002/cncr.29886 [PMC free article]

McClure L.A., Koru-Sengul T., Hernandez M.N., Mackinnon J.A., Schaefer N., Caban-Martinez A.J., Lee D.J., Kobetz E. Availability and accuracy of occupation in cancer registry data among Florida firefighters. PLoS ONE. 2019; 14: e0215867. DOI: 10.1371/journal.pone.0215867. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

McCullough ML, Zoltick ES, Weinstein SJ, et al. Circulating vitamin D and colorectal cancer risk: an international pooling project of 17 cohorts. J Natl Cancer Inst 2018. 10.1093/jnci/djy087. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

Menck H, Smart C, eds. Central Cancer. Registries, Design, Management, and Use. (Hargood Academic Publishers, Switzerland, 1994). [Google Scholar]

Mera RM, Bravo LE, Camargo MC, Bravo JC, Delgado AG, Romero-Gallo J, Yepez MC, Realpe JL, Schneider BG, Morgan DR, Peek RM Jr, Correa P, Wilson KT, Piazuelo MB Gut [PubMed]

Merten J.W., Parker A., Williams A., King J.L., Largo-Wight E., Osmani M. Cancer risk factor knowledge among young adults. J. Cancer Educ. 2017; 32(4):865–870. [PubMed] [Google Scholar]

Mortality analysis on wastewater exposure in Shijiazhuang, Hebei, China, from 2007 to 2011. Massaquoi LD, Li M, Wang J, Ma J, Yuan M, Liu DW Int J Environ Health Res. 2015; 25(2):214-27. [PubMed] [Ref list]

Muitta, E., Were, T., Nyamache, A. K., & Muhoho, N. (2019). Atypical cervical cytomorphologic predictors: A descriptive study of pre-cervical cancer patients of low education in Kenya. Pan African Medical Journal, 33. https://doi.org/10.11604/pamj.2019.33.124.15753

Muñoz-Quezada MT, Lucero BA, Barr DB, Steenland K, Levy K, Ryan PB, Iglesias V, Alvarado S, Concha C, Rojas E, Vega C Neurotoxicology. 2013 Dec; 39():158-68. [PubMed] [Ref list]

Murota H, Takeuchi S, Sugaya M, et al. Characterization of socioeconomic status of Japanese patients with atopic dermatitis showing poor medication adherence and reasons for drug suspension. J Dermatol Sci. 2015; 79(3):279–287. DOI: 10.1016/j.jdermsci.2015.05.010 [PubMed] [CrossRef] [Google Scholar]

National Cancer Institute (NCI) Causes and Prevention. [(Accessed on 3 March 2019)]; Available online: https://www.cancer.gov/about-cancer/causes-prevention.

National cancer institute review 2018

National Cancer Institute SEER cancer facts: multiple myeloma Available at http://seer.cancer.gov/statfacts/html/mulmy.html. Accessed 1 February 2019

National Cancer Registration and Analysis Service. Cancer Outcomes and Services Dataset. http://content.digital.nhs.uk/ isce/publication/dcb1521 (26 February 2018, date last accessed).

National Institute for Occupational Safety and Health. Preventing Silicosis and Deaths in Construction Workers. Atlanta, GA: Centers for Disease Control and Prevention, 2014. Available online. Last accessed February 1, 2019.

National Institutes of Health, National Cancer Institute. Saturday, November 9, 2019, Year <https://training.seer.cancer.gov/>.

National Toxicology Program. Silica, Crystalline (Respirable Size), Report on Carcinogens, Fourteenth Edition. Triangle Park, NC: National Institute of Environmental Health and Safety, 2016. Available online. Last accessed February 1, 2019.

K, P., J, W., S, M., A, M., & R, P. (2013). Esophageal Cancer, the Topmost Cancer at MTRH in the Rift Valley, Kenya, and Its Potential Risk Factors. *ISRN Oncology*, *2013*, 1–9. https://doi.org/10.1155/2013/503249

Lehmann, J., Machira, Y. W., Schneidman, M., & Chuma, J. (2020). Economic and Social Consequences of Cancer in Kenya. *Economic and Social Consequences of Cancer in Kenya*. https://doi.org/10.1596/33919

O'Connor E.A., Perdue L.A., Senger C.A. Screening, and behavioral counseling interventions to reduce unhealthy alcohol use in adolescents and adults: updated evidence report and systematic review for the US Preventive Services Task Force. JAMA. 2018; 320(18):1910–1928. [PubMed] [Google Scholar]

Ogden CL, Carroll MD (Materials Disposition), Kit BK, Flegal KM. 2014. Prevalence of childhood and adult obesity in the United States. 311(8):806–14. Doi: 10.1001/Jama.2014.732 [PMC free article] [PubMed]Oncology Training International /PMC2803035/ Feb 2019

Park M. K., Paik H. Y., Lee Y. Intake trends of red meat, alcohol, and fruits and vegetables as cancer-related dietary factors from 1998 to 2009. Osong Public Health and Research Perspectives. 2016; 7(3):180–189. Doi: 10.1016/j.phrp.2016.04.005. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

PDQ® Screening and Prevention Editorial Board. PDQ Endometrial Cancer Prevention. Bethesda, MD (Materials Disposition): National Cancer Institute. Updated <07/31/2019>.Available at: https://www.cancer.gov/types/uterine/patient/endometrial-prevention-pdq. Accessed <11/09/2019>. [PMID: 26389201]Percentage of Adults Reporting Selected Modifiable Risk Factors, Ontario, 2014

Price AJ, Key TJ. Epidemiology of prostate cancer. In: Hamdy FC, Eardley I, eds. Oxford Textbook of Urological Surgery. 1st Ed Oxford University Press, 2017. [Google Scholar]

Primack BA, Carroll MV, Weiss PM, et al. Systematic Review and Meta-Analysis of Inhaled Toxicants from Waterpipe and Cigarette Smoking. Public Health Rep. 2016; 131:76–85. [PMC free article] [PubMed] [Google Scholar]

Primack BA, Soneji S, Stool Miller M, Fine MJ, Sargent JD. Progression to Traditional Cigarette Smoking After Electronic Cigarette Use Among US Adolescents and Young Adults. JAMA Pediatrics. 2015; 169:1018–23. Doi: 10.1001/JAMA pediatrics.2015.1742. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

Prostate cancer in South Africa: pathology-based national cancer registry data (1986-2006) and mortality rates (1997-2009). Babb C, Urban M, Kielkowski D, Kellett P Prostate Cancer. 2014; 2014():419801. [PubMed] [Ref list]

Purdue M.P., Hutchings S.J., Rushton L., Silverman D.T. The proportion of cancer attributable to occupational exposures. Ann. Epidemiol. 2015; 25:188–192. Diol: 10.1016/j.annepidem.2014.11.009. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

Qiu M, Yang D, Xu R. Impact of marital status on survival of gastric adenocarcinoma patients: results from the Surveillance Epidemiology and End Results (SEER) database. Sci Rep. 2016; 6:21098. doi:10.1038/srep21098 [PMC free article] [PubMed] [CrossRef] [Google Scholar]

Rammah M, Dandachi F, Salman R, Shihadeh A, El-Sabban M. In vitro effects of waterpipe smoke condensate on endothelial cell function: a potential risk factor

for vascular disease. Toxicology Lett. 2013; 219:133–142. [PMC free article] [PubMed] [Google Scholar]

Rennie LJ, Bazillier-Bruneau C, Rousse J. Harm Reduction or Harm Introduction? Prevalence and Correlates of E-Cigarette Use among French Adolescents. J Adolescent Health. 2016; 58:440–445. [PubMed] [Google Scholar] Repro'd Biol Endocrinol. 2014 May 9; 12():37.

Reynolds A, Mann J, Cummings J, Winter N, Mete E, Te Morenga L. Carbohydrate quality and human health: a series of systematic reviews and meta-analyses. Lancet 2019; 393:434-45. 10.1016/S0140-6736(18)31809-9 [PubMed] [Cross Ref] [Google Scholar]

Rodgers K.M., Udesky J.O., Rudel R.A., Brodym J.G. Environmental chemicals, and breast cancer: An updated review of epidemiological literature informed by biological mechanisms. Environ. Res. 2018; 160:152–182. DOI: 10.1016/j.envres.2017.08.045. [PubMed] [Cross Ref] [Google Scholar]

Rosen L. An intuitive approach to understanding the attributable fraction of disease due to a risk factor: The case of smoking. Int. J. Environ. Res. Public Health. 2013; 10:2932–2943. Diol: 10.3390/ijerph10072932. [PMC free article] [PubMed] [Cross Ref] [Google Scholar]

Rossi, P. G., Djuric, O., Navarra, S., Rossi, A., Di Napoli, A., Frova, L., & Petrelli, A. (2020). Geographic inequalities in breast cancer in Italy: Trend analysis of mortality and risk factors. International Journal of Environmental Research and Public Health, 17(11), 1–14. https://doi.org/10.3390/ijerph17114165

Ross SM, McManus IC, Harrison V, Mason O Crit Rev Toxicology. 2013 Jan; 43(1):21-44. [PubMed] [Ref list]

Ruto, P. K., Muitta, E., Owino, A., & Makokha, F. W. (2020). Frequency and Pattern of All Cancer Cases at Thika Level Five Hospital in Kiambu County, Kenya. 3(4), 1–9.

Rushton L. The Global Burden of Occupational Disease. Curry. Environ. Health Rep. 2017; 4:340–348. Diol: 10.1007/s40572-017-0151-2. [PMC free article] [PubMed] [Cross Ref] [Google Scholar]

SCENIHR. 2015. Scientific Committee on Emerging and Newly Identified Health Risks: Potential health effects of exposure to electromagnetic fields (EMF): http://ec.europa.eu/health/scientific_committees/emerging/docs/scenihr_o_041. pdfExit Disclaimer, accessed August 15, 2015.

Shadmani, F. K., Farzadfar, F., Yoosefi, M., Mansori, K., Shadman, R. K., & Haghdoost, A. (2020). Premature mortality of gastrointestinal cancer in Iran: Trends and projections 2001-2030. BMC Cancer, 20(1). https://doi.org/10.1186/s12885-020-07132-5

Scheideler J.K., Klein W.M. Awareness of the link between alcohol consumption and cancer across the world: a review. Cancer Epidemiol Biomarkers Prev. 2018; 27(4):429–437. [PubMed] [Google Scholar

Schoemaker MJ, Nichols HB, Wright LB, et al. Premenopausal Breast Cancer Collaborative Group Association of body mass index and age with subsequent breast cancer risk in premenopausal women. JAMA Oncol 2018; 4: e181771. 10.1001/JAMA Oncol.2018.1771 [PMC free article] [PubMed] [Cross Ref] [Google Scholar]

Schubert J, Bewersdorff J, Luch A, Schulz TG. Waterpipe smoke: A considerable source of human exposure against furanic compounds. Anal. Chim. Acta. 2012; 709:105–112. DOI: 10.1016/j.aca.2011.10.012. [PubMed] [CrossRef] [Google Scholar]

Schwedhelm C., Boeing H., Hoffmann G., Aleksandrova K., Schwingshackl L.2016. Effect of diet on mortality and cancer recurrence among cancer survivors: A systematic review and meta-analysis of cohort studies. Nutr. Rev. 74:737–748. DOI: 10.1093/nutrient/nuw045. [PMC free article] [PubMed] [Cross Ref]

Schwingshackl L, Schwedhelm C, Hoffmann G, et al. Food groups and risk of colorectal cancer. Int J Cancer 2018; 142:1748-58. 10.1002/ijc.31198 [PubMed] [Cross Ref] [Google Scholar]

Schwingshackl L., Missbach B., Konig J., Hoffmann G. 2017. Adherence to a Mediterranean diet and risk of diabetes: A systematic review and meta-analysis. Public Health Nutr. 18:1292–1299. DOI: 10.1017/S1368980014001542. [PubMed] [Cross Ref]

Shi RL, Chen Q, Yang Z, Pan G, Zhang Z, Wang W., et al. Marital status independently predicts gastric cancer survival after surgical resection-an analysis of the SEER database. Oncotarget. 2016; 7:13228–35. [PMC free article] [PubMed] [Google Scholar]

Shihadeh A, Schubert J, Klaiany J, El Sabban M, Lush A, Saliba NA. Toxicant content, physical properties, and biological activity of waterpipe tobacco smoke and its tobacco-free alternatives. Tob Control. 2015; 24(Suppl 1): i22–i30. [PMC free article] [PubMed] [Google Scholar]

Siegel, R. L., Miller, K. D., & Jemal, A. 2018. Cancer statistics, 2018: Cancer Statistics, 2018. CA: A Cancer Journal for Clinicians, 68(1), 7–30. https://doi.org/10.3322/caac.21442

Siegel, R. L., Miller, K. D., & Jemal, A. (2020). Cancer statistics, 2020. CA: A Cancer Journal for Clinicians, 70(1), 7–30. https://doi.org/10.3322/caac.21590

Sogaard KK, Farkas DK, Pedersen L, Weiss NS, Thomsen RW, Sorensen HT. Pneumonia, and the incidence of cancer: a Danish nationwide cohort study. J Intern Med 2015; 277:429–438. [PubMed] [Google Scholar]

Souter, I, Smith KW, Dimitriadis I, Ehrlich S, Williams PL, Calafat AM, Hauser R Repro'd Toxicology. 2013 Dec; 42():224-31. [PubMed] [Ref list]

Śliwczyński, A., Kalinka, E., Sierocka, A., Iltchev, P., Kowalski, D., & Marczak, M. (2019). Population morbidity in elderly lung cancer patients from Poland with specific trends in elderly women. Przeglad Menopauzalny, 18(3), 161–165. https://doi.org/10.5114/pm.2019.90811

St Helen G, Benowitz NL, Dains KM, Havel C, Peng M, Jacob P., 3rd Nicotine and carcinogen exposure after water pipe smoking in hookah bars. Cancer Epidemiol Biomarkers Prev. 2014; 23:1055–1066. [PMC free article] [PubMed] [Google Scholar]

Strulovici-Barel Y, Shaykhiev R, Salit J, et al. Pulmonary Abnormalities in Young, Light-Use Waterpipe (Hookah) Smokers. Am J Respir Crit Care Med. 2016; 194:587–595? [PMC free article] [PubMed] [Google Scholar]

Takala J. Work-related illnesses, identification, causal factors, and prevention "safe work—Healthy work—for life;" Presented at Greek EU Presidency Conference; Athens, Greece. 16–17 June 2014. [Google Scholar]

Tan C.H., Denny C.H., Cheal Nuclear Energy., Sniezek J.E., Kenny D. Alcohol use and binge drinking among women of childbearing age—United States, 2011–2013. MMWR Morbi. Mortal Wkly. Rep. 2015; 64(37):1042–1046. [PubMed] [Google Scholar]

Tarla D.N., Manu I.N., Tamedjouand Z.T., Kamga A., Fontem D.A. Plight of pesticide applicators in Cameroon: Case of Tomato (Lycopersiconesculentum Mill) farmers in Foumbot. J. Agric. Environ. Sci. 2015; 4:87–98. [Google Scholar] [Ref list]

Tatangelo G, McCabe M, Campbell S, Szoeke C. Gender, marital status, and longevity. Maurita's. 2017; 100:64–69. DOI: 10.1016/j.maturitas.2017.03.002. [PubMed] [Cross Ref] [Google Scholar]

Tenge CN, Kuremu RT, Buziba NG, Patel K, Were PA (Public Affairs). Burden and pattern of cancer in Western Kenya. East Afr Med J. 2009 Jan; 86(1):7-10.

The Community Guide, 2018. CPSTF findings for excessive alcohol consumption. https://www.thecommunityguide.org/content/task-force-findings-excessive-alcohol-consumption.The incidence and body site of skin cancers in the population groups of South Africa.

U.S. Environmental Protection Agency (January 2009). A Citizen's Guide to Radon: The Guide to Protecting Yourself and Your Family from Radon. Retrieved October 18, 2011. University of Illinois-Chicago, College of Medicine on April 8, 2016, facts about immune system— Written by Brian Krans and Erica Cirino

US Department of Health and Human Services, 2017. Dietary Guidelines for Americans 2015–2020. Skyhorse Publishing Inc.

Vencovsky D., Postle M., Kalberlah F., Vencovska V., Fenn T., Daly E., Hanlon J., Osborne K. The Cost of Occupational Cancer in the EU-28. European Trade Union Institute (ETUI); Brussels, Belgium: 2017. [Google Scholar]

Verma DK, Kurtz LA, Sahai D, Finkelstein MM. Current chemical exposures among Ontario construction workers. J Occupy Environ Hygge. 2003; 18:12. [PubMed] [Google Scholar]

Vieira AR, Abar L, Vingeliene S, et al. Fruits, vegetables, and lung cancer risk: a systematic review and meta-analysis. Ann Oncol 2016; 27:81-96. 10.1093/annonc/mdv381 [PubMed] [Cross Ref] [Google Scholar]

W. G. Hale, V. A. Saunders, J. P. Margham 2005. Collins Dictionary of Biology, 3rd ed.

W. M. Haynes, ed., CRC Handbook of Chemistry and Physics, CRC Press/Taylor and Francis, Boca Raton, FL, 95th Edition, Internet Version 2015, accessed December 2014.

Wallrabenstein I, et al. Neuroimage the smelling of Hedione results in sex-differentiated human brain activity. Neuroimage. 2015; 113:365–373. DOI: 10.1016/j.neuroimage.2015.03.029. [PubMed] [CrossRef] [Google Scholar]

Wang L, Wilson SE, Stewart DB, and Hollenbeck CS. Marital status and colon cancer outcomes in US Surveillance, Epidemiology and End Results registries: does marriage affect cancer survival by gender and stage? Cancer epidemiology. 2011; 35:417–22. [PubMed] [Google Scholar]

Wang LW, He EY, Ghosh D, et al. Severe carbon monoxide poisoning from waterpipe smoking: a public health concern. Med J Aust. 2015; 202:446–447. [PubMed] [Google Scholar]

Wang XD, Qian JJ, Bai DS, Li ZN, Jiang GQ, Yao J. Marital status independently predicts pancreatic cancer survival in patients treated with surgical resection: an analysis of the SEER database. Oncotarget. 2016;7(17):24880–24887. DOI: 10.18632/on target.8467. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

Warren Andersen, S., Blot, W. J., Lipworth, L., Steinwandel, M., Murff, H. J., & Zheng, W. (2019). Association of Race and Socioeconomic Status with Colorectal

Cancer Screening, Colorectal Cancer Risk, and Mortality in Southern US Adults. JAMA Network Open, 2(12), e1917995. https://doi.org/10.1001/jamanetworkopen.2019.17995

WCRF World Cancer Research Fund International. Continuous Update Project (Cup) [(accessed on 20 July 2017)]; 2017 Available online: http://www.wcrf.org/int/research-we-fund/continuous-update-project-cup.
White MC, Babcock F, Hayes NS, Mariotte AB (Advisory Board), Wong FL, Kohler BA, Weir HK. Cancer. 2017 Dec 15; 123 Suppl 24:4969-4976. Doi: 10.1002/cncr.30905. PMID: 29205307

Weselak M, Arbuckle TE, Foster W J Toxicology Environ Health B Crit Rev. 2014 Jan-Mar; 10(1-2):41-80. [PubMed] [Ref list]

White M.C., Shoemaker M.L., Park S. Prevalence of modifiable cancer risk factors among US adults aged 18–44 years. Am. J. Prev. Med. 2017; 53(3): S14–S20. [PMC free article] [PubMed] [Google Scholar]

Wong CW, Kwok CS, Narain A, et al. Marital status, and risk of cardiovascular diseases: a systematic review and meta-analysis. Heart. 2018; 104(23):1937–1948. doi:10.1136/heartjnl-2018-313005 [PubMed] [CrossRef] [Google Scholar]

World cancers report 2014 Lyon: International Agency for Research on Cancer.

World Cancer Research Fund (WCRF) American Institute for Cancer Research (AICR) Food, Nutrition, Physical Activity, and the Prevention of Cancer: A Global Perspective. Continuous Update Project Expert Report 2018. [(Accessed on 3 March 2019)]; Available online: https://www.wcrf.org/sites/default/files/Full-Report-PDF-bundle.zip.

World Cancer Research Fund International/American Institute for Cancer Research. 2017. Cancer preventability estimates for diet, nutrition, body fatness, and physical activity. Wcrf.org/cancer-preventability-estimates.

World Cancer Research Fund, American Institute for Cancer Research. Diet, nutrition, physical activity, and cancer: a global perspective. Continuous update project expert report 2018. https://www.wcrf.org/dietandcancer.

World Health Organization Health Topics: Pesticides. [(Accessed on 15 May 2017)]; Available online: http://www.who.int/topics/pesticides/en/

World Health Organization Nutrition. [(Accessed on 3 March 2019)]; Available online: https://www.who.int/topics/nutrition/en/

World Health Organization Tobacco. http://www.who.int/mediacentre/factsheets/fs339/en/ Updated June 2016. Accessed October 9, 2016.

World Health Organization. 2013. Global Health Observatory Information Centre on HPV and Cervical Cancer (HPV Information Centre). Human Papillomavirus and Related Cancers in Kenya; Summary Report 2013. www.who.int/HPV center.

World Health Organization. Human papillomavirus vaccines: WHO position paper, May 2017-Recommendations Vaccine 2017; 35(43):5753-5755. [PubMed Abstract]

World Health Organization.2018. Global Health Observatory. Geneva: World Health Organization; 2018. who.int/gho/database/ en/. Accessed June 21, 2018.

K, P., J, W., S, M., A, M., & R, P. (2013). Esophageal Cancer, the Topmost Cancer at MTRH in the Rift Valley, Kenya, and Its Potential Risk Factors. *ISRN Oncology*, *2013*, 1–9. https://doi.org/10.1155/2013/503249

Lehmann, J., Machira, Y. W., Schneidman, M., & Chuma, J. (2020). Economic and Social Consequences of Cancer in Kenya. *Economic and Social Consequences of Cancer in Kenya*. https://doi.org/10.1596/33919

Yan L, Spitz Nagel EL. Soy consumption and prostate cancer risk in men: a revisit of a meta-analysis. Am J Clin Nutr 2009; 89:1155-63? 10.3945/ajcn.2008.27029 [PubMed] [CrossRef] [Google Scholar]

Zaitsu M., Kaneko R., Takeuchi T., Sato Y., Kobayashi Y., Kawachi I. Occupational class, and male cancer incidence: a nationwide, multicenter, hospital-based case-control study in Japan. Cancer Med. 2019 Jan 4 [PMC free article] [PubMed] [Google Scholar]

Zaitsu M., Kaneko R., Takeuchi T., Sato Y., and Kobayashi Y., Kawachi I. Occupational inequalities in female cancer incidence in Japan: hospital-based matched case-control study with occupational class. SSM Popup Health. 2018 Aug; 5:129–137. [PMC free article] [PubMed] [Google Scholar]

Zhang X, Keum N, Wu K, et al. Calcium intake and colorectal cancer risk: Results from the nurses' health study and health professional's follow-up study. Int J Cancer 2016; 139:2232-42. 10.1002/ijc.30293 [PMC free article] [PubMed] [CrossRef] [Google Scholar]

Zhu SH, Sun JY, Bonnevie E, et al. Four hundred and sixty brands of e-cigarettes and counting: implications for product regulation. Tob Control. 2014; 23(Suppl 3): iii3–9.

APPENDIXES

Appendix I: Cancer Registry Abstract Form

Registry Number									

Patient:

First Name	Given	Family	maiden

Name

Identification Number ----------

5= Cohabiting, 7 = child, 9= unknown]

Telephone number----------

Age: ----------Date of Birth (DD/MM/YY) ----------Sex------

County	Sub-County	Location	Sub-location	Village

Place of Birth----------Ethnicity----------

TUMOUR:

Incidence date (dd/mm/yy) ----------

certificate only, 2= Clinical only ☐ Clinical invest/Ultrasound, 4= Bio-Chem. Immunol Test, 5=Cytology/Hematology, 6= Histology of metastasis, 7= Histology of primary, 9= Unknown]

TREATMENT:

FIRST COURSE OF TREATMENT

Surgery ☐	Date	Radiotherapy ☐	Date
Chemotherapy ☐	Date	Hormone Therapy ☐	
Immune ☐	Date	Other ☐	

CONCURRENT ILLNESS:

DOCUMENTATION OF HIV STATUS

Lab reports available in Pt. file Yes ☐ No ☐ Lab No. _____

Status showed in clinical notes Yes ☐ ☐

Specifically (-ve) ☐

Specifically (+ve) ☐

Other Concurrent illness

SOURCES:

Source 1. Hosp _____Hosp. No. _____ SRC Date ___

Source 1. Lab_____ Laboratory. No. _____SRC Date _____

Referred from _____ IP No._____

Referred to _____ IP No._____

FOLLOW UP:

Status [☐ 1=Alive, 2=Dead]

Hospice No. _____

Date of Last Contact (visit)/Date of Death_____

If dead, cause of death _____

Remarks if any _____

Form filled by _____Date _____Checked by_____

Data entered by _____Date _____

Interviews was done using the telephone to collect data concerning age, sex, marital status, occupation, and lifestyle risk factors of cancer. The telephone interview was used for follow-up.

Appendix II: Questionnaire Form

Patient

Name

First Name	Given	Family	Maiden

status of marital Cohabiting, 7= child[ ]known]

Telephone number----------

Age: ----------Date of Birth (DD/MM/YY) ----------Sex------ [1=male, 2=female, 3 = unknown

Religion [1= Christian, 2= Muslim, 3= Hindu, 4= others] [ ]

Education level----------

Occupation ----------

Duration of work in the occupation mentioned above (No. of years) [ ]

Smoking status [1=Never, 2= Smoker, Ex-smoker, 8=Unknown] [ ]

Smoking status of the spouse (Where applicable) [1 = Never, 2=smoking, 3= smoker]

Drinking status [[1=Never, 2= Smoker, Ex-smoker, 8=Unknown] [ ]

Type of food 1= green, fruit arrowroots, 2= fast food, 3= red meat, 4= white meat, 5= balanced diet. [ ]

Source of domestic fuel [1= Kerosene, 2= Firewood, 3= Charcoal, 8= LPG, 4= Electricity [ ]

Form filled by---------- Date ----------Checked by----------

Data entered by----------Date----------

Appendix III: Letter of Introduction

Mount Kenya University

SCHOOL OF POSTGRADUATE STUDIES

MPH/2017/75547

29th April, 2019

The Director, Research Coordination Division
National Commission for Science, Technology & Innovation
Utalii House, 8th & 9th Floor
P.O Box 30623- 00100
NAIROBI

Dear Sir/Madam,

RE: PATRICK KIPLANGAT RUTO – REGISTRATION NO. MPH/2017/75547

The purpose of this letter is to introduce the above named student who is pursuing **Master of Public Health** in the Department of **Epidemiology and Biostatistics** in the School of **Public Health.**

The title of his research is ***"Assessment of Cancer Morbidity and Mortality Cases between the Years 2013-2017 in selected Health Facilities in Kiambu County, Kenya."***

He has been cleared by the University's Ethics Review Committee (Certificate attached) and now has to proceed to the field to collect data for his research between **May and July, 2019.**

Any assistance accorded to him will be highly appreciated.

Thank you.

Mount Kenya University
Dean, School of Postgraduate Studies
P.O. Box 342 - 01000

Dr. Samuel M. Karenga, Ph.D
Dean, School of Postgraduate Studies
Enc.

Main Campus, General Kago Road, P.O. Box 342-01000 Thika. Tel: +254 67 2820 000,
Cell: +254 720 790 796, 0709 153 000

Appendix IV: Letter of Ethical Clearance Certificate

Mount Kenya University

APRIL 23, 2019

Ref. No. MKU/ERC/1241

CERTIFICATE OF ETHICAL CLEARANCE

This is to certify that the proposal titled **"ASSESSMENT OF CANCER MORBIDITY AND MORTALITY CASES BETWEEN THE YEARS 2013-2017 IN SELECTED HEALTH FACILITIES IN KIAMBU COUNTY, KENYA"** whose Principal Investigator is Patrick Kiplangat Ruto (MPH/2017/75547) has been reviewed by Mount Kenya University Ethics Review Committee (ERC), and found to adequately address all ethical concerns.

Dr. Francis W. Makokha
Secretary, Mount Kenya University ERC

Sign: _____ **Date:** 23/04/2019

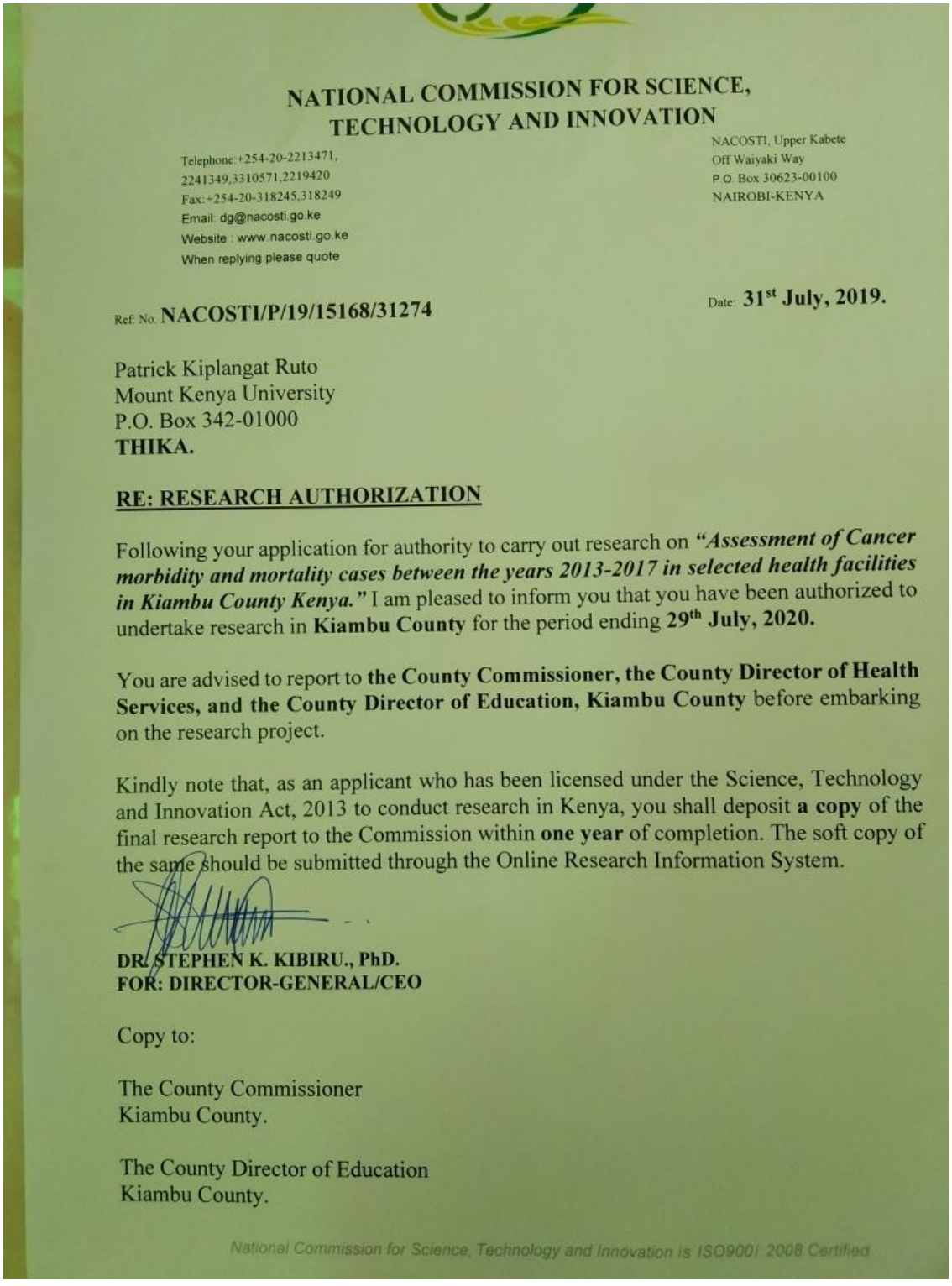
Prof. Francis W. Muregi
Chairman, Mount Kenya University ERC

The Chairman
Mount Kenya University
Ethics Review Committee
P.O. Box 342 - 0100, Thika

Sign: _____ **Date:** 23/04/2019

Main Campus, General Kago Road, P.O. Box 342-01000 Thika. Tel: +254 67 2820 000,
Cell: +254 720 790 796, 0709 153 000

Appendix V: Research permit from NACOSTI



NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone:+254-20-2213471,
2241349,3310571,2219420
Fax:+254-20-318245,318249
Email: dg@nacosti.go.ke
Website : www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/19/15168/31274**

Date: **31st July, 2019.**

Patrick Kiplangat Ruto
Mount Kenya University
P.O. Box 342-01000
THIKA.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Assessment of Cancer morbidity and mortality cases between the years 2013-2017 in selected health facilities in Kiambu County Kenya."*** I am pleased to inform you that you have been authorized to undertake research in **Kiambu County** for the period ending **29th July, 2020.**

You are advised to report to **the County Commissioner, the County Director of Health Services, and the County Director of Education, Kiambu County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

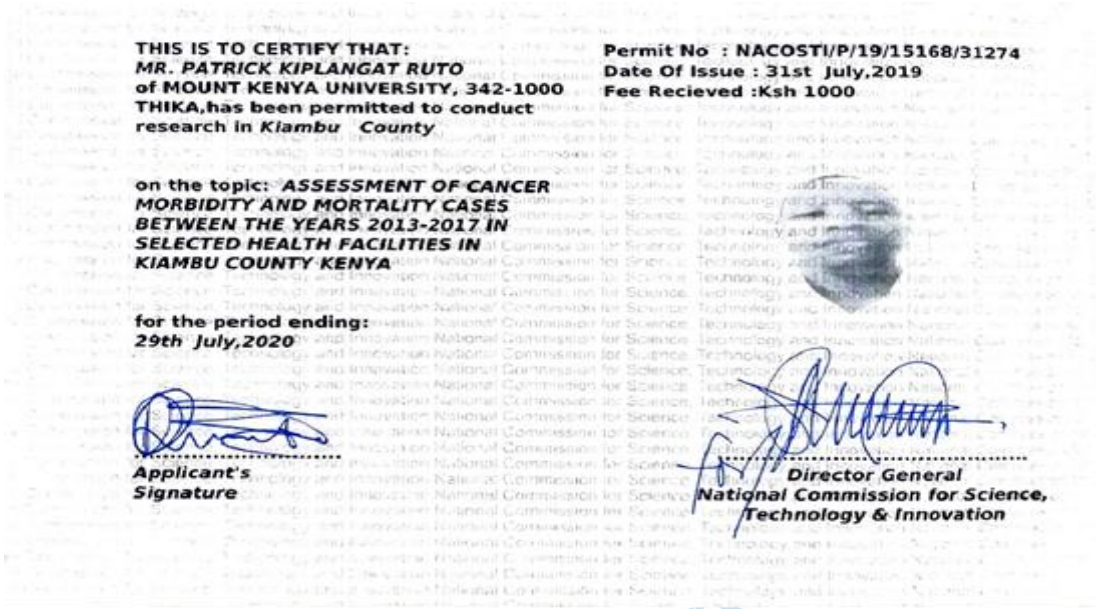
DR. STEPHEN K. KIBIRU., PhD.
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Kiambu County.

The County Director of Education
Kiambu County.

Appendix VI: Research permit from NACOSTI



THIS IS TO CERTIFY THAT:
MR. PATRICK KIPLANGAT RUTO
of MOUNT KENYA UNIVERSITY, 342-1000
THIKA,has been permitted to conduct
research in *Kiambu County*

on the topic: *ASSESSMENT OF CANCER MORBIDITY AND MORTALITY CASES BETWEEN THE YEARS 2013-2017 IN SELECTED HEALTH FACILITIES IN KIAMBU COUNTY KENYA*

for the period ending:
29th July,2020

Applicant's Signature

Permit No : NACOSTI/P/19/15168/31274
Date Of Issue : 31st July,2019
Fee Recieved :Ksh 1000

Director General
National Commission for Science, Technology & Innovation

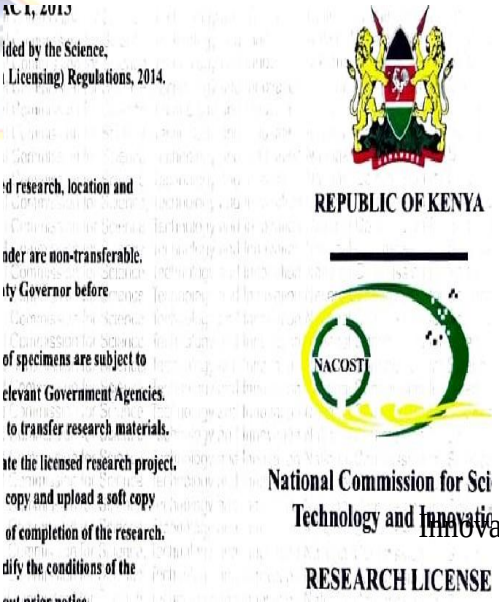
THE SCIENCE, TECHNOLOGY AND INNOVATION ACT, 2013

The Grant or Research Licenses is guida•d by the Seienee. Technolow and Innovation (Research Licet'sing) Regulations, 2014.

CONDITIONS

1. The License is[D] valid for the proposed regearch, location and specified period.
2. The License and Iny rights thereunder ire non-transferable.
3. The Licensee Shall inform the County Governor berõre commencement or the research.
4. tion, filming and collection of specimens are subject to further necessary clearance from relevant Government Agencies.
5. The License does not uthotity to tr*nsfer research materials.
6. NACOSTI may monitor and evaluate the licensed research project.
7. The Licensee shall submit one hard copy and upload x sort copy or their final report within one year of Completion
8. NACOSTI reserves the right to modify the conditions or the License including Can cellation without prior notice

lg@nacosti.go.ke,



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REPUBLIC OF KENYA

NACOSTI

National Commission for Sci
Technology and Innovati

RESEARCH LICENSE

Appendix VII: A Map of Kiambu County

Appendix VIII: Age Adjusted

MINISTRY OF HEALTH

OUT-PATIENTS ATTENDANCE SUMMARY

Institution : THIKA LEVEL 5 HOSPITAL

Medical Statistical Form 1A for month ending

District : THIKA

Region : CENTRAL

Dec 31,

A. OUT – PATIENTS

	NEW		REVISIT		TOTAL	
AGE GROUPS	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Under 1 Year	9,29	7,07	4,21	3,52	13,50	10,602
1 - 4 Years	11,87	9,36	2,10	1,64	13,97	11,008
5 - 14 Years	8,98	7,32	1,87	1,33	10,86	8,662
15 - 24 Years	10,15	14,28	1,57	1,87	11,73	16,161
25 - 34 Years	11,12	13,79	2,16	2,76	13,29	16,557
35 - 44 Years	6,49	7,91	1,87	2,55	8,36	10,469
45 - 49 Years	2,09	2,67	68	1,25	2,78	3,930
50 - 54 Years	1,98	2,85	96	1,58	2,94	4,446
55 - 64 Years	2,44	3,09	1,24	1,45	3,69	4,551
Over 65 Years	3,66	3,88	1,28	1,26	4,94	5,152
All ages						

Medical Officer-in-Charge

*To be despatched not later than the Tuesday of the month immediately following to the District Medical Officer of Health with copies to;

1.REGIONAL DIRECTOR OF HEALTH SERVICES

IN -PATIENT		OUT- PATIENT	
Number of year	**Sub Total**	**Sub Total**	**Total**
2013	18498	140380	158878
2014	21507	152878	174385
2015	23217	165271	188488
2016	24168	175,769	199937
2017	12913	115,186	128099
Total	**100303**	**749,484**	**849787**