ENSIGN GLOBAL COLLEGE, KPONG

EASTERN REGION, GHANA

ASSESSING THE TYPES AND TRENDS OF CANCER CASES PRESENTING AT THE SWEDEN GHANA MEDICAL CENTER, A FIVE YEAR REVIEW (2017 -2021)

BY

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DECLARATION

I, Desmond Opare-Agyekum, declare that this submission is my own work towards the MPH and that to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement been made in text.

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DEDICATION

I dedicate this work to God Almighty for the inspiration and passion He has placed in my heart to investigate and contribute to cancer research. I also dedicate this to John Meade Huntsman whose powerful influence in providing solutions to cancer research has inspired my vision. I also dedicate to all cancer patients and especially the staff and doctors at the Sweden Ghana Medical Center for their immense support. Most importantly I dedicate this work to my mentor and Supervisor Dr. Edward Kofi Sutherland for his guidance, support and encouragement.

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DEFINITION OF TERMS

CANCER	Defined by the WHO as a large group of diseases that can start in almost any organ or tissue of the body when cells grow uncontrollably and go beyond their usual boundaries to invade adjoining parts of the body or spread to other organs (WHO,2018).
NEOPLASM	An abnormal growth of tissue that can be either benign or malignant. Benign neoplasms are non-cancerous and do not spread to other parts of the body. They are usually slow growing and can be removed by surgery if necessary. Malignant Neoplasm on the other hand are cancerous and can invade nearby tissues and organs as well as spread to other parts of the body through bloodstream or lymphatic system
METASTATIC NEOPLASM	A cancerous growth that has spread from its original site of growth to another site. This can occur close to or distant from primary site
NON-METASTATIC NEOPLASM	A tumor type that has not spread to other parts of the body.

LIST OF ABBREVIATIONS

AI/AN- American Indian/Alaska Native

AP/I- Asian Pacific Islanders

BRCA stand for "BReast CAncer gene" and refers to BRCA1 and BRCA2.

CT- Computerized Tomography

GIZ- Deutsche Gesellschaft fur international Zusammenarbeit

KATH-Komfo Anokye Teaching Hospital

KBTH-Korle-Bu Teaching Hosptal

miRNA- microribonucleic acid

NCD- Non-Communicable Disease

NHB-Non-Hispanic Black

SDG- Sustainable Development Goals

SGMC- Sweden Ghana Medical Center

SNP- Single Nucleotide Polymorphism

WHO-World Health Organization

ABSTRACT

Background: Despite advances in cancer research and treatment, it remains the second leading cause of death globally. According to the global cancer statistics report in 2020, an estimated 19.3 million cases of cancer, excluding non-melanoma skin cancers, were reported. The mortality rate during the same period was 10 million. There is limited evidence of comprehensive cancer trends in sub-Saharan Africa and Ghana. Available data report trends for specific cancers, such as breast cancer, at specific treatment sites. This study aimed at assessing the sociodemographic characteristics of patients, the types and temporal trends of cancer cases presenting for treatment at the Swedish Ghana Medical Center.

Methodology: It is a descriptive and retrospective cross-sectional study of cancer cases which presented at the SGMC between 2017 to 2021. Each cancer was grouped under body site classification in accordance with the National Cancer Institute's Classification by body site. De-identified data from the SGMC's hospital information system was extracted into excel format and coded for analysis. STATA(version 17) and excel data tools were used for the analysis. The variables included age, sex, occupation, nationality, diagnosis and time (date of registration). Descriptive analysis was employed to show the frequency distribution of the various cancers, using bar charts, trend charts and probability density charts.

Conclusion: The study showed a growing trend in cancers for the five-year interval understudied. Breast cancers emerged the leading cancers, followed by prostate, cervical and squamous cell carcinoma of the head and neck. The findings call for a concerted effort to put in public health intervention for the awareness and prevention of cancers.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF MAPS

CHAPTER 1

1.0 INTRODUCTION

1.1 Background Information

Despite advances in oncology research and cure worldwide, cancer remains the second leading cause of death (Bray *et al*., 2021). Healthcare disparities in cancer treatment translate into differences in life expectancy and overall mortality between adults and children. Increased urbanization and growing demographic changes in the population and aging are projected to influence cancer prevalence for the next 50 years (Soerjomataram & Bray, 2021). For example, in developing countries that are witnessing economic advancement, the adoption of a Western lifestyle and dietary habits characterized by higher intake of meat, fat, and total calories along with increasing life expectancy and population groth herald a remarkable increase in the burden of colorectal cancer (Center *et al*., 2010)

Understanding disease trends and burden is crucial for planning health services and estimating the number of future healthcare providers that need to be trained (Celentano & Szklo., 2019).

According to the global cancer statistics report in 2020, an estimated 19.3 million cases of cancer, excluding non-melanoma skin cancer, were reported. Mortality for the same period was estimated at 10 million cases excluding non-melanoma skin cancer except basal cell carcinoma (Sung *et al*., 2021).

Globally, lung, liver, stomach, breast, colon, esophageal, cervical, and rectal cancers are the leading causes of cancer deaths, accounting for approximately 1.8 million, 830, 768, 685, 577,544, 342 thousand, and 339 thousand respectively (Sung *et al*., 2021).

However, the trends for various cancers vary for each region and country. In Asia, the total number of male and female cases accounted for 50% of the global incidence and 58.3% of cancer deaths during this period. Europe accounted for 22.8% of the cases and 19.6% of global cancer deaths.

Similarly, the United States recorded 20.9% global incidence and 14% worldwide cancer mortality. Asia and Africa however exhibit a disproportionately higher number of incidences and mortalities thus 58.3% and 7.2% respectively and, 49.3% and 5.7% respectively due to the different distribution of cancer types and higher case fatality rates in these areas. (Sung *et al*., 2021).

It is also noteworthy that these figures may not reflect the exact situation in Africa. There is little evidence or data on comprehensive cancer cases and trends in sub-Saharan Africa and Ghana. The disease burden in Africa is not fully known because of the lack of a coordinated population-based cancer registry in Africa's low-resource countries.

1.2 Problem Statement

Non-communicable diseases (NCDs) were noted by the World Health Organization (WHO) as the major cause of death in the late twentieth century (WHO,1999) and cancer is the leading cause of mortality from these diseases. Every year, an estimated average of over 17 million cases of cancer are recorded (Sung *et al*. 2021).

There is limited research on comprehensive cancer trends in sub-Saharan Africa. The disease burden in Africa is not fully known because of the lack of a coordinated population-based cancer registry in low-resource countries, such as Ghana. Understanding patterns and trends in disease presentation is essential for healthcare planning (Grimes and Schulz 2002). In Ghana, it will help estimate how many future healthcare professionals need to be trained to support the treatment of patients. Also, the information from these trends can help public health professionals and the cancer focused clinicians, and pharmaceutical and biomedical companies tailor novel therapeutics, technology and interventions to improve the quality of care for patients and their caregivers.

Access to relevant information on the demand and burden of diseases can facilitate policies on pricing and affordability. It also allows for the comparability of trends to other places in the world. The Swedish Ghana Medical Center (SGMC) is a major cancer treatment site in Ghana and West Africa. It has operated for approximately 10 years and currently sees different kinds of cancer cases from both Ghana and other countries in the sub-Saharan region and beyond. The SGMC has been set to perform an extensive evaluation of cancer patterns and trends at its facility since its inception in 2012. It is against this background, that this research is being conducted in collaboration with the Research Department of the Swedish Ghana Medical Center (SGMC) to generate baseline information and evidence to support public health planning, policy, and interventions at both institutional and national levels.

1.3 Rationale of the Study

To help achieve sustainable development goal 3 regarding "Good Health and Well Being" among the United Nations 17 SDGs; the reduction of deaths from non-communicable diseases by one-third will require a keen emphasis on reducing cancer-related morbidities (Manetti., 2016)

This study seeks to contribute to the understanding of the burden of cancer in Ghana as one of the leading causes of death. Understanding the types and trends will help identify the most common types of cancer, the groups of people who are most affected, and the areas where cancer is most prevalent (Parkin., 2008). This information can help policymakers and public health officials to allocate resources to prevent and treat cancer. Knowledge of these trends can help researchers identify the risk factors for cancer. For example, if a type of cancer is more common in a certain population or geographic area, researchers can investigate why it is the case. This can lead to the identification of the environmental, lifestyle, and genetic factors that contribute to the development of cancer. In addition, the study of trends will facilitate the monitoring of progress in cancer

prevention and treatment. By tracking changes in cancer incidence, mortality, and survival rates over time, researchers can evaluate the effectiveness of interventions aimed at reducing the cancer burden. More importantly, this study can guide future research on cancer prevention and treatment at institutional and national levels. By identifying the most common types of cancer and the groups of people most affected by cancer, researchers can also focus their efforts on developing new preventive strategies and treatments tailored to the specific needs of different populations.

1.4 Aim of the Study

This study aims to assess the types and trends of cancer cases presenting for treatment at the Swedish Ghana Medical Center in Ghana, West Africa, from 2017 to 2021.

1.5 Primary Objective:

To describe the types and trends of cancer cases presenting for treatment at the Swedish Ghana Center in Ghana from 2017 to 2021.

1.6 Specific Objectives

1. To assess the socio-demographic characteristics of patients who presenting at SGMC from 2017 to 2021
2. To examine the types and trends in cancers presenting at the SGMC from 2017 to 2021
3. To explore the relationship between age and breast cancers presenting at the SGMC between 2017 to 2021.

1.7 Study Questions

1. What were the sociodemographic characteristics of patients who presented at the SGMC from 2017 and 2021?
2. What were the types and trends in cancers presented at the SGMC from 2017 to 2021?
3. What is the relationship between age and onset of breast cancer using data from SGMC between 2017 to 2021?

1.8 Profile of Study Area

The Swedish Ghana Medical Center is the study site. It is located in Accra within the Kpone-Katamanso Municipality. The Center was established in 2012 as an initiative to improve cancer care by a collaboration between the Swedish Government and the Global medical investment group and Electra in 2007. As a premier private cancer center in west Africa, SGMC ensures services meet Western and European Standards. The facility has four departments that specializes in radiotherapy, brachytherapy, chemotherapy, computerized tomography (CT) scan and magnetic resonance imaging backed by power supply facilities to ensure continual and uninterrupted services. Since 2012, SGMC has treated over 8000 patients. In 2018 laboratory services was added to the suite of treatment services. Some services are however outsourced. As a sustainability focused institution, SGMC are involved with Jinko Solar (China) and GIZ (Germany) to install over 200+ solar panels to sustain an efficient energy consumption.

SMGC currently focuses on tumor and curative treatment. Range of treatment do not include blood cancers and preventive care. However, a new surgical department is being set up to assist patients to undergo radical prostatectomy.

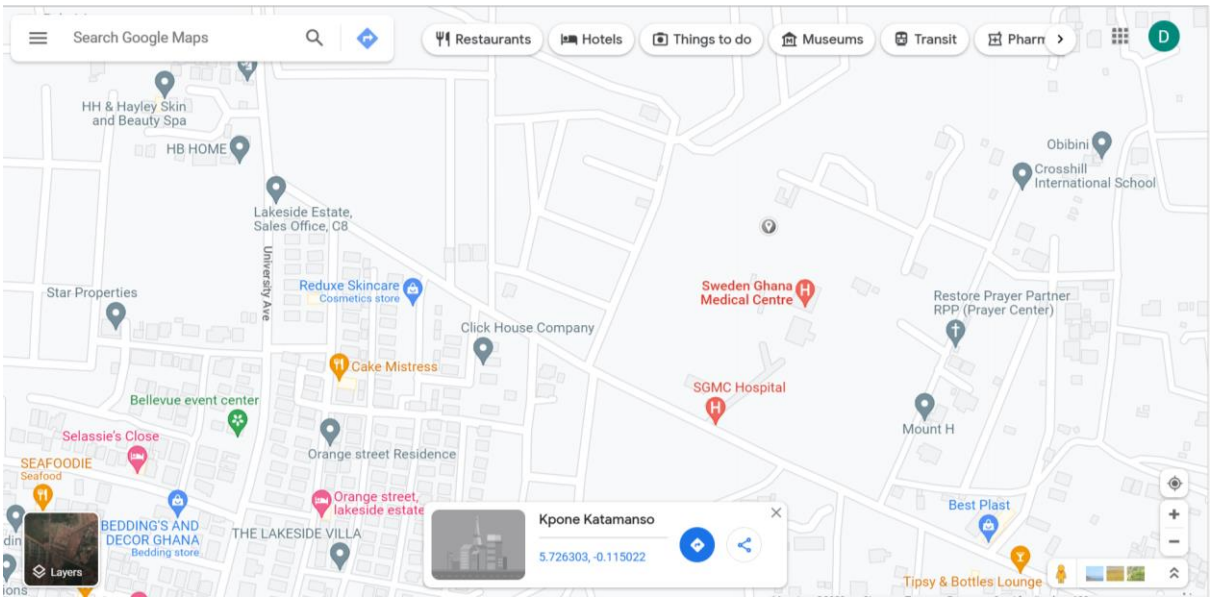


Figure 1.0 Map Showing location of Swedish Ghana Medical Center

1.9 Scope of Study

The research used data on oncology patients of the SGMC for only five-year interval (2017-2021). Non-oncology data were excluded from the analysis. Thus, 2,495 new cancer patients (first time presentation) from 2017 to 2021 were analyzed and reported. It included demographic variables such as age, date of registration, sex, occupation, cancer diagnosis and nationality. The various cancer types presenting at the facility were identified and the trends of the 5 leading cancers by body site classification were described and compared with similar studies done in other sites in Africa. A probability density distribution was also carried out to assess the relationship between age and breast cancer.

1.10 Organization of Study

The report is presented in six sections. The first chapter discusses the background, problem statement, rationale, research questions, general objectives, specific objectives, the profile of the study area, and the scope of the study. The second chapter reviewed similar studies on the topic

based on the study's objectives. The research techniques and design, data management, data analysis, ethical consideration, study limits and assumptions are covered in chapter three. The background variables and findings based on the major study variables are summarized in chapter four. Employing comparisons to the literature, chapter five discusses the findings based on the research questions. The conclusion and recommendations are presented in Chapter six by summarizing the key findings and on how the challenges for the study can be addressed.

CHAPTER 2
2.0 LITERATURE REVIEW

WHO Definition of Cancer

The WHO defines cancer as a large group of diseases that can start in almost any organ or tissue of the body when cells grow uncontrollably and go beyond their usual boundaries to invade adjoining parts of the body or spread to other organs (WHO, 2018). It usually appears as a tumor that is composed of a mass of cells. A visible tumor is the result of a series of changes that may have taken many years to develop (Knowles & Selby, 2005).

Cell growth and proliferation are among the most studied areas in biology. Growth is an increase in the size of a cell or organ tissue, and the tumor is the proliferation or increase which is often used as a loose term for these two processes; however, the distinction is especially important now that the factors driving these two processes are becoming clearer. The process of increasing the cell number is similar in all somatic cells, with growth followed by division to produce two daughter cells. This process is known as the cell cycle and has been understood for some time. However, in the last two decades, scientists have gained detailed knowledge of the molecular basis of this process (Knowles & Selby, 2005).

2.1 Global Cancer Prevalence and Mortality

In 2020, GLOBOCAN reported 19.3 million cancer cases and 10 million cancer-related deaths worldwide. Breast, lung, and prostate cancers were the most commonly diagnosed types in women worldwide, with 2.26 million (11.7%), 2.21 million (11.4%), and 1.41 million (7.3%) cases, respectively. East Asia had the highest number of cases, while North America and Europe had

lower incidences but higher mortality, 6 million (31.1%), 3.6 million (36.3%), 2.6 million (13. 3%), and 7% reported cancer deaths. South Central Asia recorded 1.95 million (10%).

China envisaged 4.8 million new cases and 3.2 million deaths in 2022, with colon, stomach, liver, and breast cancers being the most common types. Although the incidence of gastric, liver, and esophageal cancers has gradually declined in recent years, the overall incidence among Chinese women has increased since 2000. Europe reported 4.4 million cases and 1.9 million deaths.

India has approximately 1.4 million cases and 850,000 deaths from cancer, with breast and cervical cancers being the most common types in women. Although the United States and India share some similarities in cancer statistics, they also have notable differences in terms of cancer prevalence (Chhikara & Parang, 2023).

Africa had approximately 1.1 million new cases and 710,000 cancer deaths in 2020, with high mortality and declining access to cancer treatment facilities. Female patients accounted for the majority of cases and deaths on this continent.

The high morbidity and mortality from cancer underscore the need for better cancer treatment facilities. Data disaggregating cases by sex in African countries showed that 630,000 new cancer cases were reported in women (accounting for 57.5% of all cases in African countries) and 480,000 new cases were reported in men. (43% of all cases). Female cancer mortality was 390,000 (accounting for 54.4% of all cancer-related deaths in African countries); however, male mortality in African countries was much higher than that in females. This is in contrast to China, where 54% of all cancer cases are reported in men (Chhikara & Parang, 2023).

Egypt had the highest number of new cancer cases among African countries, with 130,000 cases (12.2% of all cases in African countries). This was followed by Nigeria with 120,000 (11%) and South Africa with 600,000 (7.99%), the three countries with the highest number of cancer-related

deaths. Data shows that Breast, cervical, and prostate cancers are the top three cancers of concern. Breast cancer is the most common malignancy in African women, with 190,000 new cases (16.9% of all cases) and 900,000 (12% of cancer-related deaths) in 2020). The second most common cause was the cervix, with an estimated incidence of 120,000 (10.6%) and a death toll of 800,000.

Among African men, prostate cancer had the highest cancer incidence, with 900,000 new cases (8.47%) and 0.5 million deaths (6.64%).

In addition to economic status, sociocultural conditions have been attributed to the increased incidence of cancer among African women and, in particular, to increased mortality from breast cancer. It has often been observed that women in remote areas are reluctant to seek medical advice, mainly because of the socio-cultural norms that exist in societies in various parts of Africa. A holistic approach to combat cancer is needed, including raising awareness and capacity-building through vaccination campaigns, preventive measures, and the development of low-cost diagnostics and treatments.

2.2 Profile of Cancer Cases in Ghana

Ghana currently has three major cancer sites. These are the Korle-Bu Teaching Hospital (KBTH), Akomfo Anokye Teaching Hospital (KATH), and Swedish Ghana Medical Center (SGMC). So far, three publications on adult and childhood cancer profiles and trends are available from KBTH and KATH. The KBTH study focused on profiling cancer cases over one year for both adults and children, while the KATH publication evaluated a 5-year trend in childhood cancer patterns in the pediatric oncology department. The second KBTH for childhood cancer patterns is not available for reference but only excepts of the abstract are available on PubMed. The results of these studies provide valuable insights into cancer cases in Ghana, but they are limited in scope and may not be representative of the current situation. The one-year study at KBTH was inadequate to detect

hidden patterns in cancer beyond the one-year period. The study also confirmed that data collection was incomplete because of the limited number of staff in the public health departments. In addition, the prevalence was measured using hospital visits rather than the general population.

At KBTH, breast, cervical, and uterine cancers were the most common cancers in women, while prostate, pharynx, and colorectal cancers were common in men who visited the hospital between January 2012 and December 2012. In total, 1136 patients were included in this study. This total generated 413,514 hospital visits, giving a prevalence of 274.7/100,000 visits (Calys-Tagoe *et al*., 2014).

Of the 1136 cases, 807 (71%) were diagnosed between January and December 2012. They consisted of 339 males (29.8%) and 797 females (70.2%). Their ages ranged from 1 to 92 years, with a mean of 52.3 $\pm$ 15.9 years and a median of 54 years. Patients were predominantly Ghanaian (88.1%), but also from other African countries such as Benin (2.1%), Burkina Faso (1.4%), Côte d'Ivoire (1.4%), Gambia (0.1%), and Guinea (0.1%), Nigeria (0.7%), Sierra Leone (1.5%), and Togo (3.6%). Of these, 772 (68 %) did not include a record of educational attainment. Of the 364 participants, 232 (63.7%) had a university degree, 52 (14.3%) had secondary education, 55 (15.1%) had primary education, and 19 (5.2%) had no formal education, including six who were under school age. A total of 704 (62%) cancer patients were married, and the proportion of married men (77.6%) was significantly higher than that of women (55.3%) (Calys-Tagoe *et al*., 2014).

In the second study conducted at the KATH pediatric cancer unit, the age distribution was between 0-15 years. Lymphomas (166) were the most common cancers observed across age groups. Leukemias (n = 21), Wilm's tumor (n = 20), soft tissue sarcomas (n = 11), rhabdomyosarcoma (n = 9), neuroblastoma n (96), Central Nervous system cancers (n = 3), and osteosarcomas (n = 2) were common in the 5-9-year group. Hepatoblastoma, though rare in the cancer registry among a

few others, was seen in equal proportions in both the 0-4 and 5-9-years age groups. The 10-15-year groups recorded mainly lymphomas (n=42) but less of the other cancers (Dogbe *et al*., 2015).

2.3 Risk Factors for Selected Cancers

2.3.1 Breast Cancers

The likelihood of developing breast cancer can be increased by a number of risk factors, including sex, aging, estrogen, family history, gene mutations, and an unhealthy lifestyle. Women are 100 times more likely than males to have breast cancer, and women experience it more frequently. Nearly a quarter of all breast cancer cases are related to family history (Brewer *et al*., 2017).

Breast cancer is more likely to affect a woman if her mother or sister has the condition. Women with one first-degree relative diagnosed with breast cancer have a 1.75-fold higher risk of developing the disease than women without any affected relatives, according to a cohort study of more than 113,000 women in the UK. Additionally, the risk increases by 2.5 times or more for women who have two or more first-degree relatives who have breast cancer (Brewer et al., 2017).

The inherited susceptibility to breast cancer is partially attributed to the mutations of breast cancer-related genes such as BRAC1 and BRAC2.

Obesity, alcohol consumption, smoking, air pollution and stress resulting from inadequate sleep and ionizing radiations are considered as risk factors for breast cancer. Some other factors that are deemed to be controversial due to limited research in these causal factors include blood group, age of menarche, abortion, breast density and coffee consumption.

In Sub-Saharan Africa, approximately 70% of breast cancer patients are aged 50 years or less, and most occur before or around menopause. The highest incidence was observed in multiparous women aged 40-44 years (with the average number of children being 5). Most of these early cancers appear to be negative more frequently. Adebamowo *et al*. showed that the majority of

women with breast cancer presenting at the oncology clinic of the University College Hospital of Ibadan in Nigeria were positive for ER and PR. In Caucasian or Western women, most breast cancers occur after menopause and are estrogen- or progesterone-positive, whereas parity is a well-defined protective factor. It is noteworthy that in the US, early onset of Breast Cancer is more common among African Americans than among Caucasian American women, and these cancers tend to be negative for estrogen and progesterone. This type of breast cancer has a worse prognosis than breast cancer in older women, independent of ethnic background (Sighoko *et al*., 2013).

2.3.2 Lung Cancer

Lung cancer is the second most frequent malignant neoplasm in most countries and the main cause of cancer-related mortality globally in both males and females combined. The geographic and temporal patterns of lung cancer incidence, as well as lung cancer mortality, at the population level, are mainly determined by tobacco consumption, the main etiological factor in lung carcinogenesis. Other factors such as genetic susceptibility, poor diet, occupational exposure, and air pollution may act independently or in concert with tobacco smoking in shaping the descriptive epidemiology of lung cancer (Malhotra *et al*., 2016).

2.3.3. Family History and high-penetrance genes

A positive family history of lung cancer is a risk factor in several registry-based studies that have reported a high familial risk of early-onset lung cancer. An increased relative risk was found, even after careful adjustment for smoking. Linkage analysis of high-risk pedigrees identified a major susceptibility locus on chromosome 6q23-25. Lung cancer risk is also increased within the framework of Li-Fraumeni syndrome, which is characterized by a germline mutation in the tumor suppressor gene p53(Bermejo & Hemminki, 2005).

2.3.4 Genetic Polymorphism

A gene polymorphism is a variation in the DNA sequence that occurs within a population. This explains why some people have different physical traits and why some are more susceptible to certain diseases than others.

MicroRNAs (miRNAs) are small non-coding RNAs, which regulate gene expression. Single nucleotide polymorphisms (SNPs) can occur in miRNA biogenesis pathway genes, primary miRNAs, or mature miRNA sequences. These polymorphisms may be involved in the biogenesis and action of mature miRNAs. Specific SNPs were identified in the predicted miRNA target sites within 3 untranslated regions of mRNAs. These SNPs have the potential to affect the efficiency of miRNA binding to target sites or create or disrupt binding sites. The resulting gene dysregulation may involve changes in phenotypes and may eventually prove critical for the susceptibility to cancer and its onset, as well as estimates of prognosis and therapy response. MicroRNAs have been studied most intensively in the field of oncological research and emerging evidence suggests that it altered regulation in the pathogenesis of cancer. Changes in miRNA expression have been observed in a variety of human solid cancers, including breast, colorectal, lung, kidney, prostate, cervical, gastric, bladder, pancreatic, esophageal, head and neck, ovarian, and hepatocellular carcinomas (Slaby *et al*., 2012).

2.3.5 Tobacco Smoking

The use of tobacco cigarettes is the single greatest risk factor for the development of lung cancer, with up to 90% of lung cancers attributed to smoking. An understanding of this causal relationship developed only slowly and gradually because of the decades-long latency period between smoking initiation and lung cancer occurrence.

In some parts of the world, especially the US, the incidence of lung cancer is seen to have racial and ethnic disparities. Ethnic and racial disparities are inversely related to education. Education

level correlates with socioeconomic factors, including employment opportunities and income. Age and sex also influence disease patterns (de Groot *et al*., 2018).

2.3.6 Race/ethnicity

Non-Hispanic Black (NHB) men have the highest incidence at 87.9 per 100,000. Non-Hispanic white men and the American Indian/Alaska Native (AI/AN) had incidences of 75.9 and 71.9%, respectively. These values are considerably higher than the 45.2 per 100,000 for Asian/Pacific Islanders(a/PI) and 40.6 for Hispanic men. In women in the US, the incidence rates are highest in NHW, 57.6 per 100,000) and AI/AN, 55.9 per 100,000). Lung cancer is diagnosed in NHB women at a somewhat lower rate (50.1), which is almost twice that of A/PI women (27.9) and Hispanic women (25.2) (de Groot *et al*., 2018).

2.3.7 Asbestos

Occupational exposure to carcinogens is estimated to account for 5-10% of lung cancers. Among these, asbestos was the most common. Naturally occurring silicate minerals, such as asbestos, have amphibole (amosite, crocidolite, tremolite) and serpentine (chrysolite) subtypes, and the use of asbestos in construction has been ongoing since the 19th century. Chrysotile fibers have the greatest association with thoracic malignancies(Korda *et al.,* 2017).

2.3.8 Pollution and air quality

Ambient air quality has been suggested as a potential risk factor for lung cancer since the 1920s. There are two main areas of concern for both outdoor and indoor air quality: carcinogens produced by the combustion of fossil fuels, and particulate matter in the air. Atmospheric carcinogens in outdoor environments include polycyclic aromatic hydrocarbons, sulfur dioxide, and trace metals(Turner *et al.*, 2020).

CHAPTER 3

3.0 METHODOLOGY

3.1 Study Design

This is a retrospective and cross-sectional descriptive study using secondary data from the Swedish Ghana Medical Center. About 2,495 patients' records were reviewed for the period 2017 to 2021. These were all newly registered oncology patients and did not include repeat clients/patients from previous years.

3.2 Data Collection Techniques and Tools

The data is a secondary data from the Hospital information system known as HoiSys at the research unit of the SGMC. It was exported into excel format with windows 10 version of Microsoft Suite and stored on both a secured good drive and pen drive. Cancer types were identified from the patient history and diagnosis and regrouped using the National Cancer Institute's list on Classification of Cancers by body site. The National Cancer Institute is the US federal government agency for cancer research and training. Established under the National Cancer Institute's Act of 1937, NCI is part of the US National Institutes of Health (NIH), one of 11 agencies that make up the Department of Health and Human Services (HHS). The patient occupation was regroup under eight main headings using the International Standard for Classification of Occupations.

3.3 Study Population.

The study population covered all new patients visiting the facility for the period 2017 to 2021. There were 2,495 patients which constituted 1,528 females and 967 males. However, the SGMC has over 8000 patients in their database. This includes oncology and non-oncology patients.

3.4 Study Variables.

The data variables include gender, age, nationality, occupation, and diagnosis and date of registration.

3.5 Sampling.

All the 2,495 newly registered oncology patient who presented at the SGMC from 2017 to 2021 were used for the analysis.

3.6 Data Handling.

Permission was sought from the Swedish Ghana Medical Center to carry out the study. All data has been used and analyzed only for the objectives of this study and kept confidential as agreed upon by SGMC and Ensign Global College. The outcome of the work will be discussed with SGMC for clearance before publishing it in a scientific journal. Moreover, all patients' name was replaced by numbers to ensure anonymity and confidentiality.

3.7 Data Analysis

The data was grouped by Patient ID, Gender, Age, Year of presentation, Cancer type (diagnosis), and Occupation using the International standard classification of occupation.

The results were analyzed as descriptive statistic using STATA 17 and Excel Charts. Frequency distribution and percentage estimates of recorded cases and trends were calculated. Results were presented in tables, and charts where applicable. A probability density plot was generated to assess the relationship between age and breast cancer.

3.8 Ethical Consideration.

This study was reviewed and approved by the ethics committee of Ensign Global College and administrative approval sought from the Swedish Ghana Medical Center. Data confidentiality has been signed and publication of the study stays in the confines of the agreement.

3.9 Limitations of the Study.

This study presented data on morbidities and not mortality. This is because the Swedish Ghana Medical Center is a day clinic. Earlier studies included mortalities as well. Since the SGMC has no Wards/beds for inpatient services, almost all patients are treated as day clinics hence the concentration of the patient's data is not centered on mortalities and therefore was not included in the study. Socio-demographics such as income and education were not available in-patient history. Moreover, the staged cases of cancers were not adequate and representative enough to consider for the study.

3.10 Assumptions.

Cancer increases with advancing age, but some individuals have higher cancer risk which includes the following: those with a personal or a strong family history of cancer, or those with inherited genetic mutations and polymorphisms associated with specific cancers, those who have been exposed to environmental or occupational carcinogens (asbestos, uranium miners), personal behaviors related to cancer risk(smoking, alcohol consumption, sun exposure) and those who have been exposed to a therapeutic radiation (especially if it occurred during childhood or adolescence).

3.11 Inclusion Criteria.

Only oncology patients between the period January 2017 to 2021. This constituted the 2,495 newly registered patients. Patients inclusion was based on confirmed cases from results of biopsies and no suspected cases that were unconfirmed were included in the analysis.

3.12 Exclusion Criteria.

All cases that reported and were not confirmed as cancers but other ailments were excluded from the data including cancer cases outside the 2017 to 2021 range.

CHAPTER 4

4.0 RESULTS

4.1 General Descriptive Statistics and Data Summaries of Oncology Patients at the SGMC

Chapter four presents the general descriptive statistics and findings from the study.

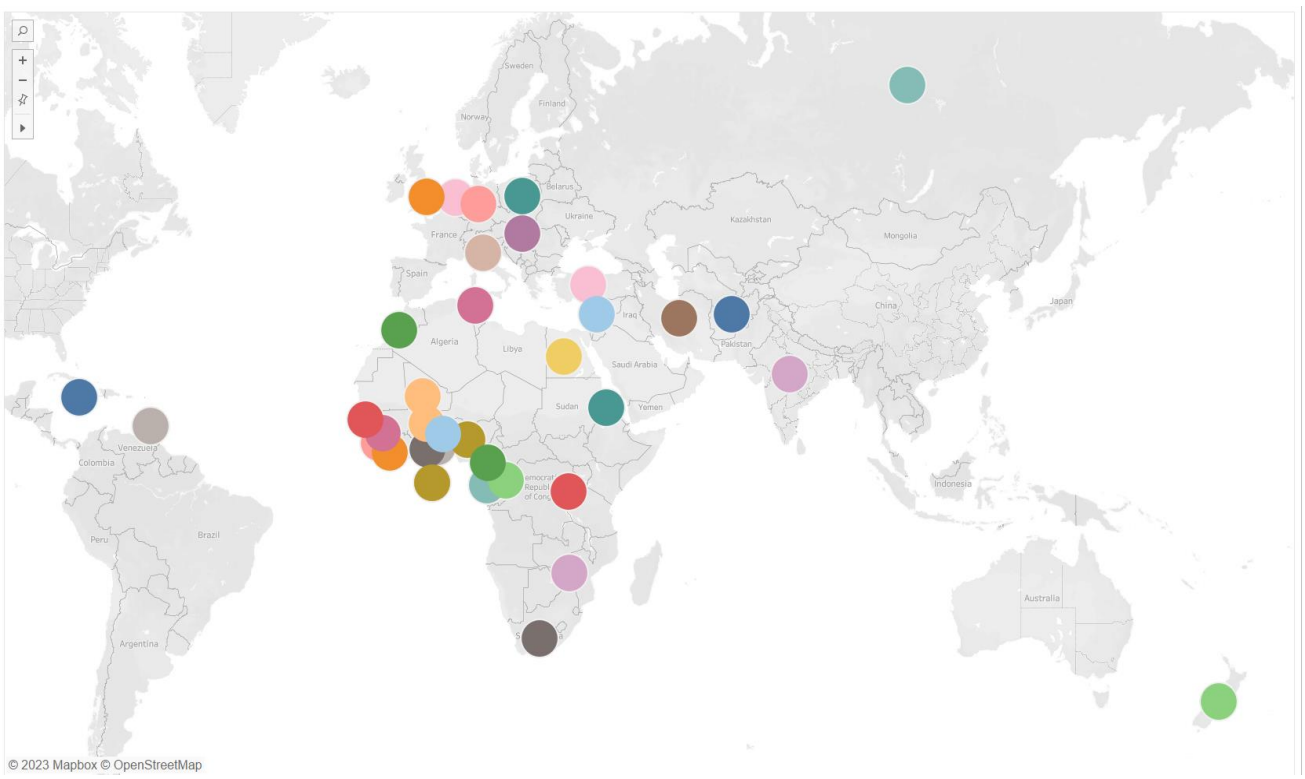
Table 1.0 Socio-Demographic Characteristics of Oncology Patients at the SGMC from 2017 to 2021

VARIABLES		
Age Category	**All, N(2495)**	**(100%)**
≤ 20 years	66.00	(2.65)
21-30 years	117.00	(4.69)
31-40 years	406.00	(16.27)
41-50 years	448.00	(17.96)
51-60 years	557.00	(22.32)
≥ 60 years	901.00	(36.11)
Occupation	**N(2,495)**	**(100%)**
Professional and Administrators (AP)	933.00	(37.41)
Health Professionals and Ass (HP & Ass)	47.00	(1.88)
Services, Technicians &Sales & Trade (STST)	710.00	(28.47)
Farmers and Gatherers (FG)	43.00	(1.72)
Students and Minors (SM)	109.00	(4.37)
Unemployed (UE)	207.00	(8.30)
Retirees (RS)	387.00	(15.52)
Gender	**N(2,495)**	**(100%)**
Female	1,528	(61.24)
Male	967	(38.76)

With reference to **Table 1.0** above, 36.11% of the cancer patients were 60 years and above. Those from the 51 and 60-year groups recorded 22.32%. This was followed by patients from 41 and 50 years, 31 and 40 years, 21 and 30 years, and those below 21 years.

It can be seen that female oncology cases were cumulatively higher than males. Apart from those below 21 years and above 59 years, the female patients were relatively higher than males for all age groups for the five-year interval. The average age of cancer patients presented over the 5 years was 53 years. The minimum age of the patients was 1 year and the maximum age was 106 years.

It also shows the distribution of occupation groups among cancer patients at the SGMC**.** Professionals and administrators excluding healthcare professionals constituted 37.41% of the patients. Approximately, 38.70% were males and 36.6% were females. This group comprises teachers, executives, engineers, consultants, aviation crew, judicial staff, and public servant administrators. About 37.8% of these professional and administrative groups were teachers. Services, Technicians, and those within the sales and trade profession constituted 28.47%. Only 1.88% were health care professionals, thus doctors and allied health professionals. Also, 15.52% of the patients were retirees and 8.30% were unemployed. Approximately, 1.72% and 2.33% were farmers and clergies/imams respectively.



Map 1.0 Map showing the Geographic Distribution of Patients of SGMC across the Globe

Map 1.0 above illustrates the geographical locations of patients visiting the SGMC. In all patients come to the center from 39 countries across the globe. A majority of the patients (81.41%) are Ghanaians, 5.53% Nigerians, 3.52% Togolese and 9.522% from 36 other countries.

4.2 Types of Cancers by Body Site Classification

Table 2.0 Percentage Distribution of Cancers by Body Site from 2017 to 2021

Cancer Site by Body Part	Gender		Total
	Male, n (%)	**Female, n (%)**	**Total ,N (%)**
Aids Related Cancers	1.00 (0.04)	0.00 (0.00)	1.00 (0.04)
Breast Cancers	12.00 (0.48)	845.00 (33.86)	857.00 (34.33)
Digestive/Gastrointestinal Cancers	209.00(8.38)	150.00 (6.01)	359.00 (14.38)
Endo/Neuroendocrine Cancers	0.00 (0.00)	2.00 (0.08)	2.00(0.08)
Eye Cancers	1.00 (0.04)	1.00 (0.04)	2.00 (0.08)
Genitourinary Cancers	433.00 (17.35)	20.00 (0.80)	453.00 (18.15)
Gynecologic Cancers	0.00 (0.00)	283.00 (11.34)	283.00 (11.34)
Germ Cell Cancers	0.00 (0.00)	1.00 (0.04)	1.00 (0.04)
Head and Neck Cancers	123.00 (4.93)	71.0 0(2.85)	194.00 (7.77)
Hematological Cancers	45.00 (1.80)	30.00 (1.20)	75.00 (3.00)
Musculoskeletal Cancers	44.00 (1.76)	45.00 (1.80)	89.00 (3.57)
Neurologic Cancers	20.00 (0.80)	18.00 (0.72)	38.00 (1.52)
Respiratory Cancers	43.00 (1.72)	37.00 (1.48)	80.00 (3.21)
Skin Cancers	30.00 (1.20)	18.00 (0.72)	48.00 (1.92)
Unknown Primaries	6.00 (0.24)	8.00 (0.32)	14.00 (0.56)
Total	**967 (38.74)**	**1,528 (61.26)**	**2,495 (100.00)**

Table 2.0 Above illustrates the distribution of oncology cases at SGMC by body site classification. There are fifteen (15) classifications based on the National Cancer Institute's classification of cancers by body parts. For the five years considered, breast cancers recorded the highest number of cases representing 34.33% of all oncology cases between 2017 to 2021. About 33.86% and 0.48% of the male and female patients respectively were breast cancer cases. This was followed by Genitourinary cancers recording 18.5% of all oncology cases. Also, 44.73% of all male cases were Genitourinary cancers and 18.51% of all female cases were gynecologic cancers. Gynecologic cancers were 11.3% of all oncology cases for the period. Digestive/Gastrointestinal Cancers constituted 14.38 % of the cases with 21.61% of all male cancers falling within this group. Moreover, 9.81% of all female cancers were Digestive/Gastrointestinal Cancers. Head and Neck cancers recorded 7.77% of all cases. This includes 12.71% of all male and 4.64% of all female patients

4.3 Trends of Cancer Presentation at SGMC from 2017 to 2021

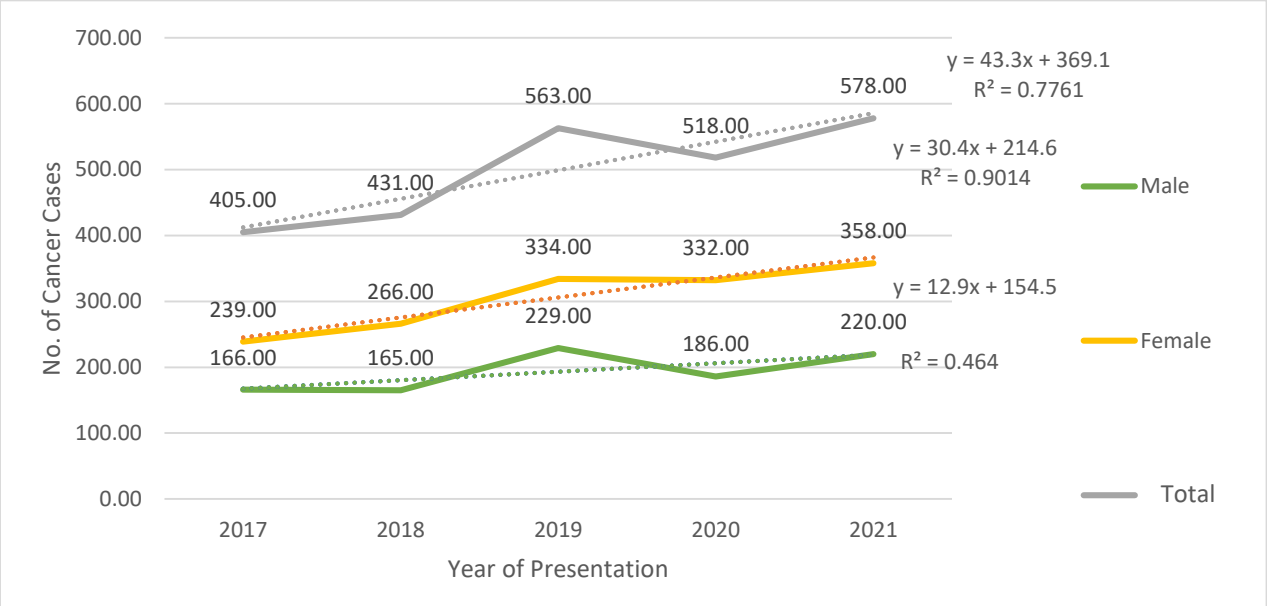


Figure 1.0 Comparisons of Trends in Cancer Presentation by Gender from 2017 to 2021

Figure 1.0 above demonstrates the growing trends in cancer presentation at the center from 2017 to 2021. The female gender shows a higher incidence of cancers than males. The highest incidences were recorded in 2019 and 2021 thus 22.57% and 23.17% of the total cases respectively. There was an overall increase in cancer cases between 2017 to 2021 despite slight dips in numbers for 2018 and 2020 in males and 2020 for females.

Table 3.0 Percent Distribution of Top Five Cancer Cases from 2017 to 2021

Cancer Site	Gender		Total N, (%)
	Male, n (%)	**Female (%)**	
Breast Cancer	12 (0.48)	845 (33.87)	857 (34.33)
Genitourinary Cancers	433 (17.35)	20 (0.80)	453 (18.15)
Digestive/Gastrointestinal Cancers	209 (8.38)	150 (6.01)	359 (14.38)
Gynecologic Cancer	N/A	283 (11.34)	283 (11.34)
Head and Neck Cancers	123 (4.93)	71 (4.64)	194 (7.77)
Total	777 (31.14)	1,369 (56.66)	2,146 (85.97)

Table 3.0 above illustrates the top 5 leading cancers by site. Breast cancers recorded the highest number of cases (34.33%) of all the cancers presenting from 2017 to 2021. This was followed by genitourinary cancer (18.15%) and Gastrointestinal Cancers (14.38%). Gynecological cancers recorded 11.34% all cancers presenting followed by Head and Neck Cancers recording 7.77% among the top five cancers for the five years under consideration.

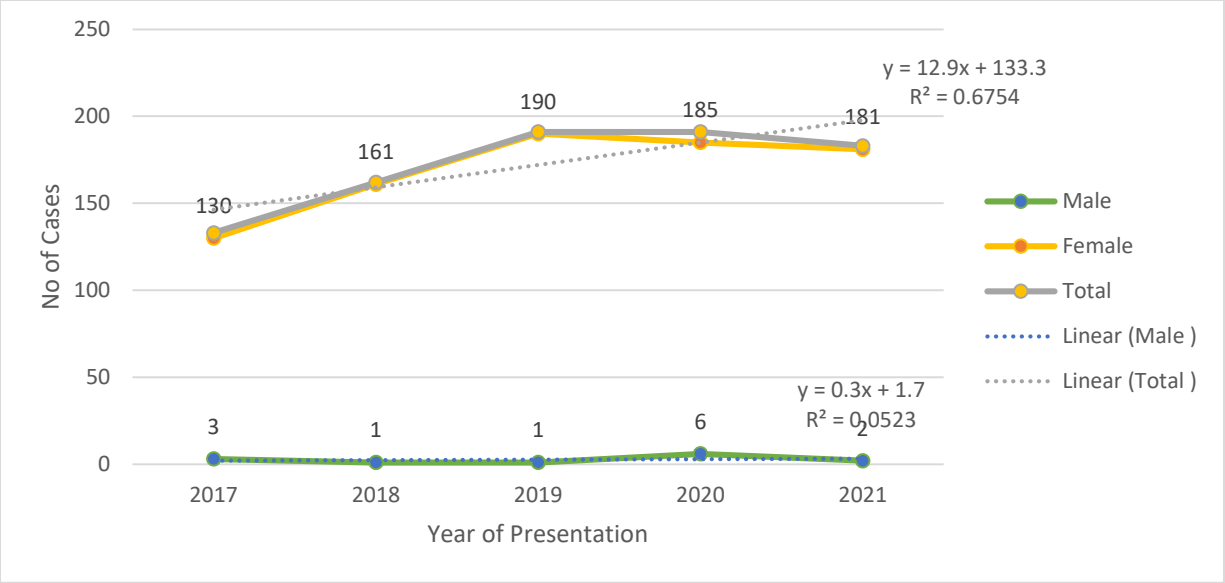


Figure 2.0 Comparison of Trends of Breast Cancer by Gender from 2017 to 2021

Figure 2 above illustrates the trends in breast cancer presentation at the SGMC from 2017 to 2021. It shows a growing trend in breast cancer cases with females recording the highest incidence over the five-year interval period. Thus 55.26% for females and 1.24% for males.

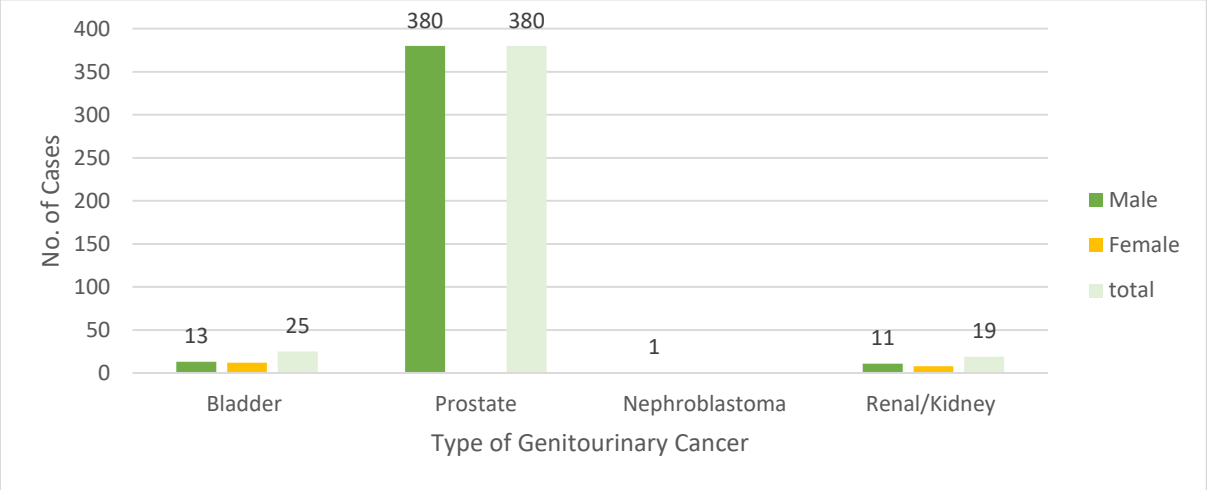


Figure 3.0 Distribution of Genitourinary Cancer by Gender from 2017 to 2021

Figure 3.0 above illustrates the distribution of genitourinary cancers among male and female genders. This includes urinary bladder cancers in both males and females, prostate cancer in males, nephroblastoma, and renal/kidney cancers in both genders. Nephroblastoma is renal or kidney cancer that occurs in infants usually below 5 years. Prostate recorded the highest number of genitourinary, thus 93% of the male genitourinary cancers. urinary bladder and renal/kidney cancers recorded 3.2 % and 2.72% cases. In the female group, urinary bladder and renal/kidney cancers recorded 60% and 38.10% respectively but with small absolute numbers in comparison to prostate cancer in men.

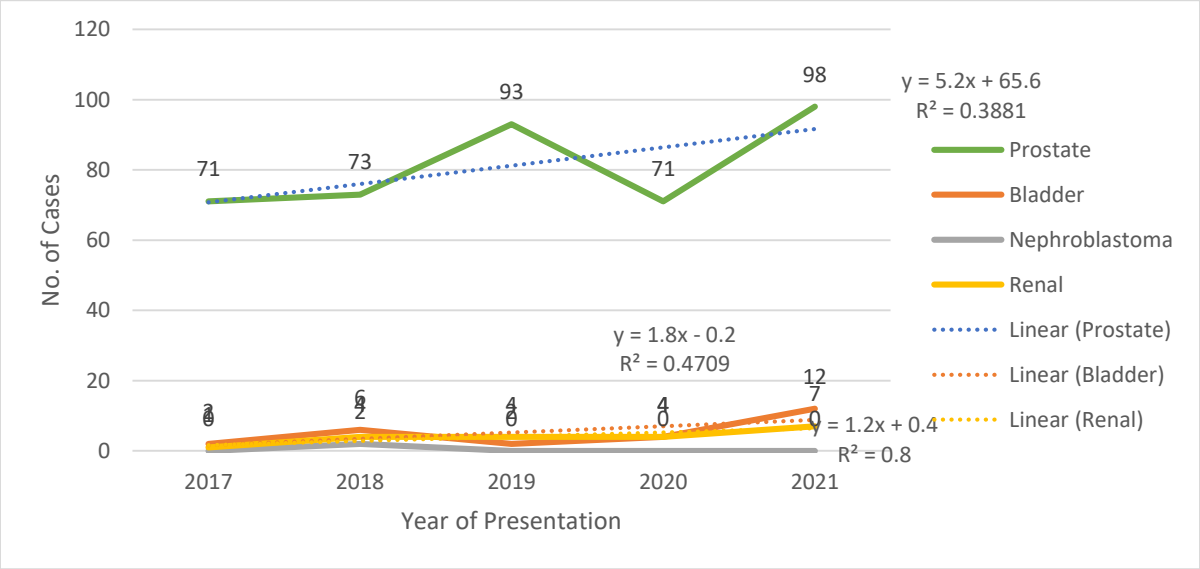


Figure 4.0 Comparison of Trends of Genitourinary Cancers from 2017-2021

Figure 4.0 above illustrates the trends in genitourinary cancers from 2017 to 2021. Except for 2020 where there was a slight dip, prostate cancer showed an increasing trend in numbers compared to bladder and renal cancers.

Table 4.0 Distribution of Digestive/Gastrointestinal Cancers from 2017 to 2021

Cancer Site	Gender		Total (%)
	Male, n (%)	Female, n (%)	
Tongue	5 (1.52)	2 (0.61)	7 (2.1)
Parotid	3 (0.91)	2 (0.61)	5 (1.52)
Esophageal	18 (5.47)	7 (0.28)	25 (7.60)
Gastric	32 (9.73)	14 (4.26)	46 (13.98)
Gall Bladder	4 (1.22)	9 (2.74)	13 (3.95)
Hepatocellular	36 (10.94)	20 (6.08)	56 (17.02)
Pancreatic	14 (4.26)	14 (4.26)	28 (8.51)
Caecum (Caecal)	0 (0.00)	2 (0.61)	2 (0.61)
Colorectal	78 (23.71)	69 (20.97)	147 (44.68)
Total	**190 (57.76)**	**139 (42.24)**	**329 (100.00)**

Table 4.0 above shows the distribution of digestive/gastrointestinal Cancers from 2017 to 2021. This group of cancers by body site classification includes the tongue, parotid gland, gullet (Esophagus), gastric organ(stomach), gall bladder, liver (hepatic organ), pancreas, caecum, colon, rectum and anus (colorectal organ). Colorectal cancers recorded the highest, thus 44.68% of all cancers within this category. About 23.71% of these were males and 20.97% were females. Also, liver cancer (hepatocellular carcinoma) recorded 17.02% of digestive/gastrointestinal cancers. About 10.94% were males and 6.08 % were females. Gastric (Stomach) cancers recorded 13.98% of the total digestive/gastrointestinal Cancers. 69.6% of these were males and 30.43% were females.

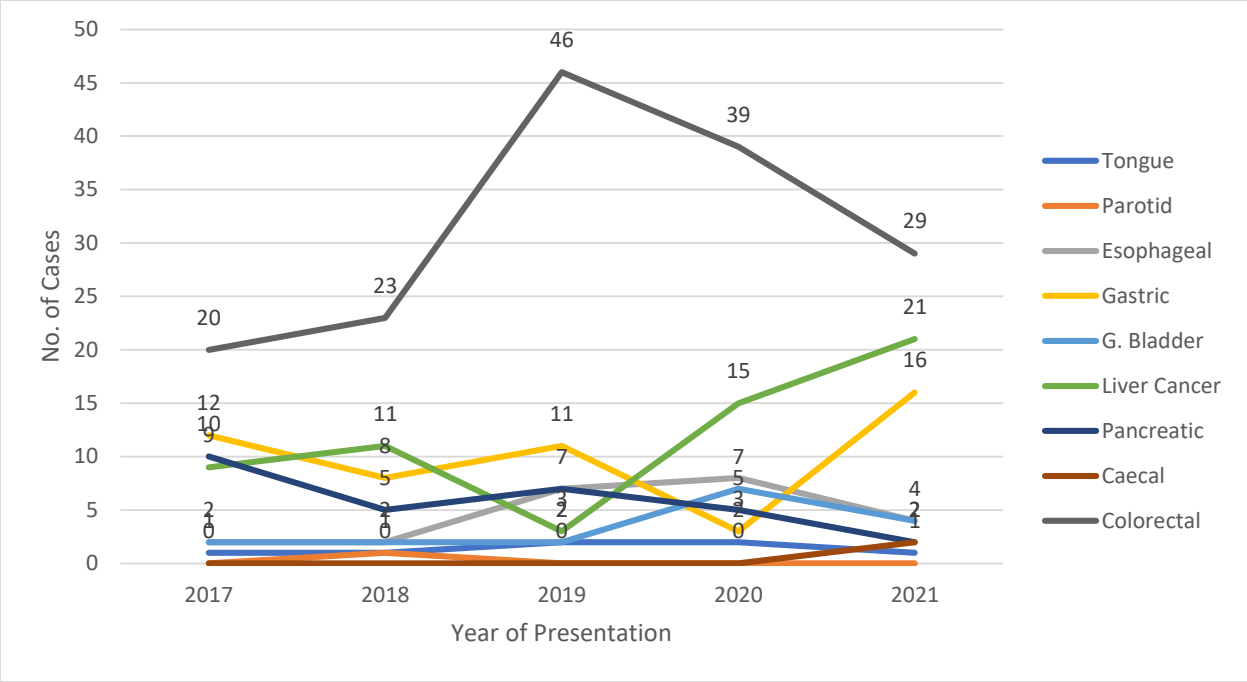


Figure 5.0 Trends of Digestive/Gastrointestinal Cancers from 2017 to 2021

Figure 5.0 above illustrates the trend of digestive/gastrointestinal cancers for the period under consideration. Even though colorectal cancers reported a high number of cases over the period, it showed a sharp rise and fall between 2018 and 2021 depicting an irregular pattern in the cases presented for the five years, and may be difficult to project the pattern of presentation for the next two years unless observed under a wider time frame.

Table 5. Distribution of Gynecologic Cancers from 2017 to 2021

Gynecologic Cancers	N (%)
Uterine Cancer	9 (3.14)
Cervical Cancer	178 (62.23)
Choriocarcinoma	3 (1.04)
Cystadenocarcinoma	1 (0.35)
Endometrial Cancers	53 (18.53)
Granulosa Cell Tumor	1 (0.35)
Vulva Cancer	1 (0.35)
Malignant Mixed Mullerian Tumor	3 (1.05)
Ovarian Cancer	37 (12.93)
Total	**286 (100.00)**

Table 5 illustrates the distribution of gynecologic cancers for the five years. Cervical cancers recorded the highest number of cases constituting, 62% of all the cases. It was followed by endometrial cancers which recorded 18.53% and Ovarian cancers with 12.93%. Uterine, Malignant mixed Mullerian tumor, choriocarcinoma, Granulosa cell tumor, and vulva cancers recorded 3.14%, 1.05%, 1.04%,0.35% and 0.35% respectively. Among this group of cancer, cervical cancer is known to be infectious and is caused by the Human Papillomavirus (HPV), through sexual contact with an infected person. It has a long latent period usually between twenty (20) to twenty-five (25) years. Figure 7.0 b shows the sharp rise in cervical cancers compared to other gynecologic cancers from 2018 to 2021.

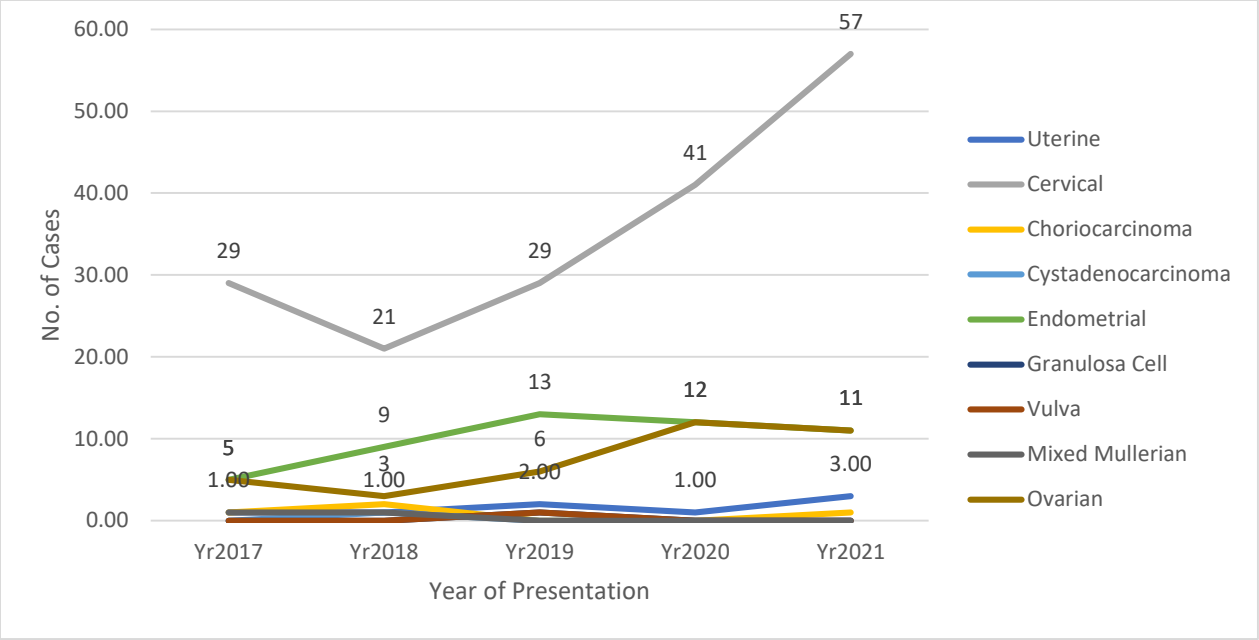


Figure 6 .0 Trends of Gynecologic Cancers from 2017 to 2021

Figure 6 above illustrates the trends of gynecologic cancers for the five years. Cervical cancers recorded the highest number of cases. It showed a growing trend over the five years with a slight dip in 2018. Endometrial cancers also showed a slight growth from 2017 and eventually dip by 2 cases between 2018 to 2021. Vulva Cancer also showed a slight growth between 2018 to 2021.

Table 6.0 Distribution of Head and Neck Cancers from 2017 to 2021

Head and Neck Cancers	Gender		Total, N (%)
	Male, n (%)	**Female,n(%)**	
Maxillary Antrum	3 (1.46)	4 (1.95)	7 (3.41)
Adenoid Cystic /pleomorphic	1 (0.45)	1 (0.45)	2 (0.98)
Mandible	0 (0.00)	1 (0.45)	1 (0.49)
Laryngeal Cancer	27 (13.17)	4 (1.95)	31 (15.12)
Basal Cell Carcinoma	1 (0.45)	0 (0.00)	1 (0.48)
Squamous Cell Carcinoma	65 (31.7)	40 (19.51)	105 (51.22)
Glioblastoma Multiform	3 (1.46)	0 (0.00)	3 (1.46)
Nasopharyngeal Cancer	18 (8.78)	9 (4.39)	27 (13.17)
Oropharyngeal Cancer	3 (1.46)	2 (0.97)	5 (2.44)
Thyroid Cancers	5 (2.44)	12 (5.85)	17 (8.29)
Head and Neck Parotid	2 (0.97)	1 (0.45)	3 (1.46)
Hypopharyngeal	1 (0.45)	0 (0.00)	1 (0.49)
Neuroblastoma	0 (0.00)	1 (0.45)	1 (0.49)
Palate Cancer	1 (0.45)	0 (0.00)	1 (0.49)
Total	**130 (63.24)**	**75 (36.76)**	**205 (100.00)**

Table 6 above shows the distribution of head and neck cancers. Among this group, Squamous Cell Carcinoma recorded the highest number of cases constituting 48.78%. This was followed by laryngeal, Nasopharyngeal, and thyroid cancers recording 15.2%, 13.17%, and 8.29% respectively.

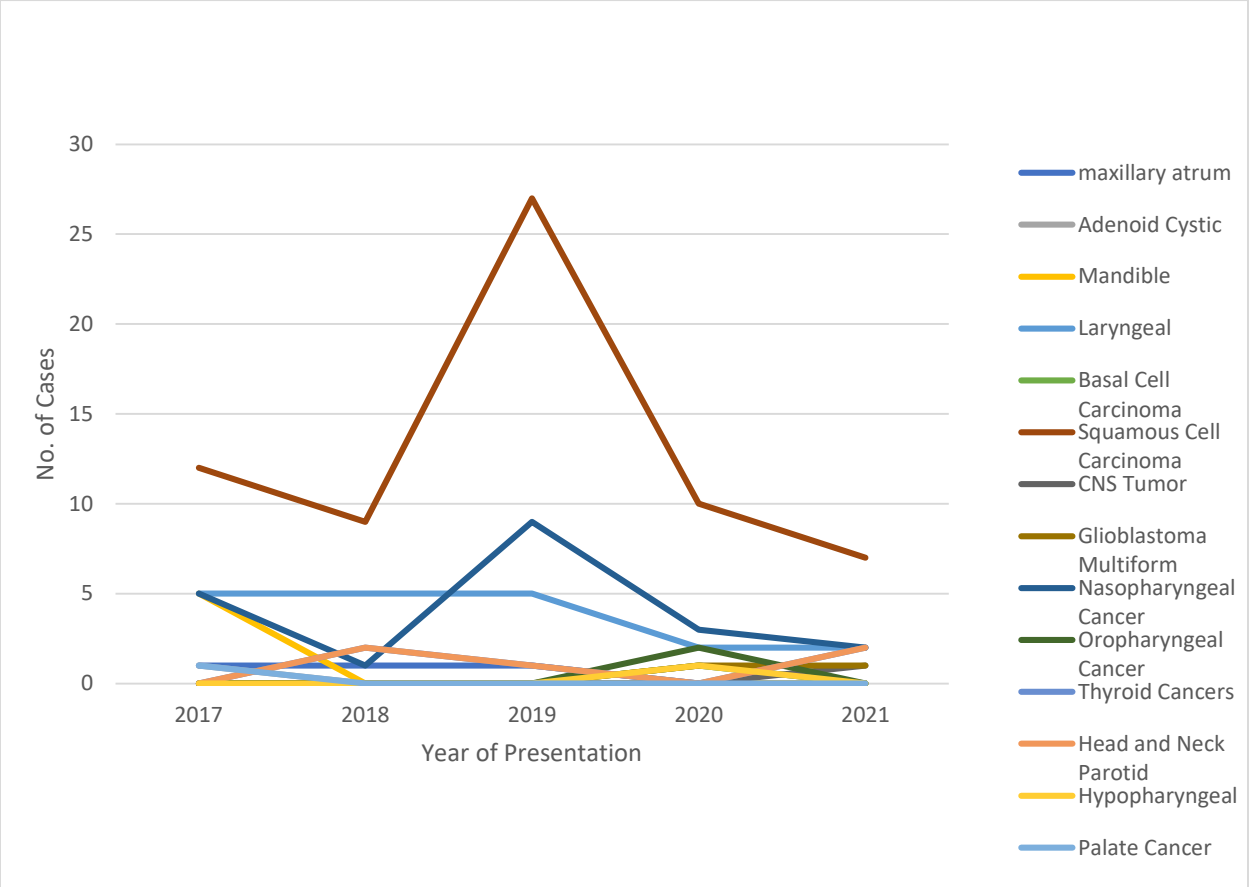


Figure 7.0 Trends of Head and Neck Cancers from 2017 to 2021

Figure 7.0 above shows the trends for the five years for all the head and neck cancers. It shows a sharp rise and falls in squamous cell carcinoma of the head and neck region between 2018 and 2020. Nasopharyngeal cancer shows a similar pattern but with relatively small absolute numbers compared to head and neck squamous cell carcinoma.

4.3 The Relationship Between Age and Incidence of Breast Cancer

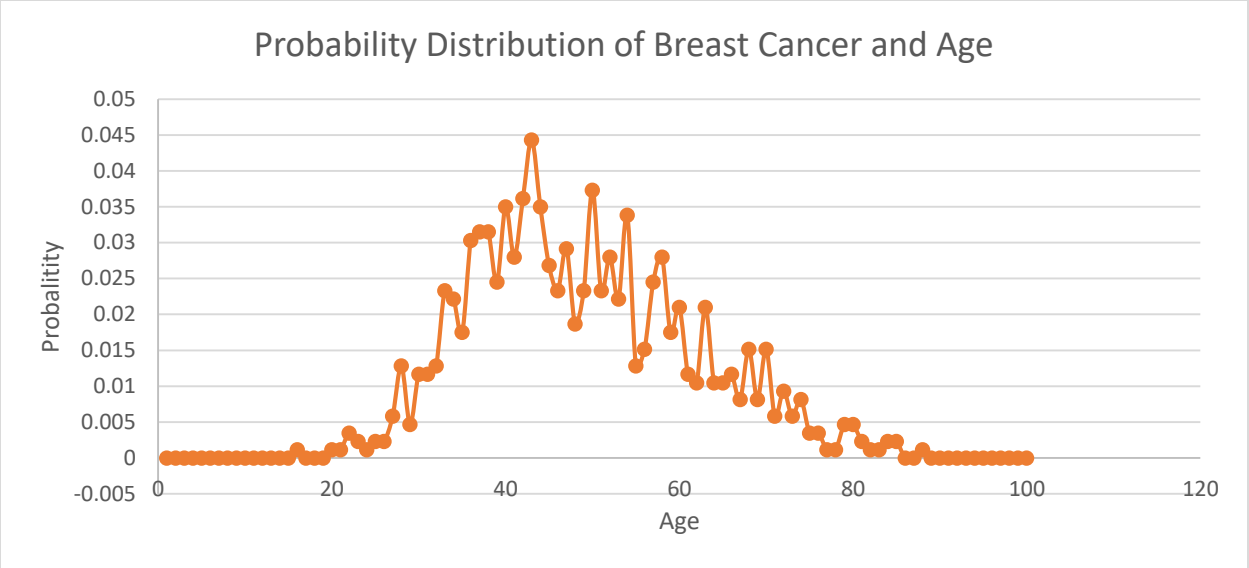


Figure 8.0 Probability Distribution showing the relationship between Age and the Risk of Breast Cancer.

Figure 8.0 shows the probability distribution of breast cancer patients with respect to age. It can be seen from the graph that the risk of breast cancer begins from 16 but rises steadily from age 20 years and increases between the ages 41 to 70 years. The risk peaks at 45 years and begins to drop steadily from 50 to 80 years. Thus, the probability distribution shows a strong relationship between age and breast cancer with peak values at 40 to 54 years.

CHAPTER 5

5.0 DISCUSSION

5.1 Introduction

The study sought to assess the types and temporal trends of cancer cases presented for treatment at the Sweden-Ghana Medical Center over five years, from 2017 to 2021. The purpose of the research is to contribute to the gap in knowledge on cancer epidemiology in Ghana and West Africa by describing the types and temporal trends of cancers presented at the SGMC as a significant private cancer care facility providing relevant information that is useful for planning public health interventions in the management of cancer morbidities and to lessen the burden on the individuals and their families as well as improving their quality of lives. The primary objective was to describe the types and temporal trends of cancer cases presented at the SGMC facility between 2017 to 2021. The specific objectives were to understudy the socio-demographic characteristics of patients who presented at the SGMC over five years and to describe the types of cancers and the temporal trends of the various cancers over the five years under consideration. Also, the secondary objective was to assess the association of age on breast cancer for the same time interval. To achieve the above objectives, electronic data was extracted and reviewed from the hospital information system (HoiSys) at the SGMC from 2017 to 2021. Data cleaning was carried out to ensure the accuracy of variables including the patient identification number, registration date, age, diagnosis, occupation, and nationality. The diagnosis of each patient was organized using the National Cancer Institute's classification of cancers by body site. Occupations of cancer patients were also organized in compliance with the International Standard Classification of occupations using eight groups; professionals and administrators, health professionals and associates, and services technicians and trade-related, farmers or gatherers, retirees and

unemployed as well as students and minors as detailed in chapter three. Chapter Four provided an overview of the main research findings.

5.2 Findings and general Descriptive Statistics

The sociodemographic characteristics of patients who presenting at the SGMC from 2017 and 2021.

5.2.1 Distribution of Cancer Cases by Age

From the study results, 36.11% of the cancer patients at SGMC were 60 years and above, 22.32% were 51 to 60 years, 17.96% were 41 to 50 years, 16.27% were 31 to 40 years, 4.69% were 21 to 30 years and 2.65% were less than 21 years. The youngest patient was 1 year and the oldest was 106 years. The mean age was 53 years. There was a general rise in the number of cases as patients aged. This is similar to another study conducted by Fapohunda et al at the Lakeshore Cancer Center in Nigeria with a mean age of 52 years(Fapohunda *et al.*, 2020). This evidence confirms age as a risk factor for the prevalence of cancer over time. The mean age difference can be attributed to other differences in environmental factors. Fapohunda et al (2020) also reported 28% for patients 60 years and above, 23% for the 51 to 60 years, 22% for the 41 to 50 years, 20% for the 31 to 40 years, 6% for the 21 to 30years, and 1% for those below 21 years.

The National Cancer Institute also recognizes age as the most important risk factor overall and for many individual cancer types(Age and Cancer Risk, NCI.2021.). White et al, corroborates that cancer can be considered an age-related disease because the incidence of most cancers increases with age, rising more rapidly beginning in midlife. However, aging is a process and not a pathology and does not necessarily lead to cancer. According to White et al, some of the same biologic mechanisms that regulate aging may be involved in the pathogenesis of age-related cancer. Thus, if environmental factors that influence these biological mechanisms can be modified, the rate of

aging may be slowed and the onset of cancer delayed or prevented(White *et al.*, 2014). The above statement however does not suggest that old age is necessarily a precursor of cancer but could be a risk factor that is influenced by other genetic and environmental factors that contribute to cancer predisposition.

5.2.2 Distribution by Occupation.

The study results showed that 37.41% of the patients were in the Professional and administrator classification. As mentioned earlier in chapter four, this group constitutes teachers, executives, engineers, professional consultants, aviation crew, judicial, and other public servants. However, 37.8% of this group are teachers. The Swedish Ghana Medical Center is an investment under the Ghana National Association of Teachers, GNAT group, hence it provides oncology care for registered members of GNAT. This is a major contributor to the high number of teachers within the Center's patient pull. This present a bias in comparisons with Professionals in the study conducted by Fapohunde et al which recorded 62% among this occupation group with a smaller population. In 2018, GNAT had 178,000 members. (Danish Trade Union Development Agency, 2020). The number has increased to 200,000 in 2023. It is interesting to note that only 1.88% of the study participants were health professionals whiles Ghana had about 115,650 employed health staff as of 2018 (Asamani *et al.*, 2019). Clearly, it shows the limited access of the SGMC facility to health workers since they do not have a similar arrangement as GNAT. This presents opportunity for research into access to oncology care for healthcare professionals who constitute a sizeable portion of the formal workforce in Ghana. The second group; Services, Technicians, Sales, and Trade related constitutes traders, entrepreneurs, artisans, small-scale business owners such as hairdressers, seamstresses and beauticians. This group contributed to 28.47% of the oncology

patient studied for the period. Many in this group are spouses to teachers who enjoy benefits of the services.

In a 45-year cohort study conducted in five Nordic countries over a population of 15 million people, 2.8 million cancer patients were studied to investigate the relationship between occupation and cancer (Pukkala *et al.*, 2009). The study repeated what other studies confirmed about occupation and cancer. It is known that all mesotheliomas (cancer of thin layer tissue of the internal organs) are associated with asbestos exposure. It also showed that workers such as fishermen, gardeners, and farmers had the highest risk of lip cancers. The commonest lips cancer is squamous cell carcinoma. It's usually common among populations with limited melanin components in the skin. The relatively small number of farmers and gathers (1.88%) in this study population doesn't provide strong evidence to back this previous finding since a very limited number of people within this classification cannot afford treatment at the Swedish Ghana Medical Center. Moreover, the methodology and objectives do not present a format to establish the correlation between occupation and cancer and this can be invested in future research by other researchers.

5.2.3 Temporal Trends and Cancers by Body Site

Among the fifteen groups by site classification, the result showed breast cancer to be 34.33% of all the cases. Female breast cancers contributed 98.76% of the breast cancers. This was followed by genitourinary cancers (18.15%) and digestive/gastrointestinal cancers (14.38%). Prostate cancer contributed 89.20% of the genitourinary cases and cervical cancer contributed 62.23% of the gynecologic cancers. Endometrial cancers and Ovarian cancers made up 18.53% and 12.93 % of the gynecologic cases. Moreover, colorectal cancers contributed 44.68% of the gastrointestinal cancer. Hepatocellular carcinoma (liver cancer) and Gastric (stomach cancer) contributed 17.02% and 13.98% respectively. Among the head and neck classification, squamous cell carcinoma

contributed 51.22% followed by laryngeal and Nasopharyngeal cancers which contributed 15.12% and 13.17% respectively.

In absolute terms this data suggest breast cancer to be the leading cancer case with 857 patients, followed by Prostate cancer in men with 380 cases, Cervical cancer with 178 cases for the period and colorectal/anal cases with 147 cases. Squamous Cell Carcinoma of the head and neck also contributed 105 cases. In the study conducted by Fapohunda et al at the Lakeshore Center in Nigeria, breast cancer recorded the leading cases with 181 patients. This was followed by prostate and colorectal cancers with 50 cases and 41 cases respectively. Cervical cases recorded 22 cases. Obviously the SGMC is a much older facility (setup in 2012), with subsidized financing for teachers hence it has more patient turnout than the lakeshore facility moreover the lakeshore cancer center started operations in 2015 and services are strictky out of pocket.

Diet is a major risk factor for colorectal cancers especially in regions with high consumption of meat diet. In Nigeria it is a major contributor to most colorectal cancer cases, hence a varying difference between the trends recorded at the SGMC and the lakeshore Center in Nigeria.

In 2014, a study was undertaken by Calys-Tagoe et al to profile cancer patients at the oncology unite of the Korle-Bu Teachig Hospital, breast cancer was identified as the leading cancer among females (40.8%) , followed by cervical cancers(24.3%) and uterine cancers (4.5%). Among males, the common cancers were prostate cancer (26.5%) pharyngeal cancer (7.4%) and colorectal cancers (6.5%)(Calys-Tagoe *et al.*, 2014).

In 2015 another study conducted in Ethiopia at the Tikur Anbessa Specialized Oncology Hopital, Gynencologic cancers recorded the highest figure with approximately 36.6% cases. This was followed by breast cancer recording 22.26% and Head and Neck Cancers at (8%) whiles Soft

tissue/Bone Cancers recorded (6%) (Wondemagegnhu, 2015). Since 2020, these figures have altered and breast cancer is the leading cancer morbidity with 20.9%, cervix uteri reporting 9.6%, colorectal cancers at 7.8% , Leukemia at 5.6% and Non-Hodgkin Lymphoma at 4.9%. All other cancers contributed 51.1% to the Cancer burden in Ethiopia (IARC, 2020).

5.2.3 Relationship Between Age and Risk of Breast Cancer

As an objective to assess the risk of age and breast cancer, a probability density plot provides a clear relationship between the risk of age and breast cancer. As indicated in Figure 8.0, incidence among breast cancer patients presented at the SGMC for the period ranged from 16 years to 89 years. Both 16 and 89 years were outliers. Incidence peaked between the ages 40 and 54 years and eventually dropped steadily from 60 to 80 year. This corroborates with findings discovered among multiparous women in sub-Saharan with breast cancer cases that peaked around 40 to 44 years (Sighoko et al., 2013).

Results from this study also present a higher prevalence of cancer among females than males. Breast cancer recorded the highest numbers among female, thus 33.87% against 0.48% in males. This figure among men corroborates what is found in most literature regarding the statistic of breast cancers, thus 1% of all breast cancer cases (Gethins, 2012). Genitourinary cancers at the SGMC are more pronounced in the males with prostate being the leading case among the males, 89.41%, and cervical cancers as the leading Gynecologic caners among women, thus 62.23%.

CHAPTER 6
6.0 CONCLUSION AND RECOMMENDATIONS

In conclusion, generally the summerized findings and descriptive socio-demograhic characteristics of cancer patients at the SGMC over the five year interval, 2017 to 2021, is similar to other studies in Ghana and Africa. Female Breast Cancer remains the leading cancer incidence globally with approximately 2, 261,419 cases as at 2020 representing 11.7% of global oncology cases (Sung *et al.*, 2021). This study validates breast cancer as the leading cancer incidence with 857 morbidities for the five year interval at the SGMC. Prostate cancer has emerged the second leading cancers in Ghana and Sub-saharan region. This does not follow the regualar parttern observed on the global scale with lung cancer emerging as the second leading cancers. It also suggest that Prostate Cancer needs as much attention as breast cancer.

Another observation of interest in this study was general increase in trends of cancers from 2017 to 2021 as shown in figure 1.0. This is consistent with projections made regarding the expected rise in cancers as developing economies continue to undergoe epidemiologic transition as a result of industralization and adoption western lifestyles that are associated with inactivity and unhealthy dieting practices. Colorectal Cancers have seen a rise in numbers considering the trend from 2017 to 2021 as indicated in figure 5.0. Also, the risk of breast cancer began from 16 years, and rose steadily from 20 years. The risk was high between 41 to 70 years with the highest prevalence between 40 to 50 years. It suggest a strong relationship between age and breast cancer.

On the basis of the findings of this study and conclusions, it is recommended that:

1. SGMC establishes a Survivorship Programs that embodies screening, early detection or diagnosis for early detection by the first quarter of 2024. This should be routinely carried out especially among the GNAT, ECG and other corporate entities who form a bulk number of their patients. As part of their corporate social responsibility members within the centers vicinity should be given the opportunity to benefit from this screening services. This implies an annual CSR budget be drawn to support this program. This preventive approach will increase the numbers and give a true reflection of the disease at the early stages to be treated before they are reported at late stages where it becomes more expensive to treat and in most cases results in terminal cases.

2. SGMC initiates an advocacy program that is focused on creating awareness on the growing trends of cancers in the Country and West African Sub region.
3. SGMC ensures that campaigns do not only focus on awareness but on risk factors for the prevailing cancer burden.
4. SGMC deepen it's relationship with other institutions to advocate for policies and funding to support cancer prevention, research and treatment at the national and regional levels.
5. SGMC deepen it's relationship with government agencies and NGO's to integrate cancer control stategies into the broader healthcare system.

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List of Cancers Presented at SGMC 2017 to 2021

SITE & TYPES OF CANCERS	GENDER		TOTAL N (%)	
	Male	**Female**		
AIDS-RELATED CANCERS	1	1	**2**	**(0.08)**
Kaposi Sarcoma				
BREAST CANCERS	13	845	**857**	**(34.33)**
DIGESTIVE/GASTROINTESTINAL	**205**	**159**	**327**	
CANCERS	2	2	**4**	
Tongue	3	2	5	
Parotid	18	7	25	
Esophageal	32	14	46	
Gastric	1	0	1	
Serous Carcinoma of the Peritoneum	4	9	13	
Gall Bladder	36	20	56	
Liver/Hepatocellular	14	14	28	
Pancreatic	-	2	2	
Colorectal and anal	78	69	**147**	**(5.89)**
Caecum				
ENDO/NEUROENDOCRINE	**3**	**1**	**6**	
CANCERS	1	-	1	
Adrenocortical carcinoma	-	1	1	
Pituitary adenoma	1	1	2	

Neuroendocrine Tumor	1	-	1	
Rectum-Neuroendocrine Tumor	1	1	2	
Carcinoid Tumors				
EYE CANCERS	1	1	**2**	
Blue Cell Tumor	-	1		
Orbital Melanoma	1	-		
GENITOURINARY CANCERS	**405**	**20**	**425**	**(17.02)**
Bladder Cancer	13	12	25	
Prostate Cancer	380	-	380	
Nephroblastoma	-	1	1	
WILMS Tumor	1	-	1	
Renal Cell	11	7	18	
GYNECOLOGIC CANCERS	-	**286**	**286**	**(11.45)**
Uterine Cancer	-	9	9	
Cervical Cancer	-	178	178	
Choriocarcinoma	-	3	3	
Cystadenocarcinoma	-	1	1	
Endometrial Cancer	-	53	53	
Granulosa Cell Tumor	-	1	1	
Vulva Cancer	-	1	1	
Malignant Mixed Mullerian Tumor	-	3	3	
Ovarian Cancer	-	37	37	

GERM CELL CANCERS	2	**2**	**4**	
Central Nervous System	2	1	3	
Ovarian Dysgerminoma	-	1	1	
HEAD & NECK CANCERS	**130**	**75**	**205**	**(8.21)**
Maxillary Antrum	3	4	7	
Adenoid Cystic Cancer	1	1	2	
Mandible	-	2	2	
Larynx	20	2	12	
Basal Cell Carcinoma	1	-	1	
Sino nasal with Orbital Invasion	1	3	4	
Squamous Cell Carcinoma	2	3	5	
Laryngeal Carcinoma	7	2	9	
Head and Neck Tumor(unspecified)	63	34	97	
Glioblastoma Multiforme	3	-	3	
Nasopharyngeal	17	6	23	
Oropharyngeal	1	1	1	
Neck Tonsillar	2	1	3	
Thyroid	5	12	17	
HnN Parotid	2	1	3	
Hypopharyngeal	1	-	1	
Neuroblastoma	-	1	1	
Palate	1	-	1	
Paraganglioma	-	2	2	

HEMATOLOGIC/BLOOD	**45**	**30**	**75**	**(3.00)**
CANCERS	5	1	6	
Acute Leukemia	1	3	4	
Lymphoblastic leukemia	-	1	1	
Myeloid Leukemia	1	-	1	
Burkitt's Lymphoma	4	2	6	
Non-Hodgkin's Lymphoma	1	-	1	
Lymphoblastic lymphoma	3	1	4	
Hodgkin's Lymphoma	1	-	1	
B Cell Lymphoma	2	1	3	
Cell Lymphoma	1	-	1	
Malt Lymphoma	1	12	13	
Hematological abdominal lymphoma	12	5	17	
Hematological malignancy	1	1	2	
Myeloma	1	1	2	
Plasmacytoma				
T-Cell Lymphoma				
MUSCULOSKELETAL CANCERS	**44**	**46**	**90**	**(3.61)**
Abdominal Leiomyosarcoma	-	1	1	
Adenocarcinoma of the chest wall	1	-	1	
Alveolar rhabdomyosarcoma	-	2	2	
Bone Cancer (Osteosarcoma)	1	-	1	
Cell adenocarcinoma	-	1	1	

Dermatofibrosarcoma protuberans	4	4	8
Embryonal rhabdomyosarcoma	1	-	1
Fibrosarcoma of the thigh	1	-	1
Giant Myxoid Liposarcoma	1	-	1
Gluteal Sarcoma	-	1	1
Histiocytic Sarcoma	-	-	-
Malignant Fibrous Histiocytoma	1	-	1
Osteosarcoma	8	7	15
Pleomorphic Liposarcoma	2	1	3
Rhabdomyosarcoma	6	20	26
Sarcoma of Lower Jaw	1	-	1
Sarcoma Desmoplastic	1	-	1
Sarcoma Giant Cell Tumor	1	1	2
Spindle Cell Liposarcoma	2	2	4
Synovial Cancer	1	1	2
Soft Tissue Sarcoma	1	-	1
Leiomyosarcoma	-	4	4

NEUROLOGIC	**19**	**19**	**38**	**(1.52)**
Astrocytoma	1	1	2	
Bone-Spine Tumor	-	1	1	
Brain Tumor	8	6	14	
Brain Tumor-Glioblastoma	-	1	1	
Multiforme	-	1	1	
CNS-Tumor-Cerebellopontine Tumor	1	1	2	
CNS Tumor-Meningioma	-	1	1	
CNS Tumor-Oligodendroglioma	1	-	1	
CNS Tumor- Cerebellopontine Tumor	3	-	3	
CNS Tumor-Peripheral Nerve Sheath	1	3	4	
Tumor	-	-	-	
CNS Tumor	-	1	1	
CNS-Anaplastic Oligodendroglioma	1	-	1	
CNS-Ependymoma of Front temporal	1	-	1	
of	-	1	1	
Ependymoma	-	1	1	
Ganglineuroblastoma	-	1	1	
Medulloblastoma	1	-	1	
Oligoastrocytoma	1	-	1	
Oligodendrioma				
Plexiform Neurofibroma				

RESPIRATORY	41	36	**78**	**(3.12)**
Bronchial Carcinoid	-	1	1	
Bronchogenic Carcinoma	2	-	2	
Lung Cancer	36	31	67	
Thymic Cancer	2	-	2	
Thymoma	1	4	5	
SKIN	26	18	**44**	**(1.76)**
Basal Cell Carcinoma	3	2	5	
Squamous Cell Carcinoma	6	4	10	
Conjunctival Squamous Cell	1	-	1	
Carcinoma	-	1	1	
Dermatofibrosarcoma Protuberans	3	-	3	
Kaposi Sarcoma	1	1	2	
Malignant Melanoma	1	0	1	
Myxoid Leiomyosarcoma				
UNKNOWN PRIMARY	6	8	**14**	**(0.56)**
Hepatic Tumor from Unknown	1	-	**1**	
Primary	5	8	**13**	
Unknown Primary				
	967	1,528	**2,495**	**(100.00)**