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Epidemiological Trends and Risk Factors for Lung Cancer: A Global Perspective

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Abstract:

Lung cancer accounts for 19% of all cancer-related fatalities and 17% and 9%, respectively, of all cancers in men and women. The worldwide epidemiology of lung cancer need ongoing monitoring due to its very high disease burden and the regional diversity in trends for population growth, ageing, and smoking behavior. Lung cancer epidemiology in significant industrialized nations like the United States and the European Union has continuously been recorded. When identifying lung tumors for therapy and preventative measures, histology and molecular indicators such genetic alterations are crucial. For instance, changes in the components and delivery methods of cigarettes as well as non-tobacco risk factors may be responsible for extensive temporal increases in the incidence of adenocarcinoma. Overall, there is still much to be learned about the worldwide epidemiology of these factors in connection to lung cancer incidence and death. Rate of occurrence Lung cancer's age-adjusted global incidence rate in 2012 was 13.6/100,000 for women and 34.2/100,000 for men. The incidence rates have changed significantly throughout time. Over time, there was a steady convergence of the incidence rates for both boys and females in the majority of nations (Australia, Canada, Denmark, Germany, the Netherlands, Russia, Sweden, the United Kingdom, and the United States) that were classed as having a high or very high HDI. This was caused by the notable declines in lung cancer rates among men and the persistent rise in lung cancer rates among women, albeit since 2010, the incidence of lung cancer in the US has also started to decline among women. One of the leading factors in the development of the various LC instances is smoking, specifically tobacco smoke.

People who smoke frequently are exposed to LC around 20 times more than those who have never smoked. For men, smoking causes 80% of LC, whereas for women, it causes 50% of LC. In nations where tobacco use has a history, smoking is responsible for up to 90% of LC cases. Studies examining the relationship between lung cancer incidence and socioeconomic status have revealed that those with lower educational attainment, poorer incomes, and low occupational positions are generally at a greater risk of developing lung cancer. Information on the use of vitamins as chemotherapy preventive agents in lung cancer has been conflicting. The replication of DNA and the repair of DNA damage depend on the B vitamins. Genome instability is caused by both genetic and epigenetic modifications to DNA. There is continual genetic diversity throughout the genome, which is natural. However, alterations that are functionally or positionally grouped in important parts of the genome are linked to malignancy, such as lung cancer.

Keywords: Convergence, Genome, European Union, malignancy, chemotherapy

1. INTRODUCTION

A significant illness burden is placed on the world by lung cancer. Except for keratinocyte carcinoma, lung cancer continues to be the most frequently diagnosed cancer and the leading cause of cancer-related mortality globally. Lung cancer accounts for 19% of all cancer-related fatalities and 17% and 9%, respectively, of all cancers in men and women. The worldwide epidemiology of lung cancer need ongoing monitoring due to its very high disease burden and the regional diversity in trends for population growth, ageing, and smoking behavior. Lung cancer epidemiology in significant industrialized nations like the United States and the European Union has continuously been recorded. Less is known, however, about potential variations in lung cancer incidence according to socioeconomic development levels between nations. This is significant because, according to the Human Development Index (HDI), a composite indicator of a country's development that takes into account population health, knowledge, and living conditions, over half (49%) of all lung cancer occurrences currently occur in nations with medium to low HDI rankings. Furthermore, although some studies have documented within-country variations in the incidence of lung cancer among certain subpopulations, there is little knowledge of the total magnitude of these regional inequalities from a global standpoint(Torre et al. 2015)(Jemal et al. 2011).

When identifying lung tumors for therapy and preventative measures, histology and molecular indicators such genetic alterations are crucial. For instance, changes in the components and delivery methods of cigarettes as well as non-tobacco risk factors may be responsible for extensive temporal increases in the incidence of adenocarcinoma. Overall, there is still much to be learned about the worldwide epidemiology of these factors in connection to lung cancer incidence and death(Samet et al. 2009).

As an update to a previous article in this journal that presented data from GLOBOCAN 2002, the goals of this study are to: describe the most recent patterns at country level, by region and HDI, and trends in lung cancer epidemiology globally; review and discuss the global perspectives of histologic and molecular features of lung cancer; report region- and country-specific profiles,

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emphasizing disparities and changing trends; and outline opportunities to lessen the burden of lung cancer. To clarify various tactics for preventing and managing lung cancer in these populations, we offer particular data in Objective for nations in Africa, Central and South America, Australia, China, and the United States(Youlden, Cramb, and Baade 2008).

ICD-10/ICD-O3 codes C33-C34 and ICD-9 code 162, which comprise malignant neoplasms of the trachea, bronchus, and lung, were used to designate lung cancer. The International Agency for Research on Cancer (IARC) project GLOBOCAN 2012, which provides up-to-date national estimates of cancer statistics for 184 countries, was used to extract information on lung cancer incidence and death. We give estimates for particular nations chosen to be roughly typical of the various areas and development levels, as well as regional incidence and mortality statistics broken down by geographic location and socioeconomic development. According to the 2012 HDI, a composite index created by the United Nations Development Program, countries are categorized into four categories of development (very high, high, medium, or poor)(Roca 2013)(Mahumud et al. 2019). Cancer Incidence in Five Continents Volume X's online detailed version was mined for histology-specific incidence rates. According to the World Health Organization (WHO) 2004 recommendations, small cell lung cancer and non-small cell lung cancer are the two main cell types that make up lung cancer. Non-small cell lung cancer comprises the subtypes adenocarcinoma, squamous cell carcinoma, and large cell carcinoma. The WHO just published a new histological categorization guide based on genetic, clinical, and histological criteria. The classifications used here were based on the criteria from 2004, as cancer registries have not yet adopted the revised standard. Registries were only taken into consideration if at least 60% of the cases had undergone microscopy analysis(“ United Nations Development Programme: Human Development Report 2013: The Rise of the South: Human Progress in a Diverse World ” 2013)(UNDP 2013).

To evaluate historical incidence patterns, longitudinal lung cancer data were gathered from the IARC and several cancer registries. For the IARC data, at least 60% of lung cancer cases were microscopically validated and only 30% were diagnosed by death certificate. Countries were included if at least 15 years of data were easily available. Each year, more than 100 cases of lung cancer were diagnosed in each of the listed nations in both men and women, individually(Cocker et al. 2019).

The WHO Mortality Database was used to analyze mortality trends across time. Only medically documented fatalities are included in this database, therefore completeness may differ between nations. Data availability (at least 12 years of data), annual death rates (>100 for each gender), and data completeness (>85%) were taken into consideration when choosing which countries to include. Despite the fact that the available mortality data only covered 10% of China's population and gave an estimated data completeness throughout the entire nation of just 4%, China was nonetheless included because it accounts for about one-fifth of the world's population(Roder et al. 2018)(Satgunaseelan et al. 2020).

2. Epidemiology:

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Rate of occurrence Lung cancer's age-adjusted global incidence rate in 2012 was 13.6/100,000 for women and 34.2/100,000 for men (Table 1). In comparison to predictions from 2002 (1.35 million for both genders), the rate translated to 1.82 million new cases of lung cancer (1.24 million males and 0.58 million women) (Youlden, Cramb, and Baade 2008). For both boys and females, the incidence rate was typically lowest in socioeconomically underdeveloped nations (low HDI) and greatest in socioeconomically developed countries (very high HDI). The incidence rates of those nations ranked high on the HDI were greater than those ranked extremely high, indicating that the effect did not follow a continuous gradient. Males in Eastern Asia (50.4/100,000) and Central and Eastern Europe (53.5/100,000) had the highest incidence rates among the geographic areas. Northern Europe (23.7/100,000) and North America (33.8/100,000) had the greatest incidence rates among females. The incidence rates have changed significantly throughout time. Over time, there was a steady convergence of the incidence rates for both boys and females in the majority of nations (Australia, Canada, Denmark, Germany, the Netherlands, Russia, Sweden, the United Kingdom, and the United States) that were classed as having a high or very high HDI. This was caused by the notable declines in lung cancer rates among men and the persistent rise in lung cancer rates among women, albeit since 2010, the incidence of lung cancer in the US has also started to decline among women (Lewis et al. 2014)(Lewis et al. 2015). In contrast, incidence rates are falling in Hong Kong for both genders while rising concurrently for both genders in Brazil and Japan. The main causative risk factor for lung cancer is tobacco use or cigarette smoking. In nations with very high HDIs, smoking accounts for over 90% of lung cancer deaths for men and 70% for women; in countries with high, medium, or low HDIs, the percentage is closer to 25% for women and 65% for men(Patel and Persky 2018)(Ali, Pathak, and Mandal 2023). Given that fewer women smoke overall and among Asian women in particular (2% in China), about 2000 and 2012, it is predicted that about 50% of female lung cancers globally are not related to main use of combustible tobacco (Parkin et al. 2005).

Table 1: Geographical and country-specific lung cancer incidence and death, 2012

S.no.	Region/Country	Males		Females	
		Incidence count	Mortality count	Incidence count	Mortality count
1.	**World**	1241601	1098702	583100	491223
2.	**Northern Africa**	11865	10569	2641	2371
3.	**Eastern Africa**	3102	2809	2049	1848
4.	**Middle Africa**	584	525	288	258
5.	**Western Africa**	1384	1225	992	860
6.	**Southern Africa**	4821	4302	2588	2316
7.	**Northern America**	125536	102415	114245	85297
8.	**Caribbean**	5999	5607	3542	3259
9.	**Central America**	6874	6180	3909	3482
10.	**South America**	39452	35260	24744	20814

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11.	**Eastern Asia**	556089	501654	240446	211141
12.	**Western Asia**	31697	28379	6701	5854
13.	**Western Europe**	80552	68063	39187	31690
14.	**Central and Eastern Europe**	106961	95692	31654	26299
15.	**Australia/New Zealand**	7811	5838	5547	4053
16.	**Argentina**	7690	7422	3554	3109
17.	**United States of America**	112054	91693	102172	75852
18.	**China**	459495	421695	193347	175487

The delay in lung cancer incidence rates reflecting previous changes in smoking prevalence is most likely due to the lengthy 30-year latency between tobacco smoke exposure and lung cancer development. For instance, due to their high smoking prevalence from the late 20th century onward (42.7% in 1980), Hungarian males had the highest lung cancer incidence in Europe in 2012 (76.6/100,000). Death Toll The global age-adjusted lung cancer death rate in 2012 was 11.1/100,000 for women and 30.0/100,000 for men. Lung cancer was a contributing factor in 1.59 million deaths in 2018, up from 1.18 million in 2002. The death rate by socioeconomic categories exhibited a trend resembling that of the incidence rates, with the very high HDI nations having the greatest mortality rate, followed by the medium HDI countries, high HDI countries, and low HDI countries. Males in Eastern Asia (44.8/100,000) and Central and Eastern Europe (47.6/100,000) had the highest death rates among the geographic areas. North America (23.5/100,000) and Northern Europe (19.0/100,000) had the highest female death rates. The trends in lung cancer mortality for most of the included countries (Australia, Denmark, France, Germany, Sweden, and the United States, for example) closely matched the trends in incidence, with declining mortality rates among men and rising or stable trends among women, and a gradual convergence of male: female mortality rates(Glass et al. 2019)(Haggar et al. 2012). In Romania, death trends were found to be parallel and growing for both genders; in Japan, mortality rates were found to be steady; in Hong Kong and the Russian Federation, there were simultaneous declining patterns by gender. Survival recently released 5-year relative survival estimates show significant worldwide heterogeneity despite the typically dismal prognosis. In every country where gender-specific figures were available, women often outlive men when it comes to lung cancer survival. According to these estimations, Libya, Mongolia, Chile, Bulgaria, and Thailand had some of the lowest 5-year relative survival rates in the world—less than 10%—while Japan had one of the highest globally at 30%. There is variation even within highly developed nations, so the difference is not only due to country-specific levels of socioeconomic development. For instance, the 5-year relative survival rate in the United Kingdom is about 10%, which is significantly lower than that of several other nations with a high HDI. The stage of lung cancer upon diagnosis is associated with a low survival probability in people with lung cancer.

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Patients with lung cancer who were classified as localized or regional had moderate 5-year survival rates in the United States between 2005 and 2011 (55% and 27%, respectively); for those with distant disease, this dropped to 4% (Ebrahimi et al. 2021). In 2012, just 20% of cases in England were detected when localized (10% were unstaged), while nearly half (49%) of cases were diagnosed as advanced (stages III or IV) (McPhail et al. 2015). stage ratios might vary according on the histology. Between 2005 and 2011, small cell lung cancers had the largest percentage of advanced malignancies identified in the US (almost 90% at stages III and IV), whereas squamous cell lung cancers had the lowest percentage (about 60%) (Meza et al. 2015). Furthermore, even in cases when the stage distribution of lung cancer is comparable, variance in the management of the disease (e.g., time to curative therapy and adherence to standards) is probably a significant factor in explaining the variations in survival between nations (Stevens et al. 2007)(Nadpara, Madhavan, and Tworek 2015). Even within the same region, Japan's survival rates are far higher than those of other nations. This may be explained by a number of factors, such as the high proportion of lung tumors with epithelial growth factor receptor (EGFR) mutations that respond well to targeted therapies, the standard procedure for long-term follow-up of lung cancer survivors, and the concerted national initiatives in Japan to monitor and enhance cancer care (Takenaka et al. 2016).

The estimates of survival vary even between nations. Between 2005 and 2009, China's 5-year relative survival estimates for lung cancer were much higher in Beijing (18%) and Haining (23%), compared to some rural locations like Qidong (8%) and Jianhu (5%). Additionally, there was at least a two-fold variation in lung cancer survival rates across Brazil, Thailand, and Italy. Since these estimations are not corrected for tumor stage, the causes of these discrepancies are unknown but might include diagnostic trends(Moore et al. 2010).(Aye et al. 2023)

Table 2: Estimates of the 5-year net survival (%) for lung cancer in particular nations and demographics

		5-year net survival (%) (95% CI)		
S.no.	**Country**	**Time Period**	**Males**	**Females**
1.	Australia	2006–2010	13 (12-13)	17 (16-17)
2.	Denmark	2009–2013	11 (11-12)	16 (15-17)
3.	Finland	2009–2013	10 (10-11)	16 (15-17)
4.	Iceland	2009–2013	14 (11-18)	20 (17-24)
5.	Norway	2009–2013	15 (14-15)	19 (18-20)
6.	Sweden	2009-2013	14 (13-15)	19 (18-19)
7.	United States	2010	13 (13-13)	18 (18-18)

2.1 Profiles unique to each region and country:

South Africa Lung cancer incidence rates are still low in much of Africa; male incidence rates are the lowest of all the continents at 7.7/100,000, and lung cancer fatality rates are 7.0/100,000 (GCO 2021). The low incidence rate of lung cancer may be partially due to Africa's usually

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lower life expectancy when compared to other continents, as the risk of the disease grows exponentially in late middle and older age (McCormack and Schüz 2012).

Women have far lower average rates of lung cancer incidence and death (2.6 and 2.4/100,000, respectively); however, rates vary by country, with South African females having far higher incidence rates (11.2/100,000) than those of other African nations. This discovery may be explained by the fact that, in comparison to other African nations, South Africa has a greater frequency of female smoking (10.4% in 1980 and 9.1% in 2012) (Ng et al. 2014) (Winkler, Mangolo, and Becher 2015). Compared to African women, African males smoke five to ten times as frequently. In Tunisia, over half (45%) of males and 4.5% of women were smokers in 2012. In Nigeria, the respective figures are 7.5% of men and 1.4% of women (Ng et al. 2014). Male current smoking prevalence ranged from 8.7% to 34.6% in Sub-Saharan nations (Benin, Malawi, Mozambique, Niger, Sierra Leone, and Swaziland) between 2003 and 2009. This is predicted to contribute to a rise in lung cancer mortality in the coming ten years (Winkler et al. 2013).

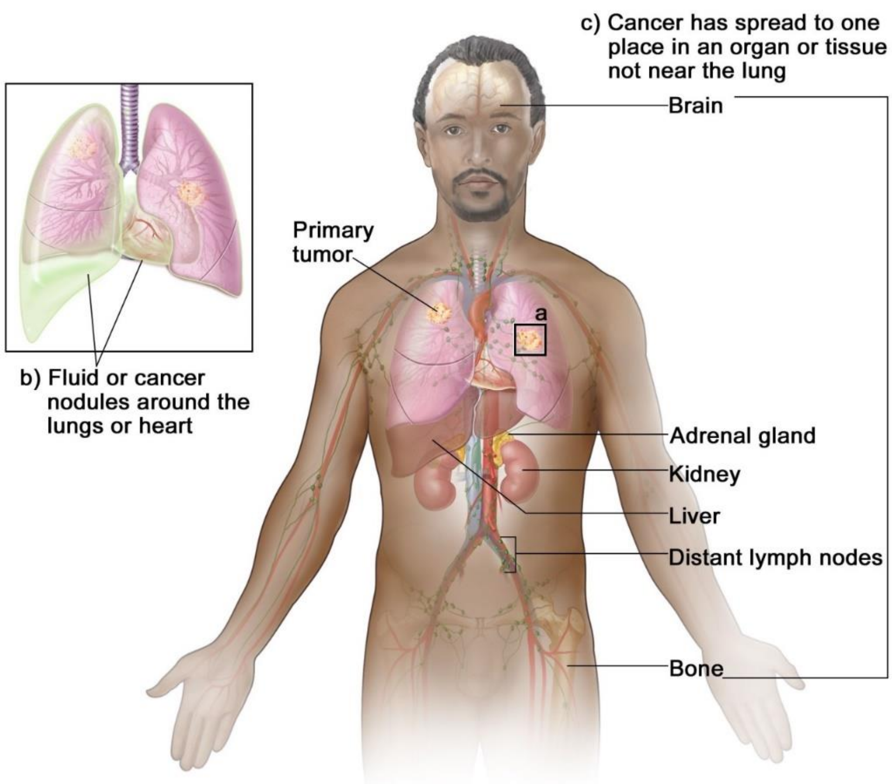

Fig 1: Stages in lungs cancer

At the end of World War II, about 25% of Australian women and over 75% of Australian males were believed to be smokers. From that point on, the percentage of adult male smokers fell, reaching 43% in 1976 and 22% in 2010 (Woodward 1984) (Gray and Hill 1977). However, the smoking frequency among adult females rose to 33% in 1976 before progressively declining to 18% in 2010. Chinese It is believed that 36% of all lung cancer cases worldwide, or more than one out of every three, occurs in China (Table 1). Throughout the last forty years, lung cancer

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has become the primary cause of cancer-related fatalities in China for both men and women, surpassing other major malignancies. From 1988 to 2011, the incidence of lung cancer has risen substantially(Chen et al. 2014). China's cancer registry coverage has been increasing, and the National Centre Cancer Registry is now in charge of overseeing them. In 2011, the incidence of lung cancer was 48/100,000 in males and 22/100,000 in women, according to data from 177 cancer registries that covered over 175 million people, or 13% of the entire Chinese population (Chen et al. 2015). In general, eastern and urban China had greater rates of lung cancer death and incidence than western and rural China.

In line with Western nations, the percentage of male lung cancer cases with adenocarcinoma has risen to a level that is comparable to or greater than squamous cell carcinoma. Most instances of lung cancer in women are adenocarcinomas.

3. Lung cancer incidence risk factors

3.1. Smoking

One of the leading factors in the development of the various LC instances is smoking, specifically tobacco smoke. People who smoke frequently are exposed to LC around 20 times more than those who have never smoked. For men, smoking causes 80% of LC, whereas for women, it causes 50% of LC. In nations where tobacco use has a history, smoking is responsible for up to 90% of LC cases. Because smoking is seen in these individuals as a moderator or a significant confounding factor, determining the reason of promoting LC in these patients is particularly challenging (Thandra et al. 2021). According to research, non-smokers who are exposed to cigarette smoke have a higher chance of developing LC because there is a 20–30% increased risk of LC for nonsmokers who marry smokers. When compared to non-smokers, the risk of LC is more than 20 to 50 times higher among heavy and ongoing smokers. The length of smoking is the most crucial risk factor for LC. The results of the American study revealed that LC rates are greater among African Americans than in other races, which may be because they smoke more. According to other study results, Japan and China have a lesser danger of spreading LC than North America and Europe. It appears that frequent and less prevalent smoking in Asian nations as compared to other nations is one of the main causes of this disparity (Rissanen et al. 2021)(Hazell et al. 2019).

3.2. Heredity and genetic susceptibility

In the setting of uncommon germ-line mutations in the tumor suppressor genes p53 and RB or RB1 (retinoblastoma) and other unique autosomal recessive illnesses including Bloom syndrome and Werner syndrome, certain families have a hereditary propensity to develop cancer. The published literature on the risk of lung cancer in families suggests a twofold increased risk in smokers with a positive family history of cancer, and this risk is further elevated if a family member was diagnosed at an early age and/or if multiple relatives have been affected. This increased risk is in the absence of a genetic syndrome. A positive family history of lung cancer is linked to a 1.5-fold greater risk of acquiring the illness in non-smoking relatives. Numerous genes' variant alleles are linked to a higher risk of developing lung cancer. Some of these genes produce the cytochrome P450 enzyme (CYP1A1 gene) and glutathione-S-transferases (GSTM1,

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GSTT1), which play key roles in the metabolism of tobacco carcinogens. Other genes, such as XRCC1, XPA, XPC, and XPD, which encode nucleotide excision repair proteins, are in charge of DNA damage repair. Additionally, acquired genetic mutations and amplifications are present in tumors, necessitating the dismantling of several regulatory mechanisms and safety nets in the cellular processes of replication, repair, and apoptosis. The majority of the lung cancer driver mutations that have received the most attention involve cellular signaling pathways. Tyrosine kinase receptors for Hepatocyte Growth Factor Receptor [HGFR] protein are encoded by the ErbB family (EGFR/ HER1, HER2, HER3, and HER4) and the c-MET gene, which is a proto-oncogene. Mutations or amplifications of these receptors can constitutively activate intracellular signaling cascades involved in cell division and proliferation (Boulenouar et al. 2022)(Consolaro and de Almeida Bianco 2017)(Feinberg 2008).

Genome instability is caused by both genetic and epigenetic modifications to DNA. There is continual genetic diversity throughout the genome, which is natural. However, alterations that are functionally or positionally grouped in important parts of the genome are linked to malignancy, such as lung cancer. Single nucleotide polymorphisms (SNPs), which occur when one nucleotide is replaced by another in a DNA sequence, might alter how a gene product functions depending on where they are located. The presence or absence of a gene can be caused by copy number changes (CNAs), which are the repetition or deletion of DNA sequences (Czene, Lichtenstein, and Hemminki 2002)(Hu et al. 2014).

3.3. Age

Due to the ongoing shortening of telomeres during repeated cell replication cycles and the increased likelihood of DNA damage with advancing age, lung cancer is in part a disease of senescence(Krist et al. 2021)(Kerpel-Fronius et al. 2022). Although lung cancer can develop in people under the age of 55, it is still quite rare in that age range. The median age upon diagnosis is currently above 70 years old. In 2006, those over 80 years old made up 24% of all lung cancer fatalities and 14% of all lung cancer patients. By the middle of this century, the number of lung cancer patients over the age of 85 is anticipated to double, at least in part due to the ageing of the population in the Western world. Compared to those aged 70 to 79 and those under 70, those who are 80 or older had a lower chance of surviving lung cancer (Zhou et al. 2017)(Nie et al. 2021).

People over 65 are diagnosed with lung cancer in the majority of instances. After the age of 50, the chance of acquiring lung cancer increases significantly and keeps rising with age. The main cause of this is long-term exposure to risk factors including smoking and environmental pollutants. The chance of acquiring lung cancer can also be affected by other variables, including smoking history, exposure to toxins (such as asbestos and radon gas), and family history of the disease. Therefore, a person's total risk for lung cancer depends on a variety of factors, including their age. Consult a healthcare provider who specializes in lung cancer prevention if you have questions about your risk of developing lung cancer (Andarini et al. 2023)(Shuryak, Kachnic, and Brenner 2021)

3.4. Race

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In the US, there are differences in the incidence and death rates of lung cancer according to racial and ethnic groupings. Lung cancer rates among African American males are significantly higher than those among non-Hispanic Caucasian white men, and both of those groups are at a higher risk than those among Native Americans, Asian Americans and Pacific Islanders, and Hispanics, for which statistics are available(Williams et al. 2022). More than twice as many African American males die of lung cancer (87.5 per 100,000) as Hispanic men (32.5 per 100,000), who have the lowest mortality rates. This number has been associated with greater smoking rates among African Americans. Non-Hispanic Caucasian whites have a somewhat higher incidence and fatality rate of lung cancer in women. Once identified, African Americans have a lower success rate(Toumazis et al. 2020)(Yang et al. 2020). Minority groups frequently experience later illness diagnosis than Caucasian whites, and African Americans also have worse 5-year survival rates at all stages of diagnosis. These discrepancies are influenced by a number of factors, including socioeconomic position, medical insurance, access to healthcare, and receipt of high-quality healthcare. However, after accounting for insurance status, a research conducted in the United States revealed that ethnicity was a predictor of more advanced illness at diagnosis, indicating that additional variables may be at play. Within ethnic groupings, the place of birth and cultural factors may also have an impact on lung cancer risk(Erhunmwunsee et al. 2022). Asians have a larger proportion of well-differentiated or less invasive adenocarcinomas, which have a better prognosis, and a lower total risk of lung cancer. However, compared to Asian Americans born in the United States, Asian men and women born abroad had a 35% greater risk of NSCLC. Asian males who were born abroad frequently smoke, which might explain the disparity (Pope et al. 2002)(Alwatari et al. 2021).

3.5. Socioeconomic status

Studies examining the relationship between lung cancer incidence and socioeconomic status have revealed that those with lower educational attainment, poorer incomes, and low occupational positions are generally at a greater risk of developing lung cancer. Levels of educational attainment and lung cancer mortality rates in the US population are remarkably correlated. Age-adjusted lung cancer mortality rates in males with more than 16 years of formal education are 10.35 per 100,000 people, compared to 51.63 deaths per 100,000 people, or five times the rate of the most educated group, among men with less than a high school education. Less educated women have a four times greater risk of dying from lung cancer than the most educated women(Shen et al. 2021)(Raman et al. 2022). The higher incidence of cigarette smoking in this population has been associated with an elevated risk of lung cancer among lower socioeconomic categories. A recent British research on hardcore smokers revealed that this group was predominately white, unmarried, male, impoverished, poorly educated, and living in rented housing. Hardcore smokers were described by defensive and rebellious attitudes towards smoking. There is a link between lower socioeconomic class and the risk of lung cancer, independent of smoking, according to previous research that has either focused on nonsmokers or has made adjustments for smoking behaviors. Numerous elements, such as tobacco smoke in the surroundings, subpar living conditions, a poor diet, and, in many areas of the world, unequal

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access to healthcare resources, are likely to be involved (Kivimäki et al. 2020)(Hwang et al. 2022).

3.6. Diet

Both mutagenic and antimutagenic natural chemicals are present in the human diet. Up to one-third of cancer fatalities in Western nations are thought to be attributable to the normal diet of the developed Western world, which consists primarily of processed foods with high fat and salt content. Heterocyclic amines (HCAs), which are created while frying meat and fish, are among the particular carcinogens connected to food. In the crust that results from protein charring, there are unusually high concentrations of HCAs. The cytochrome P450s enzymes, particularly CYP1A2, degrade HCAs. The byproducts of this process can result in DNA adducts, altering the transcription of the genome(Bade and Dela Cruz 2020)(DCPC 2021). H-Ras, K-Ras, and p53 have all undergone alterations as a result of HCA exposure in mouse studies, among other cancer-related genes. The International Agency for Research on Cancer has identified HCAs as a potential risk factor for human carcinogenesis. A risk factor for cancer is consuming too many calories. In particular, breast and colon cancer have been related to increased dietary fat intake. Gastric cancer is linked to sodium chloride. In animal models, it has been demonstrated that the polyunsaturated fatty acids in certain plant-derived oils (corn, safflower) and the saturated fatty acids from animal fats promote the growth of cancer. On the other hand, homounsaturated fatty acids, such as the oleic acid in olive oil, have no impact on the onset of cancer (Malhotra et al. 2016)(Ubago-Guisado et al. 2021).

Information on the use of vitamins as chemotherapy preventive agents in lung cancer has been conflicting. The replication of DNA and the repair of DNA damage depend on the B vitamins. When consumed in high dietary quantities or as a dietary supplement, folate (vitamin B9) has been linked to an elevated risk for lung cancer, according to a number of studies. However, a more recent study revealed no correlation between vitamin B supplementation and lung cancer, with the possible exception of a tenuous tie between riboflavin (Vitamin B2) and lower risk in current smokers(Wu et al. 2022)(Dela Cruz, Tanoue, and Matthay 2011).

3.7. Preexisting lung disease

Due to increased genetic mutation, antiapoptotic signaling, and enhanced angiogenesis, it is believed that inflammatory activities contribute to the development of lung cancer. Lung cancer risk has been associated with a number of pre-existing lung diseases. Even if there is an increased risk for emphysema and chronic obstructive pulmonary disease, tobacco use is also a factor in these conditions. The risk of lung cancer in non-smokers is nonetheless increased by conditions like asthma and chronic bronchitis. An elevated risk of lung cancer has been linked to the presence of fibrosis in the lung parenchyma. Idiopathic pulmonary fibrosis (IPF), systemic autoimmune disorders, and asbestos exposure are all causes of fibrosis. Lung cancer at that location is also associated with focal scarring in the lung. It is recognized that a number of pulmonary and systemic infections raise the chance of developing lung cancer (Hashim, Alsuwaidi, and Khan 2020)(Shimoji et al. 2020).

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A history of pneumonia or infection with Mycobacterium tuberculosis is linked to odds ratios of 1.43 and 1.76, respectively, for developing lung cancer. This ratio is constant regardless of smoking status, with never-smokers experiencing a comparable elevated risk. It is unknown if the inflammatory processes connected to infections enhance the risk of carcinogenesis or if the illness has a distinct pathogenesis. Following the diagnosis of infection, the chance of developing cancer continues to rise for extended periods of time—up to 20 years in certain cases of TB (Fujita et al. 2020)(Whittaker Brown et al. 2019).

4. Conclusion:

In summary, lung cancer's epidemiological trends and risk factors present a multifaceted challenge that demands a comprehensive and coordinated global response. Given the rising global trends in lung cancer incidence and death as well as the modest gains in survival, the global disease burden of lung cancer is anticipated to grow over the first half of this century. To estimate the existing burden and track developing trends in medium and low HDI nations, there must be a greater availability of population-based cancer data. Stronger government-level tobacco control actions as well as concerted attempts to enhance the air and environmental quality must be a part of any primary preventive strategy. Prevention, early detection, treatment, and public education are all integral components of this approach. By uniting efforts at the individual, community, and governmental levels, we can work toward reducing the global impact of lung cancer and ultimately strive for a healthier world with fewer cases of this devastating disease.

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