LOBE BASED RISK ANALYSIS OF DISCHARGES AND IN-HOSPITAL MORTALITY OF LUNG CANCER PATIENTS

By

Riddhi. J. Vyas

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Lobe Based Risk Analysis of Discharges and In-Hospital Mortality of Lung Cancer Patients

BY

Riddhi J. Vyas

Dissertation Committee:

Syed Haque PhD PhD

Dinesh Mital PhD

Shankar Srinivasan PhD

Approved by the Dissertation Committee:

_____ Date _____

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_____ Date _____

_____ Date _____

_____ Date _____

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ABSTRACT

Lung cancer occurrences are more likely as compared to any other type of cancer in the world with very high mortality rate. Based on the past research, smoking and family history of smoking are the most common causes of lung cancer by per age, race and gender. Lung cancer is the second deadliest cancer in this world after prostate cancer and breast cancer. In this research, we have used the Nationwide Inpatient Sample Data from the year 2003 to 2007 to analyze current and predict future trend of lung cancer. Towards the analyses, we have included all the anatomical sub categories of lung to determine, which lobe of lung is having considerably higher risk of catching cancer.

Our anatomical analysis concludes the risk occurrence of lung cancer follows an order from high to low: **Upper lobe, Lower lobe, Other-parts of the lung, Main bronchus, and Middle lobe.** We have also examined the association of each category of lung with race across the gender. The overall lung cancer analysis indicates, **White American** and **Black** have the higher risk of getting lung cancer as compared with other races. Further analysis of individual lobe of lung denotes, among the all races, **White American** is more susceptible to each lobe of lung except other-parts of lung.

The odds ratio analysis for individual anatomical site concludes white male and female **[odds ratio of all sub category- male/female 1.03 to 1.08]** are equally susceptible to each lobe of lung. The black females **[odds ratio of Lower lobe-male/female 1.08]** are highly associated with lower lobe of lung cancer as compared with black males. Whereas Hispanic, Asian and Native American females are more associated with middle lobe lung

cancer as compared with Hispanic, Asian and native American males **[odds ratio for middle lobe - male/female 0.89 to 0.95].**

Based on the past research, smoking is the primary cause of the death in the lung cancer by age, race and gender. In this research, we have used National Impatient Sample and census population for the state CA, Fl, TX, NY, IL, RI, VA, SC, and WI to determine the association of geographical variation with the risk factors by population. We have confirmed that incidence of lung cancer cases in **CA (bigger state by population) is lower than RI and VA (smaller state by population). In other word,** we confirmed our hypothesis that higher population, need not have to have higher incidence rate (*In this research, incidence rate refers to discharged*), but other factors like race, gender, pollution, exposure to chemical factor also play an important role to measure susceptibility of the occurrences.

This research study was limited to the National Inpatient database across the United State. Lung cancer patients were extracted base on principle diagnosis of the lung cancer symptoms.

ACKNOWLEGEMENT

I am using this opportunity to express my gratitude to advisor Dr**. Syed Haque,** who believed in me and supported me throughout my PhD. I am thankful to him for giving me an opportunity to be a pre doctoral fellow under his supervision. His authority has played important role in my development as a researcher as well as an Instructor. Thank you for being my research advisor. I would like to thank **Dr. Dinesh Mital, Dr. Shibata and Dr. Shankar Srinivasan** for being co-advisors for my PhD research and thank you for patronizing me.

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CHAPTER I

INTRODUCTION

1.1 BACKGROUND OF PROBLEM

Lung cancer occurrence is more likely as compared to any other type of cancers in the world and has a very high mortality rate. Among the all type of cancers, such as prostate, breast, skin, colon, thyroid and balder, lung cancer is the second deadliest cancer after the prostate, breast and colon cancer. Intensity of lung cancer occurrences were not always as high as today. Once upon a time, it was an exceptionally rare disease. In the year of 1878, incidence rate of lung cancer was only 1-2% of all cancers. During the year between 1927 and 1930, it had grown to 10-14% of all cancers and after the World War I; the occurrences of lung cancer had dramatically started to grow.

In spite of the advance technology, lung cancer is the most difficult caner to treat before symptoms become apparent. The lake of early detection is the primary contributor for high mortality rate, as compared to the other deadly cancers like prostate in male and breast in female.

Like, other type of cancer, lung cancer can easily spread from lung to the brain, liver, bone and become deadly. Although lung cancer is difficult to treat, it can prevented by changing a life style.

For the lung cancer major risk is associated with the use of tobacco, it accounts for almost 90 to 95% of lung cancer in the world as compared to the non-smoker. In addition to

smoking, exposure to some other others environment factor, family history, COPD [Chronic Obstructive Pulmonary Disease], alcohol consumption and genetic mutation play a vital role in causing this disease.

Statistics:

Lung cancer is an old age disease, 80% to 82% of those having cancer are above 60 to 65 years older. As per the world cancer statistics, the incidence rate of lung cancer is estimated 12**% to 13%** and the mortality rate is estimated **27%** of all cancers per year.

In the year 2014, North American Association of cancer registries has reported 224,210 new cases diagnosed and 159,260 deaths in the United States. The extraordinary rising trend of lung cancer incidence and mortality rate is not only due to smoking but also due to toxic exposure and socio economical culture.

Geographical representation of Incidence and Death rate of lung cancer in the United States as follow for the year 2014:

Incidence and mortality rate gas calculated based on census population per 100,000. In the United States, average death rate per state is 70% to 80% of incidence rate.

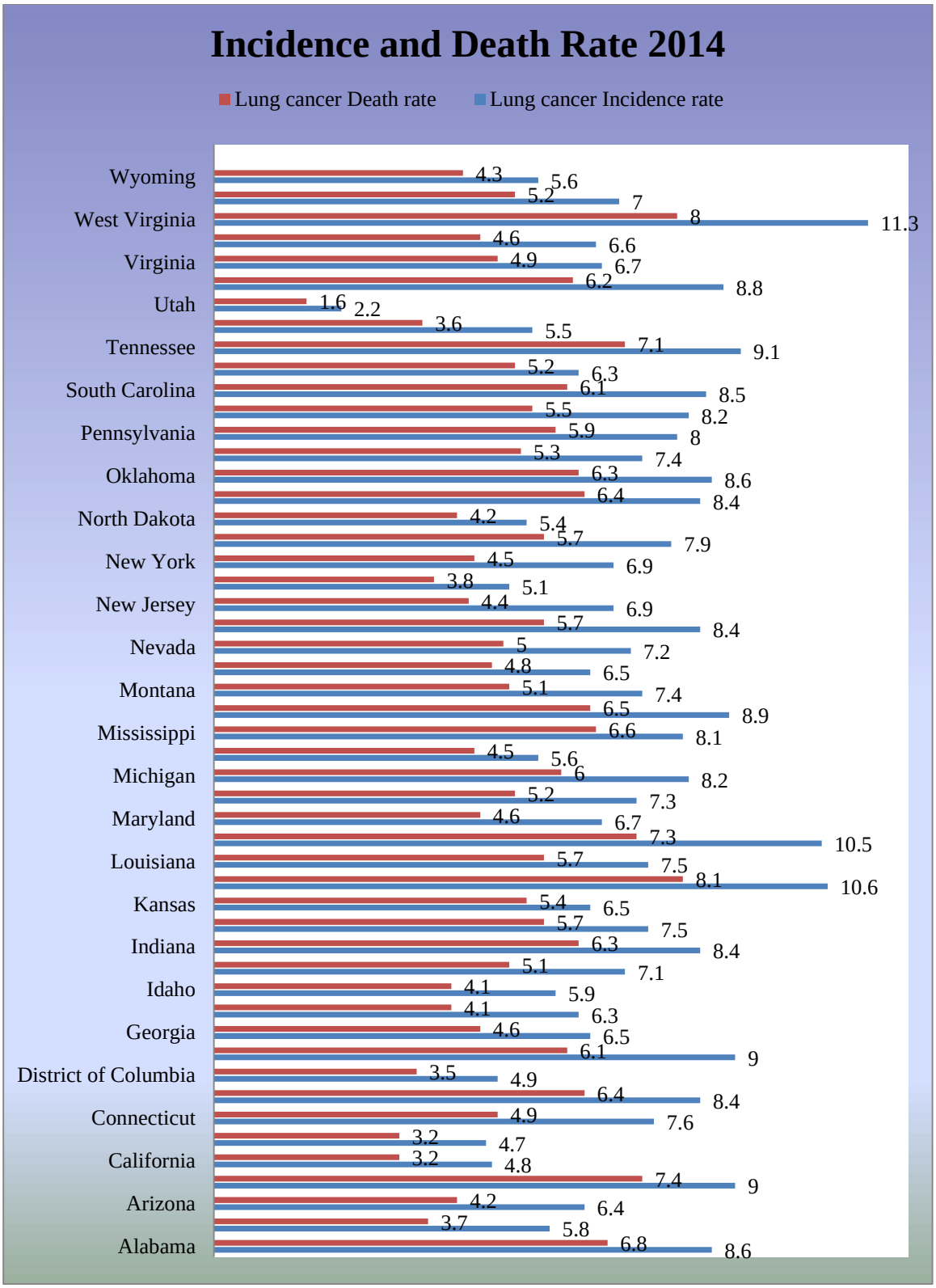

Figure 1.0 Incidence and Death Rate of Lung cancer by state (%)

As per the report produced by American Lung Association in the year 2012-2014, lung cancer causes more deaths than combination of most common cancers [colon, breast, prostate]. An estimated death rate is 28% of all other cancers in the United States. *(American Lung Association)* Lung cancer that identified at the local stage has the survival rate of 5 years, which is considerably (16%) lower as compared to other deadly cancers especially breast (89%), colon (65%) and prostate (99%). More than 50 percentages of lung cancer patients die within one year of diagnosis. *(Prognosis of Outcome, (American Lung Association)*

As per the American Cancer Society, comparison of Incidence rate and mortality rate of all three deadly cancers, 2014

Table 1.1: Comparison of lung cancer (Incidence rate) With Others Cancers

	Type of cancer	Rate
Incidence rate (year 2014)	**Lung and Bronchus**	**224,210** ↑↑↑
	Breast	**232,670** ↑↑
	Prostate	**233,000** ↑
	Colon	**136,830** ↑↑↑↑

[Surveillance, Epidemiology, and End Results Program]

Table 1.2: Comparison of lung cancer (Death rate) With Others Cancer

	Type of cancer	Rate
Mortality rate (year 2014)	**Lung and Bronchus**	**159,260** ↑
	Breast	**40,000** ↑↑↑
	Prostate	**29,480** ↑↑↑↑
	Colon	**50,390** ↑↑

[Surveillance, Epidemiology, and End Results Program]

Table 1.3: Comparison of lung cancer (Incidence rate and Death rate) with Others Cancers by Gender

	Gender	Incidence Rate	Death Rate
Year 2014	**Male**	**116,470**	**87,750 (29%)**
	Female	**109,690**	**72,590 (26%)**
	Total	**222,160**	**160,340**

[Surveillance, Epidemiology, and End Results Program]

Table 1.4: Lung cancer (Incidence rate and survival rate) By Stages

Stage At Diagnosis	Stage Distribution (%)	5 years Relative Survival Rate
Localized (Primary site)	15	53.5
Regional (Lymph nodes)	22	26.1
Distant (Metastasized)	57	3.9
Unknown (Upstaged)	6	7.8

[Surveillance, Epidemiology, and End Results Program]

Lung cancer screening has not reached up to the benchmark yet, over the widely used screening tests like mammography in breast cancer and PSA in the prostate cancer. The SCLC **[Small Cell Lung Cancer]** is very difficult to detect and in the early treatable stage, therefore the survival rate is only 5-6% as compared with NSCLC **[Non-Small Cell Lung Cancer]** 16-18% .*(American Cancer Society).*

As per the seers' data distribution of lung cancer by stages, 50% to 70% of lung cancer diagnoses in the distant stage for both SCLC and NSCLC.

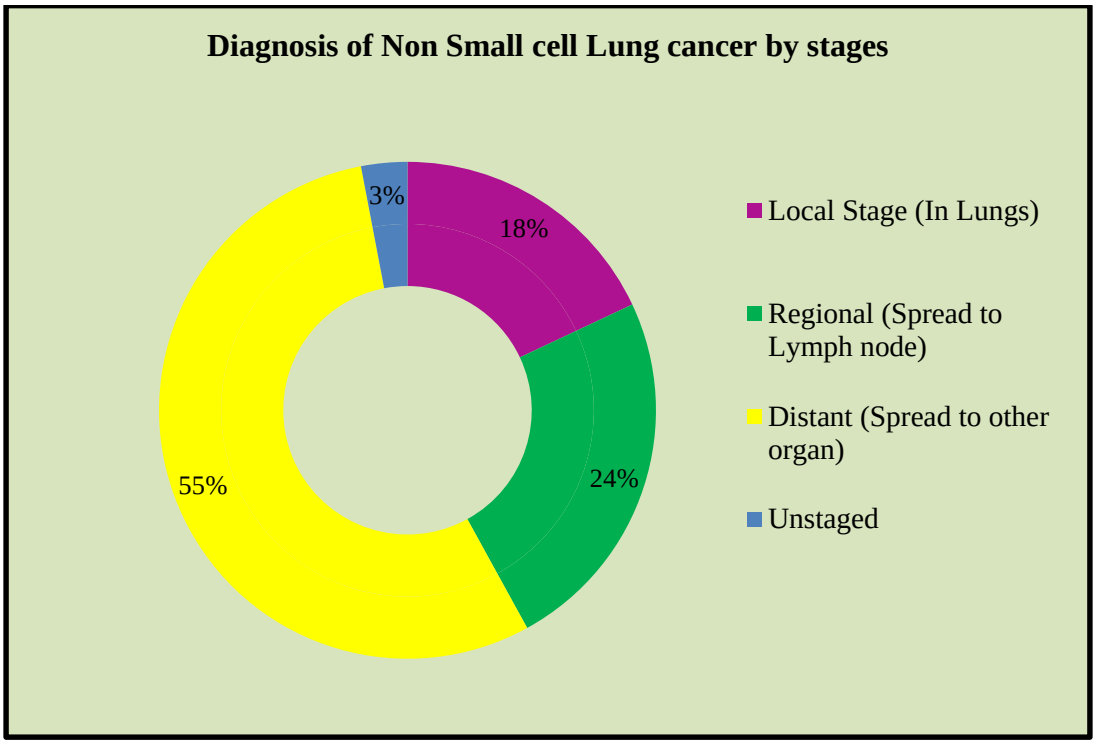

Figure 1.1 Diagnosis of NSCLS by stages

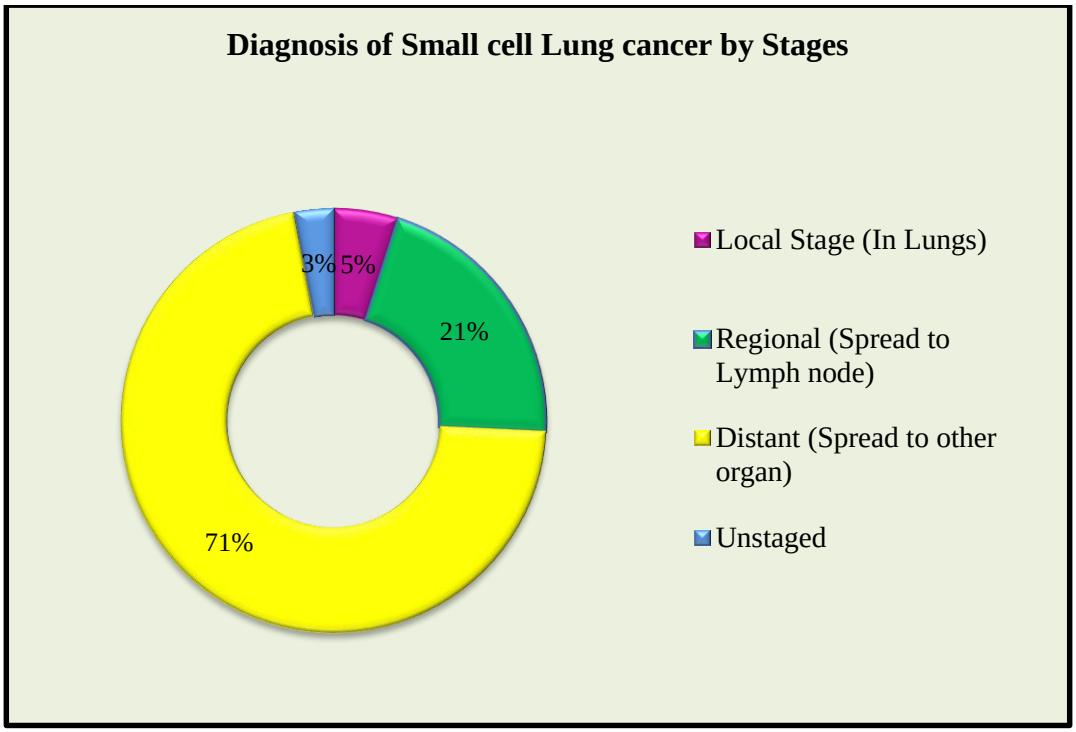

Figure 1.2 Diagnosis of SCLS by stages

There is a significant variation in the Incidence, mortality and survival rate of lung cancer among the ethnicity group. Historically, Male is having higher rate of occurrence and mortality of lung cancer as compared with female but gradually that gap is narrowing. In the United States, White Americans (female (19.5%) and male (14.5%)) have higher survival rate as compared with Black (female (15.4%) and black male (12%). *(Surveillance, Epidemiology, and End Results Program)*

The disparity in the race and gender distribution pattern reveals some the possibility of historical differences in taking tobacco over the past 50 years. Smoking is the primary risk factor for the lung cancer especially menthol cigarettes, which is easy to inhale in deep. A non-smoker has 20 to 30% chances of getting lung cancer, if he/she lives in the smoking zone or expose to tobacco smoke frequently. Secondary smoking accounts for more than 3,000 deaths per year.

In addition to smoking, lung cancer risk increases with the medical history of the tuberculosis. Certain dietary supplement, arsenic drinking water, radiation therapy of lungs and some radioactive found at the work place like uranium, silica, beryllium, cadmium, mustard gas, can also consider as a partial risk factor.*(American Cancer Society).*

In spite of those, there is accumulating evidence that genetic weakness plays significant role, especially when lung cancer starts at very early young age. Several co morbidity factors, including BMI, weight loss, COPD, alcohol along with exposure of chemical like asbestos, radon gas, and the interaction considered as a major risk factors.

It is very clear that some attention is required form the research industry in the area, not only in the diagnosis but also in the development pattern and the location. To improve the survival rate it is necessary to develop some rapid pace of medical innovation to target special development pattern with specific treatment.

1.2 STUDY SIGNIFICANCE AND OBJECTIVE:

As per the current analysis of incidence and death rate of lung cancer, including the significance association of other co-morbidity factors, compelling the need of further research, especially based on the anatomical distribution of the lung. The basic understanding of dynamic nature, for the development of lung cancer, as per the each anatomical site of lung, and the interaction with the other diseases, will enhance the ability of diagnosis and treatment of the lung cancer.

It has reported from the last few years' trend analysis that the overall rate of lung cancer is getting lower now, however, the risk of getting lung cancer is still very high. It has been known that severity of lung cancer is very high among the all other types of cancers just because the symptoms of the lung cancer are difficult to precise. Majority symptoms for the lung cancer depend on the damage or the location of the lungs, along with the ability of the functionality at the specific age. In addition to those, association of risk factor with age, gender and race also play vital role in the development specific symptoms.

In spite of the advance technology, it has been noted that survival rate of the lung cancer is less due to inability to detect the lung cancer in the early stage and to treat the lung cancer in the later stages.(..). In most of the cases, detection of lung cancer is possible only when symptoms become prominent. Due to the malignant nature of the lung cancer, it is very difficult to treat the patient with surgical removal therapy followed by radiation or chemotherapy in the advance stage.

Effectiveness of the treatment depends on the size, type, anatomical site **[Location]** along with the age and the role of co- morbidity factors in the development of the tumor. To best of our knowledge, very few researchers have reported the incidence of the lung cancer

based on the anatomical **[Lobes Based]** distribution of lung. Past research has proved that smoking, COPD, weight loss, alcohol and the environment factors such as radian gas… are responsible for the development of lung cancer but how closely these factors are linked with each anatomical site of lung and the significance role in the development of lung cancer, are not known at this point of time.

Past research has shown some promising result using the targeted therapy considering some specific characteristics including genetics structure, cancer cell and gender to determine best possible option for the treatment. Nevertheless, none of the research has included or considered the anatomical site **[Lobes]** of lung as one of the characteristics to improve the results of targeted therapy options.

The aim of this study is to establish the relationship between anatomical site along with gender, race and interaction of the co morbidity factors. This relationship might open the new door for the treatment for the specific targeted lobe with targeted therapy and improve the survival rate.

For example, if this research can establish the relationship between smoking and the upper lobe lung cancer then prevention of the smoking along with the targeted treatment for the upper lobe cancer can improve the survival rate.

The purpose of the study is to examine National Impatient Sample [NIS database] starting from the year 2003 to 2010 and classifies them based of ICD – 9 codes. The research is expected to shed new light in the lung cancer occurrence by examine the historical trends in the lung cancer incidence and mortality based on the anatomical distribution **[Lobes]** of lung by gender and race.

In USA, several state studies, based on the incidence and mortality rate, have been documenting for the past few years. The disparity of incidence and mortality rate observed in each state of USA follows the prevalence and distribution of lung cancer. The retrospective studies reported that lung cancer is the older age disease for both male and female but the variation in the occurrence is mostly likely due to geographic location, socio economic status and the exposure to the risk factor *(Gao Y et al., 2009, Anthony et al., 2005).*

Study of Trend:

Trend analysis helps to determine unusual change occur from the period to period. To improve the survival rate of lung cancer outcome and predict the risk factor associated with each lobe of lung, it is very important to know which lobe of lungs is having higher risk of getting lung cancer from past few years base on the association of race and gender.

Geographical Comparison:

To the best of our knowledge and publication of studies have reported some results based on the association of lung cancer with age, gender and risk factors. However, very few researches have included geographical location as an additional risk factor in finding the association. The aim of our study is to evaluate the role of the bigger population states in increasing the cumulative incidence and mortality rate along with the risk factor compared to smaller population states of the United States.

Co morbidity factors:

COPD **[Chronic Obstructive Pulmonary Disease]** is the systemic inflammatory disorder and leading cause of death in the United State. It is a disease of pulmonary manifestations and can increase the risk of development lung cancer. Many studies have proved that

smoking is the one of the factor of development to COPD [Chronic Obstructive Pulmonary Disease]. The risk of development of lung cancer is two to five times higher in the smoker with COPD [Chronic Obstructive Pulmonary Disease] as compared to smoker without COPD [Chronic Obstructive Pulmonary Disease]. Nevertheless, at this point, there is not clarity, which can establish relationship between associations of COPD [Chronic Obstructive Pulmonary Disease] with specific lobe of lungs. This establishment can help to understand the physiology of lung to resection in the COPD **[Chronic Obstructive Pulmonary Disease]** patient.

Pneumothorax is also one of the manifestations of lung cancer, which is highly associated with the smoker. It is a collection of air in the chest cavity, which will cause the lung to collapse. To improve the outcome of the lung cancer, it is important to estimate risk associations with COPD **[Chronic Obstructive Pulmonary Disease]**, Pneumothorax and Pneumonia in causing lung cancer. These researches can potentially minimize the death level or help to improve the functionality of lungs in the patients.

OBJECTIVES:

1. Examine the trend of Incidence and mortality as per each anatomical site distribution
2. Examine occurrence of lung cancer by ethnicity for the year 2003-2007
3. Examine the risk analysis across the ethnicity and gender
4. Examine Incidence and mortality between Geographical Location(Comparison of Smaller and Bigger states)

RESEARCH HYPOTHESIS:

Hypothesis 1:

There is a significance difference between Incidence and mortality trend with respect to anatomical site **[Lobes]** of lungs.

Hypothesis 2:

There is a significant association between each anatomical site **[Lobes]** of lungs and ethnicity of the lung cancer patient.

Hypothesis 3:

There is significant association between anatomical site **[Lobes]** of lungs and Ethnicity by gender in the lung cancer patient.

Hypothesis 4:

Incidence and mortality rates of lung cancer are higher for bigger states **[By Population]** and smaller for smaller states **[By Population]** in the United States.

CHAPTER 2:

LUNG CANCER

2.1 ANATOMY OF LUNG:

Lungs are the most important part of the respiratory system. Respiratory system consists of nasal cavity, mouth, thorax, trachea, lungs, bronchi, bronchioles, alveoli and chest. Lungs are located on the site of chest and due to it spongy structure, it plays important role in breathing process. Respiratory system consists of two lungs, left and right lungs. The left lung consists of two chambers left upper lobe and left Lower lobe. The Right lung divides into three chambers, right upper lobe, right middle lobe and right lower lobe. The left lung is smaller as compared to the right lung.

Air enters into the body through the nose or mouth, pass through thorax and trachea. Trachea end into bronchi, which is further, divides in to small tissue called bronchioles in the lungs. Bronchioles ends into air sacs called alveoli. Air travels from trachea into bronchi, bronchioles and finally into alveoli. In alveoli, oxygen from the air gets absorbs by the blood while carbon dioxide and west products of metabolism comes out from the body during exhalation.

Any obstruction of the airflow in the lungs leads serious lung disease. Airflow obstruction changes the functionality of lungs, leading abnormal growth of cells, gradually become cancerous cells

Lung cancer is an uncontrolled growth of the abnormal cells - the changes in the genes inside the lungs cause the cancers cell to grow faster and ultimately lung became week and insufficient to deliver oxygen into blood.

As per the National Cancer Institute, Lung cancer is the type of **"Cancer that forms in the tissues of the lung usually in the cells lining air passage"**

Cancer that starts inside the lungs is known as a primary lung cancer; the cancer that starts at any other part of the body and gradually starts affecting the lungs is called secondary lung cancer. *(American Cancer Society)*

2.2 DEVELOPMENT OF LUNG CANCER

Development of the primary lung cancer starts from any parts of the lungs mainly includes "UPPER LOBE, LOWER LOBE, MIDDLE LOBE, MAIN BRONCHUS, and OTHER LUNG PARTS" and spread throughout the body through the lymph system.

The lymph system has several parts including **Lymph vessels:** small veins- responsible to carry out clear fluid from the lungs; **Lymph nodes:** immune cells that connect lymph vessels and **Lymph** - collect at waste product. During the process of development, cancer cells first enter into the lymph vessels, grow inside the lymph node and spread from the lymph node to other parts of the body.

2.3 Types of the lung cancers:

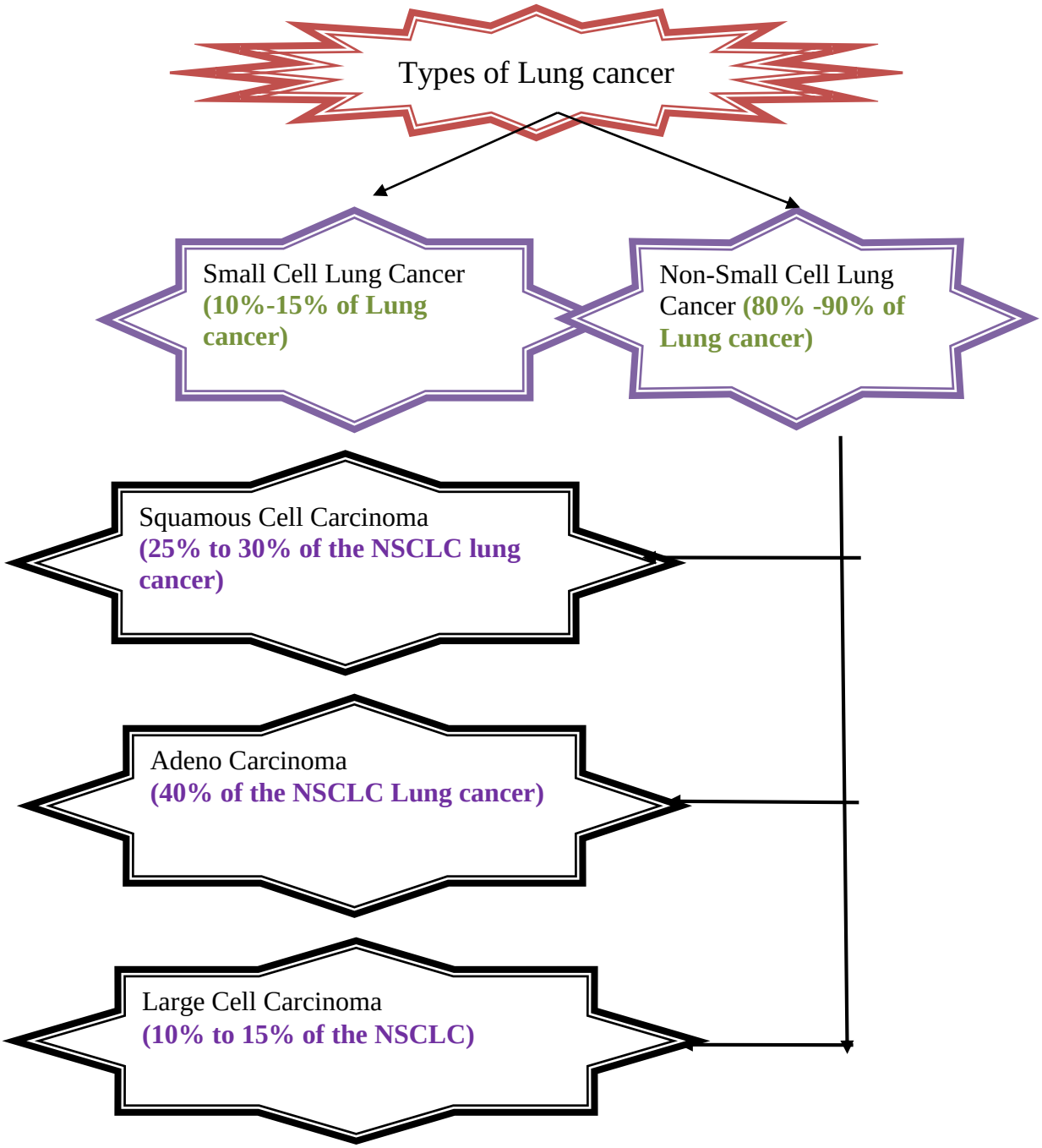

Figure 2.1 – Types of lung cancer

SCLC: Small Cell Lung Cancer: It has limited (LS) and extensive stages (ES)

- Develops near the area of chest [see the figure …
- Grows and spreads very quickly from the lungs to other body part
- Survival rate is higher in women than men (Health Lung Cancer)
- Overall survival rate is very low – at the limited stage- 14 to 24 months and at the
- extensive stage- 6-12 months with treatment and 2 to 4 months without treatment

NSCLS: Non Small Cell Lung Cancer (It has stages I..IV and 3 subtypes of cancer)

i). Squamous Cell Carcinoma:

- Develops in the middle lobe of the lung
- Major risk factor - smoking

ii). Adenocarcinoma:

- Develops at the outer parts of the lungs
- Common in the non- smoker
- Grows very slowly so it is easy to treat as compare to others
- Survival rate is higher

iii) Large Cell Carcinoma:

- Develops at any parts of the lungs
- Grows very fast so it is difficult to treat
- Survival rate is very low

2.4 SYMPTOMS, RISK FACTORS AND TREATMENT:

Symptoms:

Cough, Chest pain, bronchitis, interruption in breathing, hemoptysis (blood in cough), and shoulder pain, sudden weight loss, etc..*(American Cancer Society).*

Risk Factor:

Over the past years, several studies have been carried out in order to analyses the risk of getting lung cancer.

- Primary cause of lung cancer is smoking followed by other environment factors like exposure to asbestos, radon gas, arsenic and other organic chemical compound. In addition to that adverse child hood experience, family history of smoking and chronic disease also play vital role in development of the lung cancer.
- Lung cancer risk gradually increased after the age of 40 until the age of 78-80. However, lung cancer may develop at the young age due to genetic mutation.
- Men is having higher risk then women but after certain age due to estrogen receptor and hormonal therapy, susceptibility of getting lung cancer increases for women
- As per the history of smoking and non-smoking, man is having risk of getting lung cancer is 1 in 13 while women is 1 in 16. *(American Cancer Society)*

Emphysema and bronchitis:

Emphysema and bronchitis are the classification of COPD, which relates to the obstruction in the airflow. It is results of tobacco smoke, which directly attacks on the elasticity of alveoli, which narrow down bronchial airways as a result air traps in the alveoli, expanding their walls and damaging fragile tissue. When the lungs became larger, it requires more efforts to breath. Insufficient breathing causes insufficient amount of transfer of oxygen in to the blood, which is important in the development of new cells.

- Improper breathing will not carry out harmful chemicals from the body as a result abnormal growth of cells starts in the lungs, which will increase susceptibility of getting lung cancer in the future.

Anti Trypsin deficiency:

It is one kind of protein, which produces by the liver. The major function of the antitrypsin is to protect any kind of inflammation caused by infection and chemical agents enter through the inhalation. People, who suffer from chronic liver disease, build abnormal level of antitrypsin that can be a one of the leading cause of lung cancer in the future *(Yang et al.,2008)*

Pneumothorax:

It is a disease with excess air in the pleural cavity. It characterized with an abnormal collection of air between chest wall and lung, which creates disturbance in breathing and the shortage of oxygen starts damaging tissue around the lung,

leading different types of lung diseases like pneumonia, emphysema, bronchitis etc. The research has already proved the peoples whose lungs are already sprinkled with other lung disease like pneumonia, emphysema, bronchitis, TB, COPD, Pulmonary fibrosis are potentially under the high risk of lung cancer.

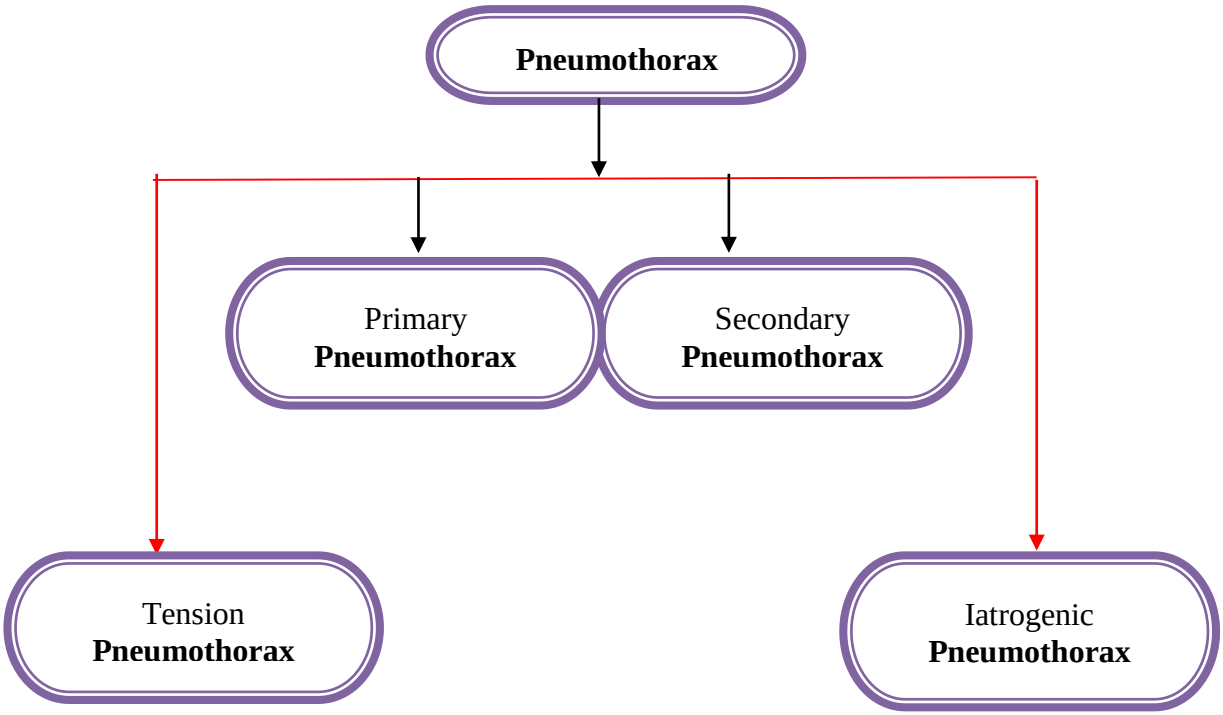

Figure 2.2 Lung cancer risk Factors

Primary Pneumothorax causes:

- Family History
- Smoking
- No history of lung disease

Secondary Pneumothorax causes:

- Underlying condition of COPD, Asthama or TB

Tension Pneumothorax causes:

- Gap in the surface of the lung – Which allows the air to be entered but does not allow to escape from the lungs, leading excessive pressure in the lungs

Iatrogenic Pneumothorax cause:

- Mechanical Injury
- Accidently Piercing in chest wall (Gunshot, stabbing…)
- Rib fracture
- Use of incorrect medical procedure or incorrect care

Pneumothorax, except Iatrogenic **Pneumothorax**, directly or indirectly considers as a risk factor to the causes of the lung cancer. (Brain Daley et al., Lbesnse et al., 1987, Veadislsvas et al., 2009)

Treatments:

Treatment for NSCLC and SCLC depends on the stages and type of cancer, most common treatments are surgery, chemotherapy, radiation, targeted therapy,For the initial stage of the cancer, surgery is the first choice followed by chemotherapy or radiation. For the advance stage of the cancer, chemotherapy along with the drugs (targeted therapy) is the usual treatment options. Over the past years, advancement in the personalizing therapy has changed the course of the lung disease. VATS (Video Assisted Thoracoscopic Surgery) is the best example of advancement in the technology. It has become popular since last few years because of the promising result with less pain and less complication as compared to the other surgical procedures.

CHAPTER 3:

REVIEW OF LITERATURE:

3.1 LUNG CANCER:

Now a day, Lung cancer is became the leading cause of death in the world and find an optimum treatment becomes a major challenge. In the United State, among the all-major classifications of lung cancer, approximately 80% of the lung cancer cases are reported as a NSCLS and only 20% are reported under the title of SCLS**[National Cancer Institute]**. The rate of incidence, mortality, treatment and survival is different for each sub category of the lung cancer *(American cancer society).*

Although, none of the disease has a specific time of occurrence but the probability of occurrence of lung cancer is higher for the elder patients. At the average approximation, risk of lung cancer significantly increases with age after 40 until the age 75–80. The average age of diagnosis of lung cancer is above 65 years, which clearly indicate that risk of getting NSCLS is higher in the elder people. (*National Cancer Institute,2012, Gao et al., 2009)).*

The association between lung cancer treatments and gender along with age does not clearly defined yet. Although, Lung cancer may treat in different way by using surgery, radiation, chemotherapy and combination of them but in the selection of the treatments, the major considerable factors are gender and age. *(National Cancer Institute)*

Past research as has been proved that after certain age (Menopause), risk of getting obstructive airways disease especially COPD and lung cancer are more for the woman ***(****Bpatel al et.,2004)* and it is because of development of lungs is differ by gender.

For women, maturation of lungs occurs at the early age. The growth of the lung depends on the FEV **[Force Expiratory Volume].** In women, FEV reaches it maximum level in early age and starts declining at early too as compared with men. *(Bpatel al et.,2004)*

In female, who starts smoking at early age, has a higher risk of getting lung cancer. Along with gender, patient's capacity of tolerance needs to be consider because at the elder age interference of other medical condition cannot be ignore so careful evaluation of cardiac functionality and illness is required. *(Bpatel al et.,2004)*

3.2 DEVELOPMENT OF LUNG CANCER:

Exposure to the certain environmental factors will change the anatomy of lungs in the two ways,

1). By changing the tissue lining in the bronchus **(***Medical Center; Theodone al et.,2002; Rom al et.,2000)*

2). By damaging DNA directly and altering the gene sequence from Metaplasia [first stage of cancer], to Atypia, Dysplasia, then Invasive Cancer ***(****Medical Cente; Theodone al et.,2002; Rom al et.,2000)*

Mataplasia:

This is the initial stage of development of lung cancer. Transformation of altering gene sequence from one cell to another cell and makes them more susceptible towards malignant lung cancer

Atypia:

This is the starting point for cancerous cell so it is also known as precancerous process, which increases the chances of the developing cancer in the premalignant cells, which has already developed in the mataplasia.

Dysplasia:

In this stage cells become similar to the cancer cells but not fully developed in the cancers tissue**..** This condition is classified depends on the level of changes in the cell from low grade to high grade. Low grade of dysplasia is slow development and it can be cure but in majority cases high grade of dysplasia turn into invasive cancer *(Medical Center; Theodone al et.,2002; Rom al et.,2000)*

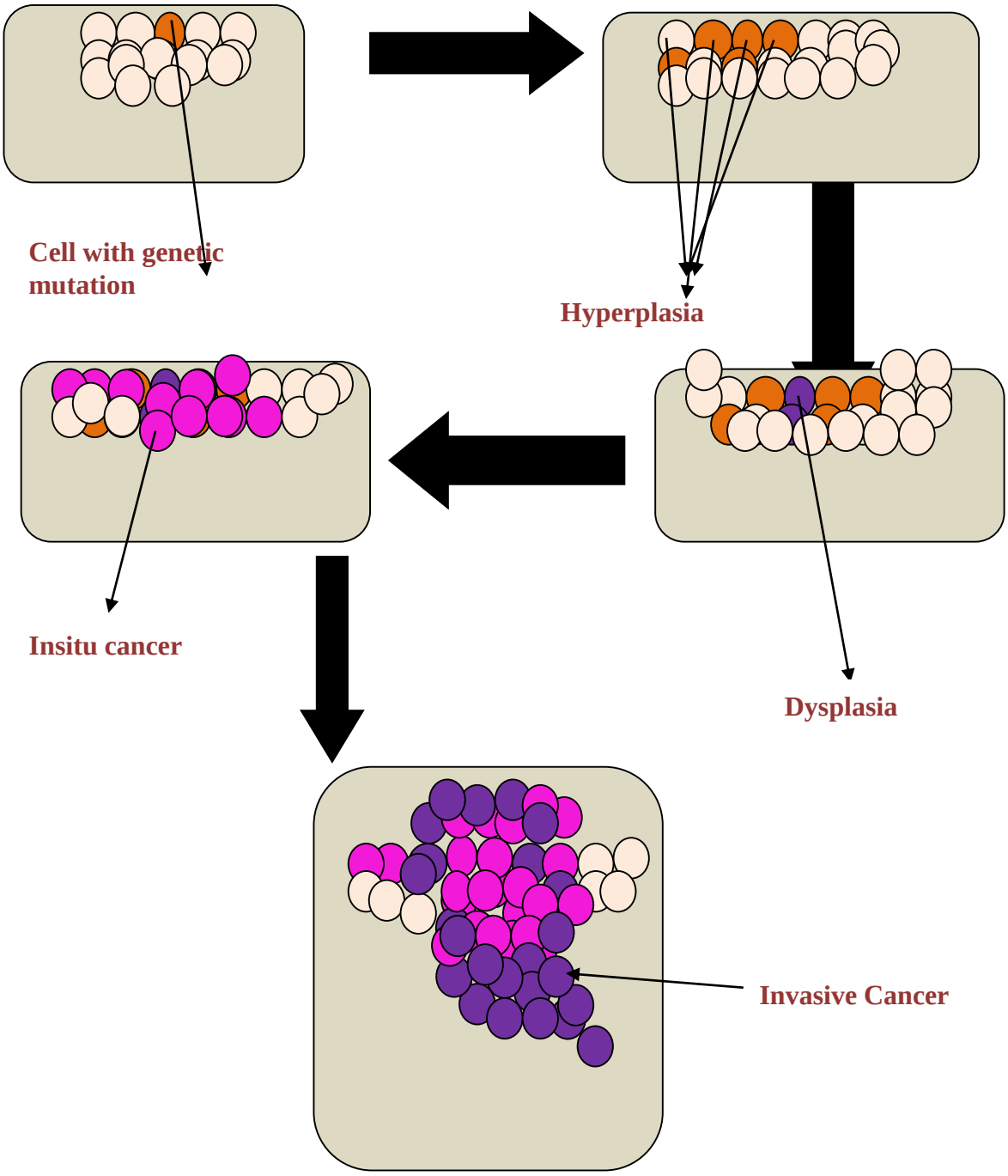

Figure 3.1: Development of Lung Cancer (Science)

Over the past years, many research studies have been carried out in order to risk factors of lung cancer. Several studies have been reported that the primary cause of lung cancer is the smoking followed by other environmental factors such as exposure to asbestos, radon gas, arsenic and several other organic chemical compounds *(Lung cancer in Georgia)*.

Effect of smoking depends on the pulmonary functionality and respiratory system ***(****Bpatel et al.,2004).*

Due to the storage and metabolism of tobacco, body habit and body composition increase the risk of getting cancer in the early age smoker *(Geoffrey et al., 2008).*

From the several decades, it has been known that smoking is the primary cause of death in lung cancer especially in the woman who starts smoking at early age. It is almost 3 times higher risk as compared with men *(Gasperino et al.,2011).* The role of smoking in causing lung cancer is depending on the total no of pack year of smoking not on the duration or per day smoking ***(****Bpatel et al., 2004).*

In addition to environmental factors, genetic mutations, family history and adverse childhood experience have contributed equally in the development of lung *cancer (Brown et al., 2010; Lung cancer in Georgia)*. The family history of chronic bronchitis considers as a high risk factor for the lung cancer *(Gao et al., 2009).*

The retrospective studies results have confirmed that the incidence rate and the mortality rates are higher in the male as compare to the female *(Gao et al., 2009)* but the hormonal therapy and estrogen receptors are considered as major risk factor for the female *(Thun et al., 2008).*

A woman who undergoes estrogen replacement therapy and smoked has a higher risk of getting lung cancer then who smoked but did not pass through the estrogen therapy *(Gasperino et al.,2011).* Several studies have conducted and noted that endogenous and exogenous both agents are responsible in developing lung cancer in women. Several case control study has conducted in the past, women has 1.5 time higher risk of getting lung cancer as compared to men with the same level of lifelong exposure to the smoking *(Edith et al.,2003).*

Smoking rate and consumption ratio among the gender has changed in last 30 year, which makes lung cancer more dominant among the all other types of cancers *(Anthony at al.,2003).*

For lung cancer, the tumor suppressor gene is P53 and the single base pair mutation occurs at the codons 157,158,175,238,248,273 and 252. The estrogen mutability is responsible for the chemical changes in the P53 so this mutation is twice common in women as compared to men *(Gasperino et al.,2011).*

In the smoking related cancer, the mutation occurs at the codon site 12 of the proto-oncogene K-Ras and a woman has 3 time higher risk than men *(Gasperino et al.,2011).* The difference in the gender survival rate is depends on the stage of lung cancer was diagnosis. At the average women lives 12month longer than men due to effect of intrinsic factor *(Ouellette et al.,1998).*

Predispose to certain biomarkers can be one of the risk factor for the lung cancer. Research has shown certain evidence that GRPR (Gastrin Releasing peptide receptor) has been identified as a risk factor for the lung cancer in women. GRPR is associated with Smoking and gets activate in the early age.

Since the GRPR gene is located on the X- Chromosome, women have potentially higher risk than men do. Furthermore, EGFR (Epidermal growth factor receptor) may also play important role in spread the lung cancer also *(Rosella et al., 2009, Shrivr et al., 2000).*

As per the IARC report, rate of all types of lung cancer is higher in the western countries like US, Canada, Australia, Europe etc***(IARC).*** In other side the most developing county like China, due to consumption of cigarette, shows higher incidence rate of lung cancer from last decades *(IARC;,Lam et al.,2004)* .

Incidence rate among the whites are higher in the Italy, France as compare to US and Canadian Whites. *(Pathos-physiology ,Ouellette et al.,1998)*. However, the rate of cigarette consumption is less per day in women as compared to men, women were high susceptible to the cancer at the early age**.**

The global burden of cancer increases in such a way that it becomes the most common cause of mortality and morbidity in the world. Among the all-different types of cancers, lung cancer is the second most deadly cancer in this world after prostate cancer in the male and breast cancer in the female. Worldwide report suggests that in North America, male and female both are equally susceptible for the lung cancer.

In addition to that female from the north Europe, Australia/Newzeland and male from the eastern and southern Europe, Asia and Micronesia have higher lung cancer risk as compare with others geographical sites in this world*(Jemal et al., 2011).*

In North America (USA), each year about 230,000 new and about 160,000 deaths cases have been reported for the lung cancer. *(American Cancer society, 2013)*

The retrospective studies reported that lung cancer is the older age disease for both male and female but the variation in the occurrence is mostly likely due to geographic location,

socio economic status and the exposure to the risk factor *(Gao Y et al., 2009, Anthony et al., 2005).*

To the best of our knowledge and publication of studies have reported some results based on the association of lung cancer with age, gender and risk factors. However, very few researches have included geographical location as an additional risk factor in finding the association. The rate of lung cancer is differing based on the geographic location in the United State. In 1960, Mason, from national cancer institute, has introduced lung cancer geographic mapping system.

From the year 1973 to the year 2002, rate of occurrence of SCLC increased from 23% to 50% in women but in the comparison of other types of lung cancer, the rate was actually decreased 5% *(Govindan R et al.,2006*).

Research indicated that there was a declined in the incidence rate of SCLC but had no improvement in the survival rate in women *(Govindan R et al.,2006).* The relationship between, average dose of smoking and risk of lung cancer is not clearly indicated in the past research but it varies between age, sex and race.

Mortality rate of lung cancer is almost double last few years. In United States, the death due to cancer measures, one out of 4. Following report for the year 2013 indicates that, Death rate of lung cancer among the all other cancer is still higher in both male and female.

Table 3.1: Estimated New Cases – Year 2013/2014/2015 by Gender

Gender	Types of Cancer	Cases Year2013	Cases Year2014	Cases Year2015	Average	%
	Prostate	238,590	233,000	220,800	230,797	29%
	Lung Bronchus	118,080	116,000	115,610	116,563	15%
	Colorectal	73,680	71,830	69,090	71,533	9%
	Urinary Bladder	54,610	56,390	56,320	55,773	7%
Male	Melanoma of Skin	45,060	43,890	42,670	43,873	6%
	Kidney & pelvis	40,430	39,140	39,850	39,807	5%
	Non Hodgkin Lymphoma	37,600	38,279	38,270	38,050	5%
	Oral Cavity	29,620	30,220	32,670	30,837	4%
	Leukemia	27,880	30,100	30,900	29,627	4%
	Pancreas	22,740	24,600	25,510	24,283	3%
	Total	**688,290**	**855,220**	**848,200**	**797,237**	**100%**

Gender	Types of Cancer	Cases Year2013	Cases Year2014	Cases Year2015	Average	%
	Breast	232,340	232,670	231,840	232,283	31%
	Lung & Bronchus	110,110	108,210	105,590	107,970	14%
	Colorectal	69,140	65,000	63,610	65,917	9%
	Uterine corpus	49,560	52,630	54,870	52,353	7%
Female	Thyroid	45,310	47,790	47,230	46,777	6%
	Non Hodgkin Lymphoma	32,140	32,530	32,000	32,223	4%
	Melanoma of skin	31,630	32,210	31,200	31,680	4%
	Kidney Pelvis	24,720	24,780	24,120	24,540	3%
	Pancreas	22,480	22,890	3,370	16,247	2%
	Ovary	22,240	22,280	23,290	22,603	3%
	Total	**639,670**	**810,320**	**810,170**	**753,387**	**100%**

(Wiley)

Table 3.2: Estimated Death Cases – Year 2013 by Gender

Gender	Types of Cancer	Cases Year2013	Cases Year2014	Cases Year2015	Average	%
	Lung Bronchus	87,260	86,930	86,380	86,857	30%
	Prostate	29,720	29,480	27,540	28,913	10%
	Colorectum	26,300	26,270	26,100	26,223	9%
	Pancreas	19,480	20,170	20,710	20,120	7%
Male	Liver & Int Bile duct	14,890	15,870	17,030	15,930	6%
	Leukemia	13,660	14,040	14,210	13,970	5%
	Esophagus	12,220	12,450	12,600	12,423	4%
	Urinary Bladder	10,820	11,170	11,510	11,167	4%
	Non Hodgkin Lymphoma	10,590	10,470	11,480	10,847	4%
	Kidney & pelvis	8,750	8,900	9,070	8,907	3%
	Total	**233,690**	**310,010**	**312,150**	**285,283**	**100%**

Gender	Types of Cancer	Cases Year2013	Cases Year2014	Cases Year2015	Average	%
	Breast	72,220	72,330	71,660	72,070	30%
	Lung & Bronchus	39,620	40,000	40,290	39,970	17%
	Colorectal	24,530	24,040	23,600	24,057	10%
	Uterine corpus	18,980	19,420	19,850	19,417	8%
Female	Thyroid	14,030	14,270	14,180	14,160	6%
	Non Hodgkin Lymphoma	10,060	10,050	10,240	10,117	4%
	Melanoma of skin	8,430	8,590	10,170	9,063	4%
	Kidney Pelvis	8,190	8,520	8,310	8,340	4%
	Pancreas	6,780	7,130	7,520	7,143	3%
	Ovary	6,150	6,230	6,380	6,253	3%
	Total	**208,990**	**275,710**	**227,280**	**237,327**	**100%**

(Wiley)

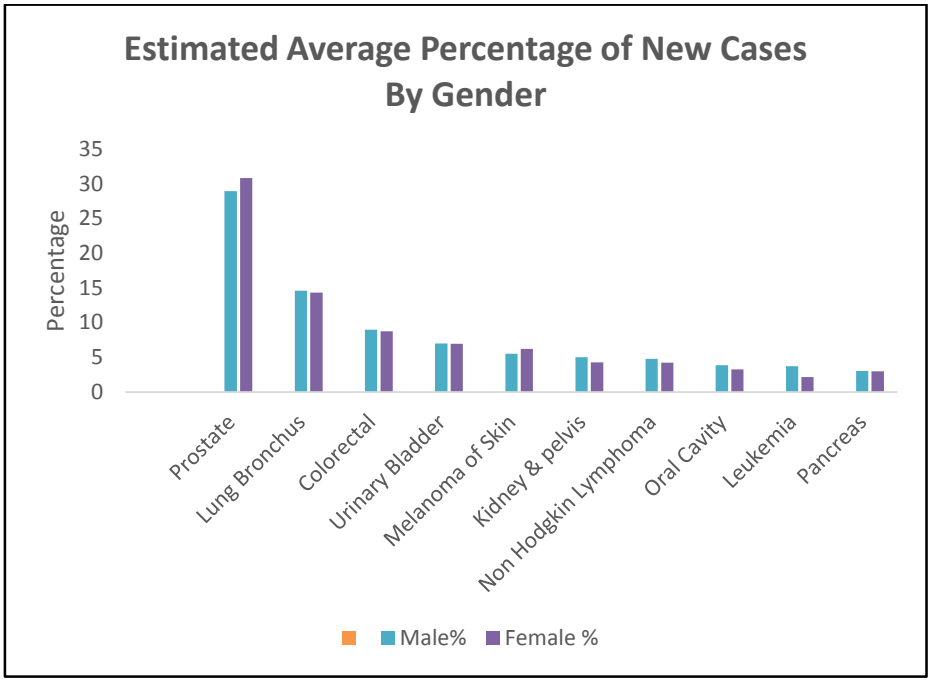

Figure 3.2: Estimated Percentage by Gender 2013-2015

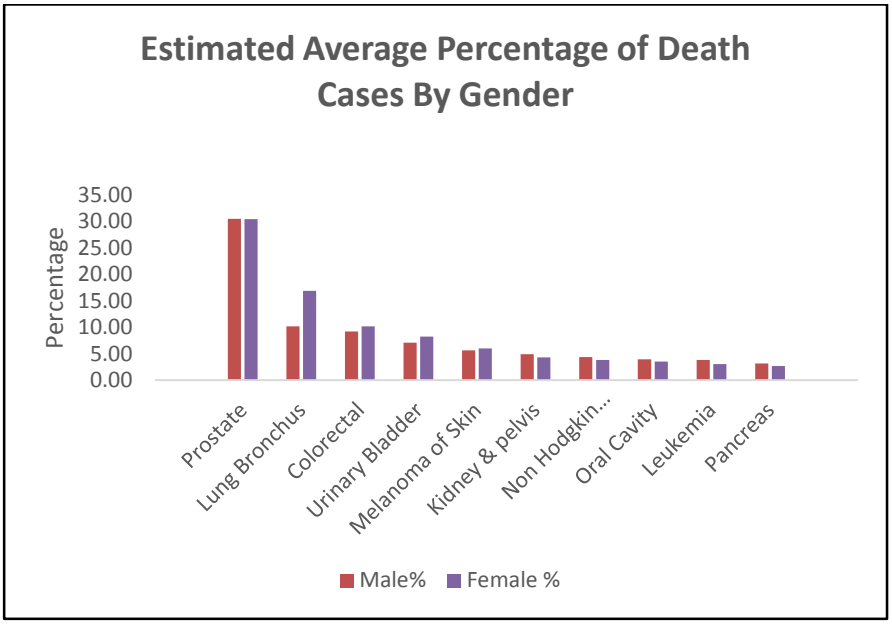

Figure 3.3: Estimated Percentage by Gender 2013-2015

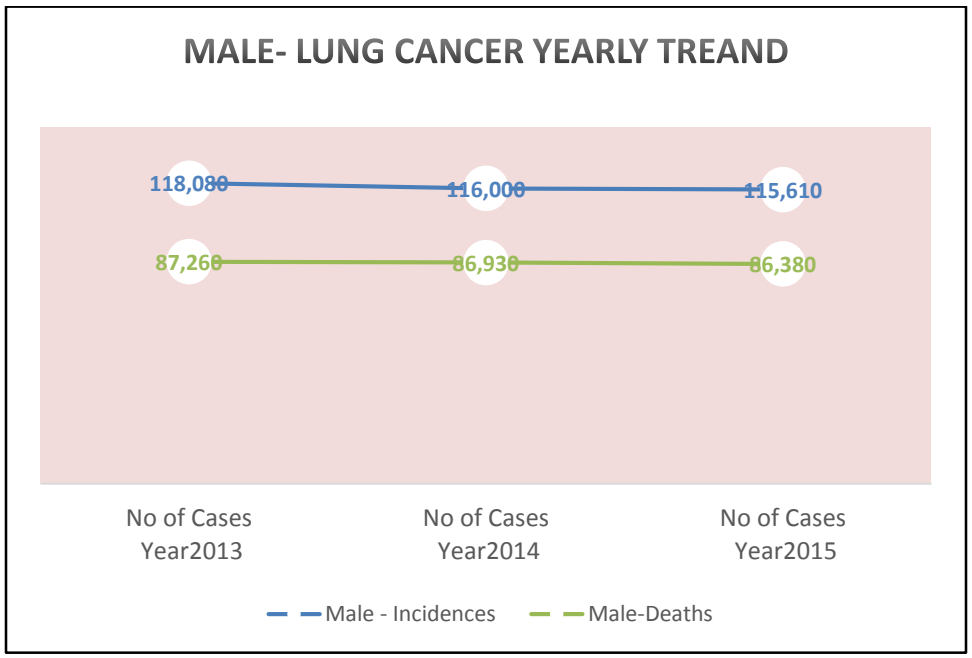

Figure 3.4:Lung Cancer Yearly Trend By Male -2013-2015

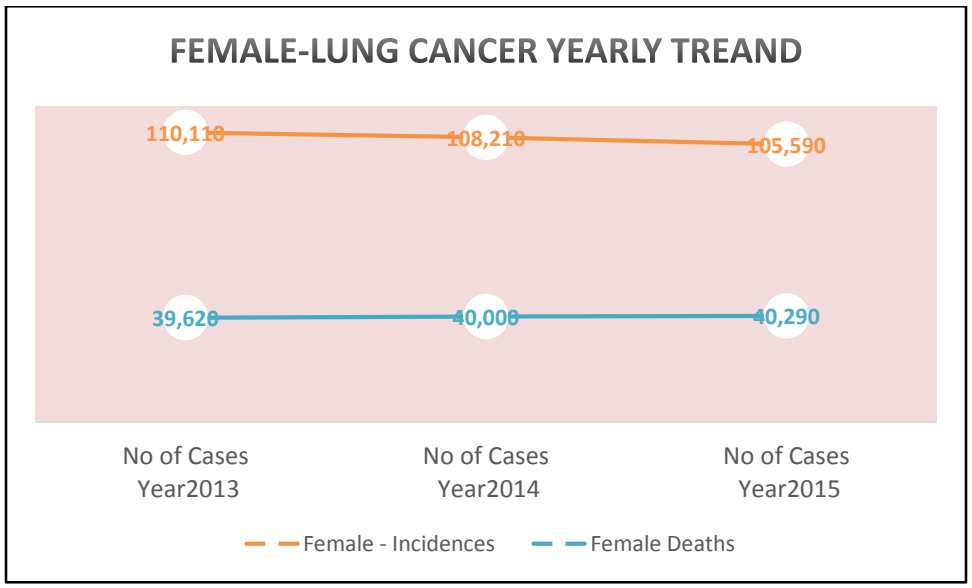

Figure 3.5: Lung Cancer Yearly Trend By Female -2013-2015

Research has shown that certain cancers, coronary heart diseases and diabetes have a strong association, if so with BMI too (weight, height, waist and hip circumferences) *(Geoffrey et al.,2008).*

During the postmenopausal period women, who treated for the diabetes with insulin, have a high risk of lung cancer *(Luo et al., 2012).* Women, who smoke during the postmenopausal period, their baseline BMI and weight show inverse association and waist circumference shows positive association with lung cancer. For never smoker or former smoker women, height shows positive association with lung cancer *(Geoffrey et al., 2008).* The patterns of occurrence of the lung cancer by ethnicity have reported the incidence and mortality rates are higher in the Black American as compare to White. The disparity in the race and gender is likely due to genetic and metabolic susceptibility of tobacco product, economical status and exposure to carcinogenic environment *(Alberg et al., 2005).*

It is observed in the many countries that lung cancer most likely occur in the poor and less educated people *(Yang et al.,2001).* The disparity between ethnicity not very well understood at this stage but it could be due to historical pattern of smoking. *(Alberg et al., 2005).*

It has been observed that cigarette with methanol may increase the risk of getting lung cancer and black American are consuming it at high rate as compared other races *(Alberg et al., 2005)*

3.3 DIAGNOSIS, TREATMENT AND HEALTHCARE COST:

The survival rate of the lung cancer depends on the early stage detection of the cancer. There are many detection techniques are available in the market, including MRI(Magnetic Resonance Imaging), CT(Computerized Tomography), PET(Position Emission Tomography) and combination of them but none of the technology has such type of power to detect the cancer in the early stage. Only 20 to 25% of lung cancer are detected in the early stage *(Gregory et al.,2013),* which indicate requirement of improvement in the screening technique.

However, approach of combination of biomarker mainly " CEA+NSE+CYFRA-21-1+CA-125+Ferritin+ CA-19.9 showed 89.49% sensitivity for adenocarcinoma*"(Lung cancer screening).*

Although there is no enough evidence that can prove that investment in finding this biomarker and the DNA methylation tool is worth efforts in order to increase the survival rate of lung cancer by early diagnosis *(Jeffery et al.,2002).*

There are various treatments available for the lung cancer including radiation, surgery, chemotherapy and combination of them but recommendation of suitable treatment is depend on the stages of the diagnosis and involvement of the lymph tissue in casing lung cancer.

Erolotinib (Tracevu) Targeted Therapy: EROLOTINIB is a targeted therapy for the EGFR mutation. This targeted therapy is very effective in the women who never smoked or suffering from NSCLS. Research also indicated that it is more effective in the Asian ethnicity.

It improves the survival rate by inactivating mutation in EGFR (EPIDURAL GROWTH FACTOR RECEPTOR GENE), which is very common and frequently appearing mutation in women *(Tekada et al., Hsieh Rk et al., 2005).*

Avasin: Avasin is a targeted therapy for the VEGFR. VEGFR mutation plays significant role in feeding new blood vessels in the developing tumor. Avasin shows promising result when it combines with Chemotherapy treatment *(Genetech,2014).*

For stage I and II cancer, surgery is the best option as minimum lymph node involvement appears and in certain cases, surgery followed by the radiation for potential care. Chemotherapy used as primary treatment before/after the surgery to prevent some patients to dying through the cancer.

For stage III and stage IV, Sugary is not the suitable option. Treatment with combination of drugs with radiation, chemotherapy can be considered as an option but it does not help to improve the quality of the life*(National Cancer Institute,2012)* The treatment with Avastin in combination with Eloxatin or Xeloda followed by RT is one of the best treatment option for metastatic rectal cancer*(Michaela et al., 2014).*

Few researches indicate that screening of lung cancer cannot reduce the mortality rate but it can help to improve the survival rate by detecting cancer in the early age *(Kreuzer p Boffetta et al., 1999).* Although screening technique can improve the survival rate, it is not effective in the same way for both the sex; the development of cancer is differ by gender. *(Radiology)*

Research indicates that survival rates of lung cancer differ by gender. Women's survival rate is longer than men's survival rate, regardless of stages of detection and type of cancer.

Women shows sign and system at the early stages of lung cancer, which increase their chances of surgery and removal of complete tumor effected area. Therefore early symptoms with less damage increases their survival changes *(Carolina et al., 2004).*

As per report generated by national cancer Institute, in the year 2010 cost of medical expense of cancer was reached with $124.6 million including breast cancer(16.5 billion), colorectal cancer(14 billion), lymphoma cancer(12 billion),lung cancer (12 billion) and prostate(12 billion) *(National Cancer Institute,2012).*

Based on the incidence and survival rate reported for last couple of years, in 2020 the total cost of cancer targeted to reach up to 158.0 million. As per the current advancement, every year cost is increased 2% from the initial phase to final phase of treatment and which is expected 5% in the year 2020.

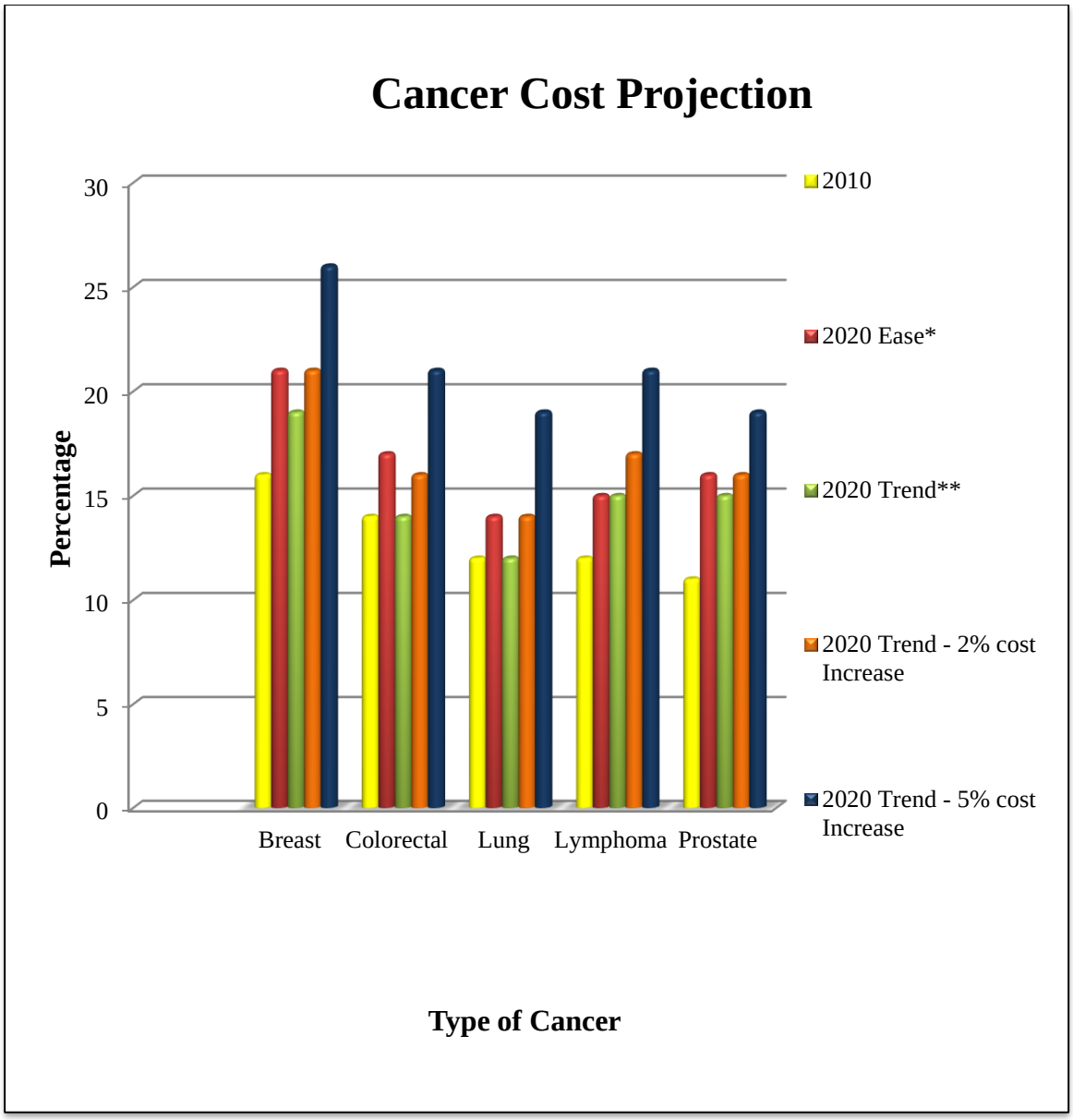

Figure 3.6: Cancer Cost Projection

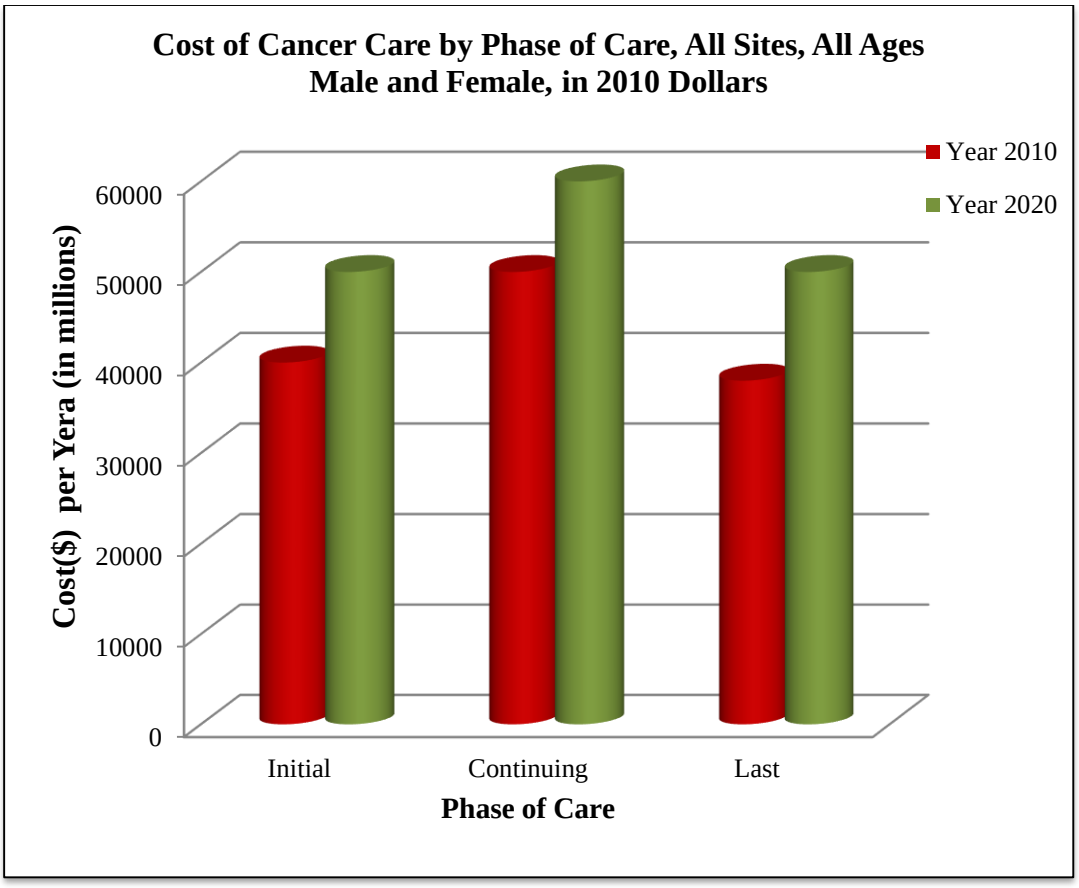

Figure 3.7: Cancer Cost per Stages Projection

As per the rising cost of, it is important to find some targeted treatment to ensure that patients reach to most effective approach of the treatment and will in turn increase the survival rate.

To best of our knowledge, very few researchers have reported the incidence of lung cancer based on the anatomical distribution of lung. Tumors are more commonly found to occur in the upper lobes of the lung than in the lower lobes *(Sahmoun et al., 2005; Lee et al., 1998)* of the lung but the association of the risk factors is not very well understood at this point *(Lee et al., 1998).*

However, one of the previous researches has reported that small cell lung cancer (SCLC) is highly associated with the upper lobe as compare to the lower lobe and middle lobe of the lung *(Sahmoun et al., 2005).*

It has been also observed that carcinogens may present longer in the upper lobe due to less proficient lymphatic clearance or to less effective ventilation passage so the upper lobe is prevalence in the frequent smokers *(Lee et al., 1998).*

The aim of our study is to determine the historical trends in lung cancer incidence and mortality based on the anatomical distribution site of lung by gender and race to determine unusual change occur from period to period.

We believe that our research will shed a new light in the lung cancer occurrence and increase the more room to figure out target treatment based on specific site of cancer occur in lung and association with co morbidity.

CHAPTER 4:

METHODOLOGY

4.1 NATIONAL IMPATEINT SMAPLE DATABASE:

HCUP family is very huge database which store certain adversary information about ambulatory care, patient stay and, emergency visit. A federal –State –Industry Partnership and AHRQ create HCUP databases. NIS database is part of Health cost and utilization project (HCUP). It contains data from 8 million hospital stays each year. Some clinical and resource useful information like typical discharge track under the protection of privacy and compliance, physician and hospital are also collected in NIS database

Apart from that, The NIS database includes Diagnosis types, procedures, enrollment and discharge information, demographic, length of stay, payment types, hospital features and severity definition (Co morbidity factors). The NIS includes more than 100 clinical and nonclinical data elements for each hospital stay.

4.2 IDENTIFICATION OF VARIABLE AND DATA FILES:

Demographic and mortality information are collected from NIS core and NIS severity file for the year 2003 to 2007. Those two files were merge base on the 'Key' variable.

All results in this research are based on the national impatient sample (NIS) database between the years 2003 to 2007. Lung cancer incidences extracted from the NIS database using ICD-9 code. We have used the following ICD-9 code for malignant neoplasm and non-malignant neoplasm.

List of ICD- 9 Code for lung cancer:

- 162.2 – Main bronchus
- 162.3 - Upper lobe, bronchus or lung
- 162.4 – Middle lobe, bronchus or lung
- 162.5 – Lower lobe, bronchus or lung
- 162.8 – Other parts of bronchus or lung
- 212.3 – Non-malignant neoplasm

List of Variables:

Study Variables	Original Variable	Variable description
Age	AGE	Age in years, Numerical Variable
Mortality	DIED	Patient did not die during Hospitalization (DIED=0);Patient died during hospitalization (DIED =1),Categorical (Binary) Variable
Gender	FEMALE	Gender of patient FEMALE =1 is Male; FEMALE=0 is female, Categorical (Binary) Variable
Race	RACE	1=White, 2= Black, 3= Hispanic, 4= Asian/Pacific, 5= Native Am. 6= Other
Principle Diagnosis	DX1	First listed diagnosis based on ICD-9 code
Secondary Diagnosis	DX2	Secondary diagnosis based on ICD-9 code

Table 4.1 List of Variables

List of Derived variables:

Definition and type of some of variables:

1. **Race:**

    - Original data type is Number
    - Definition: 1-6
    - New data type : Character

    Classification:

Original Value	Definition
1	White
2	Black
3	Hispanic
4	Asian
5	Native American
6	Others

Table 4.2 Derived Variable Race

2. **Gender :**

- Original Data type : Number
- Definition: 0,1
- New data type : Character

Classification:

Original Value	Definition
0	M
1	F

Table 4.3 Derived Variable Gender

3. **Disease staging mortality level: Original (No change)**

Original Value	Definition
0	Extremely Low
1	Very Low(Less than 5% of patient)
2	Low (5-25% of patient)
3	Medium (25-75 % of patient)
4	High (75 -95% of patient)
5	Very High (> 95% of patient)

Table 4.4 Definition of Disease Staging Mortality Level

Cencus population and NIS extraction

Country	Year	Census Population	NIS (All disease)	NIS Lung cancer
USA	2003	290,809,777	7977728	24197
	2004	293,655,404	8004571	23054
	2005	296,410,404	7995048	24412
	2006	299,398,484	8074825	23394
	2007	301,621,157	8043115	23301

Table 4.5: Census population data and NIS lung cancer data

CHAPTER 5:

STUDY LIMITATIONS:

- Used NIS files 2003 to 2007**:** Due to inconsistent variable definition, data files 2008 to 2010 excluded from the research
- Due to discrepancy of the data, Odds ratio for Native American was excluded from the calculation; further research is required to confirm the result.
- Due to insufficient information, Other's Ethnicity excluded from the research

CHAPTER 6:

RESULTS:

RESULT 6.1:

TREAND ANALYSIS

The historical trend of incidence and mortality rate of the lung cancer from 2003–2007, as shown in Figure 6(a), indicate a strong association with the previously reported results and future expectation. Our analysis clearly indicates that due to a strong decline in the smoking (Alberg et al., 2005) the incidence and mortality rate will continue to decline or remain steady in the future. For the year 2003, incidence and mortality peak indicated a high rate, from the year 2004 the peak is shifting slightly in a downward trend. It is because of improvement in the diagnostic tools and better patient's management.

Further analysis of incidence and mortality rate of anatomical sites (lobes) of lung as shown in Figures 6(b) to 6(g), indicates the **UPPER LOBE** of lung is correlated strongly with general lung cancer cases. We have also observed the incidence and mortality rates of lung cancer are significantly lower for other lobes of lung.

Among the all-anatomical sites (lobes), occurrence of lung cancer follows an order of high to low: **Upper lobe, Lower lobe, Other parts of the lung, Main bronchus, and Middle lobe.**

The mortality rates between non-malignant and malignant lung cancer as shown in Figure 6(h) and represented with different colors. For the given years 2003 – 2007, malignant lung cancers show high mortality rate as compare to non-malignant lung cancer. Among the all of sub sites (lobes) of lung, the upper lobe and lower lobe are strongly associated with the mortality rate: a continuous increasing mortality rate recorded as compare to other sub site (lobes) of lung.

Figure 6.1 (a) Incidence and Mortality rate of lung cancer 2003-2007

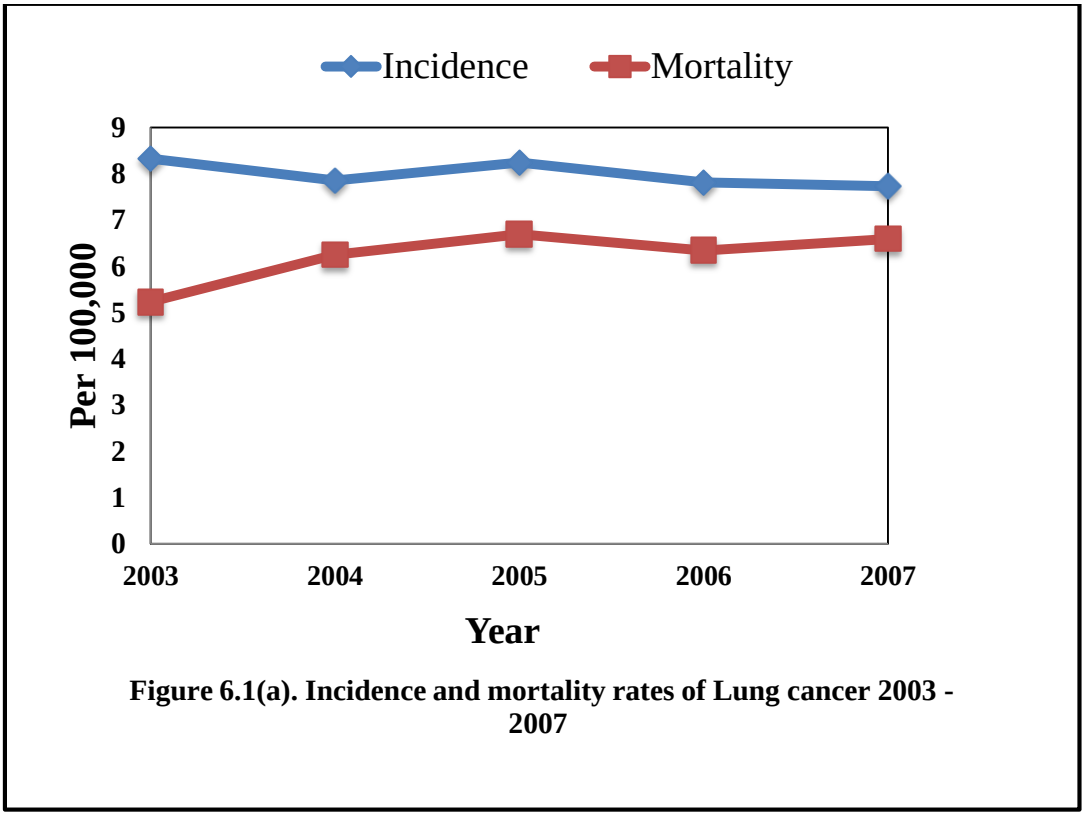

Figure 6.1(a). Incidence and mortality rates of Lung cancer 2003 - 2007

Figure 6.1 (b) Incidence and mortality rates of main bronchus lung cancer 2003-2007

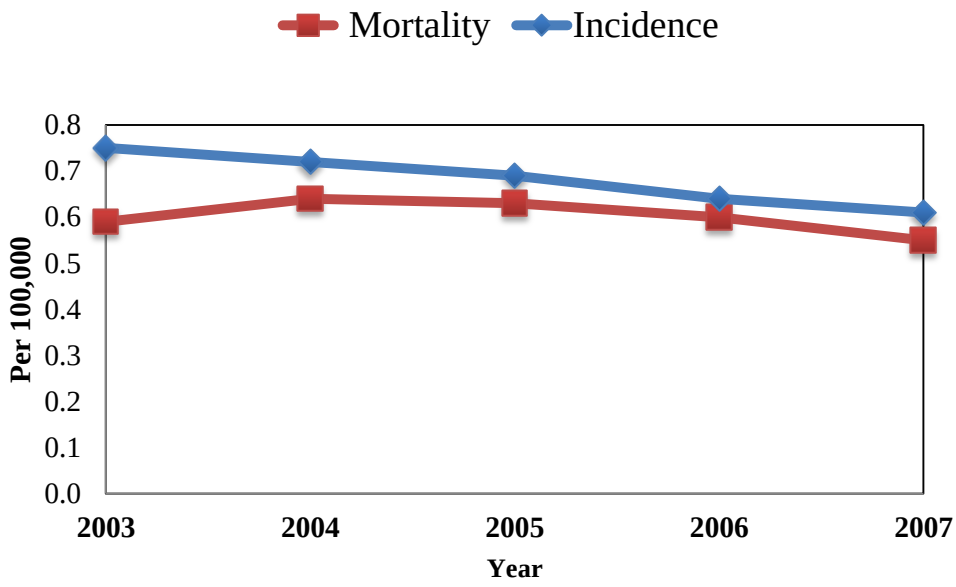

Figure 6.1 (b). Incidence and mortality rates of MAIN BRONCHUS Lung cancer 2003 - 2007

Figure 6.1 (c) Incidence and mortality rates of upper lobe lung cancer 2003-2007

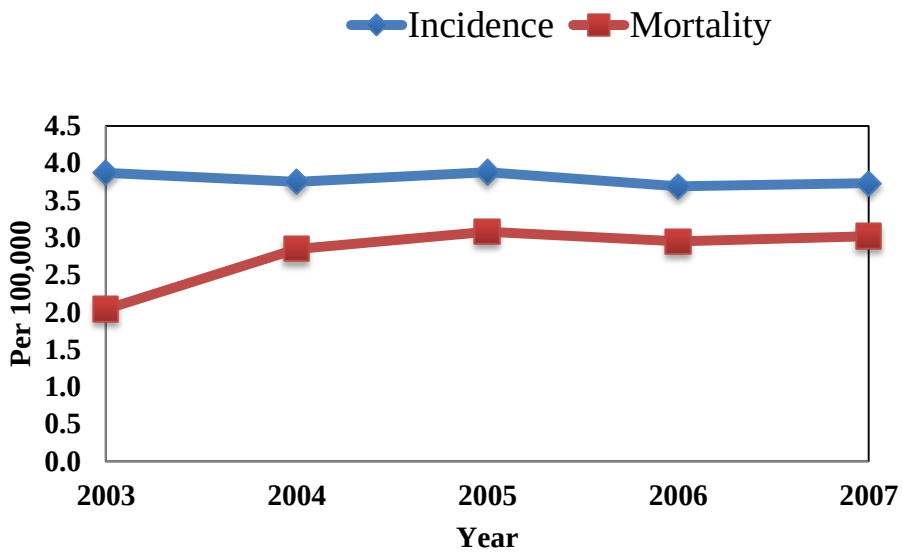

Figure 6.1 (c). Incidence and mortality rates of Upper Lobe Lung cancer 2003 - 2007

Figure 6.1 (d) Incidence and mortality rates of middle lobe lung cancer 2003-2007

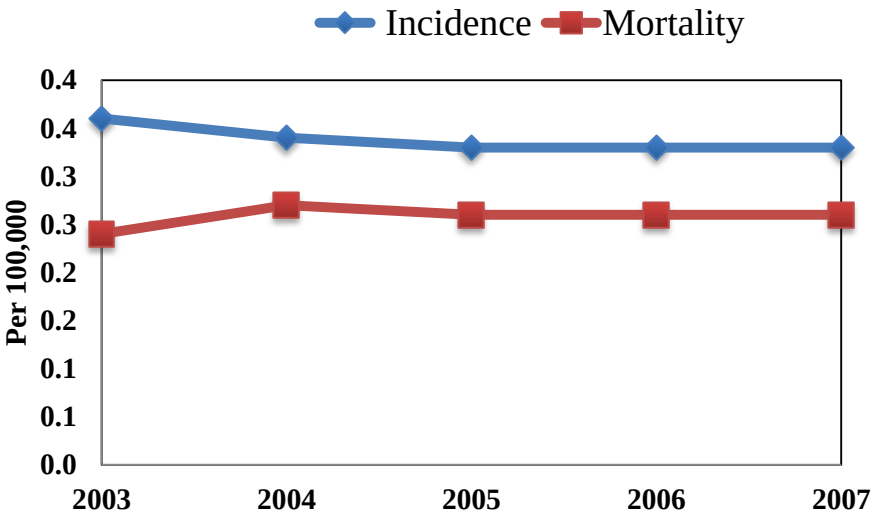

Figure 6.1 d.: Incidence and mortality rates of Middle Lobe Lung cancer 2003 - 2007

Figure 6.1(e) Incidence and mortality rates of Lower Lobe lung cancer 2003-2007

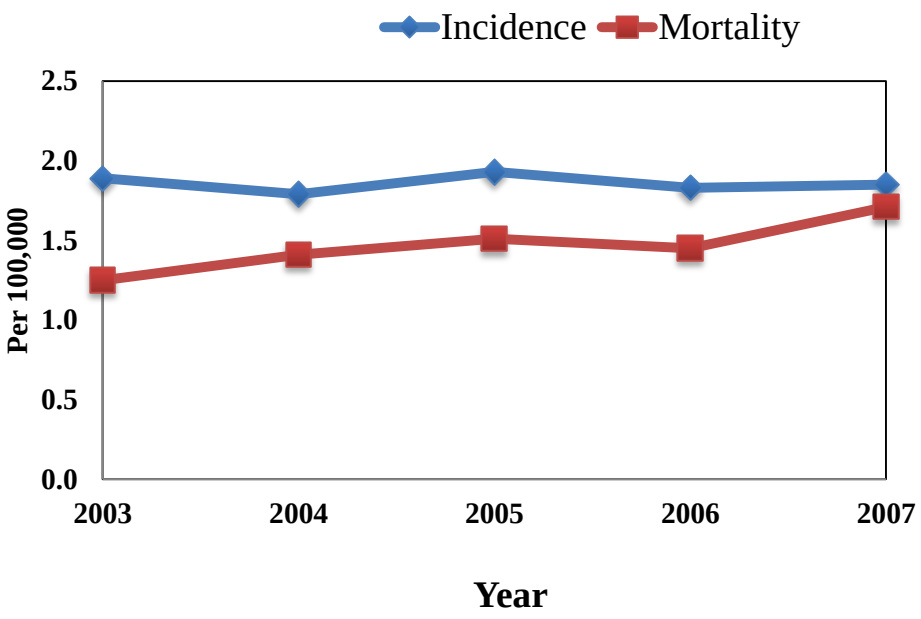

Figure 6.1 e.Incidence and mortality rates of LOWER Lobe Lung cancer 2003 - 2007

Figure 6.1(f) Incidence and mortality rates of nonmalignant lung cancer 2003-2007

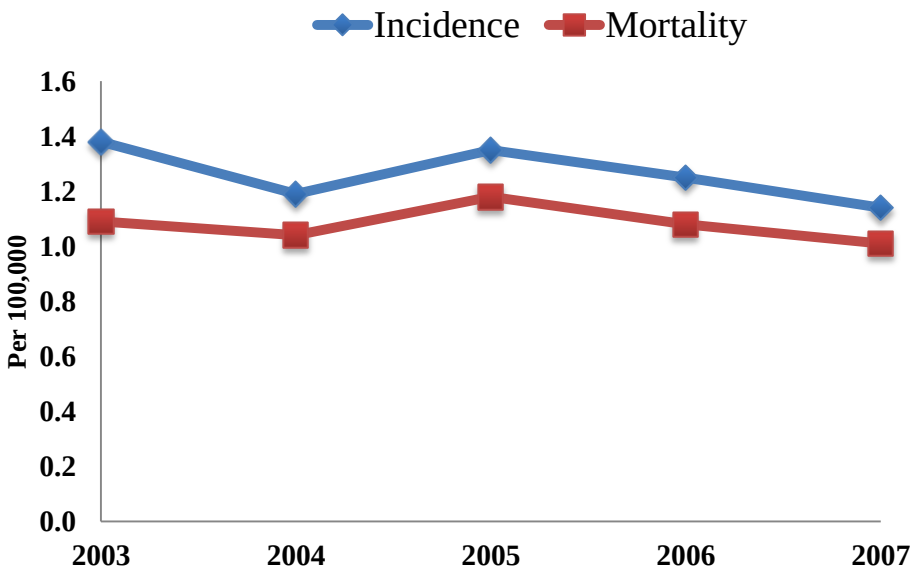

Figure 6.1 f. Incidence and mortality rates of OTHER PART Of Lung 2003 - 2007

Figure 6.1(g) Comparison of mortality rates of malignant/nonmalignant lung cancer 2003-2007

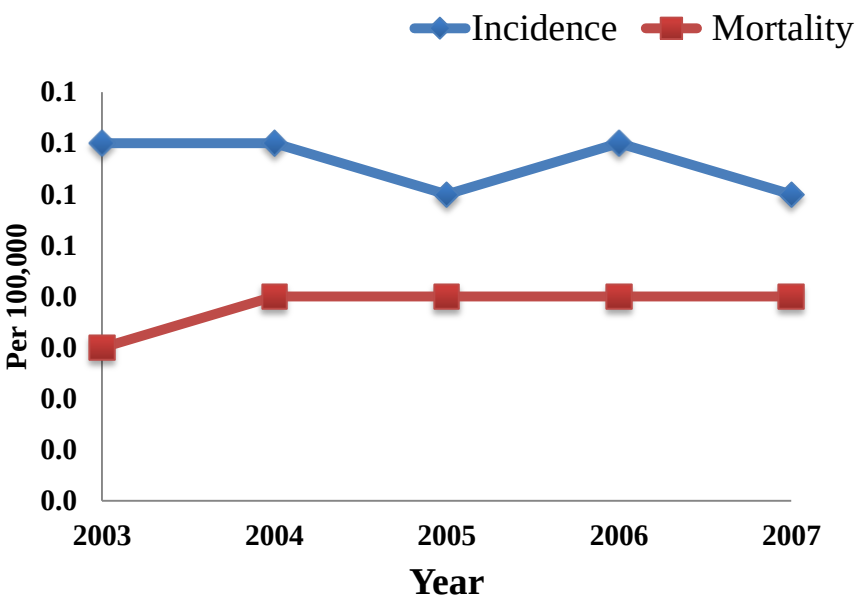

Figure 6.1 g . Incidence and mortality rates of NON MALIGNENT Lung Cancer 2003 - 2007

Figure 6.1(h) Comparison of mortality rates of malignant/nonmalignant lung cancer 2003-2007

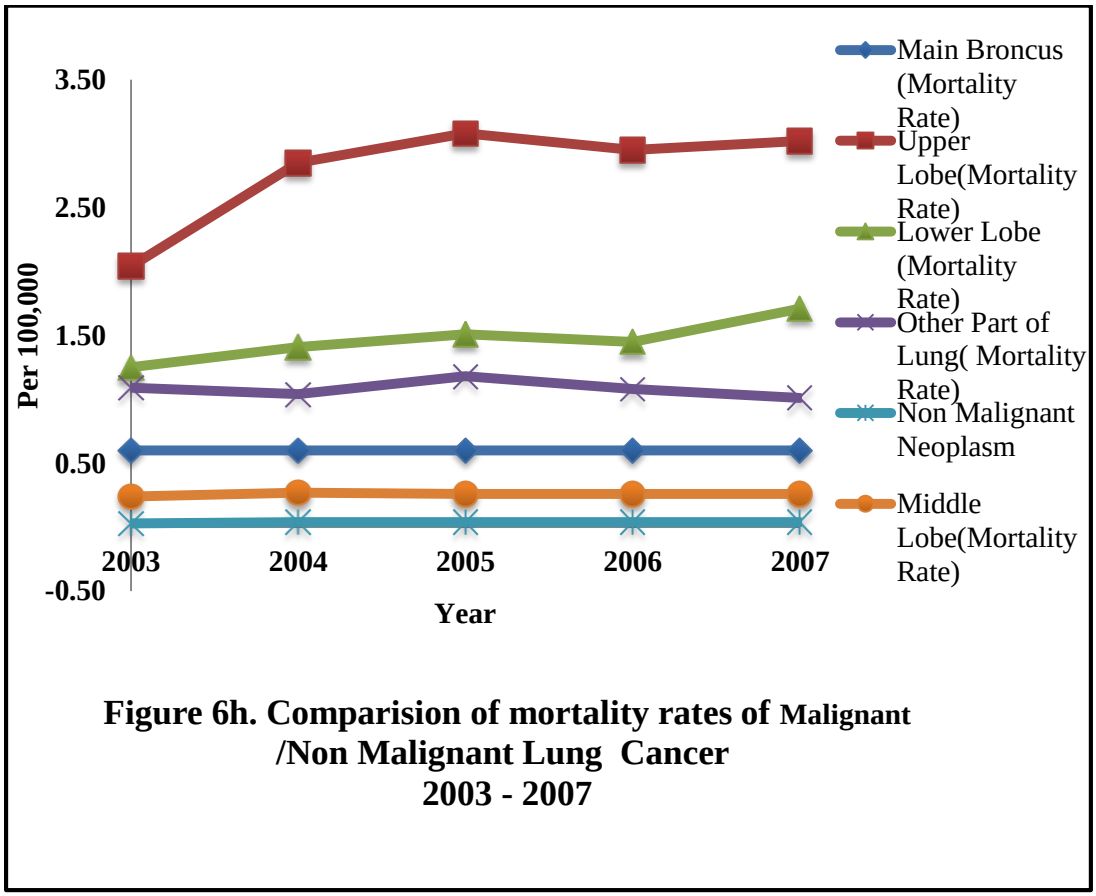

Figure 6h. Comparision of mortality rates of Malignant /Non Malignant Lung Cancer 2003 - 2007

Table 6.1: Incidence and mortality rate of different anatomical sites of lings by population (census)

Country	Year	Census Population	NIS (ALL Disease)	NIS (LUNG Cancer)	NIS (Total Incidence)	% Rate of Incidence base on Population	NIS (Total Mortality)	% Rate of Mortality Base on Population
Main Bronchus	2003	290,809,777	7977728	24197	2193	0.8	1710	0.6
	2004	293,655,404	8004571	23054	2124	0.7	1876	0.6
	2005	296,410,404	7995048	24412	2045	0.7	1856	0.6
	2006	299,398,484	8074825	23394	1915	0.6	1806	0.6
	2007	301,621,157	8043115	23301	1850	0.6	1658	0.6
Upper Lobe	2003	290,809,777	7977728	24197	11257	3.9	5922	2.04
	2004	293,655,404	8004571	23054	11000	3.8	8378	2.85
	2005	296,410,404	7995048	24412	11514	3.9	9119	3.08
	2006	299,398,484	8074825	23394	11051	3.7	8844	2.95
	2007	301,621,157	8043115	23301	11260	3.7	9101	3.02
Lower Lobe	2003	290,809,777	7977728	24197	5501	1.9	3646	1.25
	2004	293,655,404	8004571	23054	5257	1.8	4146	1.41
	2005	296,410,404	7995048	24412	5707	1.9	4488	1.51
	2006	299,398,484	8074825	23394	5489	1.8	4332	1.45
	2007	301,621,157	8043115	23301	5572	1.9	5156	1.71
Other Part of Lung	2003	290,809,777	7977728	24197	4007	1.4	3157	1.09
	2004	293,655,404	8004571	23054	3485	1.2	3067	1.04
	2005	296,410,404	7995048	24412	3988	1.4	3491	1.18
	2006	299,398,484	8074825	23394	3742	1.3	3231	1.08
	2007	301,621,157	8043115	23301	3427	1.1	3060	1.01
Non Malignant	2003	290,809,777	7977728	24197	206	0.1	95	0.03
	2004	293,655,404	8004571	23054	200	0.1	110	0.04
	2005	296,410,404	7995048	24412	190	0.1	113	0.04
	2006	299,398,484	8074825	23394	220	0.1	113	0.04
	2007	301,621,157	8043115	23301	192	0.1	117	0.04

**Incidence rate: (NIS lung cancer Incidence data/ Census population) *100,000*
** Mortality rate: (NIS lung cancer mortality data/ Census population) *100,000*

Our census base historical trend for ethnicity as shown in Figure 6.2 (a) indicates that the incidence rate of lung cancer is similar between the Black and the White Americans. Among the all ethnicity, occurrence of lung cancer follows an order of high to low: **White and Black Americans, Hispanic, Asia and North American.**

RESULT 6.2:

EXAMINE OCCURRENCE OF LUNG CANCER BY ETHNICITY FOR THE YEAR 2003-2007

Figure 6.2 (a) indicates that among the all races, white race is showing strong association with the lung cancer

Figure 6.2.(a): Occurrences of Incidence of Lung cancer by ethnicity by year 2003-2007

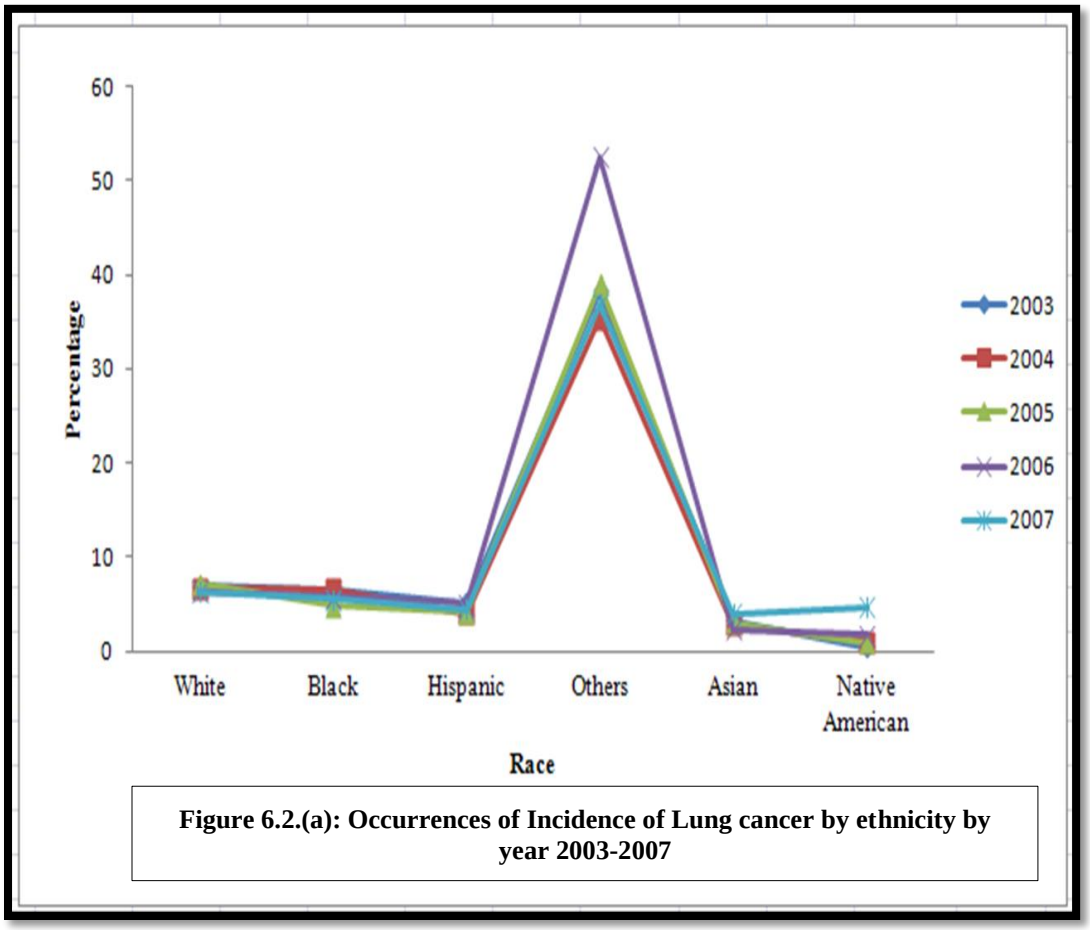

Figure 6.2.(a): Occurrences of Incidence of Lung cancer by ethnicity by year 2003-2007

Table 6.2: Incidence of lung cancer by ethnicity by year 2003-2007

Race	White	Black	Hispanic	Others	Asian	Native American
Census Population2003	209673849	33443124	17448587	15994538	11632391	2617288
NIS Incidence	14572	2215	895	6125	380	10
Total Incidence	6.95	6.62	5.13	38.29	3.27	0.38
Census Population2004	211725546	33770371	17619324	16151047	11746216	2642899
NIS Incidence	14077	2208	696	5714	332	27
Total Incidence	6.65	6.54	3.95	35.38	2.83	1.02
Census Population2005	213711901	34087196	17784624	16302572	11856416	2667694
NIS Incidence	15299	1628	737	6365	358	25
Total Incidence	7.16	4.78	4.14	39.04	3.02	0.94
Census Population 2006	215866307	34430826	17963909	11975939	16466917	2694586
NIS Incidence	13774	1989	907	6294	384	46
Total Incidence	6.38	5.78	5.05	52.56	2.33	1.71
Census Population 2007	217468854	34686433	18097269	16589164	12064846	2714590
NIS Incidence	13872	1912	796	6114	479	128
Total Incidence	6.38	5.51	4.4	36.86	3.97	4.72

**** Total Incidence = (NIS incidence *100,000)/Cencus populaiton*

Further analysis based on anatomical site of lung as shown in Figures 2(b) to 2(f), indicate all anatomical sites of lungs including main bronchus, upper lobe, lower lobe and middle lobe are highly associated with White Americans as compared with other races, while other part of lungs are significantly higher in Black American as compared to other races. The five years relative occurrence of the lung cancer suggests White Americans have a potentially high risk of lung cancer associated with each category of lung except other-lung part.

Figure 6.2 (b) Incidence of Lung cancers based on Anatomy of lung by Race 2003

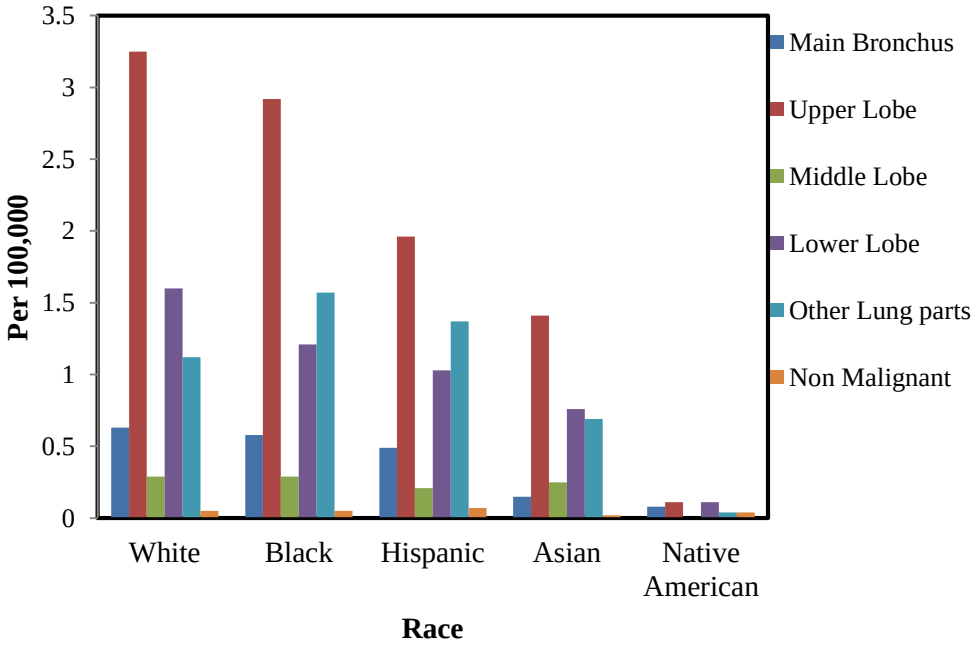

Figure 6.2 (b) . Incidence of Lung cancer based on Anatomy of lung by race -2003

Figure 6.2 (c) Incidence of Lung cancers based on Anatomy of lung by Race 2004

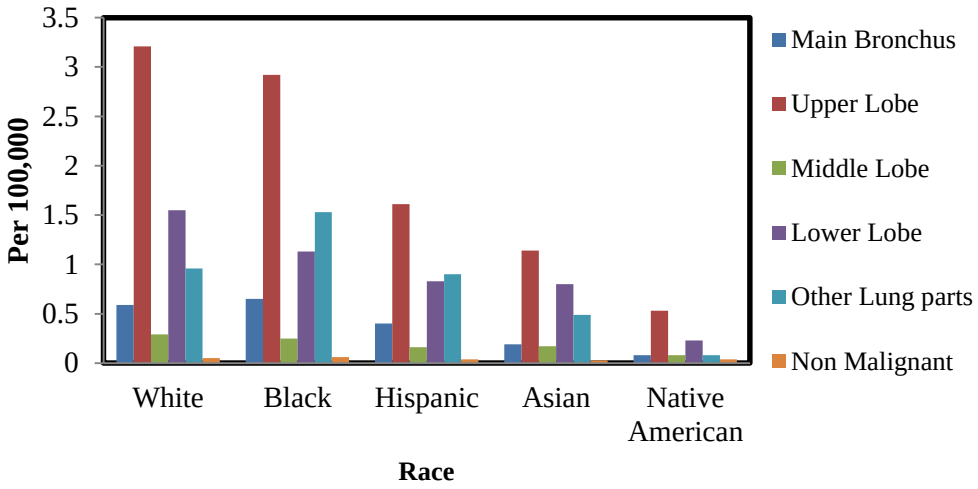

Figure 6. 2(C) Incidence of Lung cancer based on Anatomy of lung by race -2004

Figure 6.2 (d) Incidence of Lung cancer based on Anatomy of Lung by Race 2005

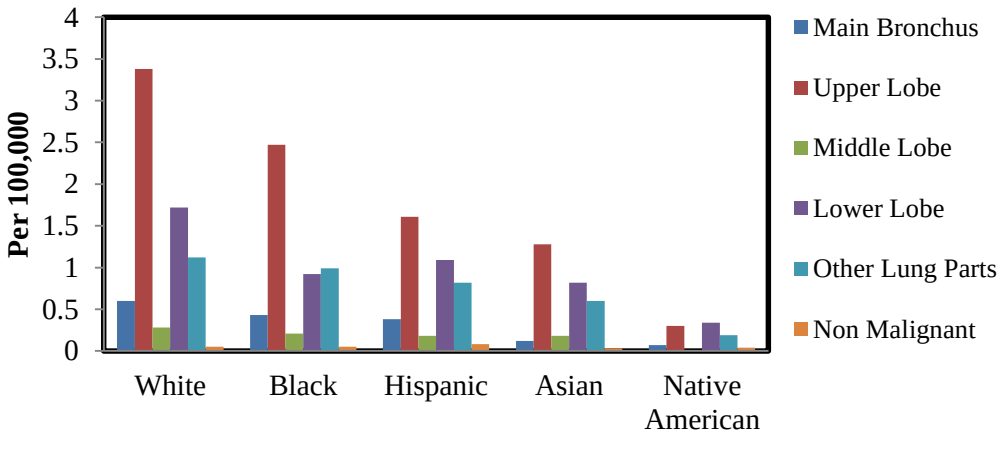

Figure 6.2(d) Incidence of Lung cancer based on Anatomy of lung by race -2005

Figure 6.2 (e) Incidence of Lung cancers based on Anatomy of Lung by Race 2006

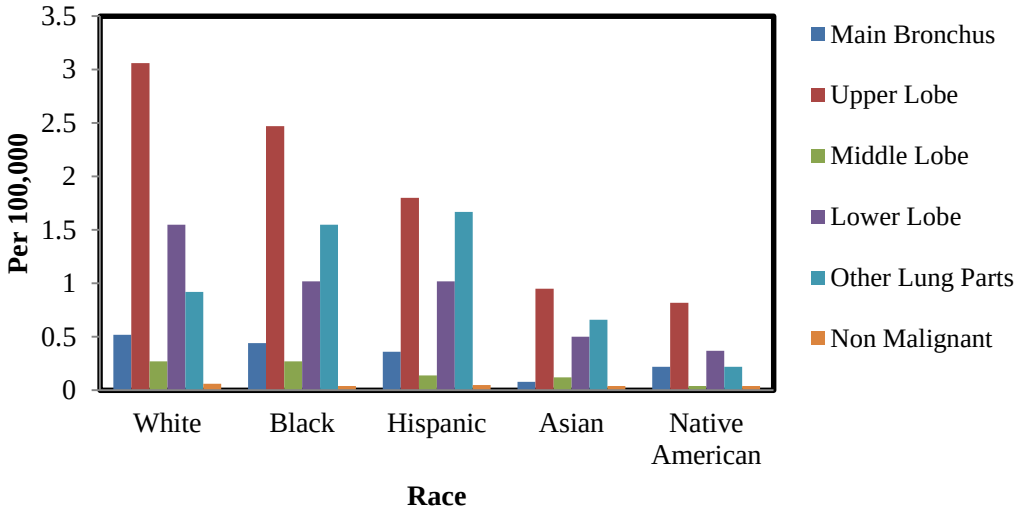

Figure 6.2d(e) Incidence of Lung cancer based on Anatomy of lung by race -2006

Figure 6.2 (f) Incidence of Lung cancers based on Anatomy of Lung by Race 2007

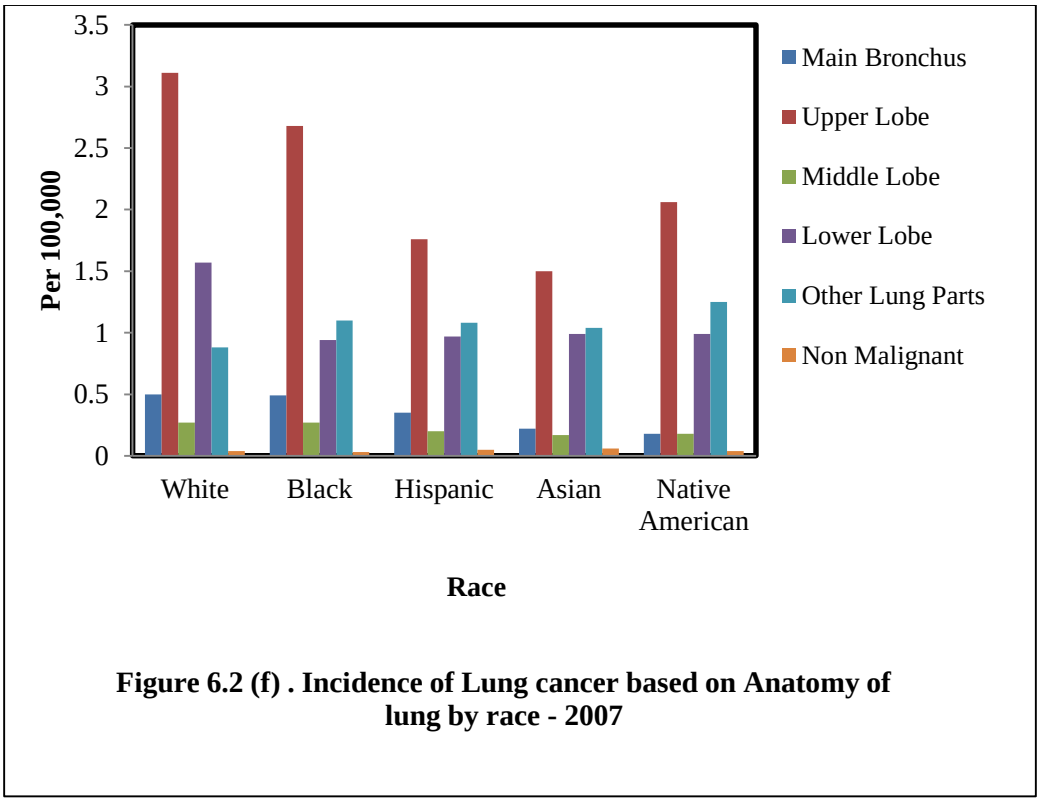

Figure 6.2 (f) . Incidence of Lung cancer based on Anatomy of lung by race - 2007

RESULT 6.3:

EXAMINE THE RISK ANALYSIS ACROSS THE ETHNICITY AND GENDER

The odds ratio for relative risks of getting lung cancer (each anatomical site) from 2003 to 2007 data has been showing in the Figures 6.3.1(a) to 6.3.5(e). These results base on ethnicity and gender.

6.3(a): RISK ANALYSIS ACROSS THE ETHINICITY: WHITE AMERICAN

For the White Americans as per shown in Table 6.3(a),

The average of five years odds ratio of male vs. female for each lobe of lung including main bronchus, upper lobe, lower lobe, middle lobe and other lung part are **1.0**, which indicates both sexes are equally susceptible to get lung cancer for each lobe of lungs. However, the odds ratio of male vs. female for non-malignant cancer is **0.81**, which indicates White female are having high potential risk of getting non-malignant lung cancer as compared with White male.

Figure 6.3 (a) Odds ratios White Male Vs White Female 2003 – 2007

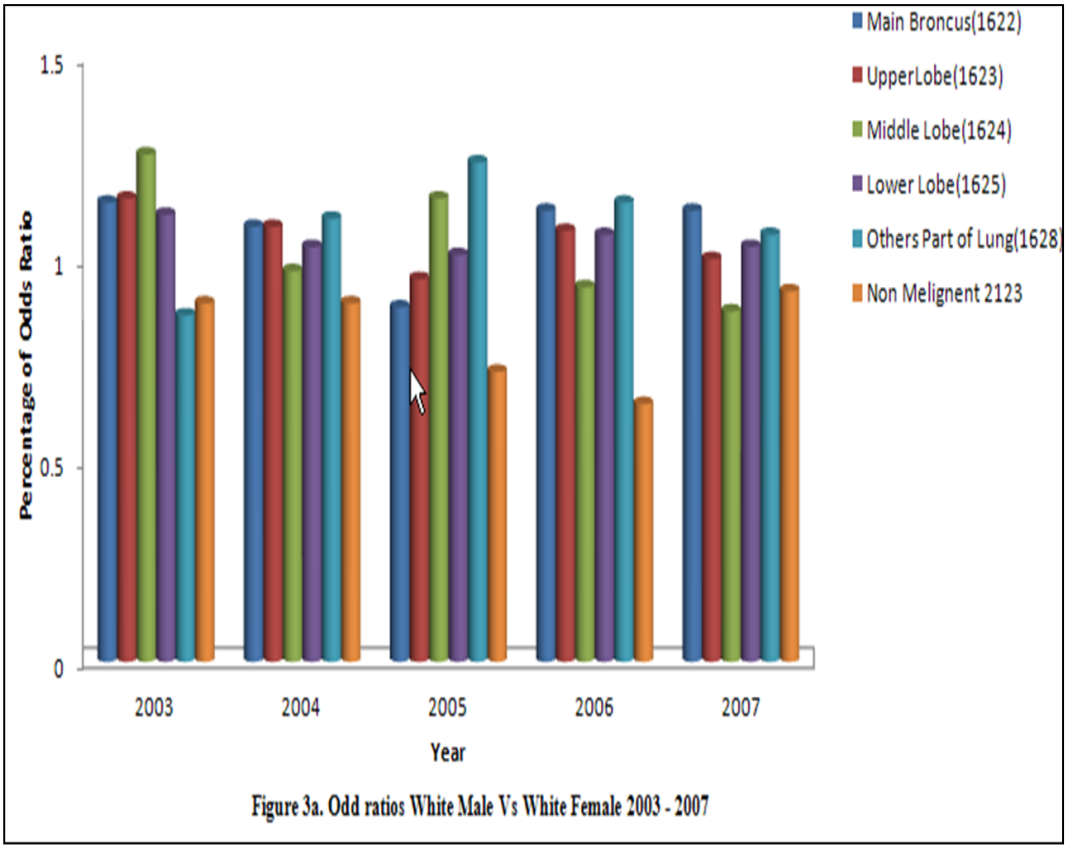

Figure 3a. Odd ratios White Male Vs White Female 2003 - 2007

Table 6.3(a) Odds ratios White Male Vs White Female 2003 - 2007

White	Main Bronchus (1622)	Upper Lobe (1623)	Middle Lobe (1624)	Lower Lobe (1625)	Others Part of Lung(1628)	Non Malignant 2123
2003	1.14	1.15	1.26	1.11	0.86	0.89
2004	1.08	1.08	0.97	1.03	1.1	0.89
2005	0.88	0.95	1.15	1.01	1.24	0.72
2006	1.12	1.07	0.93	1.06	1.14	0.64
2007	1.12	1	0.87	1.03	1.06	0.92
Average	**1.068**	**1.05**	**1.036**	**1.048**	**1.08**	**0.812**

*** Formula Odds ratio: Total occurrences of White male/ total occurrences of White female*

6.3(b): RISK ANALYSIS ACROSS THE ETHNICITY: BLACK

For Black Americans as per shown in Table 6.3(b)

The average five years odds ratio of male vs. female is higher than **1.0** for main bronchus, upper lobe, middle lobe and other lung part. Which indicates Black males have 30% higher risk of getting main bronchus, 40% higher risk of getting upper lobe, 50% higher risk of getting middle lobe and 34% higher risk of getting at other lung part, as compare with Black females. However, the odds ratio of male vs. female for lower lobe and non-malignant cancer is **1.0**, which indicates both sexes are equally susceptible for getting lower lobe and non-malignant lung cancer.

Figure 6.3 (b) Odds ratios Black Male Vs Black Female 2003 – 2007

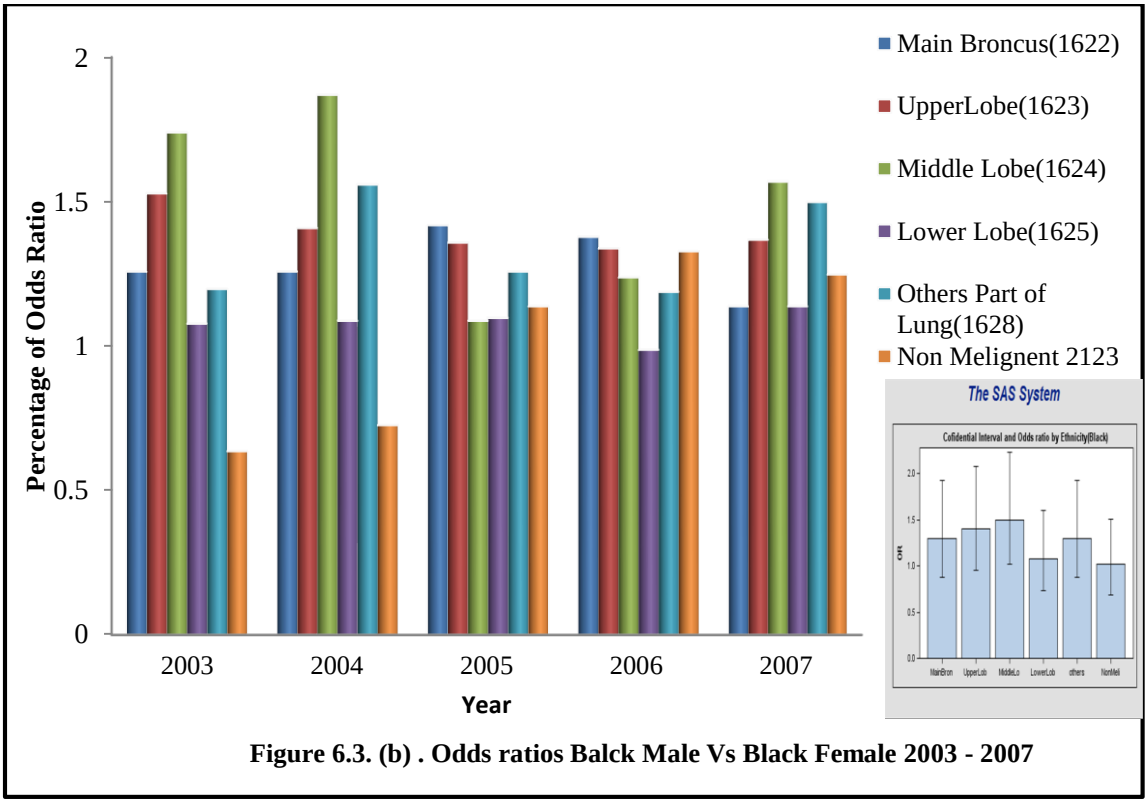

Figure 6.3. (b) . Odds ratios Balck Male Vs Black Female 2003 - 2007

Table 6.3(b): Odds ratios Black Male Vs Black Female 2003 - 2007

Black	Main Bronchus (1622)	Upper Lobe (1623)	Middle Lobe (1624)	Lower Lobe (1625)	Others Part of Lung(1628)	Non Malignant (2123)
2003	1.26	1.53	1.74	1.08	1.2	0.64
2004	1.26	1.41	1.87	1.09	1.56	0.73
2005	1.42	1.36	1.09	1.1	1.26	1.14
2006	1.38	1.34	1.24	0.99	1.19	1.33
2007	1.14	1.37	1.57	1.14	1.5	1.25
Average	**1.292**	**1.402**	**1.502**	**1.08**	**1.342**	**1.018**

6.3.(C): RISK ANALYSIS ACROSS THE ETHINICITY: HISPANIC

For Hispanic as per shown in Table 6.3(c)

The average of five years odds ratio of Hispanic male vs. Hispanic female is higher than **1.0** for Main bronchus, Upper lobe, Lower lobe and other lung parts. Which indicates Hispanic males have 80% higher risk of getting main bronchus, 39% higher risk of getting lower lobe ,71% higher risk of getting upper lobe and other lung part as compared with Black females. However, the odds ratio of male vs. female for middle lobe and non-malignant cancer is **0.9**, which indicates Hispanic females have higher risk of are getting middle lobe and non-malignant lung cancer.

Figure 6.3 (c) Odds ratios Hispanic Male Vs Hispanic Female 2003 – 2007

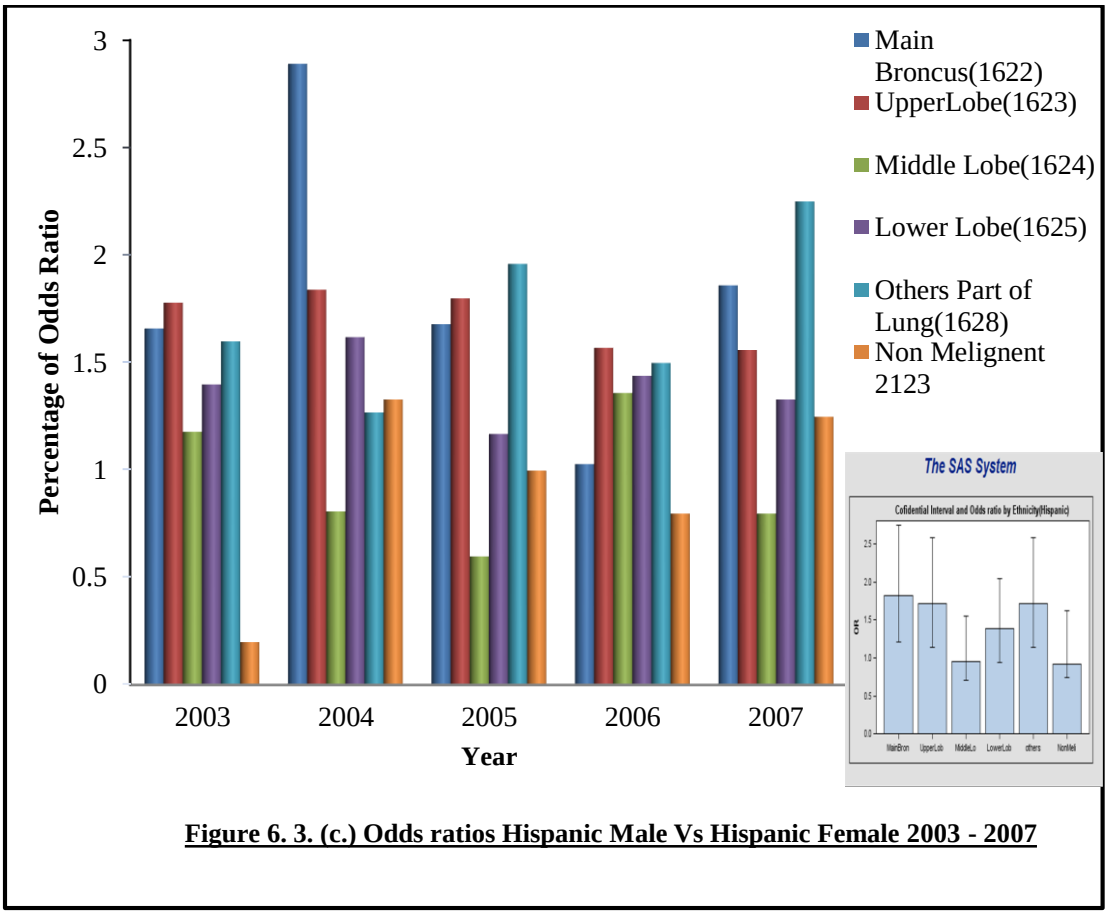

Figure 6. 3. (c.) Odds ratios Hispanic Male Vs Hispanic Female 2003 - 2007

Table 6.3 (c): Odds ratios Hispanic Male Vs Hispanic Female 2003 - 2007

Hispanic	Main Bronchus (1622)	Upper Lobe (1623)	Middle Lobe (1624)	Lower Lobe (1625)	Others Part of Lung(1628)	Non Malignant (2123)
2003	1.66	1.78	1.18	1.4	1.6	0.2
2004	2.89	1.84	0.81	1.62	1.27	1.33
2005	1.68	1.8	0.6	1.17	1.96	1
2006	1.03	1.57	1.36	1.44	1.5	0.8
2007	1.86	1.56	0.8	1.33	2.25	1.25
Average	**1.824**	**1.71**	**0.95**	**1.392**	**1.716**	**0.916**

6.3.(d) RISK ANALYSIS ACROSS THE ETHINICITY: ASIAN

For Asians as per shown in Table 6.3(d),

The average of five years odds ratio of male vs. female is higher than **1.0** for main bronchus, upper lobe, lower lobe, other lung part and non-malignant. Which indicates Asian males have 45% higher risk of getting main bronchus, 45% higher risk of getting upper lobe, 22% higher risk of getting lower lobe, 79% higher risk of getting at other lung part and 6% higher risk of getting non-malignant cancer as compare with Black females. But the odds ratio of Asian male vs. female for middle lobe cancer is **0.8**, which indicates Asian females have higher risk of are getting middle lobe lung cancer as compared with Asian male.

Figure 6.3(d) Odds ratios Asian Male Vs Asian Female 2003 – 2007

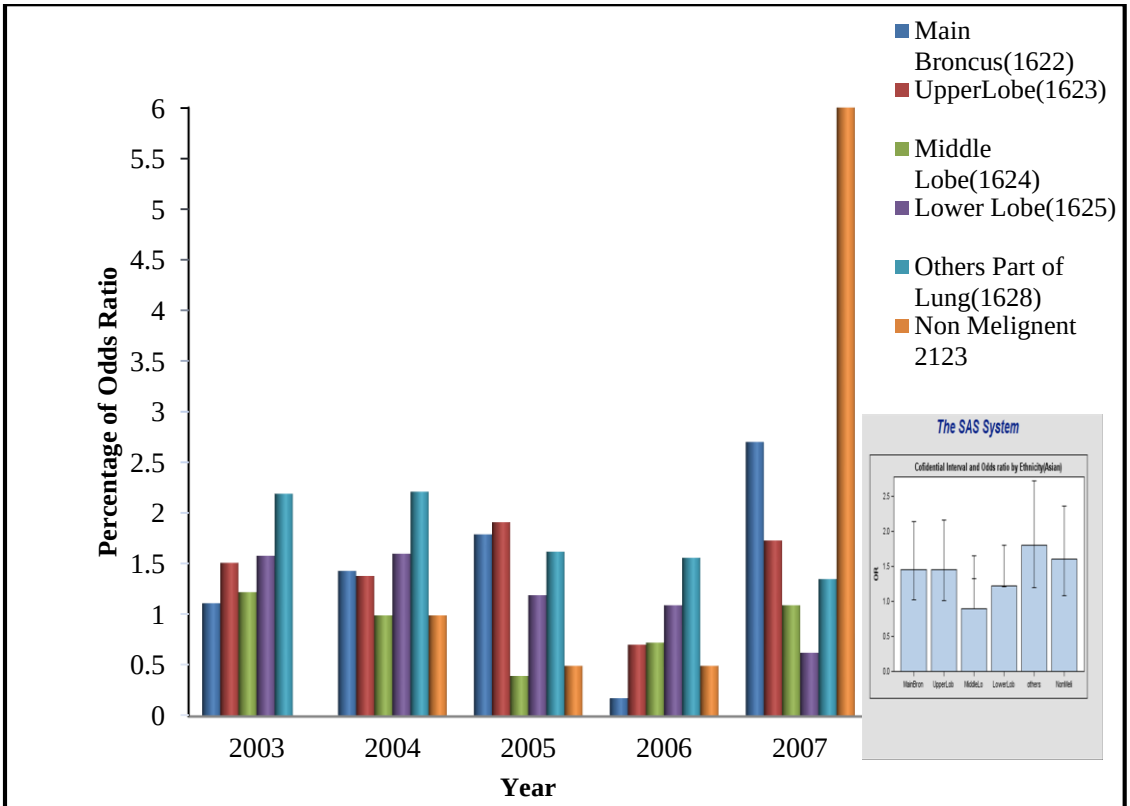

Figure 6.3. (d) .Odds ratios Asian Male Vs Asian Female 2003 - 2007

Table6.3 (d): .Odds ratios Asian Male Vs Asian Female 2003 - 2007

Asian	Main Bronchus (1622)	Upper Lobe (1623)	Middle Lobe (1624)	Lower Lobe (1625)	Others Part of Lung(1628)	Non Malignant 2123
2003	1.12	1.52	1.23	1.59	2.2	0
2004	1.44	1.39	1	1.61	2.22	1
2005	1.8	1.92	0.4	1.2	1.63	0.5
2006	0.18	0.71	0.73	1.1	1.57	0.5
2007	2.71	1.74	1.1	0.63	1.36	6
Average	**1.45**	**1.456**	**0.892**	**1.226**	**1.796**	1.6

6.3. (E) : RISK ANALYSIS ACROSS THE ETHNICITY: NATIVE AMERICAN

Native Americans as per shown in Table 6.3(e)

The average of five years odds ratio of male vs. female for upper lobe and lower lobe are higher than **1.0**, which indicates Native American males have 100% higher risk of getting upper lobe and 50% higher risk of getting lower lobe as compare with Black females. The odds ratio **1.0** indicates that both sexes are equally susceptible of getting other part of lung cancer. But the odds ratio of Native American male vs. female for main bronchus cancer is **0.9** and middle lobe is **0.13**, which indicates Native American females have higher risk of are getting main bronchus and middle lobe lung cancer as compared with Native American male.

Figure 6.3(e.) Odd ratios Native American Male Vs Native American Female 2003 – 2007

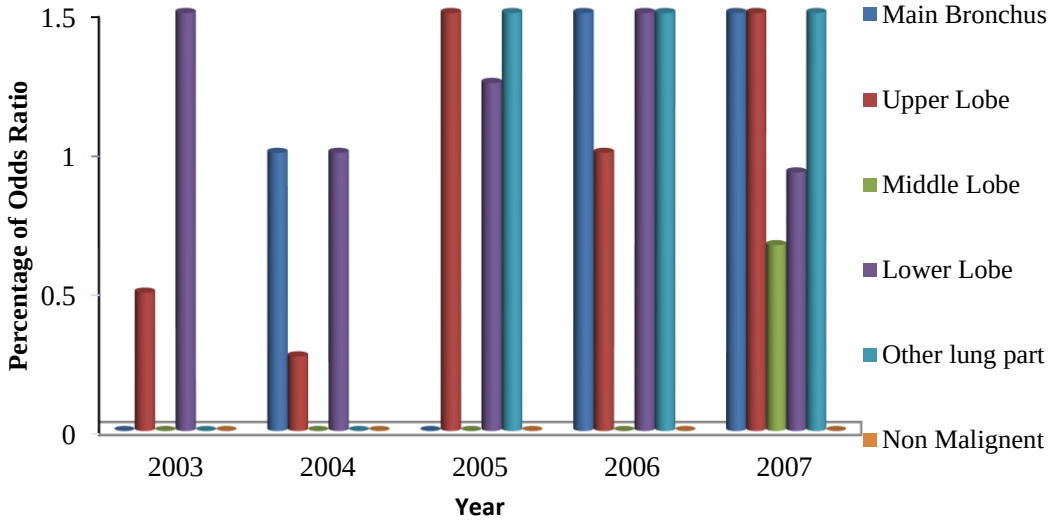

Figure 6.3. (e.) Odd ratios Native American Male Vs Native American Female 2003 - 2007

Table 6.3 (e): Odd ratios Native American Male Vs Native American Female 2003 - 2007

Asian	Main Bronchus (1622)	Upper Lobe (1623)	Middle Lobe (1624)	Lower Lobe (1625)	Others Part of Lung(1628)	Non Malignant (2123)
2003	1.12	1.52	1.23	1.59	2.2	0
2004	1.44	1.39	1	1.61	2.22	1
2005	1.8	1.92	0.4	1.2	1.63	0.5
2006	0.18	0.71	0.73	1.1	1.57	0.5
2007	2.71	1.74	1.1	0.63	1.36	6
Average	**1.45**	**1.456**	**0.892**	**1.226**	**1.796**	**1.6**

Table 6.4: Odds ratio based on 95% of CI

Odds Ratio Based on 95% CI

White/Race	Male	Female	Stand Error	Odds(M/F)	LN(odds)	Lower Limit	Upper Limit	LN (Lower Limit)	Odd Ratio	LN(Upper Con Limit)
Main B	51.5	48.496	0.2	1.06	0.06	-0.33	0.45	0.72	1.06	1.57
Upper	51.1	48.876	0.2	1.05	0.05	-0.34	0.44	0.71	1.05	1.55
Middle	50.66	49.34	0.2	1.03	0.03	-0.36	0.42	0.7	1.03	1.52
Lower	51.146	48.854	0.2	1.04	0.04	-0.35	0.43	0.7	1.04	1.54
Other	51.722	48.278	0.2	1.08	0.08	-0.31	0.47	0.73	1.08	1.6
Non M	44.58	55.42	0.2	0.812	0.21	-0.18	0.6	0.84	0.812	1.82
Black/Race	**Male**	**Female**	**Stand Error**	**Odds(M/F)**	**LN(odds)**	**Lower Limit**	**Upper Limit**	**LN(Lower Limit)**	**Odd Ratio**	**LN (Upper Limit)**
Main B	56.266	43.734	0.2	1.292	0.26	-0.13	0.65	0.88	1.292	1.92
Upper	58.3	41.4	0.2	1.4	0.34	-0.05	0.73	0.95	1.4	2.08
Middle	59.49	40.52	0.2	1.5	0.41	0.02	0.8	1.02	1.5	2.23
Lower	51.91	48.09	0.2	1.08	0.08	-0.31	0.47	0.73	1.08	1.6
Other	57.1	42.896	0.2	1.3	0.26	-0.13	0.65	0.88	1.3	1.92
Non M	49.5	50.594	0.2	1.018	0.02	-0.37	0.41	0.69	1.018	1.51
Hispanic/Race	**Male**	**Female**	**Stand Error**	**Odds(M/F)**	**LN(odds)**	**Lower Limit**	**Upper Limit**	**LN(Lower Limit)**	**Odd Ratio**	**LN (Upper Limit)**
Main B	63.03	36.964	0.21	1.824	0.6	0.19	1.01	1.21	1.824	2.75
Upper	63.58	36.942	0.21	1.71	0.54	0.13	0.95	1.14	1.71	2.59
Middle	47.702	52.298	0.2	0.95	0.05	-0.34	0.44	0.71	0.95	1.55
Lower	58.056	41.944	0.2	1.392	0.33	-0.06	0.72	0.94	1.392	2.05
Other	62.584	37.416	0.21	1.716	0.54	0.13	0.95	1.14	1.716	2.59
Non M	44.762	55.238	0.2	0.916	0.09	-0.3	0.48	0.74	0.916	1.62
Asian/Race	**Male**	**Female**	**Stand Error**	**Odds(M/F)**	**LN(odds)**	**Lower Limit**	**Upper Limit**	**LN(Lower Limit)**	**Odd Ratio**	**LN (Upper Limit)**
Main B	52.956	47.044	0.2	1.45	0.37	0.02	0.76	1.02	1.45	2.14
Upper	57.916	42.084	0.2	1.456	0.38	0.01	0.77	1.01	1.456	2.16
Middle	45.646	54.354	0.2	0.892	0.11	0.28	0.5	1.32	0.892	1.65
Lower	53.76	46.24	0.2	1.226	0.2	0.19	0.59	1.21	1.226	1.8
Other	63.68	36.32	0.21	1.796	0.59	0.18	1	1.2	1.796	2.72
Non M	60.474	39.526	0.2	1.6	0.47	0.08	0.86	1.08	1.6	2.36

Native Am	Male	Female	Stand Error	Odds(M/F)	LN(odds)	Lower Limit	Upper Limit	LN(Lower Limit)	Odd Ratio	LN (Upper Limit)
Main B	75.334	24.666	0.23	0.9	0.11	-0.34	0.56	0.71	0.9	1.75
Upper	50.952	49.048	0.2	2.088	0.74	0.35	1.13	1.42	2.088	3.1
Middle	18	42	0.28	0.134	2.01	1.46	2.56	4.31	0.134	12.94
Lower	58.076	41.924	0.2	1.502	0.41	0.02	0.8	1.02	1.502	2.23
Other	38.276	61.724	0.21	1.066	0.06	-0.35	0.47	0.7	1.066	1.6
Non M	40.2	40	0.22	1.066	0.06	-0.37	0.49	0.69	1.066	1.63

RESULT 6.4:

EXAMINE INCIDENCE AND MORTALITY BETWEEN GEOGRAPHICAL LOCATION (COMPARISON OF SMALLER AND BIGGER STATES)

The historical trend of incidence and mortality rate of different states from the year 2003-2007 has shown in the following figures.

The bigger state vs smaller state incidence and mortality occurrence of the lung cancer from 2003 -2007, as shown in the **Figures 6.4(a) …6.4(f),** indicates that geographical location along with age, race and risk factors play role in determining the rate of lung cancer. We also observed, among the all states (California, Florida, Texas, New York, Illinois, South Carolina, Colorado, Rhode Island, Wisconsin, Vermont) CA is the biggest state by population but it shows consistently lower number of incidence and mortality rate as compared to other states.

Our analysis also confirmed among the all state, Vermont is the smallest state but it consistently shows higher incidence and mortality rate starting from the year 2004. Florida and New York are consistent with the higher rate of incidence and mortality. While Rhode Island also shows higher peak starting from the year 2003 and gradually getting lower.

We have also observed that Florida, South Carolina, New York, Rhode Island, Vermont belong to the Eastern site of USA and show consistently some notable incidence and mortality rate as compared to California, Colorado, Wisconsin, Illinois and Texas which belongs to central and western site of USA and possible reasons could be environment factor.

Figure 6.4(a) Incidence and mortality rate of the year 2003

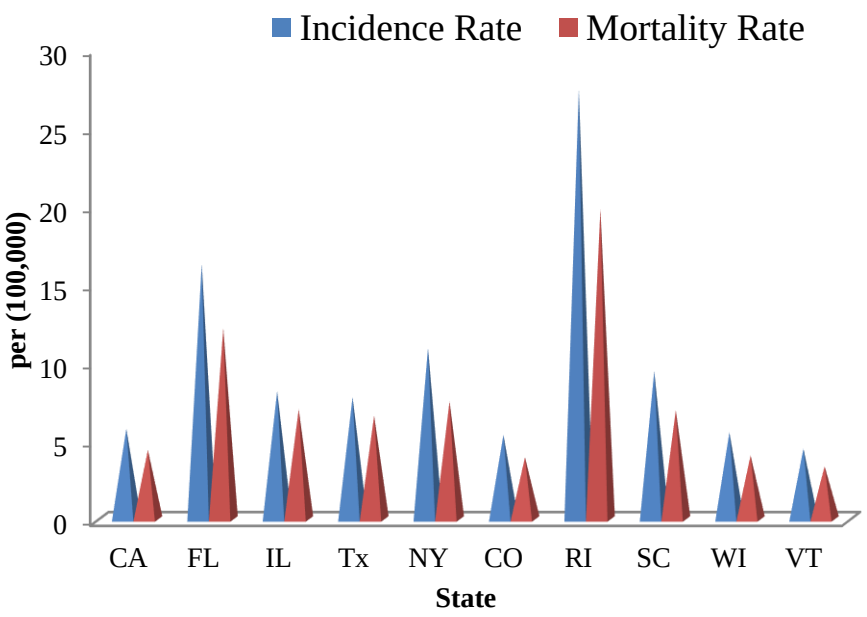

Figure 6.4 (a) Comparision of Bigger state Vs Small State 2003

Table 6.4 (a) Comparisons of Smaller Vs Bigger State 2003

Country	*US State*	*Cencus Data*	*Total Incidence*	*Mortality Level 3*	*Mortality Level 4*	*Mortality Level 5*	*Total Mortality*	*% of Incidence Base on Census*	*% of Mortality Base on Census*
United State	CA	35,484,453	2058	275	917	384	1576	5.8	4.44
2003	FL	17,019,068	2776	428	1277	377	2082	16.31	12.23
	IL	12,653,544	1040	259	496	137	892	8.22	7.05
	Tx	22,118,509	1731	457	815	197	1469	7.83	6.64
	NY	19,190,115	2108	175	924	352	1451	10.98	7.56
	CO	4,550,688	246	41	108	31	180	5.41	3.96
	RI	1,076,164	295	52	125	36	213	27.41	19.79
	SC	4,147,152	394	62	199	29	290	9.5	6.99
	WI	5,472,299	305	55	129	39	223	5.57	4.08
	VT	619,107	28	3	16	2	21	4.52	3.39

Figure 6.4(b) Incidence and mortality rate of the year 2004

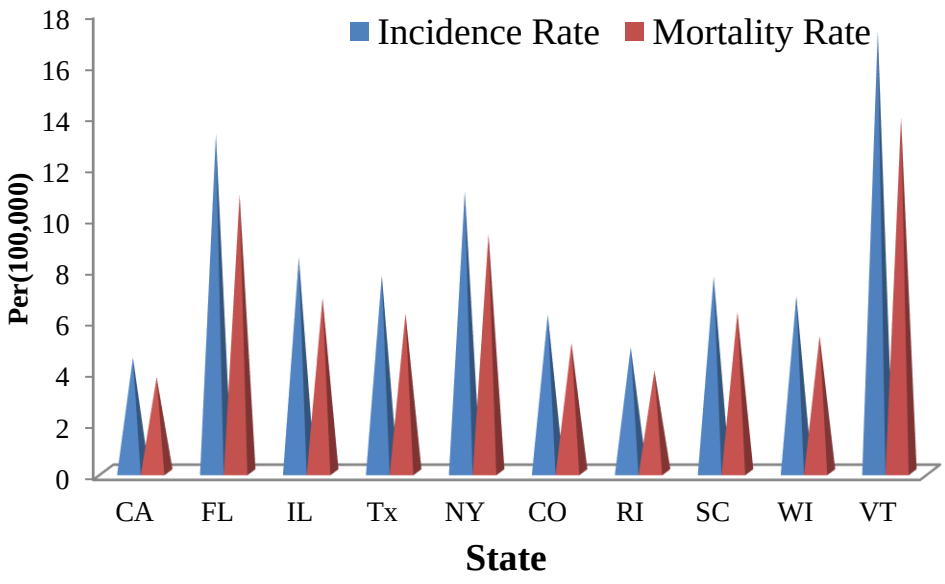

Figure 6.4 (b) Comparision of Bigger state Vs Small State 2004

Table 6.4(b): Comparisons of Smaller Vs Bigger State 2004

Country	*US State*	*Census Data*	*Total Incidence*	*Mortality Level 3*	*Mortality Level 4*	*Mortality Level 5*	*Total Mortality*	*% of Incidence -Base on Census*	*% of Mortality - Base on Census*
United State	CA	35,893,799	1613	169	602	566	1337	4.49	3.72
2004	FL	17,397,161	2295	244	960	682	1886	13.19	10.84
	IL	12,713,634	1068	115	452	301	868	8.4	6.83
	TX	22,490,022	1731	199	748	453	1400	7.7	6.22
	NY	19,190,115	2108	252	806	728	1786	10.98	9.31
	CO	4,601,403	284	29	119	85	233	6.17	5.06
	RI	1,080,632	53	5	21	17	43	4.9	3.98
	SC	4,198,068	321	32	138	93	263	7.65	6.26
	WI	5,509,026	380	55	161	78	294	6.9	5.34
	VT	621,394	107	13	37	36	86	17.22	13.84

Figure 6.4(c) Incidence and mortality rate of the year 2005

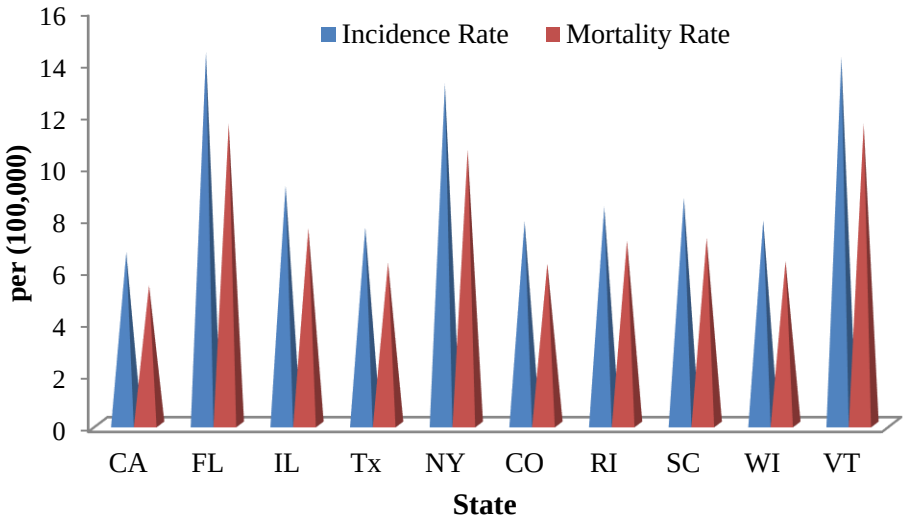

Figure 6.4 (c) Comparision of Bigger state Vs Small State 2005

Table 6.5 (c): Comparisons of Smaller Vs Bigger State 2005

Country	*US State*	*Census Data*	*Total Incidence*	*Mortality Level 3*	*Mortality Level 4*	*Mortality Level 5*	*Total Mortality*	*% of Incidence Base on Census*	*% of Mortality Base on Census*
United State	CA	36132147	2390	297	799	832	1928	6.61	5.34
2005	FL	17789864	2547	282	1061	714	2057	14.32	11.56
	IL	12765427	1172	112	495	354	961	9.18	7.53
	Tx	22859968	1731	166	702	549	1417	7.57	6.2
	NY	19254630	2523	306	919	807	2032	13.1	10.55
	CO	4,665,177	364	48	135	105	288	7.8	6.17
	RI	1,076,189	90	7	32	37	76	8.36	7.06
	SC	4,255,083	370	30	174	101	305	8.7	7.17
	WI	5,536,201	434	51	179	117	347	7.84	6.27
	VT	623,050	88	9	34	29	72	14.12	11.56

Figure 6.4 (d) Incidence and mortality rate of the year 2006

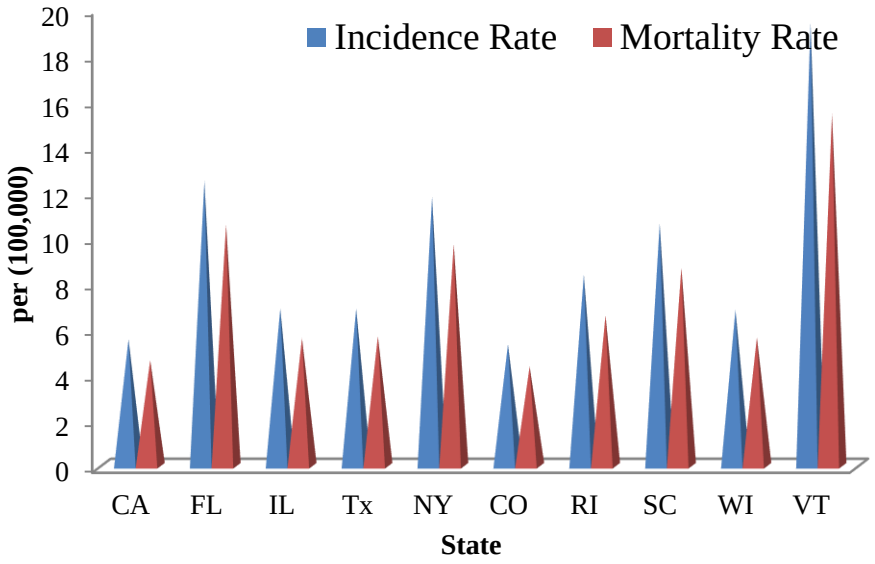

Figure 6.4(d) Comparision of Bigger state Vs Small State 2006

Table 6.4 (d): Comparisons of Smaller Vs Bigger State 2006

Country	*US State*	*Census Data*	*Total Incidence*	*Mortality Level 3*	*Mortality Level 4*	*Mortality Level 5*	*Total Mortality*	*% of Incidence Base on Census*	*% of Mortality Base on Census*
United State	CA	36457549	2012	184	706	792	1682	5.52	4.61
2006	FL	18089888	2250	172	850	882	1904	12.44	10.53
	IL	12831970	880	87	397	231	715	6.86	5.57
	TX	23507783	1612	147	693	489	1329	6.86	5.65
	NY	19306183	2266	228	842	796	1866	11.74	9.67
	CO	4753377	252	24	103	79	206	5.3	4.33
	RI	1067610	89	1	30	39	70	8.34	6.56
	SC	4321249	457	45	181	148	374	10.58	8.65
	WI	5556506	378	37	146	128	311	6.8	5.6
	VT	623908	121	15	47	34	96	19.39	15.39

Figure 6.4(e) Incidence and mortality rate of the year 2007

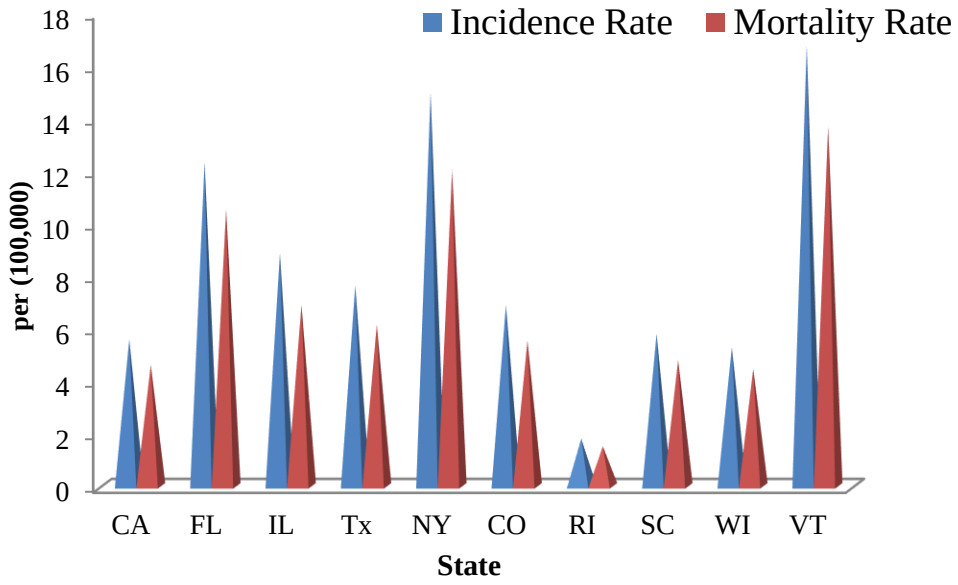

Figure 6.4 (e) Comparision of Bigger state Vs Small State 2007

Table 6.4 (e): Comparisons of Smaller Vs Bigger State 2007

Country	*US State*	*Census Data*	*Total Incidence*	*Mortality Level 3*	*Mortality Level 4*	*Mortality Level 5*	*Total Mortality Level*	*% of Incidence Base on Census*	*% of Mortality Base on Census*
United State	CA	36553215	2040	208	708	769	1685	5.58	4.61
2007	FL	18251243	2247	159	805	956	1920	12.31	10.52
	IL	12852548	1138	168	437	279	884	8.85	6.88
	TX	23904380	1824	221	675	571	1467	7.63	6.14
	NY	19297729	2886	347	1105	868	2320	14.96	12.02
	CO	4,861,515	335	42	110	117	269	6.89	5.53
	RI	1,057,832	19	0	5	11	16	1.8	1.51
	SC	4,407,709	255	22	102	87	211	5.79	4.79
	WI	5,601,640	296	22	107	121	250	5.28	4.46
	VT	621,254	104	10	34	41	85	16.74	13.68

CHAPTER 7:

SUMMARY AND CONCLUSION

Several studies have reported on the trend analysis and predicted the future trend of lung cancer. Our initial study has confirmed that due to on the smoking in the USA, the incidence and the mortality rate have started coming down or at least not increasing compared to the previous years. As reported in the past, lung cancer more frequently appears in the upper lobe than in the lower lobe of the lung. Our preliminary anatomy study of lung confirms the rate of occurrence of cancer follows an order of high to low: upper lobe, lower lobe, and other parts of the lung, main bronchus, and middle lobe.

The higher to the lower rate at each lung site could be relate to the delivery of the protective substance via the circulation and carcinogenic substances via the airways of lung, family history and dietary factors *(Gao et al., 2009; Lee et al., 1998)*. Results of previous research have also indicated, upper lobe of lung cancer is predominance among the smoker *(Lee et al., 1998)* and our result confirm that White Americans have higher risk of getting upper lobe lung cancer as our compared with other race (Black, Asian, Native American and Hispanic).

Lung cancer rate in different genders is still controversial issue, although previous research have been reported that up to certain age there is high risk of lung cancer in male as compared to females. Our analysis based on odds ratio for each anatomical site of lung indicates White males and females have equal risk of getting each category of lung cancer. The Black females have higher risk of getting lower lobe lung cancer as compared to Black males.

The Hispanic, Asian and Native American females have higher risk of getting middle lobe lung cancer as compared with males. Further research is under way for identifying incidence of various sub categories of the lung cancer and associated risk factor. In this analysis, we have concluded that as per the overall lung cancer analysis White American and Black American have equal susceptibility of lung cancer but the as per the anatomical site distribution White American (male and female) have higher risk of getting each category of lung cancer as compare with other races.

Table 7.1: Risk analysis by gender across the ethnicity

Race	Main Bronchus	Upper Lobe	Middle Lobe	Lower Lobe	Other Lungs parts	Non Malignant
White	Male and Female Equal	Male and Female Equal	Male and Female Equal	Male and Female Equal	Male and Female Equal	Female has **20% more** Susceptibility
Black	Male has **20% more** Susceptibility	Male has **40% more** Susceptibility	Male has **50% more** Susceptibility	Male and Female Equal	Male has **30% more** Susceptibility	Male and Female Equal
Hispanic	Male has **80% more** Susceptibility	Male has **71% more** Susceptibility	Female has **10% more** Susceptibility	Male has **39% more** Susceptibility	Male has **71% more** Susceptibility	Female has **9% more** Susceptibility
Asian	Male has **45% more** Susceptibility	Male has **45% more** Susceptibility	Female has **11% more** Susceptibility	Male has **22% more** Susceptibility	Male has **79% more** Susceptibility	Male has **60% more** Susceptibility
N.American	Female has **10% more** Susceptibility	Male has **100% more** Susceptibility	Male has **13% more** Susceptibility	Male has **50% more** Susceptibility	Male and Female Equal	0

As per geographic analysis, we have established bigger state by population need not have to have higher incidence and mortality rate. CA is the bigger state by population but it shows lower incidence and mortality rate as compared to other states. One of the major reasons could be that California is the first state in USA, which started tobacco control program in the year 1986 and tobacco is the biggest enemy of lung cancer (John et al., 2010)

Secondly, lung cancer is old age disease and as per the department of health and lung service, California has approximately 14% of old age population, which is very smaller as per the total population of California *(Administration of Ageing)*. In additional to that socio-economic status considers as risk factor or lung cancer. The poverty rate in CA is approximately 13% of the total population, which is lower as compare to bigger population state like TX, NY. (Texas and New York have rates, 16.2 and 14.5% respectively).

The bigger state New York and Florida are consistently at the higher site of incidence and mortality rate. During the World tread center attack on 9/11, hundreds of thousands people were exposed to the dust, fame, fumes, which increased the respiratory problem in the New York state *(NYC report)*. Among the all bigger state, New York, Florida, IL and TX have considerable higher percentage of black people and research has proved that black people have higher risk of getting lung cancer as compared to other ethnicity due to the use of methanol cigarettes. (Alberg et al.,2005). Old age population in FL is approximately 17% of total population, which is highest in all bigger state. *(Henry Foundation)*

At the opposite side, Rhode Island considers as smallest by population USA but it exhibit high incidence and mortality rate for some years then gradually going lower. Rhode Island has its own toxic legacy. It has a worst air quality, river, and lakes contaminated by

industrial toxic chemicals. (Toxic center action). Few cities of Rhode Island has twice-national poverty rate. Overall poverty rate of Rhode Island is 12%, which is higher as compared to other smaller states.

Vermont also has smaller population but it shows high rate of lung cancer starting from the year 2004. As per the report generated by the Vermont Agency of National Resources and American lung associated, Vermont has highest level of air pollution. The pollution emitted from the motorcycle is also responsible for the formation of ground level ozone and which is big enemy for the lung and respiratory diseases *(American Lung Association Fighting for Air).* Other states like, SC, CO, WI is not consistently at higher site of incidence and mortality of lung cancer. The rate of blacks people is higher in SC it is approximately 28% of total population. The rate of old age people in WI is 14% of total population.

CONCLUSION:

By seeing the lethal affects and complex interaction of gender, ethnicity along with each sub site of lung cancer, a sense of urgency requires in order to improve survival rate of lung cancer. Disparity among the interaction factors indicates strong involvement of biological factor in raising the severity of lung cancer disease. To reveal the complexity of interaction factors, join research efforts of molecular biology, clinical industry and public health, will be required.

To improve the overall outcome of disease, advance technique in the early microscopic level of tumor detection and improvement in health care facility is required.

Table 7.2: Comparison of % of poverty, old age and black population of different state

Country	*US State*	*Census Population*	*% of Poverty rate*	*Total Num of Poverty*	*% Old age population*	*Total Num of old age*	*%of black population*	*Total Num of black population*
United State	CA	36457549	13.7	4994684	11	4010330	6	2187453
	FL	18089888	11.1	200797 8	18	3256180	15	2713483
	IL	12831970	11.5	147567 7	13	1668156	14	1796476
	TX	23507783	16.2	380826 1	11	2585856	12	2820934
	NY	19306183	14.5	279939 7	14	2702866	14	2702866
	CO	4753377	11	541885	11	522871	4	190135
	RI	1067610	12	128113	15	160142	6	64057
	SC	4321249	15	648187	14	604975	28	1209950
	WI	5556506	11	605659	14	777911	5	277825
	VT	623908	8	47417	15	93586	1	6239

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