



**NEAR EAST UNIVERSITY  
INSTITUTE OF GRADUATE STUDIES  
DEPARTMENT OF MATHEMATICS**

**CANCER INCIDENCE IN SIERRA LEONE RELATIVE TO NEIGHBORING  
COUNTRIES**

**M.Sc. THESIS**

**Mariatu Abliatu SESAY**

**Nicosia**

**January, 2023**

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**MASTERS THESIS**

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**M.Sc. Thesis**

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**Nicosia**

**January, 2023**

### Approval

We certify that we have read the thesis submitted by Mariatu Abliatu Sesay titled "CANCER INCIDENCE IN SIERRA LEONE RELATIVE TO NEIGHBOURING COUNTRIES" and that in our combined opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Educational Sciences.

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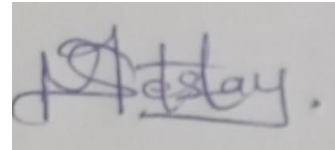
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### Declaration

I hereby declare that all information, documents, analysis and results in this thesis have been collected and presented according to the academic rules and ethical guidelines of Institute of Graduate Studies, Near East University. I also declare that as required by these rules and conduct, I have fully cited and referenced information and data that are not original to this study.



Mariatu Abliatu Sesay

.../.../.....

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Mariatu Abliatu Sesay

**To my parents.....**

## **Abstract**

### **Cancer Incidence In Sierra Leone, Relative To Neighbouring Countries**

**Sesay, Mariatu Abliatu**

**M. Sc., Department of Mathematics**

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Cancer is a disease that develops when cells in one area of the body multiply and expand uncontrollably. Healthy tissue, including organs, can be invaded and destroyed by cancerous cells. Before it is discovered, cancer can begin in one area of the body and spread to others. The medical word for this process is metastasis.

Male(M) and female(F) incidences of cancers are identified in a list form such as Lung, skin, colon and Rectal cancer,(a disease in which the cells in the colon or rectum grow out of control), prostate, brain, bladder, Esophageal cancer, liver, and stomach cancers were shown to be the most common in men. Whereas Breast, gynecological, skin, Colon and rectal cancer, lung, Melanoma, liver, brain, endometrial cancer, stomach, Cervical cancer, Ovarian cancer, and bladder were similarly listed for females (F) which are also common in females.

Statistics include information on the number of people who are diagnosed with cancer and pass away from it each year, the number of people who survive after receiving a cancer diagnosis, the average age at diagnosis, and the number of survivors at a certain point after diagnosis. In addition, they offer data on differences between groups according to age, gender, racial/ethnic group, geographic region, and other criteria.

The purpose of the study was to provide information about the incidence and mortality rates of cancer in Sierra Leone in comparison to neighboring nations. This study was conducted using the statistical software for social sciences SPSS and MS Excel. The percentages and frequencies of the data descriptive analysis were determined in this study and evaluated using the Age Standardized Ratio (ASR). This investigation will determine the cancer incidence in Sierra Leone by comparing it to nearby nations. For all malignancies in both sexes, percentages and ASR for incidence and mortality were analysed.

**Keywords:** cancer incidence, sierra leone, statistical analysis, guinea and liberia

## Özet

### **Cancer Incidence In Sierra Leone, Relative To Neighbouring Countries**

**Sesay, Mariatu Abliatu**

**M. Sc., Department of Mathematics**

**Ocak 2023, 73 sayfa**

Kanser, vücudun bir bölgesindeki hücrelerin kontrolsüz bir şekilde çoğalması ve genişlemesiyle gelişen bir hastalıktır. Organlar da dahil olmak üzere sağlıklı doku, kanserli hücreler tarafından istila edilebilir ve yok edilebilir. Keşfedilmeden önce, kanser vücudun bir bölgesinde başlayabilir ve diğerlerine yayılabilir. Bu işlem için tıbbi kelime metastazdır. Erkek(E) ve kadın(K) kanser insidansları, Akciğer, deri, kolon ve Rektum kanseri (kolon veya rektumdaki hücrelerin kontrolden çıktığı bir hastalık), prostat, beyin kanseri gibi bir liste şeklinde tanımlanır. , mesane, yemek borusu kanseri, karaciğer ve mide kanserlerinin erkeklerde en sık görüldüğü gösterildi. Meme, jinekolojik, cilt, kolon ve rektal kanser, akciğer, Melanoma, karaciğer, beyin, endometrial kanser, mide, Rahim ağzı kanseri, Yumurtalık kanseri ve mesane benzer şekilde kadınlarda da yaygın olarak sıralanmıştır (F).

İstatistikler, her yıl kanser teşhisi konan ve kanserden ölen insan sayısı, kanser teşhisi konulduktan sonra hayatta kalan insan sayısı, ortalama teşhis yaşı ve teşhisten sonra belirli bir noktada hayatta kalanların sayısı hakkında bilgiler içerir. . Ayrıca yaş, cinsiyet, ırk/etnik grup, coğrafi bölge ve diğer kriterlere göre gruplar arasındaki farklılıklar hakkında veriler sunarlar.

Çalışmanın amacı, komşu ülkelerle karşılaştırmalı olarak Sierra Leone'de kanser insidansı ve ölüm oranları hakkında bilgi vermektir. Bu çalışma, sosyal bilimlerde SPSS ve MS Excel istatistik yazılımı kullanılarak yapılmıştır. Bu çalışmada veri betimsel analizinin yüzdeleri ve frekansları belirlenmiş ve Yaş Standardize Oranı (ASR) kullanılarak değerlendirilmiştir. Bu araştırma, Sierra Leone'deki kanser insidansını yakın ülkelerle karşılaştırarak belirleyecektir. Her iki cinsiyetteki tüm maligniteler için, insidans ve mortalite için yüzdeler ve ASR analiz edildi.

Anahtar Kelimeler: kanser insidansı, sierra leone, istatistiksel analizi, guinea ve liberia



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## CHAPTER I

### Introduction

#### 1.1 Introduction

Cancer is the leading cause of death in the world and one of the leading causes of death in the population. If no preventive measures are taken, the global cancer burden is expected to rise by up to 70% in the next two decades if no preventive measures are taken. Cancers such as lung, breast, and colon cancer, which were long thought to be the primary cause of incidence and mortality in economically developed countries, are now being diagnosed at a higher rate in developing countries. Most countries have seen worrying increases in cancer incidence rates in recent years.

Even though the mortality rate has decreased, the disease is still a significant cause of mortality in Europe, accounting for about 20%–40% of all cancer-related mortality globally. Cancer can start in one part of the body and spread to another. The medical word for this process is metastasis. Lung, skin, colon, and rectal cancers, prostate, brain, bladder, esophageal cancer, stomach, and liver cancers were shown to be in men the most. Whereas Breast, gynecological, skin, Colon and rectal cancer, lung, Melanoma, liver, brain, Endometrial cancer, stomach, Cervical cancer, Ovarian cancer, and bladder were similarly listed for females (F) which are also common in females. All of these can result in painful mortality. According to scientific belief, cancer is a condition that may be prevented and treated if caught in its early stages and treated with lifestyle changes, including quitting smoking, abstaining from drug use, and adhering to a healthy diet. Avoid using meat and fat excessively, and engage in frequent activity. Given the significant geographic disparity in global occurrences of the infection, the relationship between the disease and factors relating to the surroundings as well as the mind, and the need to fulfill the needs of any government initiative to fight cancer in Sierra Leone and its neighboring countries, citizens are required to understand how the precise classification of cancer kinds and incidence rates affect their societies. Such an aspect has increased the significance of my analysis in order to record the extent of cancer of how it spread and its geographic distribution in Sierra Leone and its neighboring nations, as well as to identify the ecological, geographical, biological, and social variables that influence it, this study integrates statistics and medical geography.

### **1.1.1 Research Challenges.**

The challenges the researcher encountered while conducting his study are:

The inconsistent nature and, in some cases, the veracity of the statistical data.

Researchers must consult numerous medical, statistical, and geographic references and publications with scientific information on the subject to formulate their findings within an appropriate statistical framework. The lack of information about that condition and the resistance of several administrators and employees to work alongside researchers to gather tumor information

### **1.1.2 Research. Objectives.**

This research's main goal was to evaluate cancer-related data using statistical methods. Comparison of their occurrence in Sierra Leone and surrounding nations. In ways that generate the following:

Analysis of geographical elements, both biological and artificial, that may be connected to the formation, growth, and prevalence of cancer using statistical analysis and environment

Understanding both the geographical contexts of countries is necessary to lower cancer rates.

Describe the types and incidences of cancer in your field of study. Additionally, to compel the country to address issues like these that our nation and developing nations generally, that is lacking in our country

### **1.1.3 Significant of this Research.**

The significance of this study is clear from the title. In a region where this kind of sampling appears to be a new area of study, the majority of researchers and statisticians work to establish a connection between surveys and studies, the physical surroundings, public health, and the origin of illnesses and their elevated numbers.

- It is crucial to weigh the benefits and drawbacks of human existence in order to prevent many diseases, including cancer. Given its significance, we will work to achieve the right conclusions possible to effectively safeguard the populace's safety and well-being. Additionally, the following sub-importance are listed:
- This subject focuses on statistics and medical geography.



- The study would aid in comparing countries to identify which organisms appear to be more in the world.
- The research will help statisticians determine if cancer incidence is rising or falling.
- The rise of new diseases and their high prevalence are all going to be highlighted.
- This study now includes references from medical researchers.
- The data analysis will demonstrate the rates of disparity and change in incidence from one nation to another, which might also help determine the causes of the incidence.

#### 1.1.4 Research Limitations.

The research is only focused on the main areas:

- **Regional restraint:** The study will be limited to the cancer incidence in Sierra Leone in comparison to its neighbors.
- **The human's limitations:** This research is restricted to the demographics of Sierra Leone in comparison to Guinea and Liberia.
- **The duration:** During the academic year 2021-2023, Applied Science.

#### 1.1.5 Definition of Terms.

1. **Cancer-** The term "cancer" refers to a disease where somebody's cells grow uncontrollably and spread throughout the body.
2. **Incidence-** The occurrence of new cases of illness or injury within a population over a given period is referred to as a "incidence." The number of new instances within a community is how some epidemiologists define incidence, but others define incidence as the number of new cases per unit of population.
3. **Mortality-** This describes the condition of being mortal. In medicine, the phrase is also used to describe death rates or the number of fatalities among a particular population within a given period.
4. **Prevalence-** This is defined as the number of individuals in a population who have a disease or health condition at any particular time.
5. **Organisms-** An independent living creature that maintains its life with organs with distinct functions but interdependent with one another.

6. **Diseases**- An organism's structure or function that is out of balance without being directly caused by physical harm
7. **Demography**- Demography is the statistical study of human populations, composition, and mobility over time and space.
8. **Neighboring countries**-This is where neighboring nations /countries have a shared boundary.
9. **Psychological factors**- Psychological elements include things like individual-level meanings and processes that are influenced by mental states.
10. **Medical geography**- Analysis of geographic trends in disease and access to healthcare is a focus of medical geography.
11. **Statistical data**- It is the study of data that involves obtaining, structuring, analyzing, interpreting, and presenting it.
12. **Limitations**- The limitations of the study are those elements of methodology or design that affected or influenced how your research findings were interpreted.

## CHAPTER II

### Literature Review

#### 2.1 Cancer

##### 2.1.1 *Definition of Cancer*

The term "cancer" refers to a disease in which some of the body's cells grow uncontrollably and spread throughout the body.

A person's body is made up of billions of cells, and cancer can develop almost everywhere. Human cells frequently divide into new ones to produce more when the body needs more cells. The process of cell division brings this on. New ones because of aging or damage replace older cells.

These cells can develop into tumors, which are clumps of tissue. Tumors that are malignant may or may not be present. The term "metastasis" refers to the process by which cancerous cells spread throughout the body to form new tumors, infiltrate nearby tissues, or both. Cancerous tumors are also known as malignant tumors. Leukemia and other blood malignancies rarely form solid tumors, but many other cancers do.

- The tissues around a benign tumor are not invaded or disseminated. While dangerous tumors can come back after removal, benign ones typically do not. However, benign tumors have a huge potential for growth. Some may have symptoms or adverse effects that are potentially fatal, such as benign brain tumors. Changes in the genetic code may occur because healthy cells develop cancer. These modifications could result in cancer-causing substances like radiation, chemicals, smoking, or infectious disorders, including viral infections. A spontaneous mistake or mutation in the DNA copy that occurs during cellular division or because this mutation or mistake inherited from the cell nucleus are also stimulating components, as are genes that affect the high quality of specific genes.
- ***Cancer and hereditary factors.*** Malignancies are not always inherited. However, people who have inherited defective genes are more likely to develop certain types of cancer. Genetic testing can be used to identify some of these faulty genes.

- ***Cancer and genetics.*** In the case of a cancer cell, these genes are active to provide the cell with novel characteristics, including abnormal growth and division, and to support the cancerous cells in growing under peculiar conditions.
- ***Authentic cancer genetic traits.*** Genes that work to stop the growth of a cancer cell by correcting any errors in gene copies, controlling cell division, forming colonies to stop the spread of viruses, and supporting the immune system

## 2.1.2 TYPES OF CANCER

**2.1.2.1 *Colon/rectal (left/right rectal) cancer:*** Colon-rectal cancer is a diverse illness that affects the colon and the rectum, both of which are components of the gastrointestinal system. Benign mucous polyps are the precursor to all types of colon and rectal cancer.

These benign tumors develop in the big intestine wall and have the potential to progress to malignancy. One aspect of preventative medicine is benign nephrectomy and good outcomes.

- ***Symptoms of Colon/rectal cancer.***

1. Continental pain
2. Weight loss is a sign that typically shows up later and denotes a potential disease spread.
3. The rectum is where bleeding starts.
4. Constipation or diarrhea are examples of changes in bowel habits. In-depth examination should be done if these symptoms emerge because they may also be observed in other illnesses.

- ***Reasons for Colon/rectal cancer.***

1. The occurrence of colic, cancer of the other organs, or ulcerative colitis, particularly the patient's uterus and breast.
2. Contrary to popular belief, hemorrhoids do not increase the chances of getting colorectal cancer.
3. In the family, there is a history of mucus polyps and colon/rectal cancer. Contrary to popular belief, hemorrhoids do not actually cause colon cancer.

**2.1.2.2 *Lung Cancer:*** Mucus builds up and extraction becomes more challenging as a result of some of the layer's lining cells in the trachea growing more quickly and irregularly than usual. Additionally, some of these abnormally expanding cells have the potential to quickly multiply and develop cancer. The lung retains mucus because of the conflict between these cells and the killing of healthy cells. Cancer, which creates a block or tumor that constricts the trachea, is among the leading causes of death for both men and women in the majority of developed

countries. Lung cancer is the most common type of cancer that kills both men and women in the United States.

- ***Symptoms of Lung cancer.***

Significant weight loss with stress that has no apparent explanation.

1. Swallowing difficulties brought on by esophageal pressure from the tumor.
2. Chest noises while breathing
3. Sputum removal from the trachea is difficult
4. Persistent coughing.
5. Breathing difficulties.
6. Phlegm out with blood.

- ***Reasons for Lung cancer.***

1. The air is highly polluted
2. Smoking, which increases a smoker's risk of lung cancer compared to non-smokers.

### **2.1.2.3 Cervical cancer.**

The cervix is the passageway between the vagina and the womb (uterus). It is occasionally referred to as the "neck of the womb" and is a component of the reproductive system. Human papillomavirus (HPV) infections, which account for nearly all cervical malignancies, are the main cause of these diseases.

- ***Symptoms of Cervical cancer.***

1. Abnormally heavy or prolonged menstruation flow.Pain during intercourse.
2. Bleeding after sex.
3. Pain in the pelvis.
4. A change in the color, consistency, or smell of your vaginal fluid, such as increased discharge or an odd or unpleasant odor. Vaginal bleeding after menopause.
5. Vaginal bleeding between periods

- **Reasons for Cervical cancer:**

1. Cervical cancer is mostly brought on by chronic infection with specific kinds of human papilloma virus (HPV).

2. When two people have sex, the common virus HPV is spread from one to the other. However, only a small percentage of women will develop cervical cancer. At some point in their lives, HPV will be present in at least half of sexually active individuals.

**2.1.2.4 Liver cancer.** If the tumor is primary, the uncontrolled and abnormal growth of liver cells is known as liver cancer. In the case of secondary infection, the liver is impacted after being transmitted from one person to another.

- ***Symptoms of Liver cancer:***

1. High temperature.
2. Upper abdominal discomfort
3. Feel tired and idle.
4. Weight loss and loss of appetite
5. The body and eyeball becoming yellow
6. Nausea and vomiting.

- ***Reasons for Liver cancer:***

1. Hepatitis B virus infection.
2. Drink (Alcohol) heavily.
3. Intake of Toxic food

**2.1.2.5 Brain Cancer:** Brain tumors are collections of abnormal brain cells. Different types of brain tumors exist.

- ***Symptoms of Brain cancer/Tumor:***

1. Headaches.
2. Vision or speech problems.
3. having a persistent case of nausea, vomiting, and sleepiness
4. seizures (fits)
5. Mental or behavioral changes, such as memory problems or changes in personality.  
Memory issues or personality changes are examples of mental or behavioral changes.
6. Gradual loss of strength or paralysis on one side of the body.

- ***Reasons for Brain Cancer:***

1. Having a sudden, intense need to sleep.
2. Constant migraines (often worse in the morning).
3. Vomiting (typically first thing in the morning) or feeling ill.

4. Weakness of the face, arm, or legs on one side only.
5. Improper balance or clumsiness (including difficulties with balance).
6. Having a strong sense of annoyance or losing interest in daily activities.
7. Eye issues, including double, blurry, or irregular eye movement.
8. Feeling extremely exhausted much faster than normal

**2.1.2.6 Bladder cancer:** When aberrant cells in the bladder develop uncontrollably, bladder cancer results. The bladder is a hollow organ with an expandable or retractable muscle wall. It is situated at the base of the abdomen. Urine is held in the bladder until it is discharged. If cancerous cells do not spread outside the bladder lining, they are referred to as "superficial bladder cancer." Sometimes, cancerous cells might move to the bladder, lymphatic system, and other bodily structures. Spreading bladder cancer is the name of the condition.

- ***Symptoms of Bladder cancer:***

The following signs of bladder cancer are most typical:

1. Urgent desire to urinate or frequent, brief urination (experiencing the sudden need to urinate)
2. Pelvic soreness or discomfort during urinating in the lower back.
3. Urine with blood in it.

**2.1.2.7 Prostate cancer:** Prostate cancer affects men more frequently than any other type of cancer, and statistical records show that it has the second-highest number of cancer-related deaths among men in Africa and the United States. Prostate cancer will be detected in about one in six men at some point in their lives, although only one in 35 men will pass away from the condition. A cancerous growth Called prostate cancer, it typically starts on the outside of the prostate. Most men with prostate cancer experience relatively modest growth. Many people who have the condition will not even be aware they have it. The prostate gland is showing early signs of prostate cancer.

- ***Causes of prostate cancer:***

Typically, prostate cancer is associated with aging. The danger of having a tumor, which some people regard as one of the diseases of aging, increases with age. When the bodies of some elderly people were dissected, it was discovered that a significant portion of them had prostate cancer cells in them. According to a study, prostate cancer was found in over 30% of the corpses of fourth-graders who passed away. Therefore, more than 50% of those who passed away after turning 85 and 30% of those who died in their sixty.

**2.1.2.8 Breast cancer:** According to the most recent WHO data, 615 breast cancer-related fatalities—or 1.01% of all mortality—occurred in Sierra Leone in 2020. Sierra Leone is rated 16th in the world with a death rate that has been age-adjusted for population size of 28.09 per 100,000. According to the latest recent WHO data, 246 people died from breast cancer in Liberia in 2020, which represents 0.73% of all fatalities. Liberia has an age-adjusted mortality rate of 17.79 per 100,000 people, ranking it 81st in the world. Women are more commonly diagnosed with breast cancer. Africa's North and Middle East It is on the rise and accounts for 14-42% of all female cancers. The age-standardized incidence in Guinea is 14.5 new cases per 100,000 people, and the mortality rate is 7.9 cases per 100,000 people. One of the most prevalent malignancies in women is this one. The majority of cases happen when they are approaching 50 or even earlier before 50; however, this does not rule out the possibility of an earlier onset. Men can have the condition; however, the likelihood is relatively low (1% compared to women).

- ***Reasons for Breast Cancer:***

Several factors, including the following, can influence the likelihood of infection:

Breast cancer develops because of small breast cell fractions that start to proliferate uncontrollably. These cells multiply more quickly than healthy cells do, and they continue to assemble to form bulk or lumps. Invasive lobular carcinoma is a type of breast cancer that typically starts in the milk production ducts, lobules, or other breast tissues. Researchers suggest that hormonal, behavioral, and environmental factors may all contribute to an increased risk of breast cancer. However, the cause of why some women without disease-related risk factors develop cancer while others with the same risk factors do not, the complicated interplay of a person's genetic makeup and environmental variables is probably what causes breast cancer. People who have sisters or mothers who have been affected by this tumor are more accustomed to self-examination because the disease has affected a family member. Women who became pregnant for the first time after the age of thirty may be more likely to develop the disease, and excessive drinking and smoking are other risk factors that are thought to be related to it.

- ***Symptoms of Breast cancer:***

Although not all breast changes are tumors and not all tumors are cancerous. The following signs of breast cancer are most typical:

1. Secretions of the nipple
2. Local pain in the breast



3. Nipple shrinkage
4. Change in breast size or shape
5. Developing a bump in the breast
6. thickening of the armpits or breasts

### 2.1.3 Related Research.

**2.1.3.1 Biological causes.** Genetics and genetic variables have been related to some cancers, according to epidemiological studies. There seems to be more than one child in a family with a retinal tumor, and certain families are more likely than others to experience breast cancer (Ferly et al., 2015). Leukemia is also more likely to strike infants. Certain malignancies, including colorectal cancer, exhibit a familial trend of occurrence.

- **Aspects of the surroundings:** Approximately 80–90percent of total of malignancies are due to environmental causes, and the following are among the most significant ones:
- **Food:** Epidemiological studies have been carried out to ascertain the dangers of diet, particularly those that examine the relationship and correlation between specific cancers. Meals may contain chemicals, such as nitrosamine compounds, which, when consumed, cause cancer, or they may be contaminated with substances that do so, such as aflatoxin compounds produced by fungi. According to studies, certain eating habits and cancer have been linked. Eating smoked fish is linked to stomach cancer, as is consuming salty Chinese fish with a tendency to cause nasal pharynx. Additionally, eating a diet high in fat has been linked to the development of prostate, breast, and colon cancer, and eating beef has also been strongly associated with the disease. Colon cancer and high-fiber diets have the opposite association. Fibers may increase intestinal volume, lowering the amount of carcinogens in the bowel cavity. It has been demonstrated that vitamin A may protect against dorsal carcinoma and that eating meals high in fresh produce lowers one's risk of developing gastrointestinal, uterine, neck, and respiratory cancers.
- **Alcoholic beverages:** Several types of cancer, including those of the liver, esophagus, larynx, and pharynx, are associated with binge drinking. The tissues that encountered undigested alcohol showed an increase in relative risk. As a result, there is an elevated risk for esophageal, oral, and pharyngeal cancer. Furthermore, it was found that people with cirrhosis brought on by alcoholism have a much higher risk of developing liver cancer.

- ***Environmental Pollution:*** Exposure at work, the two main causes of cancer are exposure to radiation and air pollution. A worker may meet a variety of cancer-causing occupational hazards while performing his or her job. The chemical causes of many cancers, such as those brought on by arsenic, asbestos, nickel, mustard, chromium, and lung cancer; include substances like benzene and aromatic amines. The skin and wood industries both put their employees at risk for sinus cancer. Exposure to ionizing radiation is a leading cause of cancer. Nuclear bomb radiation has been linked to lung, bone, thyroid, skin, and leukemia. This association has been investigated through a number of studies and research, involving people who were exposed to excessive and inadequate levels of radiation while receiving treatment or working with radiation.
- ***Smoking:*** Multiple cancers are brought on by smoking, whether it is chewed or smoked. 90% of cases of lung cancer, 75% of cases of oral, pharyngeal, esophageal, and laryngeal cancer, men who smoke in the United States cause about 50% of cases of bladder cancer and an additional 40% of cases of pancreatic cancer. Women develop esophageal, laryngeal, oral, and pharynx cancers at a rate of 40% due to smoking, while men develop lung cancer at a rate of 75%. 30% of cases of bladder cancer and 25% of cases of pancreatic cancer, respectively.
- ***Infection:*** Cancer may develop as a result of specific viruses and infections. It has been proven that DNA and RNA cause a variety of cancers in animals. Epidemiological studies have connected particular DNA viral subtypes to cancer, highlighting these viruses' effects on people.
- ***Sexual relations:*** Multiple relationships increase the risk of cervical cancer. Additionally, studies have demonstrated a higher risk of ovarian, endometrial, and breast cancer among those females who have never been married or had children. Breast cancer and the age at which a woman has her first child have been connected. Breast cancer is less likely to affect women who had their first child before the age of 20 than it is to affect those who had their first child after the age of 35.
- ***Sunbathing:*** People with pale skin are more likely to develop skin cancer from sun exposure.

#### **2.1.3.2 Cancer treatment method.**

**2.1.4 Medical procedures.** Surgery, chemotherapeutic agents, radiation therapy, immune therapies, monoclonal. Antibody therapy and other approaches can all be used to treat cancer. The type and extent of the tumor, the disease's stage, the patient's overall health,

and the treatment test all affect how the patient will be treated. Additionally, several cancer treatment options under research are experimental. Surgery may occasionally be used to completely eradicate cancer while causing no harm to the rest of the body. Because cancer tends to spread to distant locations or infiltrate neighboring tissues, chemotherapy is frequently useless in treating it. It is also sometimes ineffective in treating cancer that has already spread to other body parts. Cancer is a class of disorders; radiation can also harm healthy cells. Although blood vessel inhibitors were formerly believed to have the ability to treat a variety of cancer types, this was not the case throughout the process.

- ***Chemotherapy-Innovative Cancer Therapy.*** Chemotherapy is a type of cancer treatment that entails giving one or more drugs to the patient, such as anti-cancer medications, as a regular part of the treatment plan. Chemotherapy can be administered to treat a condition, increase life expectancy, or lessen a patient's symptom load.
- ***Radiation treatment.*** A linear accelerator is typically used to deliver radiation therapy, also known as radiotherapy or TX, which uses ionizing radiation to control or eliminate malignant cells. The usual application is in the treatment of cancer. Radiation therapy uses X-rays to eradicate cancer cells and shrink tumors.
- ***Surgery.*** Though theoretically conceivable, it is not possible to completely cure cancer. Before surgery, cancer can occasionally spread to other body parts. Complete surgical removal is typically not achievable in these circumstances. Local tumor growth leads to lymph node dissemination. The surgical eradication of 14 breast cancers for cases of breast cancer, prostatectomy for cases of prostate cancer, and surgery for people with non-cell lung cancer are examples of cancer surgical operations that are carried out on the rest of the body. The aim of surgery could be to eliminate cancer or the entire affected tissue, even though the cancer cell is undetectable to the eye and can recur, growing into new cancer.

## **2.2 STATISTICAL ANALYSIS ON CANCER.**

Cancer statistics provide a timeline of the impact of the disease on society and describe what occurs in large populations of people. Statistics provide information on things like the number of individuals that are diagnosed with and pass away annually from cancer, the number of cancer survivors who are still alive, the typical age of the patients, and the number of survivors that are still surviving at a particular time after being diagnosed with cancer.

They also let us know how different groups differ from one another based on age, gender, nationality or ethnicity, geography, plus additional elements. Statistical information on cancer

can also show us patterns. We can follow changes in the likelihood of getting cancer overall as well as individual malignancies by examining trends in cancer rates across time. The most prevalent cancers, according to the anticipated amount of new cancer cases in 2020, are non-Hodgkin lymphoma, leukemia, skin, endometrial cancer, thyroid, pancreatic, liver, melanoma of the skin, kidney, bladder, renal pelvis cancer, and breast cancer.

In 2020, it is anticipated that 43% of males will be diagnosed with colorectal, lung, and prostate cancer. Lung, colorectal, and breast cancer are predicted to account for 50% of all new cancer diagnoses in women by 2020, making them the three most prevalent cancers in women. Based on cases from 2013 to 2017, the cancer incidence rate, or the number of new cases per 100,000 men and women annually, is 442.4. There are 158.3 cancer deaths per 100,000 men and women per year (based on 2013–2017 deaths). Statistical data shows that 70% of cancer occurrences are caused by unhealthy habits like smoking and disinterest in nourishing foods. Patients are urged by doctors to heed this advice. The following statistic illustrates the distribution of cancer patients:

- **Genetics**- 0.3% of cancer cases due to genetics.
- **Physical and chemical agents**- 2-20% of cases all over the world, which includes smoking and 80% of lung cancer is caused by smoking.
- **Lifestyle**- for example (**Alcohol**) statistics shows that 3.6% cancer cases are because of Alcohol, and 3.5% of cancer death.
- **Infection**- Communicable diseases account for about 18% of cancer cases, ranging from 25% in Africa to fewer than 10% in wealthy nations.
- **Radiation (both ionizing and non-ionizing radiation)** - Exposure to radiation may be a factor in 10% of invasive cancers.

### 2.2.1 GLOBAL STATISTICS ON CANCER

The number of new cancer cases recorded globally in 2020 was 18,094,716 million. In 2020, there will be 190 cases of age-standardized malignancies per 100,000 people worldwide (excluding non-melanoma skin cancer). (206.9 per 100,000) Men were more affected than women (178.1 per 100,000). Globally, cancer has become a major health concern. In a recent report on the global burden of cancer, the International Association for Research on Cancer (IARC) used GLOBOCAN 2020 estimates for 36 cancers in 185 countries. In 112 out of 183 countries, cancer is predicted to be the top or second cause of death in 2019. The major

findings of the GLOBOCAN 2020 report that are pertinent to the surgical oncology community include the increasing worldwide burden of cancer, the disparities in cancer incidence and mortality across the globe, and the influence of the human development index (HDI) on cancer incidence and the world population's cancer burden by 2040. GLOBOCAN 2020 estimates that there was nearly 10.0 million cancer-related deaths and 19.3 million newly diagnosed cases of cancer in 2020. In 2040, there will be 28.4 million new cases of cancer diagnosed worldwide, predicts GLOBOCAN. Breast cancer is now more common in women than lung cancer (11.4%), with colorectal (10.0%), prostate (7.3%), and stomach (5.6%) cancers following closely behind. Lung cancer is the highest cause of cancer-related mortality, accounting for 1.8 million fatalities (18%), and is followed by colorectal (9.4%), liver (8.3%), stomach (7.7%), and female breast (6.9%). Males are more likely than females to develop colorectal, lung, and prostate cancers, while females are more likely to develop breast, colorectal, and lung cancer. Collectively, the top 10 malignancies are responsible for more than 60% of cancer cases and 70% of cancer-related deaths. The GLOBOCAN report emphasizes the differences and heterogeneity between the cancer burden in transitioning (low and medium HDI countries) and transitioning (very high and high HDI countries) countries. Currently, the incidence of cancer for both men and women is three times higher in high-income countries (HIC) than it is in low- and middle-income countries (LMIC). However, LMICs will contribute the majority of the increase in the incidence of cancer globally over the next 50 years. Cancers linked to unhealthy lifestyle choices and developing economies both bear significant weight. The incidence of cancer is greatly influenced by rapid urbanization, lifestyle factors, and rising life expectancy. 60% of the world's population lives in Asia, where there are 50% of all cancer diagnoses and 58% of cancer deaths, according to estimates. Both cancer incidence (22.8% and 20.9%) and mortality (19.6% and 14.2%) are the highest in Europe and the Americas, respectively.

- ***Global cancer incidence in men.***

1. With 15.4% of all new instances of cancer reported in men worldwide in 2020, lung cancer was the most prevalent type.
2. Lung, prostate, and colorectal cancers had been the top three cancer-related causes overall, providing for 41.9% of cases (omitting skin cancers that are not melanoma).
3. Stomach and liver cancers made up the remaining prevalent malignancies that

contributed more than 5%

Table 2.1

*Global cancer incidence in men*

| Rank | Cancers                       | New cases in 2020 | % of all cases |
|------|-------------------------------|-------------------|----------------|
|      | All cancers                   | 9,342,957         |                |
| 1.   | Lung                          | 1,435,943         | 15.4           |
| 2.   | Prostrate                     | 1,414,259         | 15.1           |
| 3.   | Colorectal                    | 1,065,960         | 11.4           |
| 4.   | Stomach                       | 719,523           | 7.7            |
| 5.   | Liver                         | 632,320           | 6.8            |
| 6.   | Bladder                       | 440,864           | 4.7            |
| 7.   | Esophagus                     | 418350            | 4.5            |
| 8.   | Non-Hodgkin lymphoma          | 304,151           | 3.3            |
| 9.   | Kidney                        | 217,249           | 2.9            |
| 10.  | Leukemia                      | 269,503           | 2.9            |
| 11.  | Lip.Oral cavity               | 264,211           | 2.8            |
| 12.  | Pancreas                      | 262,865           | 2.8            |
| 13.  | Melanoma of skin              | 173,844           | 1.9            |
| 14.  | Brain, central nervous system | 168,346           | 1.8            |
| 15.  | Larynx                        | 160,265           | 1.7            |
| 16.  | Thyroid                       | 137,287           | 1.5            |
| 17.  | Multiple melanoma             | 98,613            | 1.1            |
| 18.  | Nasopharynx                   | 96,371            | 1.0            |
| 19.  | Oropharynx                    | 79,045            | 0.8            |
| 20.  | Testis                        | 74,458            | 0.8            |
| 21.  | Hypopharynx                   | 70,254            | 0.8            |
| 22.  | Hodgkin lymphoma              | 48,981            | 0.5            |
| 23.  | Gallbladder                   | 41,062            | 0.4            |
| 24.  | Penis                         | 36,068            | 0.4            |
| 25.  | Salivary glands               | 29,694            | 0.3            |
| 26.  | Kaposi sarcoma                | 23,413            | 0.3            |

27. Mesothelioma 21,560 0.2

- ***Global cancer incidence in women.***

1. In 2020, 25.8% of all newly diagnosed instances of cancer in women were breast cancer, making it one of most common type of female cancer overall.
2. Among all cancer cases, colorectal, breast, and lung, cancers made up 44.5%. (Omitting skin cancers that are not melanoma).
3. Cervical cancer ranked fourth among all female cancers in prevalence in 2020, 6.9% of all new cancer cases are caused by this condition.

Table 2.2

*Global cancer incidence in women*

| Rank | Cancer               | New cases in 2020 | % of all cases |
|------|----------------------|-------------------|----------------|
|      | All cancers          | 8,751,759         |                |
| 1.   | Breast               | 2,261,419         | 25.8           |
| 2.   | Colorectal           | 868,630           | 9.9            |
| 3.   | Lung                 | 770,828           | 8.8            |
| 4.   | Cervix uteri         | 604,127           | 6.9            |
| 5.   | Thyroid              | 448,915           | 5.1            |
| 6.   | Corpus uteri         | 417,367           | 4.8            |
| 7.   | Stomach              | 369,580           | 4.2            |
| 8.   | Ovary                | 313,959           | 3.6            |
| 9.   | Liver                | 273,357           | 3.1            |
| 10.  | Non-Hodgkin lymphoma | 240,201           | 2.7            |
| 11.  | Pancreas             | 232,908           | 2.7            |
| 12.  | Leukemia             | 205,016           | 2.3            |
| 13.  | Esophagus            | 185,750           | 2.1            |
| 14.  | Kidney               | 160,039           | 1.8            |
| 15.  | Melanoma of skin     | 150,791           | 1.7            |

|     |                               |         |     |
|-----|-------------------------------|---------|-----|
| 16. | Brain, central nervous system | 137,756 | 1.6 |
| 17. | Bladder                       | 132,414 | 1.5 |

Table 2.2 (Continued)

|     |                  |         |     |
|-----|------------------|---------|-----|
| 18. | Lip. Oral cavity | 113,502 | 0.9 |
| 19. | Multiple myeloma | 77,791  | 0.9 |
| 20. | Gallbladder      | 74,887  | 0.9 |
| 21. | Vulva            | 45,240  | 0.5 |
| 22. | Nasopharynx      | 36,983  | 0.4 |
| 23. | Hodgkin lymphoma | 34,106  | 0.4 |
| 24. | Larynx           | 24,350  | 0.3 |
| 25. | Salivary glands  | 23,889  | 0.3 |
| 26. | Oropharynx       | 19,367  | 0.3 |
| 27. | Vagina           | 17,908  | 0.2 |
| 28. | Hypopharynx      | 14,000  | 0.1 |
| 29. | Kaposi sarcoma   | 10,857  | 0.1 |
| 30. | Mesothelioma     | 9,310   | 0.1 |

- ***Global cancer incidence: both sexes***

1. In 2020, 12.5% and 12.2% of all new cases of cancer were breast cancer and lung cancer, respectively, making them the two malignancies that affect people the most globally.
2. In 2020, cases of colorectal cancer increased by 1.9 million, making up 10.7% of all cancer cases.
3. Non-melanoma skin cancer is not included in any of the tables' percentages of all cancers.

Table 2.3

*Global Cancer Incidence: Both Sexes*

| Rank | Cancer      | New cases in 2020 | % of all cases |
|------|-------------|-------------------|----------------|
|      | All cancers | 18,094,716        |                |
| 1.   | Breast      | 2,261,419         | 12.5           |



|     |                      |           |      |
|-----|----------------------|-----------|------|
| 2.  | Lung                 | 2,206,771 | 12.2 |
| 3.  | Colorectal           | 1,931,590 | 10.7 |
| 4.  | Prostrate            | 1,414,259 | 10.7 |
| 5.  | Stomach              | 1,089,103 | 6.0  |
| 6.  | Liver                | 905,677   | 5.0  |
| 7.  | Cervix uteri         | 604,100   | 3.3  |
| 8.  | Esophagus            | 604,127   | 3.3  |
| 9.  | Thyroid              | 586,202   | 3.2  |
| 10. | Bladder              | 573,278   | 3.2  |
| 11. | Non-Hodgkin lymphoma | 544,352   | 3.0  |

Table 2.3 (Continued)

|     |                               |         |     |
|-----|-------------------------------|---------|-----|
| 12. | Pancreas                      | 495,773 | 2.7 |
| 13. | Leukemia                      | 474,519 | 2.6 |
| 14. | Kidney                        | 431,288 | 2.4 |
| 15. | Corpus uteri                  | 417,367 | 2.3 |
| 16. | Lip. Oral cavity              | 377,713 | 2.1 |
| 17. | Melanoma of skin              | 324,635 | 1.8 |
| 18. | Ovary                         | 313,959 | 1.7 |
| 19. | Brain, central nervous system | 308,102 | 1.7 |
| 20. | Larynx                        | 184,615 | 1.0 |
| 21. | Multiple Myeloma              | 176,404 | 1.0 |
| 22. | Nasopharynx                   | 133,354 | 0.7 |
| 23. | Gallbladder                   | 115,949 | 0.6 |
| 24. | Oropharynx                    | 98,412  | 0.5 |
| 25. | Hypopharynx                   | 84,254  | 0.5 |
| 26. | Hodgkin lymphoma              | 83,087  | 0.5 |
| 27. | Testis                        | 74,458  | 0.4 |
| 28. | Salivary glands               | 53,583  | 0.3 |
| 29. | Vulva                         | 45,240  | 0.3 |
| 30. | Penis                         | 36,068  | 0.2 |
| 31. | Kaposi sarcoma                | 34,270  | 0.2 |
| 32. | Mesothelioma                  | 30,870  | 0.2 |
| 33. | Vagina                        | 17,908  | 0.1 |

### 2.2.2 Cancer Statistics in Africa

The number of problems facing the nation is excessively attributed to African Americans. In terms of mortality rate and survival time, cancer is the most deadly of all diseases. Typically, cancer occurs in people of all races or ethnicities (DeSantis, Siegel, et al., 2016). Globally, nearly by two thirds of all mortality are caused through low and average income nations. In the nations of Africa, breast cancer, liver cancer, cervix uteri cancer, Kaposi sarcoma, prostate cancer, and other malignancies are the most prevalent malignancies some academics claim that an aging population is a cause of Hodgkin's disease. Moreover, cancer is associated with risky behaviors that communities engage in, such as unhealthy eating, not exercising, drinking alcohol intoxicatingly, and smoking. Hepatitis B and C, as well as the Infections caused by the human papillomavirus significantly affect the development of liver and cervical cancer, the top two malignancies in Africa.

Table 2.4

*ASR For Incidence And Mortality In Africa (Morhason-Bello et al., 2013)*

| Cancer           | Incidence in Africa, ASR |            |            | Mortality in Africa, ASR |            |            |
|------------------|--------------------------|------------|------------|--------------------------|------------|------------|
|                  | Men                      | Women      | Both sexes | Men                      | Women      | Both sexes |
| Bladder          | 6.7(3.7)                 | 1.7(1.5)   | 4.0(2.5)   | 4.8(2.8)                 | 1.2(1.1)   | 2.9(1.8)   |
| Breast           | -                        | 28.9(26.3) | -          | -                        | 16.0(15.3) | -          |
| Cervix           | -                        | 25.2(31.7) | -          | -                        | 17.6(22.5) | -          |
| Colorectal       | 6.9(6.8)                 | 5.0(4.7)   | 5.9(5.7)   | 5.5(5.5)                 | 4.0(3.8)   | 4.7(4.6)   |
| Kaposi's sarcoma | 6.0(8.1)                 | 2.8(3.6)   | 4.3(5.7)   | 5.1(6.9)                 | 2.3(3.1)   | 3.6(4.8)   |
| Liver            | 11.7(13.1)               | 5.3(6.3)   | 5.0(9.5)   | 11.7(13.2)               | 5.5(6.6)   | 8.4(9.7)   |
| Lung             | 8.4(5.9)                 | 1.4(2.0)   | 5.0(3.7)   | 7.9(5.6)                 | 1.9(1.9)   | 4.7(3.6)   |
| Non Hodgkin      | 6.3(8.5)                 | 4.1(3.8)   | 5.2(4.6)   | 5.3(4.6)                 | 3.5(3.2)   | 4.3(3.8)   |
| Lymphoma         |                          |            |            |                          |            |            |
| Esophagus        | 6.7(8.5)                 | 3.5(4.2)   | 5.0(6.2)   | 6.5(8.2)                 | 3.4(4.0)   | 4.8(6.0)   |
| Esophagus        | 6.7(8.5)                 | 3.5(4.2)   | 5.0(6.2)   | 6.5(8.2)                 | 3.4(4.0)   | 4.8(6.0)   |
| Ovary            | -                        | 4.2(1.5)   | -          | -                        | 3.4(3.2)   | -          |

Prostrate            17.5(21.2)       -            -            12.5(15.0)       -            -

### 2.2.3 Cancer statistics in Sierra Leone 2020.

The total population in Sierra Leone for 2020 is approximately 7,976,985; the total number of newly diagnosed cancer cases for that year is recorded at 4,708; the number of deaths is 3,389; and the number of prevalent cases (5 years) for both males and females is 7,262; these are data recorded by the WHO.

- **Data source and method.**

#### *Incidence.*

**Country-specific statistics:** Countrywide the Cancer Registry for Sierra Leone

**Method:** Estimates of "all sites" from neighboring nations divided utilizing frequency information.

#### *Mortality.*

**Country-specific statistics:** No information.

**Method:** Cancer registry data from neighboring nations' incidence and mortality ratios was used to generate national incidence estimates.

Table 2.5

#### **Summary statistics 2020**

|  | <i>Males</i> | <i>Females</i> | <i>Both sexes</i> |
|--|--------------|----------------|-------------------|
| Population   | 3 981 239    | 3 995 746      | 7 976 985         |
| Number of new cancer cases                               | 1836         | 2 872          | 4 708             |
| Age-standardized incidence rate (World)                  | 92.4         | 114.6          | 102.1             |
| Risk of developing cancer before the age of 75 years (%) | 9.9          | 12.2           | 11.0              |
| Number of cancer deaths                                  | 1 389        | 2 000          | 3 389             |
| Age-standardized mortality rate (World)                  | 73.0         | 83.2           | 76.9              |
| Risk of dying from cancer before the age of 75 years (%) | 7.8          | 9.3            | 8.5               |

Table 2.5(Continued)

|  |             |              |              |
|--|-------------|--------------|--------------|
| 5-year prevalent cases                     | 2 645       | 4 617        | 7 262        |
| Top five most frequent cancers excluding   | Prostate    | Breast       | Breast       |
| Non-melanoma skin cancer (ranked by cases) | Liver       | Cervix uteri | Cervix uteri |
|  | Colorectal  | Liver        | Liver        |
|  | Stomach     | Ovary        | Prostate     |
|  | Non-Hodgkin | Colorectal   | Colorectal   |
|  | Lymphoma    |              |              |

Mortality rates has linked to the most prevalent cancers in Sierra Leone are rising, including those of the breast, prostate, cervix, liver, and stomach. 2.33 million Women in Sierra Leone may have the possibility of having cervical Cancer and who are above the age of 15. According to current statistics, 504 women are given a cervical cancer diagnosis each year, and 367 of them pass away from the Disease. In Sierra Leone, The second most prevalent illness in women is cervical cancer, which also ranks second among cancers in women between the ages of 15 and 44. On the prevalence of HPV in the Sierra Leonean population as a whole, there is currently no data. The World Health Organization, however, released a report in 2020 that is static and provides information on the cancer patients in Sierra Leone with specific statistics. The Sierra Leone cancer incidence for females in 2020 is depicted in Figure 2.1, with breast cancer accounting for the majority of cases. The World Health Organization claims that, prostate cancer accounted for the majority of cases in men, as shown in Figure 2.2. Prostate cancer had the highest age-standardized mortality rate per 100,000 in Sierra Leonean men, as seen in Figure 2.4. According to Figure 2.3, breast and cervical cancers caused the highest Age-Standardized Rate of cancer death among Sierra Leonean women. In Figure 2.5, it shows the average cancer incidence for both male and female Sierra Leone. Figures 2.6 and 2.7 showing the Sierra Leonean male and female cancer mortality profiles are also shown.

Figure 2.1

*The Sierra Leone Cancer Incidence For Female 2020*

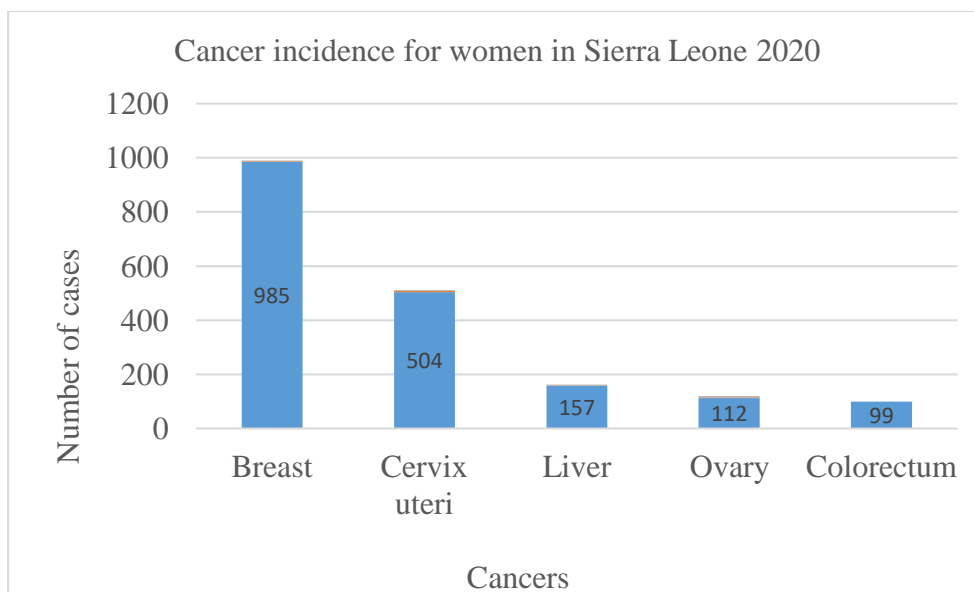


Figure 2.2

*The Sierra Leone Cancer Incidence For Male 2020*

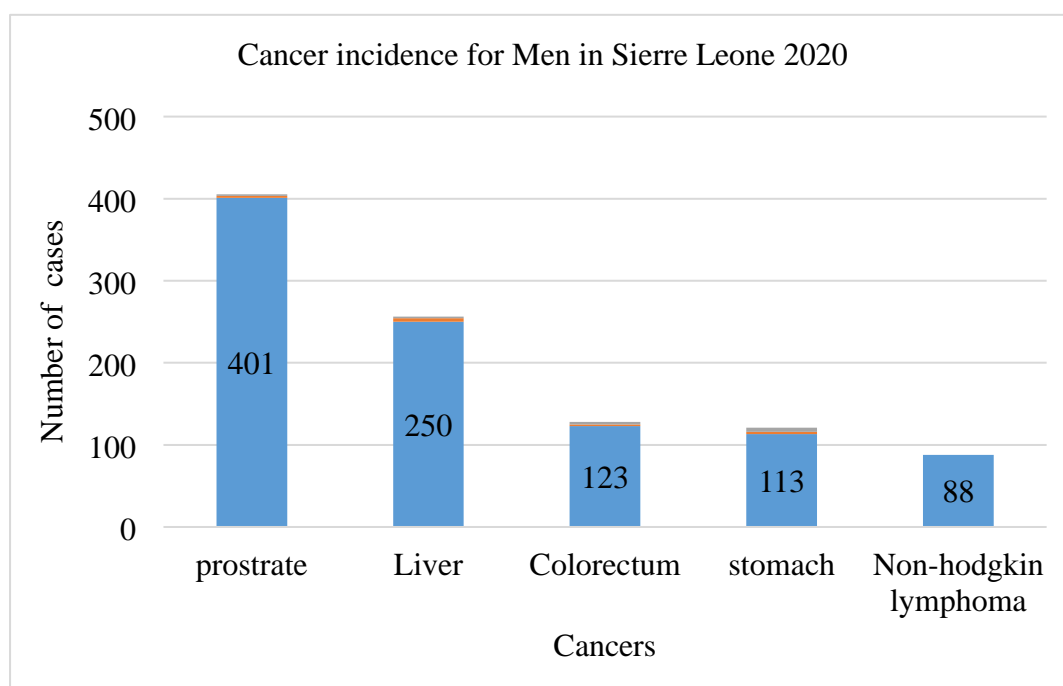


Figure 2.3

*Age-Standardized Rate Cancer Mortality Of Female In Sierra Leone*

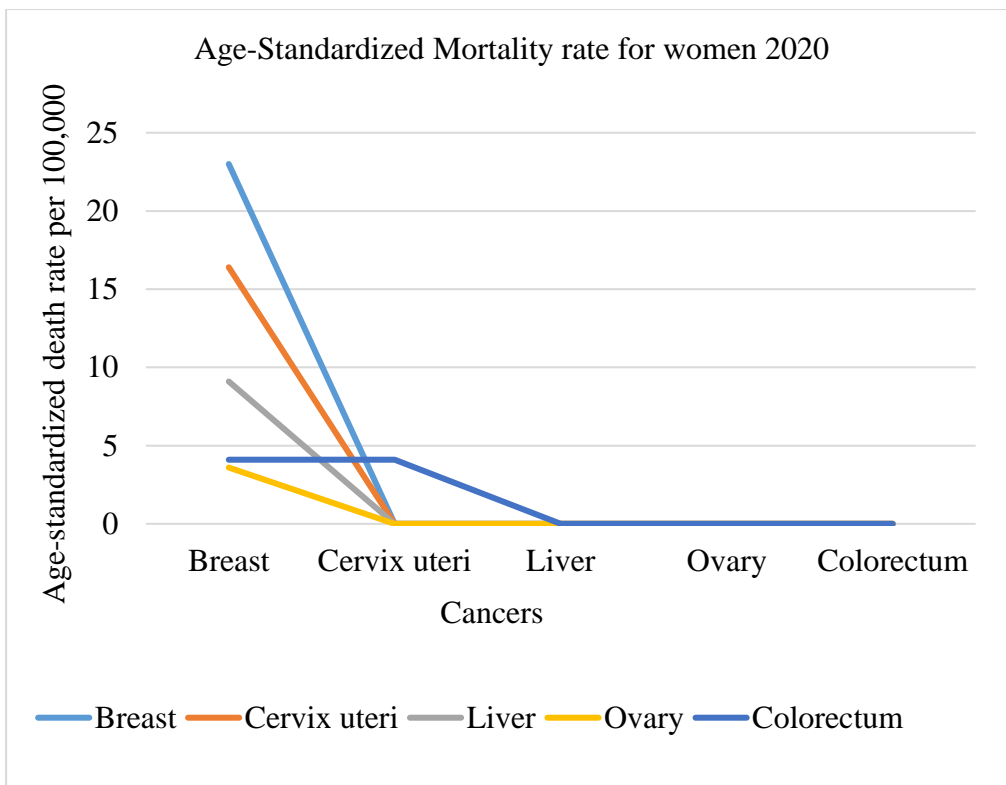


Figure 2.4

*Age-Standardized Rate Cancer Mortality Of Male In Sierra Leone*

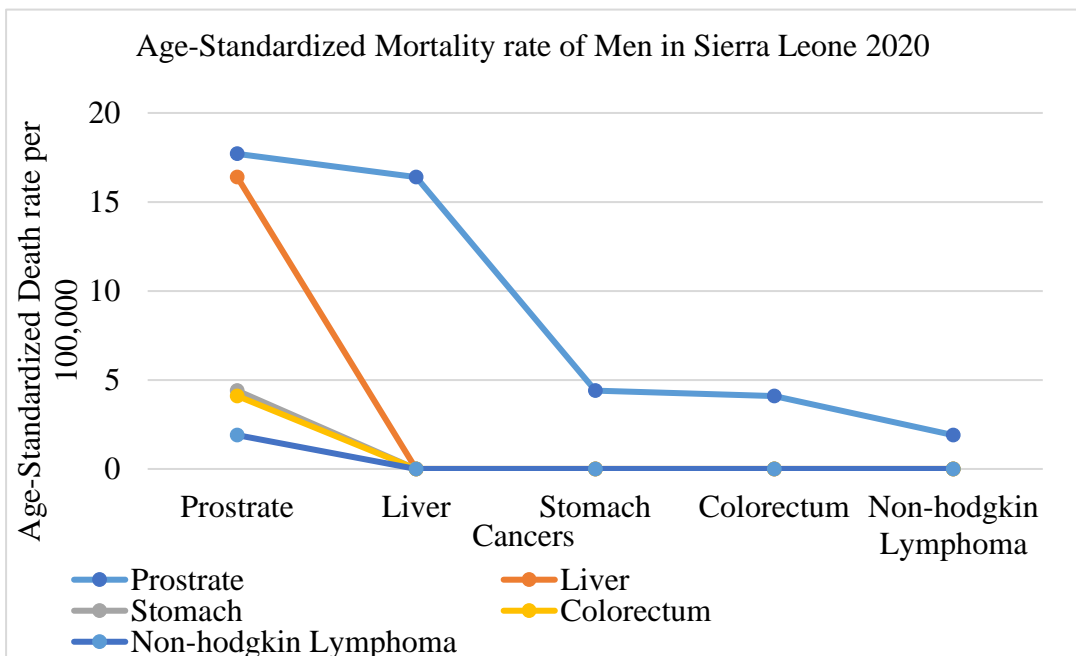
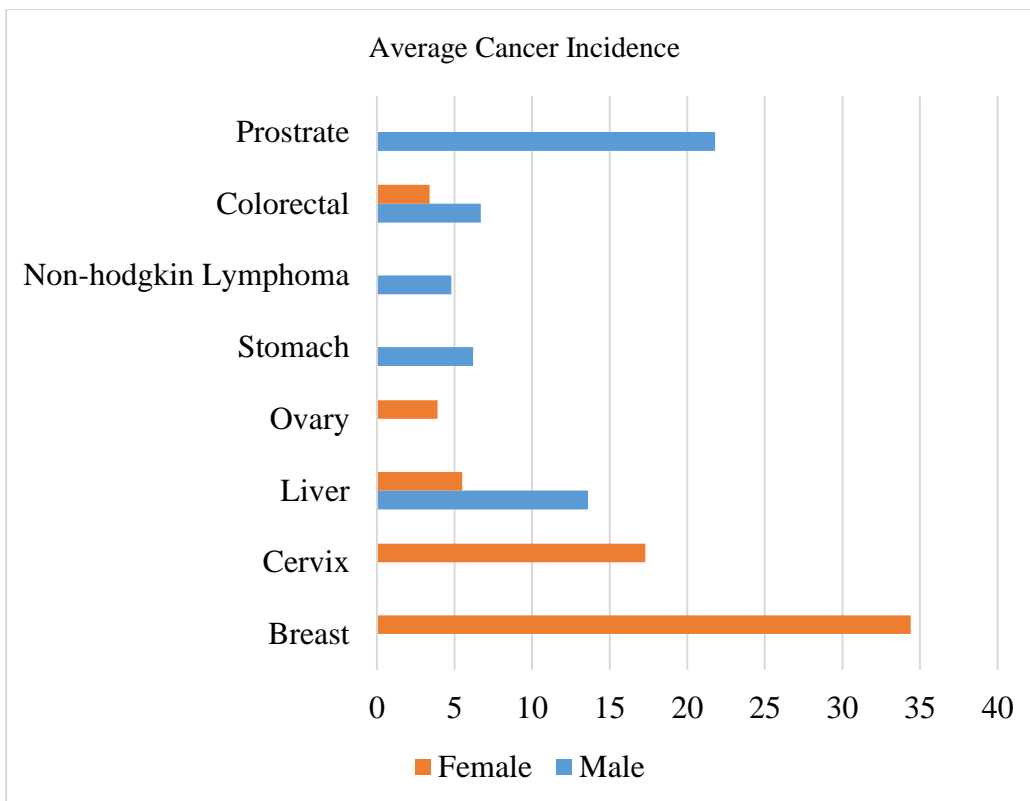


Figure 2.5

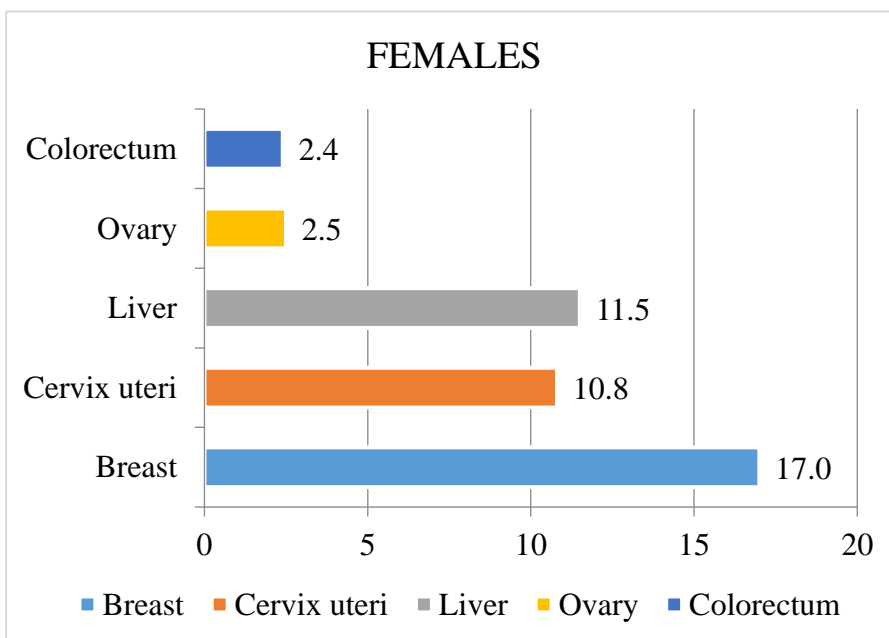
*Average Cancer Incidence For Both Male And Female In Sierra Leone 2020*



The chart below shows Sierra Leone's mortality rate or percentage for women.

Figure 2.6

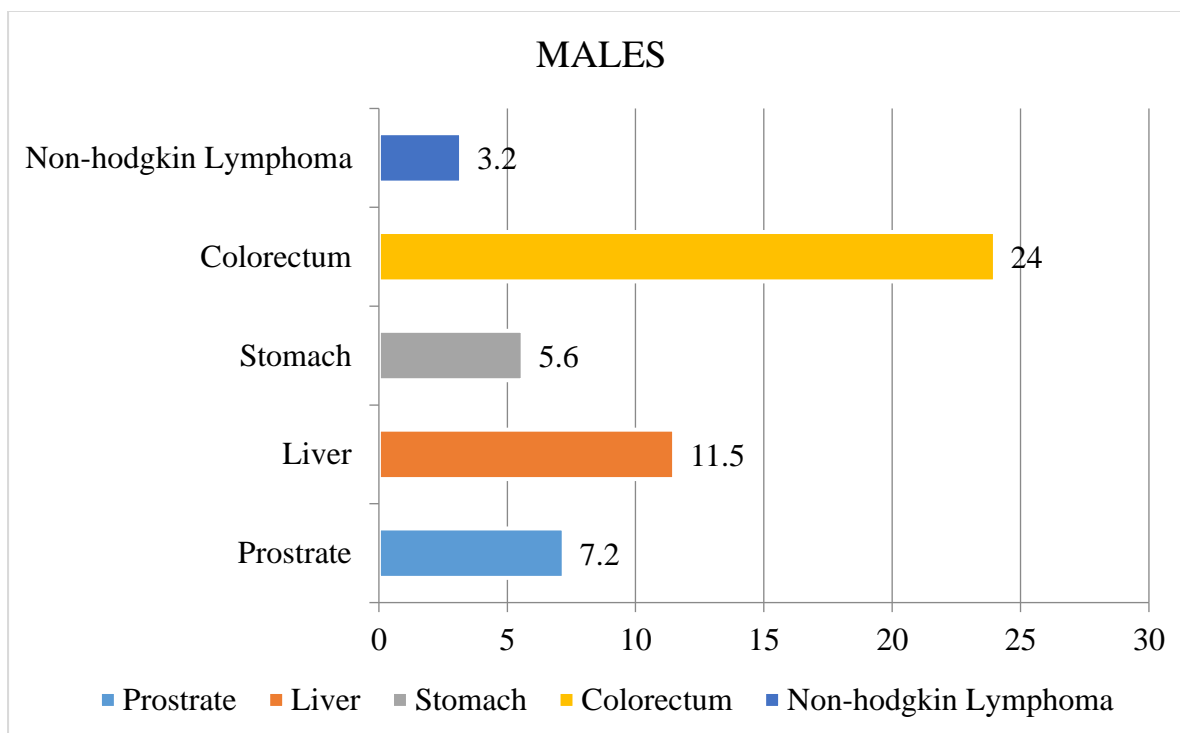
*Cancer Mortality Profile For Women In Sierra Leone 2020*



The chart below shows Sierra Leone's mortality rate or percentage for women.

Figure 2.7

## Cancer Mortality Profile For Men Sierra Leone 2020



## CHAPTER III

### RESEARCH METHODOLOGY

#### 3.1 Methodology

This chapter discusses and explains research methodologies for Sierra Leone, Guinea, and Liberia.

I performed a brief literature review on the prevalence of cancer in Sierra Leone and its neighboring nations. I was able to get data and information from many researchers and with the aid of World Health Organization records.

The percentage, mean, and comparison using the Age-standardized rates of cancer incidence and mortality from the three separate nations are included in the literature selection.

The literature search comprised articles, reviews, abstracts, and manuscripts on cancer incidence utilizing resources like PubMed, The Lancet, Cochrane, and the library. I used Science Direct and Google Scholar. I also extracted articles from search engines and databases using the snowballing technique. Additionally, I consulted websites for the WHO, UNFPA, UNICEF, and Global Cancer Observatory (GLOBOCAN), as well as gray literature.

##### 3.1.1 Research Design.

This study's subject is cancer incidence in Sierra Leone in comparison to surrounding nations. The study was split into six chapters. The first chapter introduced the subjects and data



collection, outlining the goals and significance of the study as well as the methodology's limitations.

The chapter 3 is the statistical area, which I make use of the demographics concepts and the study of samples and analytic methods including percentages, time of life rates. Conclusions and recommendations are covered in the sixth chapter, which begins with an analysis of morbidity and prevalence in 2020 in Sierra Leone, Guinea, and Liberia. Additionally to concept testing the study's conclusions, suggestions, and citations were all examined in the last section.

### **3.1.1.1 Research Sample**

#### **3.2 *Sierra Leone***

On April 27, 1961, the newly formed nation of Sierra Leone appointed Milton Margi as its prime minister. Republics are governed by elected presidents was established in the nation ten years later, on April 19, 1971.

The ecological and agricultural zones to which people have adapted are numerous and diverse. Sierra Leone was placed under the control of a colonial governor when it became a British crown colony in 1808. The British government chose a method of "indirect rule," in which they relied on local institutions that had only been slightly reorganized, to carry out colonial objectives and maintain order. Formerly known as "kings" and "queens," these monarchs were forced into a subordinate role and gave up their former titles to become "paramount chiefs". The government nominated some of these rulers. The Sierra Leoneans did not simply accept such manipulations. British attempts to levy an annual tax on all homes in the nation gave rise to the "Hut Tax uprising" in 1898. Particularly the Temne and Mende people refused to pay, attacking and pillaging commercial posts and murdering police officers, missionaries, and anybody else thought to be cooperating with the colonial administration. In addition to the pan-African calls for autonomy, pressures to end colonialism were also a result of Britain's post-World War II weaker position. Beginning in the west, Sierra Leone has a coastline that stretches for around 250 miles (400 kilometers), making it a country with both abundant maritime resources and potential for enticing tourists. Low-lying mangrove swamps, farms, and rain-forested plains are next encountered until a hilly plateau in the east, where Mount Bintumani rises to a height of 6,390 feet, is reached (1,948 meters). Tropical weather prevails, and the agricultural cycle is governed by two seasons: the period between December and May known as the "dry season," which includes harmattan, during which chilly, dry winds from the Sahara desert blow in, follows the wet

season, which runs from May to November. In close proximity to the third-largest natural harbor in the world, the nation's capital, Freetown, is located on a peninsula in the sea. Sierra Leone was traditionally the hub of colonial administration and trade in the area due to its advantageous position.

### **3.2.1 Demography.**

On the Atlantic, side of West Africa is the nation of Sierra Leone. The land spans 402 kilometers of coastline and has a total size of 72,300 km<sup>2</sup> (27,915 mi<sup>2</sup>) (249.8 mi). Nearly 91% of Sierra Leone's total area is made up of this terrain. Thus, Sierra Leone is ranked 120th in the globe and is the 19th-smallest country in Africa. 43% of all citizens live in cities, just less than half of all people. At 279 meters above sea level on average, Sierra Leone is rather low in elevation. Bintumani, the tallest mountain peak, has an elevation of 1,948 meters. 19 islands in the ocean belong to the nation. Direct national borders exist with the two neighboring nations of Guinea and Liberia. About 6,950 kilometers separate New York City from Freetown, the nation's capital (4,319 mi). According to the National Statistics Report Census 2016, Sierra Leone has a population of about 7 million people, with children and young adults making up the majority. When civil war first broke out in 1991 and the "Ebola" epidemic started in 2014 and ended in 2015, the population was growing at a rate of little over 2% annually, though this rate has since slightly decreased. The World Health Organization states that the current population is 8,141,000, the life expectancy for male is 54.2 years, and that for female is 55 years. Birth rate is 32.4 years and death rate is 11.3 years. The mortality rate for both male and female is 49.9%:50.1%.

### **3.3.2 Data collection Procedure.**

Three nations, Sierra Leone, Guinea, and Liberia, have data on cancer in 2020 that was gathered from the World Health Organization's (WHO) official website.

A comparison was made between Sierra Leone data and information gathered from tumor treatment facilities there.

In addition to the six most prevalent cancers—breast, colorectal, lung, liver, prostate, and non-Hodgkin lymphoma—these data also included information on cancer mortality rates for both males and females.

### **3.3.3 Data Analysis Procedure.**

In conducting this research, SPSS, a statistical package for social science, and MS Excel were both used. Age-Standardized Rate (ASR) was utilized in this study and evaluation to calculate the frequencies and percentages of the data for the descriptive analysis.

- **Percentage.** With the aid of graphical forms and SPSS, the proportion of patients from Sierra Leone who had each type of cancer, whether they were male or female, was compared to that of nearby nations.
- **Age-standardized rate (ASR).** Age-standardized death rates are averages weighted by the percentages of people in each age group in the WHO standard population, which is equal to the sum of age-specific mortality rates per 100,000 people. The standard population is the age group (k), wherein the rate of incidence or mortality per 100,000 persons also involves the age range. The age range can be in an order of 0, 1-4, 5-9... 5-9... 40-44, 45-49, and 50-54years and over. The fundamental statistics for each type of cancer in Sierra Leone, Guinea, and Liberia were compared in graphic representations. The main goal is to compare mortality rates between nations while taking into account the variations in age distributions between nations to determine the ASR of mortality. In fact, without the use of ASR, it would not be clear if varying death rates were caused by age or by other variables. The prevalence of a particular illness in a group, assuming the population has a normal age structure. Alternative words for age standardization (ASR). When the age structures of the two populations are considered, there are differences, comparing the rates between two times in two separate geographic locations is typically more accurate.

**3.4.1 Data Analysis plan.** A collection of data, its intended application, and your method of analysis can all be thought through with the use of an analysis strategy. A crucial step in ensuring that you get and use all the data you need is to develop an analysis plan. Planning your analyses ahead of time can be a time wisely spent. Data analysis of different cancer are been calculated to know the percentage of cancer in a country and also the mean percentage of cancers and they can be compared to know which country among the three countries has the highest and lowest incidence and mortality rate.

## CHAPTER IV

### RESULTS AND DISCUSSIONS

Research on cancer incidence and mortality rates is examined in this chapter for Sierra Leone, Guinea, and Liberia.

#### 4.1 Incidence and mortality in 2020

##### 4.1.1 *Percentage Incidence and mortality.*

- *Sierra Leone*

The total population of Sierra Leone in 2020 will be approximately 7,976,985. The number of new cases of cancer for that year was recorded as 4,708 for males and females, and the number of deaths was 3,389 for both sexes. While the number of prevalent cases (5 years) for both males and females is 7,262, these are data recorded by the WHO.

- *Percentage of incidence and mortality in Sierra Leone 2020*

Table 4.1 Prostate cancer is the most common cancer in men in Sierra Leone, accounting for about 21.8% of cases and deaths, according to estimates of incidence and mortality. Another noteworthy finding is that the age-standardized ratio for lung cancer was the lowest at 2.0%.

Table 4.1

*Estimated Incidence And mortality For Male In Sierra Leone*

| Cancer            | INCIDENCE  |              |             | MORTALITY    |              |             |
|-------------------|------------|--------------|-------------|--------------|--------------|-------------|
|                   | Number     | (%)          | ASR (M)     | Number       | (%)          | ASR(M)      |
| Colorectal        | 123        | 6.7          | 6.0         | 82           | 24           | 4.1         |
| Liver             | 250        | 13.6         | 12.3        | 391          | 11.5         | 9.1         |
| Stomach           | 11.3       | 6.2          | 5.7         | 191          | 5.6          | 4.4         |
| Non-Hodgkin       | 88         | 4.8          | 3.0         | 109          | 3.2          | 1.9         |
| Lymphoma          |            |              |             |              |              |             |
| Prostrate         | 401        | 21.8         | 27.4        | 244          | 7.2          | 17.4        |
| <u>All cancer</u> | <u>975</u> | <u>100.0</u> | <u>54.4</u> | <u>1,017</u> | <u>100.0</u> | <u>36.9</u> |

- *Estimated incidence and mortality for female in Sierra Leone.* It is interesting to note that the prevalence of breast cancer among Sierra Leonean women nearly doubled to 34.3%, almost exactly in comparison to other cancers. On the other hand, there are some

parallels in ASR between the cervix and uterine malignancies. The highest incidence percentages were for ASR (37.2%) and breast cancer (34.3%), respectively. However, the highest death rate was 17.0%, and the ASR for breast cancer was 24.0.

Table 4.2

*Estimated Incidence And Mortality For Female In Sierra Leone*

| Cancers            | INCIDENCE    |              |             | MORTALITY    |              |             |
|--------------------|--------------|--------------|-------------|--------------|--------------|-------------|
|                    | Number       | (%)          | ASR (W)     | Number       | (%)          | ASR(W)      |
| Breast             | 985          | 34.3         | 37.8        | 577          | 17.0         | 23.0        |
| Cervix Uteri       | 504          | 17.5         | 21.2        | 367          | 10.8         | 16.4        |
| Liver              | 157          | 5.5          | 9.4         | 391          | 11.5         | 9.1         |
| Ovary              | 112          | 3.9          | 4.4         | 84           | 2.5          | 3.6         |
| Colorectal         | 99           | 3.4          | 5.0         | 82           | 2.4          | 4.1         |
| <b>All Cancers</b> | <b>1,857</b> | <b>100.0</b> | <b>77.8</b> | <b>1,501</b> | <b>100.0</b> | <b>56.2</b> |

- *Estimated incidence and mortality for both Men & Women in Sierra Leone*

In Sierra Leone, prostate cancer and breast cancer have the highest incidence percentages for men and women, respectively, with mortality rates of 17.0% for women (breast) and 7.2% for men (prostrate). Estimates of incidence and mortality for both sexes form the basis of these statistics. Contrarily, colorectal cancer has the lowest mortality rate (2.4% and 4.1 ASR), while non-Hodgkin lymphoma cancer has the lowest incidence percentage in men (4.2%), women (3.4%), and ASR (1.9%).

Table 4.3

*Estimated Incidence And Mortality For Both Men And Women In Sierra Leone*

| Cancers      | INCIDENCE |      |         | MORTALITY |      |         |
|--------------|-----------|------|---------|-----------|------|---------|
|              | Number    | (%)  | ASR (I) | Number    | (%)  | ASR (M) |
| Breast       | 985       | 20.9 | 37.8    | 577       | 17.0 | 23.0    |
| Cervix Uteri | 504       | 10.7 | 21.2    | 367       | 10.8 | 16.4    |
| Liver        | 4.7       | 8.6  | 19.4    | 391       | 11.5 | 9.1     |
| Ovary        | 112       | 3.9  | 4.4     | 84        | 2.5  | 3.6     |
| Stomach      | 113       | 6.2  | 6.2     | 191       | 5.6  | 4.4     |
| Non-Hodgkin  | 88        | 4.8  | 4.8     | 109       | 3.2  | 1.9     |
| Lymphoma     | 88        |      |         |           |      |         |
| Colorectal   | 222       | 4.7  | 5.1     | 82        | 2.4  | 9.1     |

|           |     |     |      |     |     |      |
|-----------|-----|-----|------|-----|-----|------|
| Prostrate | 401 | 8.5 | 27.4 | 244 | 7.2 | 17.7 |
|-----------|-----|-----|------|-----|-----|------|

Table 4.3 (Continued)

|                    |              |              |              |              |              |             |
|--------------------|--------------|--------------|--------------|--------------|--------------|-------------|
| <u>All Cancers</u> | <u>2,832</u> | <u>100.0</u> | <u>126.3</u> | <u>2,045</u> | <u>100.0</u> | <u>85.2</u> |
|--------------------|--------------|--------------|--------------|--------------|--------------|-------------|

- **Guinea**

The total population of Guinea in 2020 will be approximately 13,132,792. The number of new cases of cancer for that year was recorded at 7,871 for males and females, and the number of deaths was 5,888 for both sexes. According to WHO data, there were 12,336 prevalent cases over the course of the previous five years, 12,336 of which were male and 12,336 of which were female.

- ***Percentage of incidence and mortality in Guinea 2020***

The incidence rates for liver cancer in Guinea are 26.4% and 28.8% ASR, respectively, and the mortality rates are 23.8% and 21.6% ASR. Men are also more likely than women to develop the disease. Table 4.4 shows that age-standardized ratios were 2.9% and mortality incidence rates were 3.3% for lung cancer, the disease with the lowest percentages at 4.5% and 4.6%, respectively.

Table 4.4

*Estimated Incidence And Mortality For Men In Guinea*

| Cancers             | INCIDENCE    |              |             | MORTALITY    |              |             |
|---------------------|--------------|--------------|-------------|--------------|--------------|-------------|
|                     | Number       | (%)          | ASR (I)     | Number       | (%)          | ASR(M)      |
| Liver               | 739          | 26.4         | 28.8        | 1404         | 23.8         | 21.6        |
| Prostrate           | 699          | 24.9         | 35.7        | 415          | 7.0          | 22.5        |
| Stomach             | 149          | 5.3          | 5.9         | 244          | 4.1          | 3.8         |
| Lung                | 126          | 4.5          | 4.6         | 194          | 3.3          | 2.9         |
| Non-Hodgkin         | 144          | 3.9          | 3.9         | 198          | 3.4          | 2.9         |
| Lymphoma            |              |              |             |              |              |             |
| <u>Total Number</u> | <u>1,857</u> | <u>100.0</u> | <u>78.9</u> | <u>100.0</u> | <u>100.0</u> | <u>53.2</u> |

- ***Estimated incidence and mortality for Women in Guinea***

Cervical cancer has the highest incidence rates for females in Guinea, with a 40.8% incidence rate and an age-standardized ratio of 50.1%, as well as the highest death rates (24.8%) and age-standardized ratios (37.2%). These numbers are derived from estimates of the incidence

and mortality of women in Guinea. Contrarily, brain-central system cancer has the lowest incidence rate (3%, ASR, 3.1%, death rate, and age-standardized ratios, 2.8% mortality rate).

Table 4.5

*Estimated Incidence And Mortality For Women In Guinea*

| Cancer               | INCIDENCE   |              |             | MORTALITY   |              |             |
|----------------------|-------------|--------------|-------------|-------------|--------------|-------------|
|                      | Number      | (%)          | ASR (W)     | Number      | (%)          | ASR(W)      |
| Breast               | 2068        | 40.8         | 18.2        | 1463        | 24.8         | 10.4        |
| Cervix uteri         | 739         | 14.6         | 50.1        | 409         | 6.9          | 37.2        |
| Liver                | 673         | 13.3         | 17.2        | 1404        | 23.8         | 21.6        |
| Brain-Central System | 152         | 3            | 3.1         | 221         | 3.8          | 2.8         |
| Non-Hodgkin Lymphoma | 145         | 2.9          | 2.8         | 198         | 3.4          | 2.4         |
| <b>All cancers</b>   | <b>3777</b> | <b>100.0</b> | <b>91.4</b> | <b>3695</b> | <b>100.0</b> | <b>74.4</b> |

- ***Estimated incidence and mortality for both Men and Women in Guinea***

Cancers that affect both men and women most frequently in Guinea are liver cancer and cervix cancer, with an incidence percentage of 40.8 for cervix cancer and an ASR of 50.1, and a mortality rate of 24.8%. The incidence for men (liver) is 17.9%, and the ASR is 21.8%. The age-standardized ratios have mortality rates of 37.2% for women (cervix) and 21.6% for men (liver). These figures are based on estimates of incidence and mortality for both sexes. Contrarily, brain-centered system cancer has the lowest incidence rate in men (3%) and an age-standardized mortality rate of 2.8%. Female non-Hodgkin lymphoma cancer has the lowest mortality rates (3.4% and 2.4% ASR).

Table 4.6

*Estimated incidence and mortality for both men and women in Guinea*

| Cancers              | INCIDENCE |      |         | MORTALITY |      |        |
|----------------------|-----------|------|---------|-----------|------|--------|
|                      | Number    | (%)  | ASR (I) | Number    | (%)  | ASR(M) |
| Breast               | 739       | 14.6 | 18.2    | 409       | 6.9  | 10.4   |
| Brain-Central system | 152       | 3    | 3.1     | 221       | 3.4  | 2.8    |
| Cervix uteri         | 2068      | 40.8 | 50.1    | 1463      | 24.8 | 37.2   |
| Non-Hodgkin Lymphoma | 289       | 3.7  | 6.7     | 198       | 3.4  | 2.4    |

|         |     |     |     |     |     |     |
|---------|-----|-----|-----|-----|-----|-----|
| Lung    | 126 | 4.5 | 4.6 | 194 | 3.3 | 2.9 |
| Stomach | 194 | 5.3 | 5.9 | 244 | 4.1 | 3.8 |

Table 4.6 (Continued)

|                     |              |              |              |              |              |           |
|---------------------|--------------|--------------|--------------|--------------|--------------|-----------|
| Prostrate           | 699          | 24.9         | 35.7         | 415          | 7.0          | 22.5      |
| <u>Total Number</u> | <u>4,222</u> | <u>100.0</u> | <u>124.3</u> | <u>3,144</u> | <u>100.0</u> | <u>82</u> |

- **Liberia.**

The total population in Guinea for 2020 is approximately 5,057,792; the number of new cases of cancer for that year was recorded at 3,552, for males and females, and the number of deaths was 2,603 for both sexes. While the number of prevalent cases (5 years) for both males and females is 5,620, these are data recorded by the WHO.

***Percentage of Incidence and Mortality in Liberia in 2020***

- ***Estimated incidence and mortality for Men in Liberia.***

The male population of Liberia has a high incidence of prostate cancer, with incidence rates of 31.4% and 41.9% ASR and mortality rates of 10.6% and 26.6% ASR, respectively.

Colorectal cancer had the lowest percentages and age-standardized ratios, with incidence rates of 5.5%, death rates of 4.6%, and age-standardized ratios of 3.9%, as shown in Table 4.7.

Table 4.7

*Estimated incidence and mortality for Men in Liberia*

| Cancers            | INCIDENCE    |              |             | MORTALITY    |              |             |
|--------------------|--------------|--------------|-------------|--------------|--------------|-------------|
|                    | Number       | (%)          | ASR (M)     | Number       | (%)          | ASR(M)      |
| Prostrate          | 450          | 31.4         | 41.9        | 275          | 10.6         | 26.6        |
| Liver              | 277          | 19.4         | 19.5        | 453          | 17.4         | 15.2        |
| Colorectal         | 66           | 4.6          | 5.5         | 62           | 2.4          | 3.9         |
| Stomach            | 72           | 5            | 5.4         | 119          | 4.6          | 4.2         |
| Non-Hodgkin        | 73           | 5.1          | 4.4         | 97           | 3.7          | 2.9         |
| Lymphoma           |              |              |             |              |              |             |
| <u>All cancers</u> | <u>1,324</u> | <u>100.0</u> | <u>76.7</u> | <u>1,006</u> | <u>100.0</u> | <u>52.8</u> |

- ***Estimated incidence and mortality for Women in Liberia:***

In Liberia, cervix cancer has the highest incidence percentages for women, with 30.9% and incidence rates of 40.9%, mortality rates of 18.0%, and age-standardized



mortality rates of 30.8%. These figures are based on hypotheses regarding the incidence and mortality of women in Liberia. Contrarily, non-Hodgkin lymphoma cancer has the lowest incidence rate (3.1%), age-standardized ratio (ASR) (3.5%), death rate (3.7%), and mortality rate (2.9%) of all types of cancer.

Table 4.8

*Estimated incidence and mortality for women in Liberia*

| Cancers              | INCIDENCE |       |         | MORTALITY |       |        |
|----------------------|-----------|-------|---------|-----------|-------|--------|
|                      | Number    | (%)   | ASR (W) | Number    | (%)   | ASR(W) |
| Breast               | 528       | 24.9  | 31.9    | 300       | 11.5  | 18.7   |
| Cervix uteri         | 656       | 30.9  | 40.8    | 469       | 18.0  | 30.8   |
| Liver                | 178       | 8.4   | 11.5    | 453       | 17.4  | 15.2   |
| Colorectal           | 65        | 3.1   | 4.4     | 62        | 2.4   | 3.9    |
| Non-Hodgkin Lymphoma | 66        | 3.1   | 3.5     | 97        | 3.7   | 2.9    |
| All Cancers          | 1,493     | 100.0 | 92.1    | 1,381     | 100.0 | 71.5   |

- *Estimated incidence and mortality for both Men and Women in Liberia*

Cancers that affect both men and women most frequently in Liberia are prostate cancer and cervix cancer, with mortality rates of 30.8% for women (cervix) and 26.6% for men (prostrate). Contrarily, men have the lowest incidence rate (4.4%) and age-standardized mortality rate (2.9%) for non-Hodgkin lymphoma cancer. Female colorectal cancer has the highest incidence (3.1%) and lowest mortality rates (3.1% and 3.9 ASR, respectively) of any cancer type.

Table 4.9

*Estimated incidence and mortality for both Men and Women in Liberia*

| Cancers      | INCIDENCE |      |         | MORTALITY |      |        |
|--------------|-----------|------|---------|-----------|------|--------|
|              | Number    | (%)  | ASR (M) | Number    | (%)  | ASR(M) |
| Breast       | 582       | 24.9 | 31.9    | 300       | 11.5 | 18.7   |
| Liver        | 455       | 12.8 | 31.9    | 453       | 17.4 | 15.2   |
| Cervix Uteri | 656       | 30.9 | 40.8    | 469       | 18.0 | 15.2   |
| Prostrate    | 450       | 31.4 | 41.9    | 275       | 10.6 | 26.6   |
| Colorectal   | 131       | 7.7  | 4.9     | 62        | 2.4  | 3.9    |
| Stomach      | 72        | 5    | 5.4     | 119       | 4.6  | 4.2    |

|                      |       |       |       |       |       |       |
|----------------------|-------|-------|-------|-------|-------|-------|
| Non-Hodgkin Lymphoma | 139   | 3.9   | 3.9   | 97    | 3.7   | 2.9   |
| All Cancer           | 2,485 | 100.0 | 144.1 | 1,775 | 100.0 | 102.3 |

#### 4.1.2 Percentage comparison 2020

##### 4.1.2.1 Incidence *percentage comparison 2020*.

- ***Percentage Estimated of incidence in Sierra Leone, Guinea, and Liberia 2020 (male).***

Table 4.10 shows the anticipated incidence rate in percentage terms for the male population in Sierra Leone, Guinea, and Liberia in 2020. Sierra Leone and Liberia had the highest proportion of males with prostate cancer, while Guinea had the highest proportion of males with liver cancer.

Table 4.10

*Percentage Estimated Of Incidence Male Of All Countries 2020*

| Cancer               | Sierra Leone (%) | Guinea (%) | Liberia (%) |
|----------------------|------------------|------------|-------------|
| Colorectal           | 6.7              | 0          | 4.6         |
| Liver                | 21.8             | 24.6       | 19.4        |
| Prostrate            | 21.8             | 24.9       | 31.4        |
| Non-Hodgkin Lymphoma | 4.8              | 3.9        | 5.1         |
| Stomach              | 6.2              | 5.3        | 5           |

- ***Percentage Estimated of incidence in Sierra Leone, Guinea and Liberia 2020 (female).*** Table 4.11 displays the female incidence percentage that is projected for 2020 in Sierra Leone, Guinea, and Liberia. The two countries with the highest breast cancer incidence rates were Guinea and Sierra Leone. As we can see, Liberia has the highest incidence of cervix cancer, with Guinea having a higher percentage of breast cancer than Sierra Leone. In addition, compared to Sierra Leone and Guinea, Liberia has the highest rate of cervix cancer.

Table 4.11

*Percentage Cancer Incidence For Female Of All Countries 2020*

| Cancers | Sierra Leone (%) | Guinea (%) | Liberia (%) |
|---------|------------------|------------|-------------|
| Breast  | 34.3             | 40.8       | 24.9        |
| Cervix  | 17.5             | 14.6       | 30.9        |
| Liver   | 5.5              | 13.3       | 8.4         |

|                      |     |    |     |
|----------------------|-----|----|-----|
| Colorectal           | 3.4 | 0  | 3.1 |
| Non-Hodgkin Lymphoma | 0   | 29 | 3.1 |

- ***Mean Percentage Estimated of incidence of Men and women for all countries 2020.***

Cervix uteri, which is from Guinea, has the highest mean percentage of female cancer incidence among the three countries, whereas colorectal, also from Guinea, has the lowest.

Table 4.12

*Mean Percentage Estimated Of Incidence For both sexes of all countries*

| Cancers              | Sierra Leone (%) | Guinea (%) | Liberia (%) |
|----------------------|------------------|------------|-------------|
| Breast               | 17.2             | 7.3        | 2.5         |
| Cervix uteri         | 8.7              | 20.4       | 15.5        |
| Colorectal           | 5.1              | 0          | 3.0         |
| Liver                | 9.6              | 19.9       | 3.9         |
| Prostrate            | 10.9             | 12.5       | 15.7        |
| Stomach              | 3.1              | 2.7        | 2.5         |
| Non-Hodgkin Lymphoma | 2.4              | 8          | 4.1         |

#### 4.2.2.2 Mortality percentage comparison 2020.

- ***Percentage Estimated of Mortality in Sierra Leone, Guinea, and Liberia for Male 2020.***

In Guinea, liver cancer still has the highest percentages for both sexes. According to statistical data, colorectal cancer had the greatest percentage rate in Sierra Leone, while Guinea had the lowest rate of colorectal cancer mortality.

Table 4.13

*Percentage Estimated Mortality Of male For All countries 2020*

| Cancers              | Sierra Leone (%) | Guinea (%) | Liberia (%) |
|----------------------|------------------|------------|-------------|
| Colorectal           | 24.0             | 0.0        | 2.4         |
| Liver                | 11.5             | 23.8       | 17.4        |
| Prostrate            | 7.2              | 7.0        | 10.6        |
| Stomach              | 5.6              | 4.1        | 4.6         |
| Non-Hodgkin Lymphoma | 3.2              | 3.4        | 3.7         |

- ***Percentage Estimated of Mortality in Sierra Leone, Guinea, and Liberia for Female 2020.***

Sierra Leonean women had the greatest percentages of breast cancer cases, while females in Guinea had the highest percentages of the disease. In Sierra Leone and Guinea, there were no female non-Hodgkin lymphoma deaths; however, Table 4.14 displays the percentage mortality rate for all cancer types.

Table 4.14

*Percentage Estimated Mortality For Female Of All Countries 2020*

| Cancers              | Sierra Leone (%) | Guinea (%) | Liberia (%) |
|----------------------|------------------|------------|-------------|
| Breast               | 17.0             | 24.8       | 11.5        |
| Cervix uteri         | 10.8             | 6.9        | 18.0        |
| Liver                | 11.5             | 23.8       | 17.4        |
| Colorectal           | 2.4              | 0          | 2.4         |
| Non-Hodgkin Lymphoma | 0.0              | 3.4        | 3.7         |

- ***Percentage Mortality Estimated for Men and women in Sierra Leone, Guinea and Liberia 2020.***

Table 4.15 displays the estimated death rates for men and women in Sierra Leone, Guinea, and Liberia. Similar to the incidence rates, the highest mortality rates associated with liver cancer were found in Guinea, followed by Liberia. The lowest mortality rate ever observed was in Guinea, with ovarian, colorectal, and ovarian cancer mortality rates being nil in Liberia.

Table 4.15

*Mean Percentage Estimated Of Mortality For Men And Women 2020*

| Cancers      | Sierra Leone (%) | Guinea (%) | Liberia (%) |
|--------------|------------------|------------|-------------|
| Breast       | 8.5              | 12.4       | 5.75        |
| Cervix uteri | 5.4              | 3.45       | 9.0         |
| Liver        | 11.5             | 23.8       | 17.4        |
| Ovary        | 1.25             | 23.8       | 0.0         |
| Stomach      | 2.8              | 2.05       | 2.4         |
| Colorectal   | 13.2             | 0.0        | 2.4         |
| Prostrate    | 3.6              | 3.5        | 5.3         |

### 4.1.3 Age-Standardized rate per 100,000 (ASR)

- *Age Standardized Rate of incidence and mortality 2020.*

**4.1.3.1** The incidence and mortality rates for each type of cancer in Sierra Leone, Guinea, and Liberia were calculated and graphically compared for both males and females.

**4.1.3.2 For women**

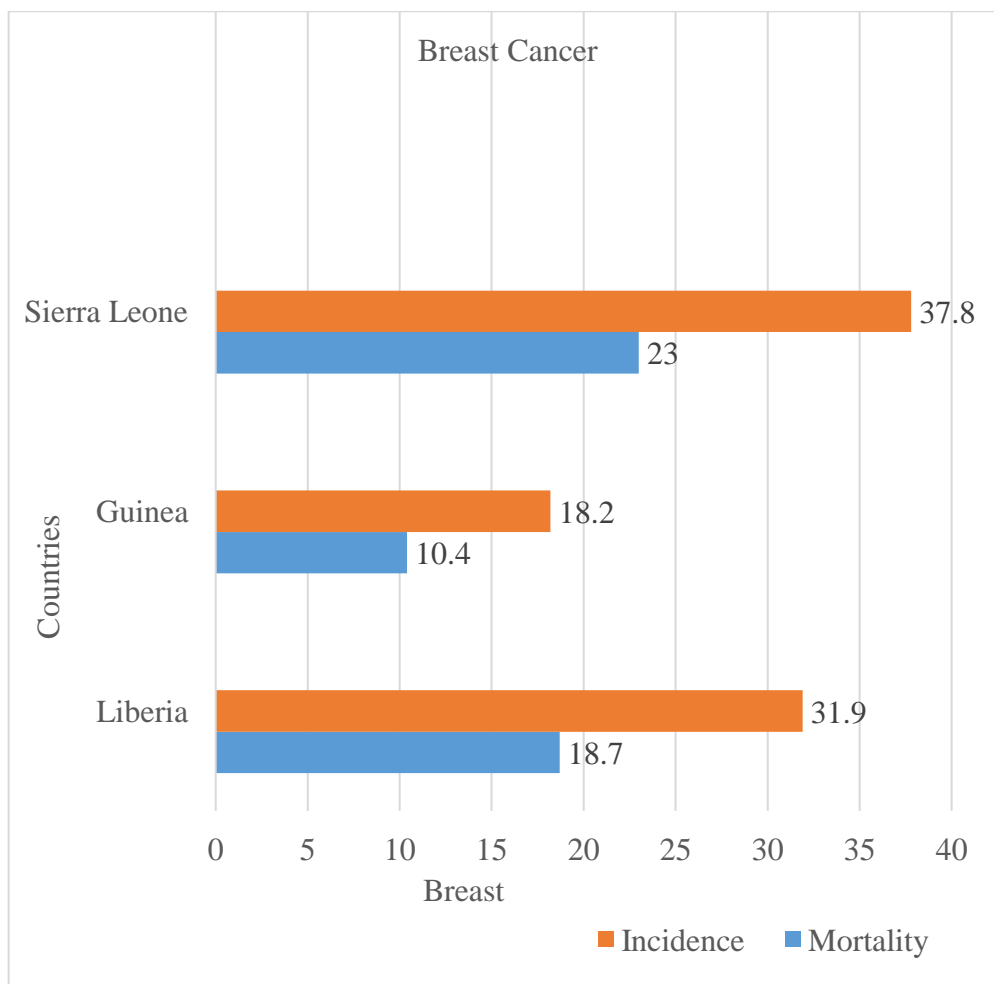
*Incidence and mortality estimates for women in Sierra Leone, Guinea, and Liberia 2020*

- **Breast**

The ASR estimates for female incidence and mortality in Sierra Leone, Guinea, and Liberia in 2020 are shown here. Figure 4.1 depicts a gradient in the incidence and mortality results, with Sierra Leone having the highest incidence and mortality rate for breast cancer and Guinea having the lowest.

Figure 4.1

*Breast ASR Of Female Incidence And Mortality Of All Countries*



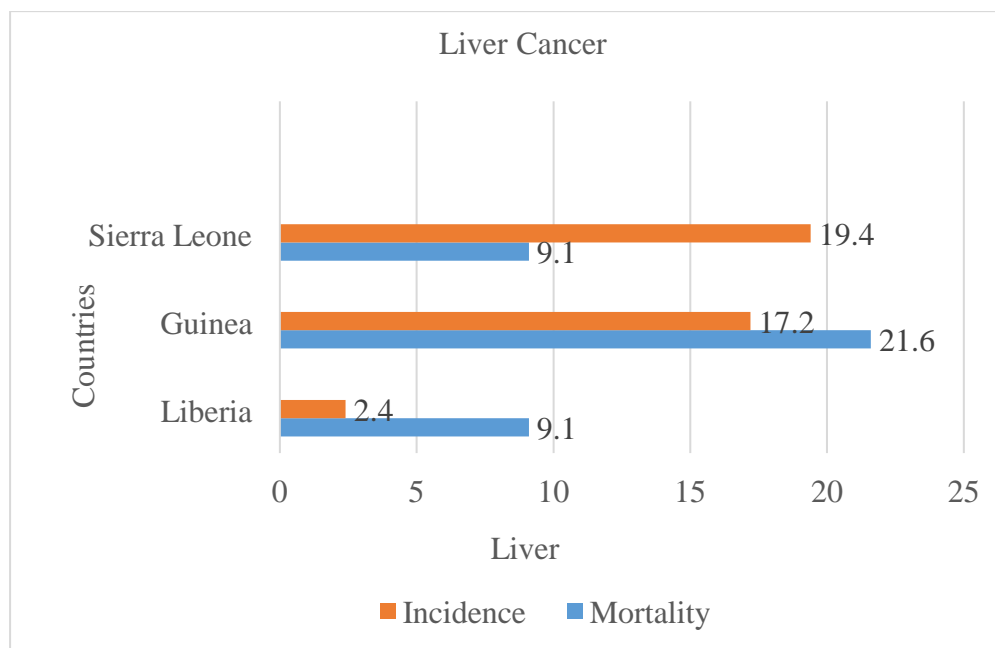
- **Liver**

Incidence and mortality rates of liver cancer among women in Sierra Leone, Guinea, and Liberia, as estimated by the ASR in 2020, are depicted in Figure 4.2. Sierra Leone and Guinea

both had the highest age-standardized incidence values for liver cancer, with Guinea also having the highest age-standardized mortality rate. As opposed to Sierra Leone, which has the lowest mortality rate, Liberia has the least incidence and the second-highest mortality.

Figure 4.2

*Liver Cancer ASR Of Female Incidence And Mortality Of All countries*

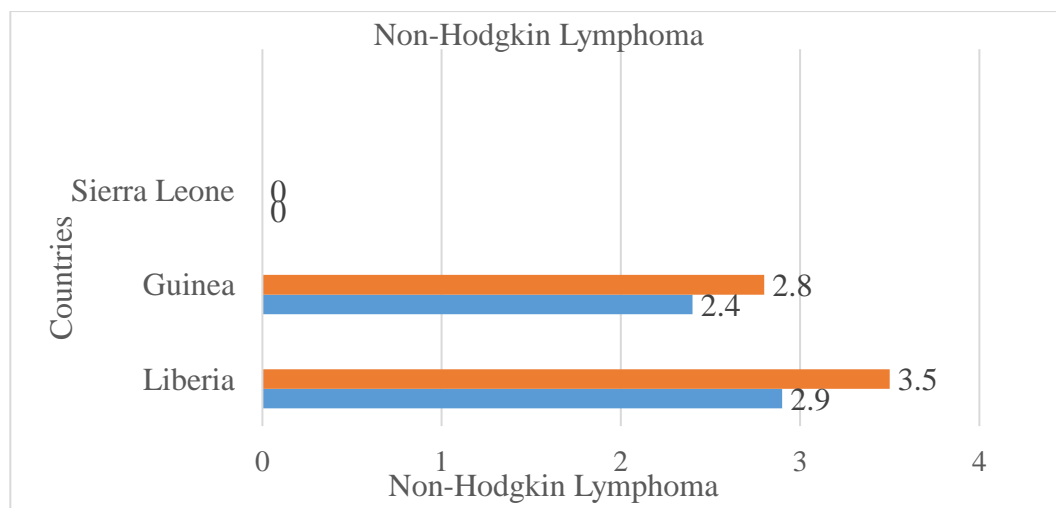


- **Non-Hodgkin Lymphoma**

The incidence and mortality of non-Hodgkin lymphoma in women in Sierra Leone, Guinea, and Liberia in 2020 are depicted in Figure 4.3 using ASR estimates. The figure below shows a representation of the incidence and mortality statistics, with female incidence and mortality in Liberia having the highest values, Guinea coming in second, and Sierra Leone having the lowest ASR numbers.

Figure 4.3

*Non-Hodgkin Lymphoma Cancer ASR Of Female Incidence And Mortality Of All Countries*

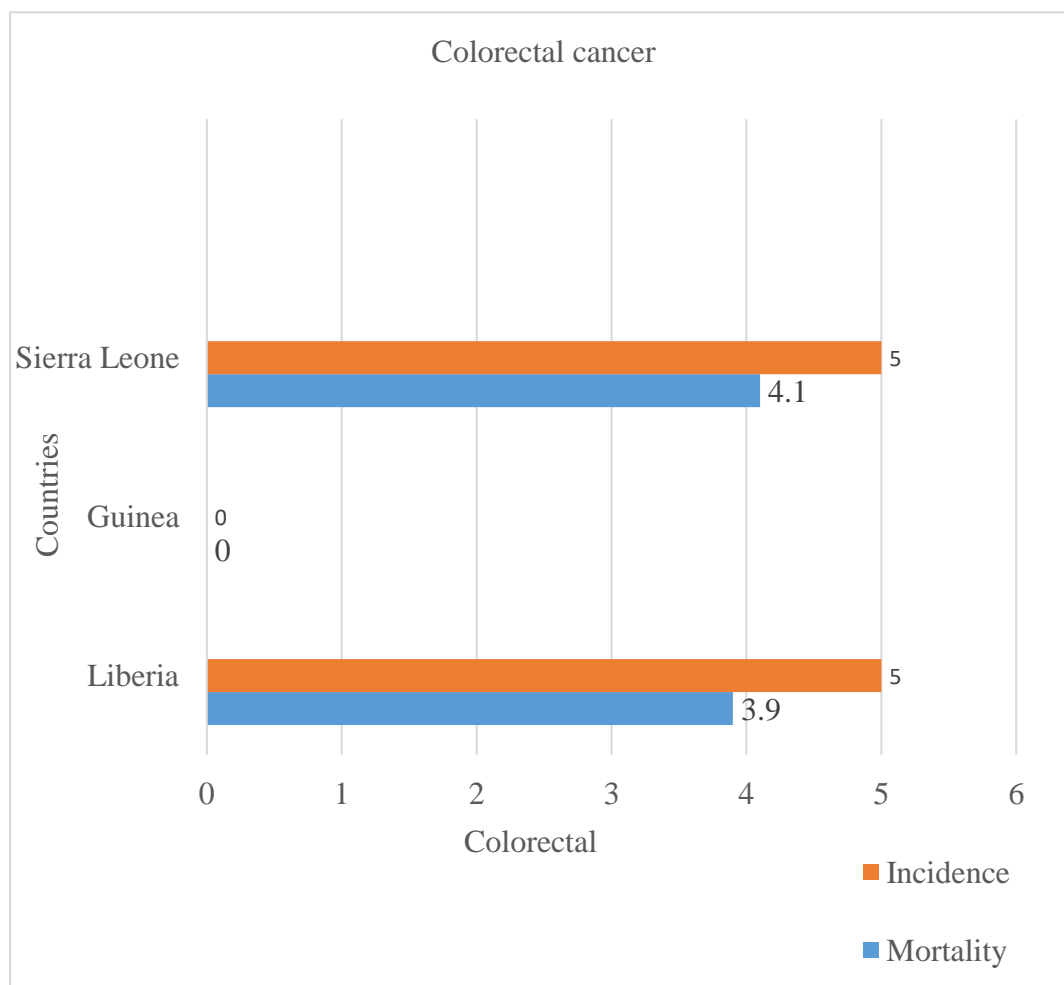


- **Colorectal**

The incidence and mortality rates of colorectal cancer in men in Sierra Leone, Guinea, and Liberia in 2020 are shown in Figure 4.4 based on ASR estimates. According to the findings on colorectal cancer, there is no incidence or mortality data available for Guinea. Contrarily, Sierra Leone and Liberia both had the highest rates of female colorectal cancer incidence and mortality.

Figure 4.4

*Colorectal Cancer ASR Of Female Incidence And Mortality Of All Countries*



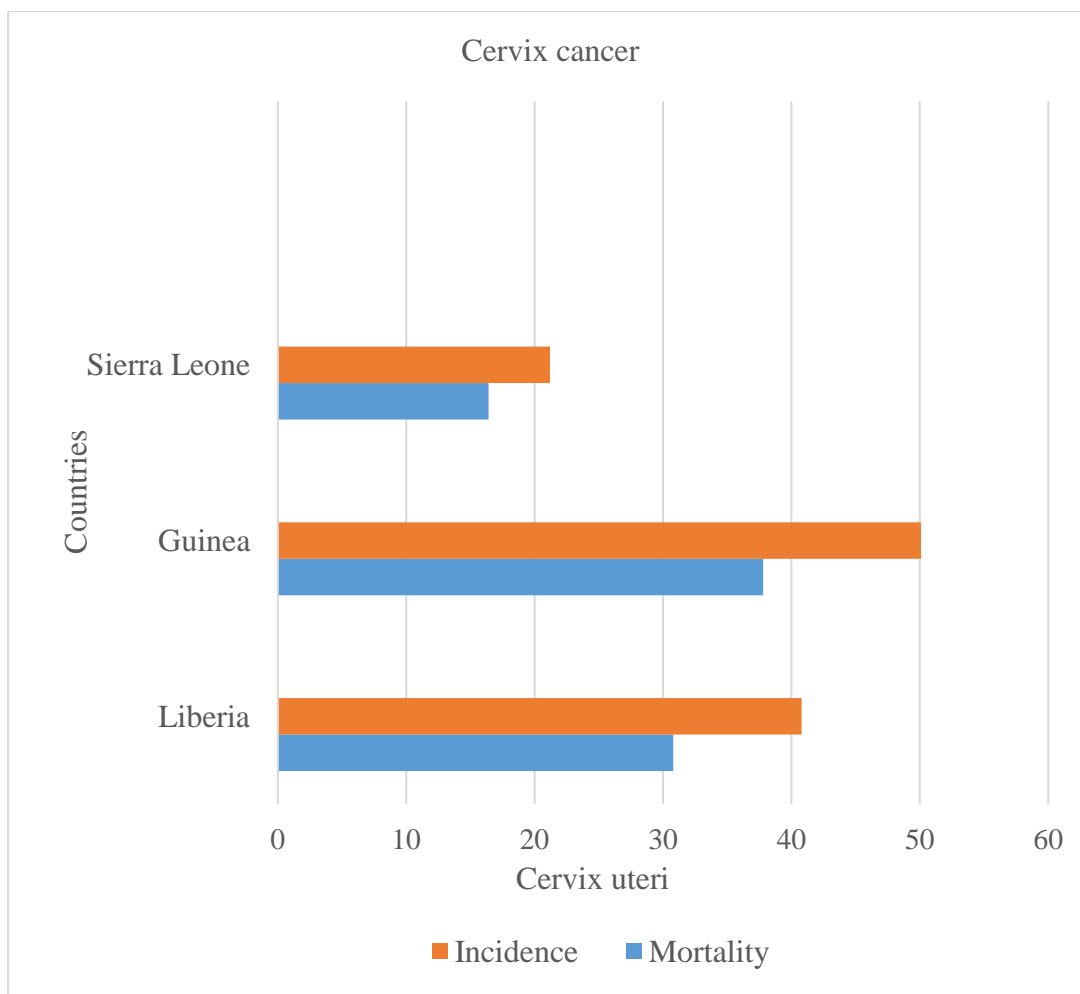
- **Cervix uteri**

Table 4.5 displays the findings of ASR's projections for female cervix cancer incidence and mortality in Sierra Leone, Guinea, and Liberia in the year 2020. Guinea had the highest ASR values for cervical cancer, with a significant disparity between it and its nearest rival, Liberia, in terms of both incidence and mortality. Sierra Leone had the lowest values, with a modest difference in incidence and mortality.

Figure 4.5

*Cervix Cancer ASR Of Female Incidence And Mortality Of All Countries*





- **Brain Cancer**

The incidence and mortality of brain cancer among women in Sierra Leone, Guinea, and Liberia in 2020, according to ASR estimates, are unknown in Sierra Leone, and Liberia has no records, while Guinea has the highest ASR numbers in terms of both incidence and mortality.

#### 4.1.3.2 For Male

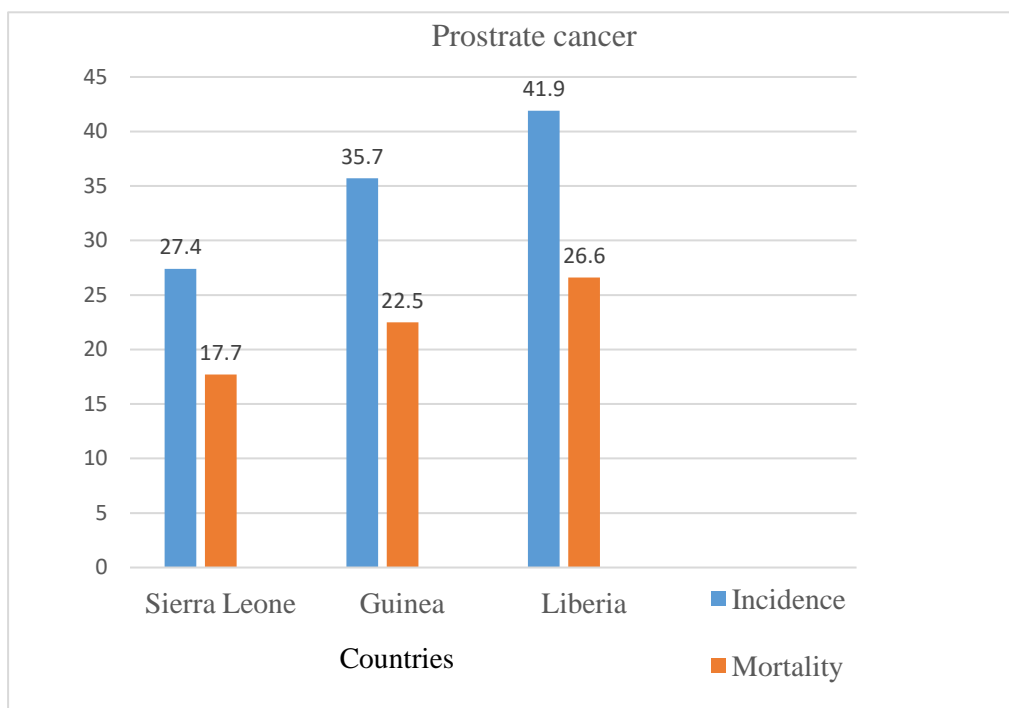
Age-standardized rate estimated of incidence and mortality in Sierra Leone, Guinea, and Liberia 2020 (Male)

- **Prostrate**

Figure 4.6 uses age-standardized rates to show the incidence and mortality rates of prostate cancer in men in Sierra Leone, Guinea, and Liberia in 2020. The findings are displayed as a gradient, with the highest male incidence and mortality rates occurring in Liberia, the second-highest rates occurring in Guinea, and the smallest rates occurring in Sierra Leone.

Figure 4.6

*Prostrate Age-Standardized Rate Of Male Incidence And Mortality Of All Countries*

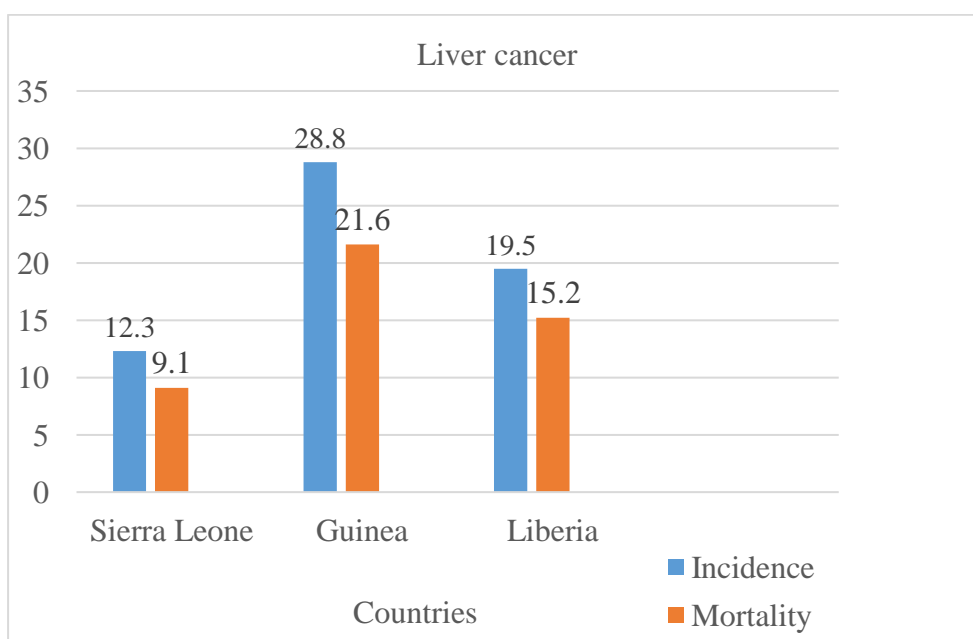


- **Liver**

Figure 4.7 depicts the ASR estimates for male liver cancer incidence and mortality in Sierra Leone, Guinea, and Liberia in 2020. Guinea has the highest liver cancer rate, with Liberia coming in second and Sierra Leone coming in last, with a significant disparity between them.

Table 4.7

*Liver Age-standardized Rate Of Male Incidence And Mortality Of All Countries*

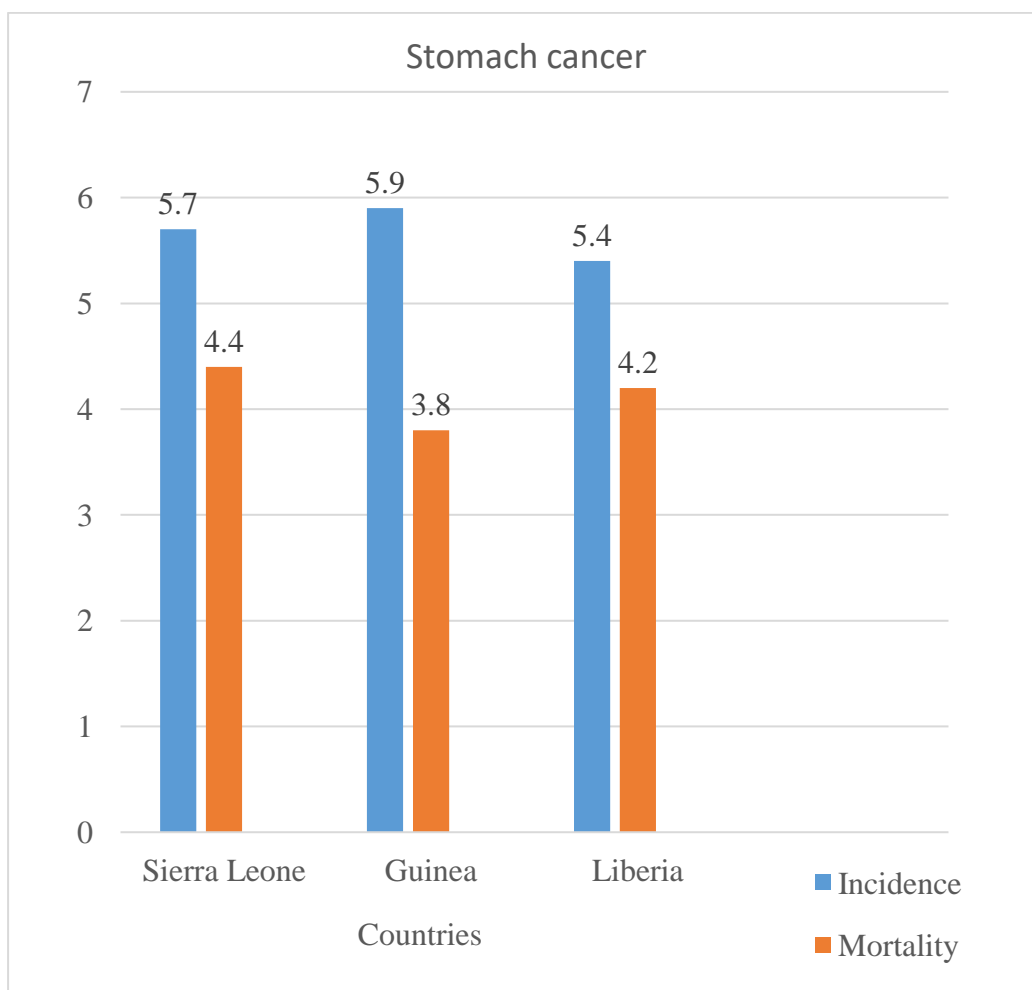


- **Stomach**

Incidence and mortality rates of stomach cancer among women in Sierra Leone, Guinea, and Liberia, as estimated by the age-standardized rate in 2020, are depicted in Figure 4.8. Sierra Leone and Guinea both had the highest age-standardized incidence values for liver cancer, with Sierra Leone also having the highest age-standardized mortality rate. As opposed to Guinea, which has the lowest mortality rate, Liberia has the lowest incidence and the second-highest mortality.

Figure 4.8

*Stomach Age-Standardized Rate Of Male Incidence And Mortality Of All Countries*

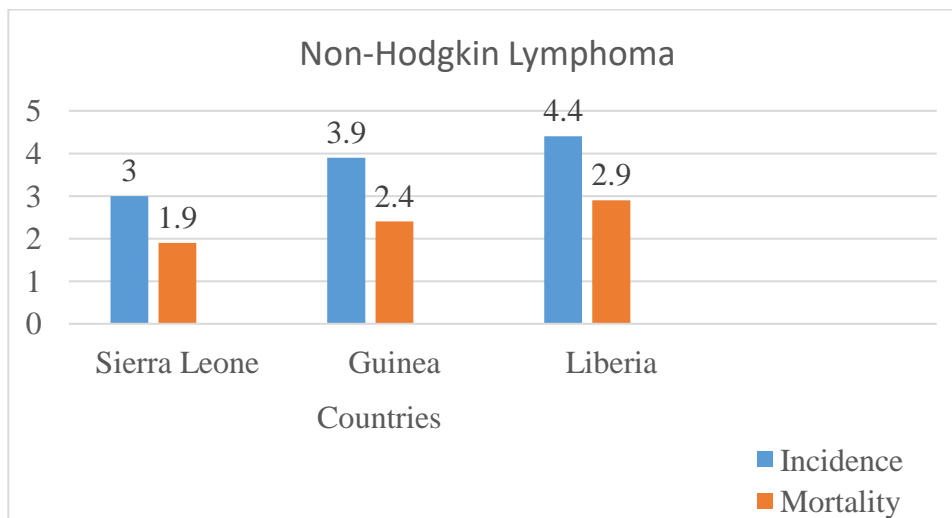


- **Non-Hodgkin Lymphoma**

Figure 4.9, which uses age-standardized rates, illustrates the incidence and mortality rates of non-Hodgkin lymphoma cancer in men in Sierra Leone, Guinea, and Liberia in 2020. The figure shows a gradient in the incidence and mortality statistics, with the highest male incidence and mortality values occurring in Liberia, the second-highest values occurring in Guinea, and the lowest values occurring in Sierra Leone.

Figure 4.9

*Non-Hodgkin Lymphoma Age-Standardized Rate Of Male Incidence And mortality Of All countries*

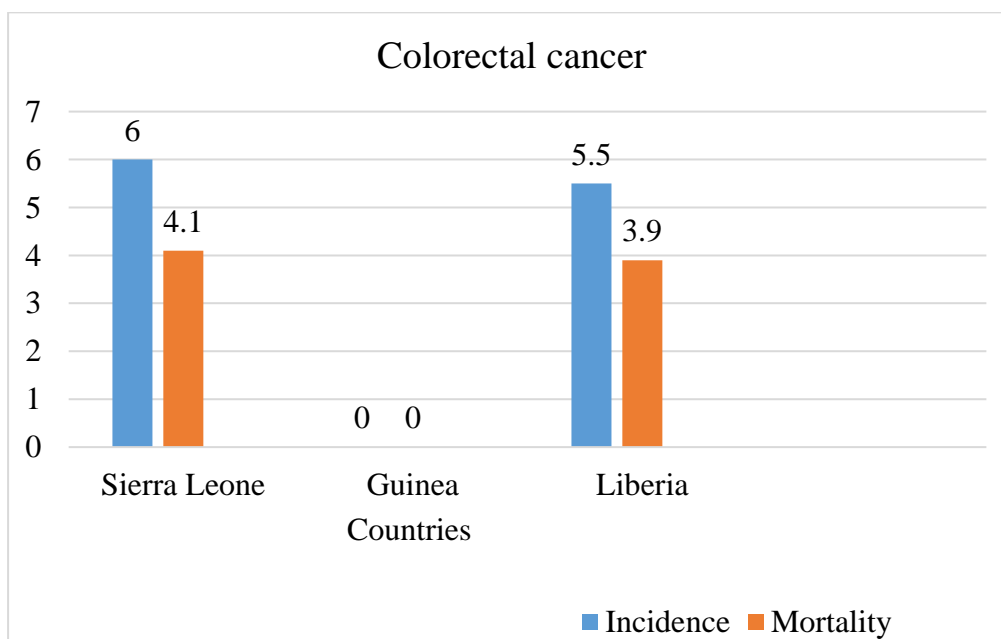


- **Colorectal**

The incidence and mortality rates of colorectal cancer in men in Sierra Leone, Guinea, and Liberia in 2020 are depicted in Figure 4.10 using age-standardized rates. The figure depicts a gradient in the results for both incidence and mortality, with male incidence and mortality in Sierra Leone reaching the highest value, followed by Liberia. Guinea shows no records according to the statistics for 2020.

Figure 4.10

*Colorectal ASR Of Male Incidence And Mortality Of All Countries*



#### 4.1.3.2 Age-standardized rate for both Male and Female

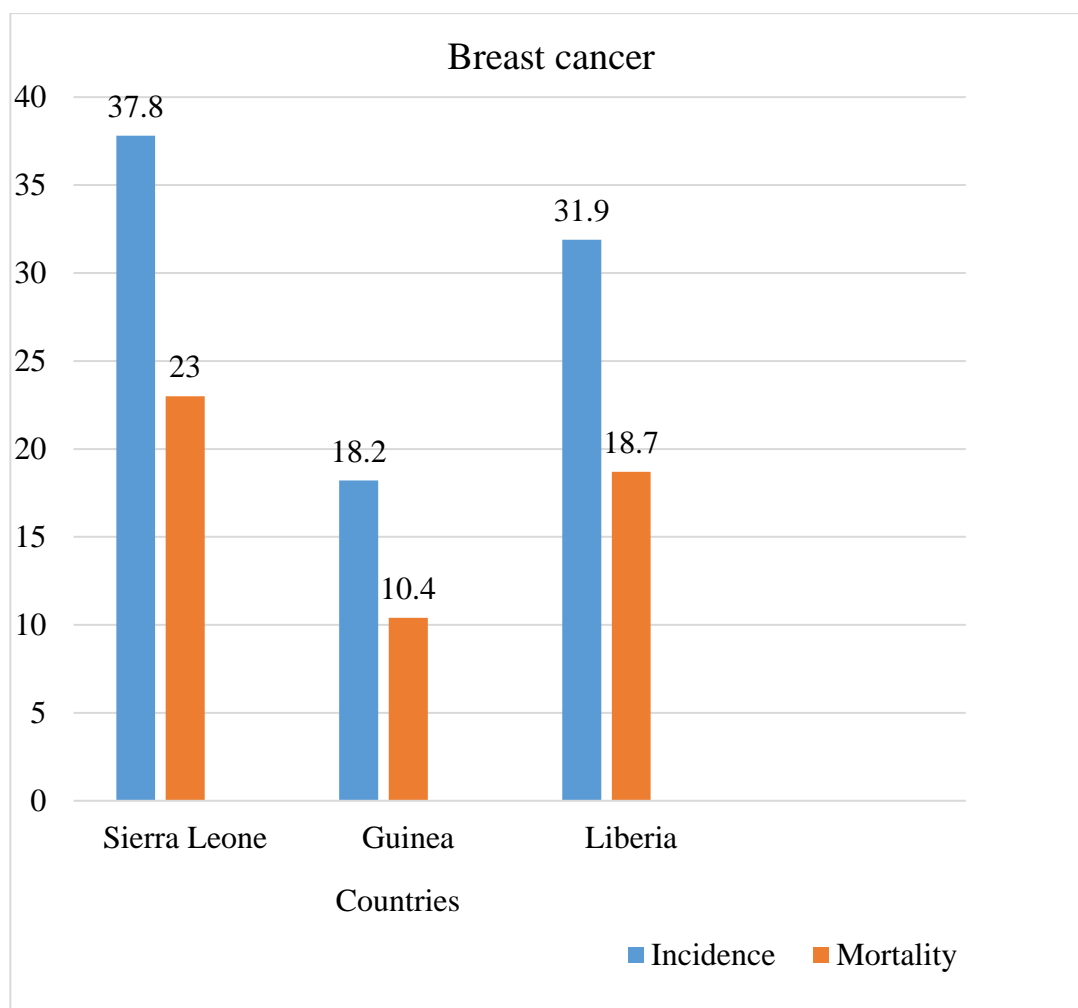
### *Incidence and Mortality for all cancer for all countries*

- **Breast.**

With an incidence and mortality rate of approximately 37.8%, Sierra Leone had the highest age-standardized incidence and mortality for breast cancer, significantly higher than Liberia, which came in second, and Guinea, which had the lowest ASR values. Figure 4.11, displays the estimated age-standardized incidence and death rates for breast cancer for both sexes.

Figure 4.11

*The Breast ASR Incidence And Mortality Rates Of Male And Female*

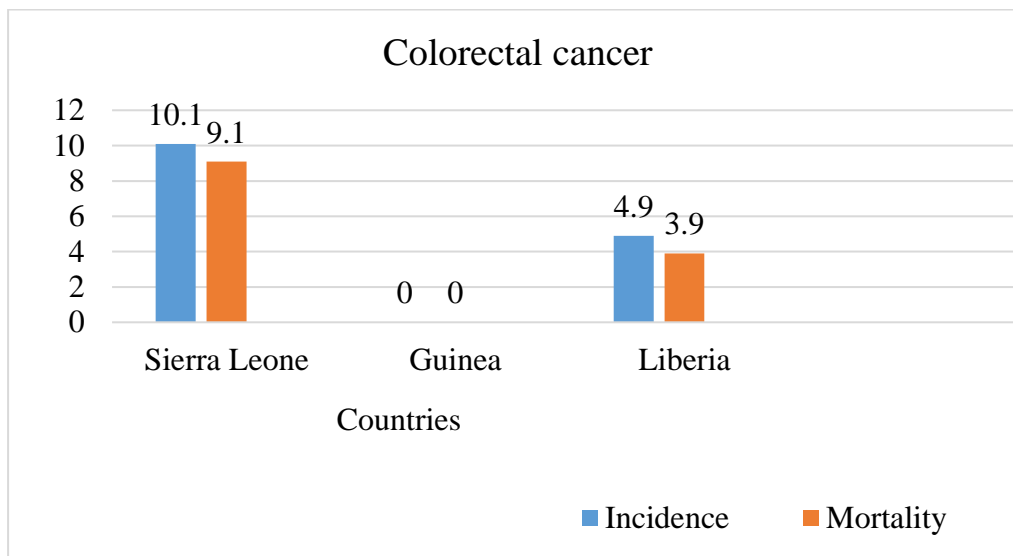


- **Colorectal**

The incidence and mortality rates of colorectal cancer in men in Sierra Leone, Guinea, and Liberia in 2020 are shown in Figure 4.12, based on ASR estimates. According to the findings on colorectal cancer, Guinea has the lowest age-standardized rate of incidence and mortality. The incidence and mortality of male colorectal cancer were the highest in Sierra Leone and Liberia.

Figure 4.12

*The Colorectal ASR Incidence And Mortality Rates Of Male And Female*

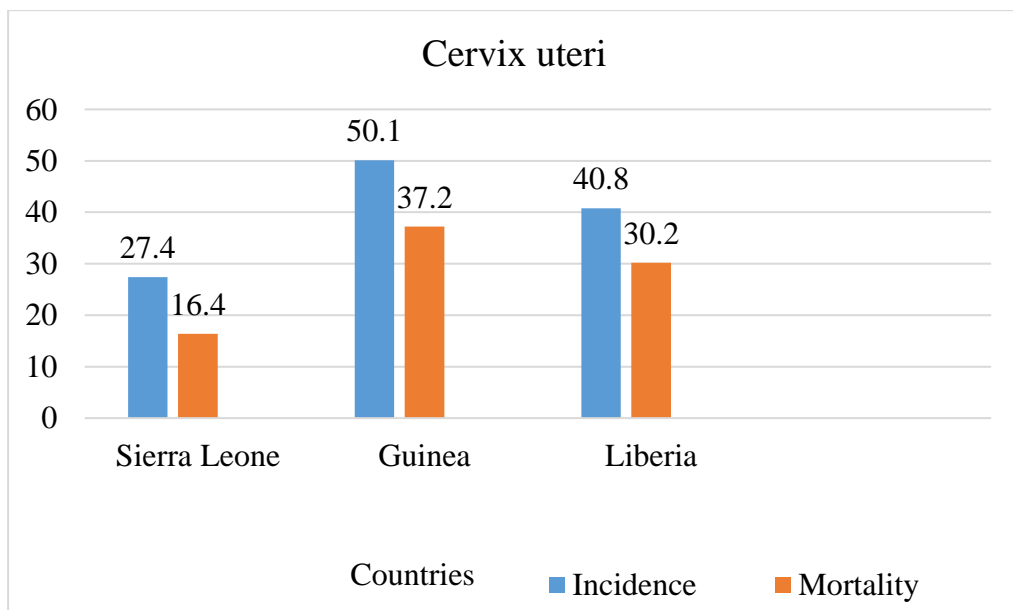


- **Cervix uteri**

The estimated age-standardized incidence and mortality rates for male and female cervix cancer are shown in Figure 4.13. The countries with the highest age-standardized incidence and mortality rates were Liberia, Guinea, and Sierra Leone, in that order. Liberia had the highest ASR for both incidence and mortality rates.

Figure 4.13

*The Cervix Uteri ASR Incidence And Mortality Rates Of Male And Female*

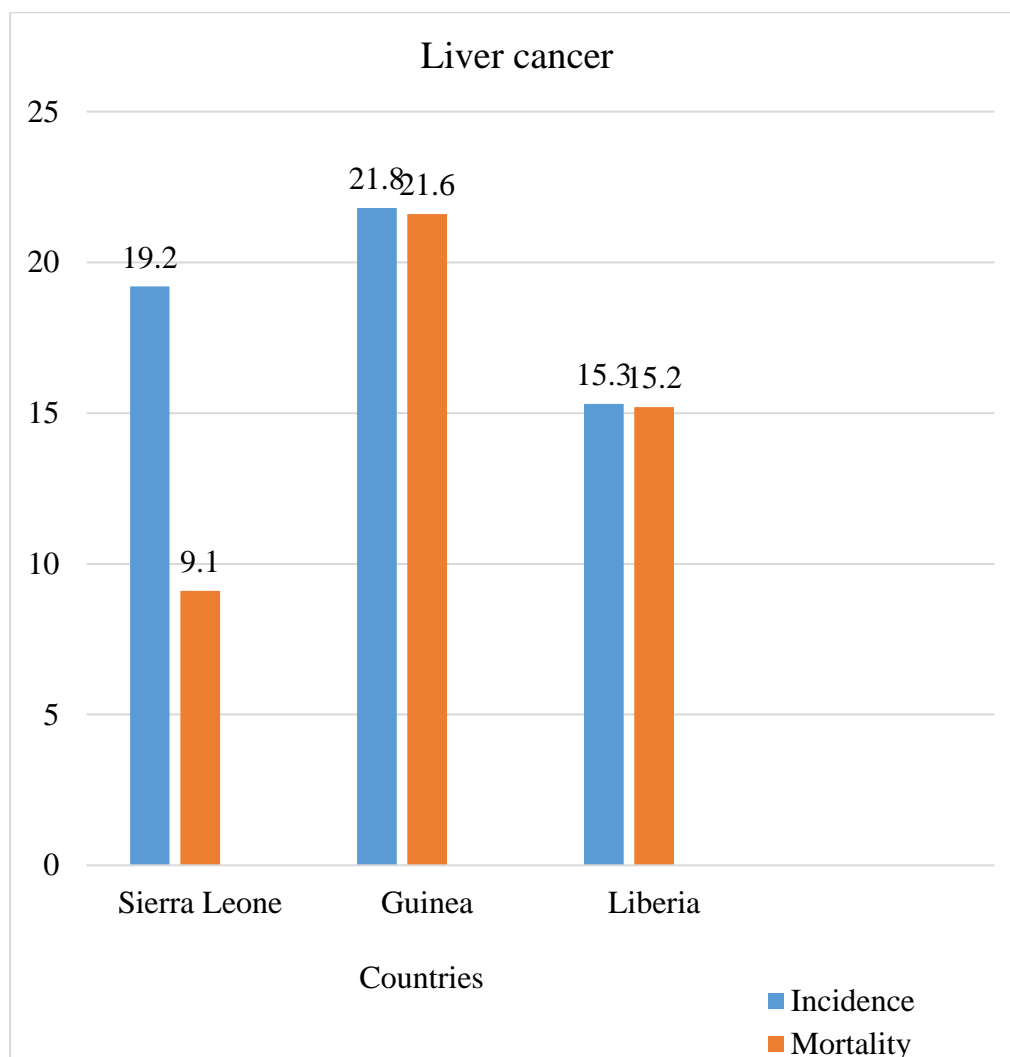


- **Liver**

The estimated age-standardized incidence and death rates of liver cancer in men and women are shown in Figure 4.14. In stark contrast to Sierra Leone and Liberia, Guinea recorded the highest ASR levels. The second-highest incidence and lowest mortality ASR values are seen in Sierra Leone.

Figure 4.14

*The Liver ASR Incidence And Mortality Rates Of Male And Female*

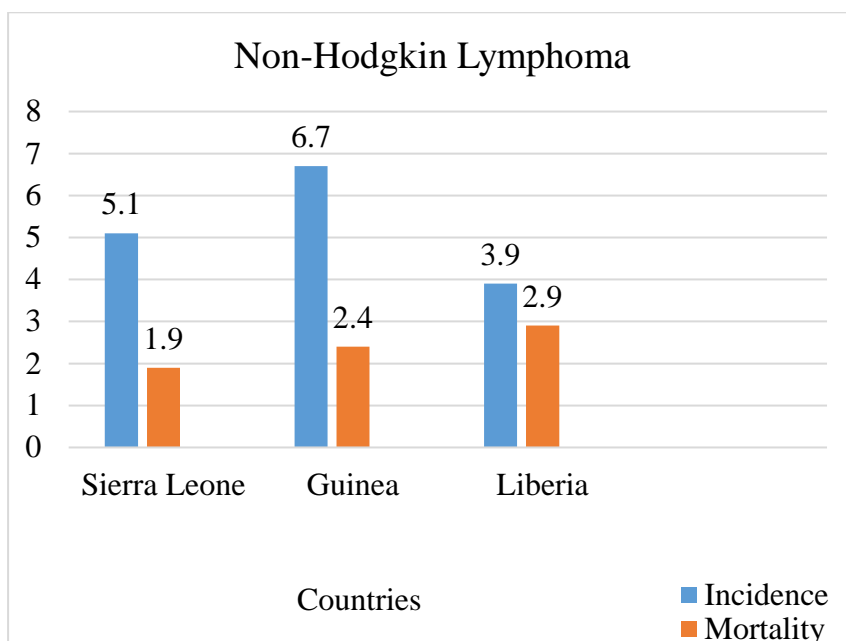


- **Non-Hodgkin Lymphoma**

The estimated age-standardized incidence and mortality rates for male and female non-Hodgkin lymphoma cancers are shown in Figure 4.15. The countries with the highest age-standardized incidence rates were Guinea, Sierra Leone, and Liberia, in that order. In addition, the countries with the highest mortality rate were Liberia, Guinea, and Sierra Leone, in that order. Guinea had the highest ASR for incidence, and Liberia had the highest mortality ASR value.

Figure 4.15

*Non-Hodgkin Lymphoma ASR Incidence And Mortality Rates Of Male And Female*

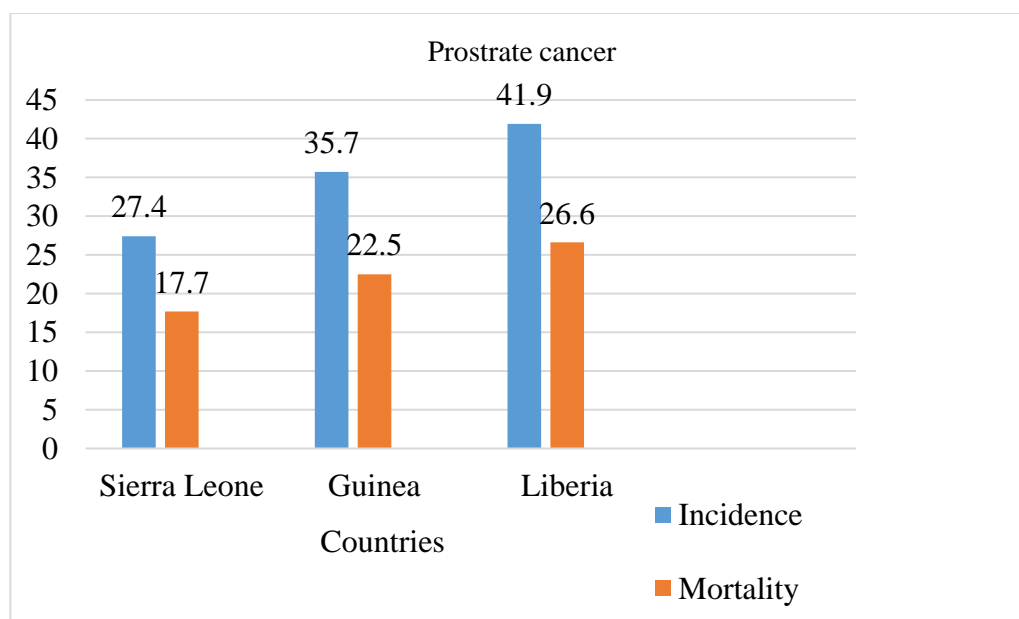


- **Prostrate**

The estimated age-standardized incidence and mortality rates of prostate cancer in both sexes are shown in Figure 4.16. Liberia recorded the highest incidence and mortality rates. The second-highest ASR incidence and mortality are in Guinea, and the lowest incidence and mortality ASR values are seen in Sierra Leone.

Figure 4.16

*Prostrate ASR Incidence and mortality Rates Of Male And Female*



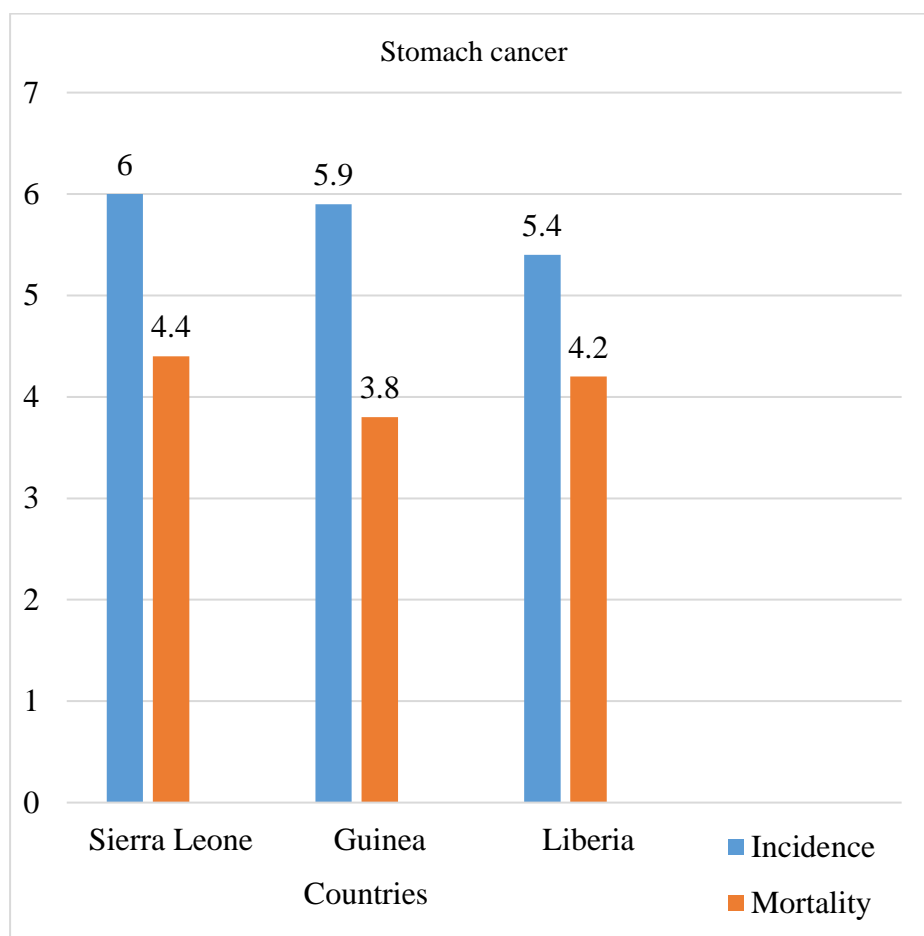
- **Stomach**



With an incidence and mortality rate of approximately 6.0 and 4.4 for stomach cancer for both sexes, Sierra Leone had the highest age-standardized incidence and mortality for stomach cancer, significantly higher than Guinea, which came in second, and Liberia, which had the lowest incidence ASR values. Figure 4.17 displays the estimated age-standardized incidence and mortality rates for stomach cancer for both sexes.

Figure 4.17

*Stomach ASR Incidence And Mortality Rates Of Male And Female*



#### 4.2 Comparison average and Age-standardized rate 2020

In 2020, the average and age-standardized rate per 100,000 for Sierra Leone, Guinea, and Liberia will have been determined. The estimation of incidence and mortality for both males and females is shown in Tables 4.3 for Sierra Leone, 4.6 for Liberia, and 4.9 for Guinea.

Table 4.1 contrasts Sierra Leone with its neighbors in terms of mortality as well as male and female incidence. Contrarily, the countries with the highest incidences of prostate cancer in men were Sierra Leone (27.4%), Liberia (41.9%), and Guinea (35.7%). According to statistics, prostate cancer appears to be the most common malignancy among men in all three countries.

In Guinea, cervix cancer had the highest incidence and mortality rates among female cancers, followed by Liberia and Sierra Leone with respective incidence and mortality rates of 40.8% and 27.4%. According to the ASR incidence comparison, men in Sierra Leone had the highest rate of prostate cancer at 27.4%, followed by those in Guinea at 35.7% and Liberia at 41.9%. According to the ASR incidence comparison, the highest rate of breast cancer in females was found in Sierra Leone at 37.8%, while the highest rate for cervix cancer in females was found in Guinea at 50.1%. In addition, cervical cancer was reported in women from Liberia at 40.8%. In Sierra Leone, prostate cancer was the main factor contributing to male mortality (17.7%), Liberia (26.6%), and Guinea (22.5%), while it was also the leading cause of death for men in Sierra Leone. Cervical cancer had the highest female mortality percentage in Guinea and Liberia at 37.2% and 30.8%, respectively, and breast cancer had the highest rate in Sierra Leone at 23.0%. Prostate cancer had the highest male mortality rate in Sierra Leone at 17.7%, but it had the same rate in Guinea at 22.5%, according to the ASR mortality comparison. In Liberia, there were 26.6% cases of liver cancer. The ASR mortality comparison for females reveals that the highest value in Sierra Leone was 23.0% breast cancer, while Guinea and Liberia recorded 37.2% cervix cancer and 30.8 cervix cancer, respectively, as the highest cancer type values in the three-nation.

## **CHAPTER V**

### **DISCUSSIONS**

#### **5.1 Discussions.**

When cells in one region of the body grow and spread uncontrollably, a disease called cancer results. Healthy tissue, including organs, can be invaded and destroyed by cancerous cells. Before it is detected, cancer can begin in one area of the body and spread to others. The medical word for this process is metastasis.

The most common cancers in men were found to be lung, skin, colon, rectal, prostate, brain, bladder, esophageal, liver, and stomach cancers. Males are more likely than females to develop these cancers, whereas females are also more likely to develop breast, gynecological, skin, colon, and rectal cancers, lung, melanoma, liver, brain, endometrial cancer, stomach, cervical cancer, ovarian cancer, and bladder.

Based on the research of the three countries, Sierra Leone, Guinea, and Liberia, it is evident that Guinea has the highest human population, as well as the highest number of cancer cases and deaths, followed by Sierra Leone and Liberia, which have the lowest population. The major goal of the study was to compare the information on cancer prevalence in Sierra Leone and surrounding nations using statistical analyses. Graphic comparisons were made between the basic data for each kind of cancer in Sierra Leone, Guinea, and Liberia. The basic objective is to compare mortality rates between countries while accounting for the differences in age distributions across countries to calculate the ASR of mortality. Without the use of ASR, it would be impossible to tell whether differences in mortality rates were caused by age or by other variables.

The incidence of a particular illness in a group, assuming the population has a normal age structure. Alternative words for age standardization (ASR) Statistics reveal the number of individuals who are diagnosed with cancer and die from it every year, the number of people who live after obtaining a cancer diagnosis, the typical age at diagnosis, and the number of survivors at a specific time after diagnosis. They also provide information on disparities between groups based on age, gender, race or ethnicity, geography, and other factors.

Indicators of trends can be found using cancer statistics. The ability to evaluate changes in the chance of developing and dying from certain malignancies as well as cancer generally is provided by examining trends in cancer rates across time. When Sierra Leone was compared to its neighbors in terms of male and female incidence as well as mortality, Sierra Leone had the lowest rates of prostate cancer in men, with a percentage incidence of 27.4%, and Liberia

had the highest percentage incidence of 41.9%, followed by Guinea with a percentage incidence of 35.7%. According to statistics, prostate cancer appears to be the most prevalent tumor among men in the three nations. Guinea had the highest incidence and fatality rates for cervix cancer among female cancers, followed by Liberia and Sierra Leone with 40.8% and 27.4%, respectively. Furthermore, 40.8% of Liberian women have cervical cancer. In Sierra Leone (17.7%), Liberia (26.6%), and Guinea (22.5%), more males died from prostate cancer than any other disease. In Sierra Leone, men also died from prostate cancer more frequently than from other diseases. With corresponding death rates of 37.2% and 30.8% for cervical cancer in women, Guinea and Liberia had the highest rates, while 23.0% for breast cancer were in Sierra Leone. According to the ASR mortality comparison, the highest male mortality rate was caused by prostate cancer in Sierra Leone (17.7%), while the same disease occurred in Guinea (22.5%). The highest number in Sierra Leone was 23.0% breast cancer, according to the ASR mortality comparison for females, whereas the highest values in Guinea and Liberia were 37.2% and 30.8% cervical cancer, respectively.

## CHAPTER VI

### CONCLUSIONS AND RECOMMENDATIONS

#### 6.1 Conclusions.

This study intends to provide and demonstrate the geographical patterns and cancer distribution in the study area to explain the cancer incidence in Sierra Leone and surrounding nations.

To reduce cancer, countries should be conscious of their geographic conditions. The primary goal is to persuade the state to address issues like these that are lacking in our nation and emerging nations in general. According to this viewpoint, the significance of this study is implied by its title. In an area where this type of research appears to be a new field of study, the majority of researchers and statisticians work to explain the relationship between statistics and medicine, the geographic environment, and human health, as well as the origin of diseases and their high rates. The following primary finding is deduced from the investigation and statistical work:

This research will estimate the cancer incidence in Sierra Leone in 2020 and compare it to adjacent nations.

1. The incidence and mortality rates of the three nations were calculated using the ASR results for males and females
2. In Liberia and Sierra Leone, prostate cancer was the most prevalent cancer in men, while Guinea had the highest incidence of liver cancer.
3. In all three nations' breast and cervix cancer were the most frequent cancers in women.
4. Analysis of the incidence and mortality of all cancer types for both sexes has been done using percentages and ASR.
5. The most noticeable aspect is that neither Guinea nor Liberia's mean age-standardized ratios are statistically significant. While in Sierra Leone, there are various age-standardized percentages for each kind of cancer.
6. While there was no difference in the mean ASR findings for females in Sierra Leone, the mean ASR results for males varied across all cancer types. Furthermore, the mortality rates for men and women were the same.
7. According to the ASR results from Guinea, all cancer categories had the same mean incidence rate and mortality rate.

#### 6.1.1 Recommendations.

1. Weight gain in adulthood should be avoided, and body weight should remain within normal ranges.
2. Limit your sedentary behaviors and engage in physical activity for 30 minutes or more each day.
3. Avoid consuming excessive amounts of meals and drinks with added sugar.
4. The maximum amount of alcohol one woman should consume per day is one drink.
5. The intake of Foods that are preserved in salt or are salted, or those that are salty, should be limited .
6. It is not recommended that you take supplements to prevent cancer. Ensure that you are getting the nutrients you need through your diet.
7. When going out on a very sunny day, ensure that you dress well by covering your chest to avoid sun radiation, as it is one of the preventive measures against breast cancer.
8. The governments of Sierra Leone, Guinea, and Liberia should improve their medical systems.

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