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# **The Relation between Tobacco Smoking and Lung Cancer**

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## **Abstract**

Tobacco smoking is a widely distributed public health problem and it is the leading cause of lung cancer. The incidence from lung cancer is trying to be controlled and reduced over the past years and the coming years in certain regions around the world due to decades of tobacco control policies and public education; meanwhile in other regions its uncontrolled and the mortality from lung cancer is expected to increase over the coming years because of the long term smokers which their ages range between 45-54 years, as nicotine is responsible for the uncontrollable addiction. For instance, in the US, new cases of lung cancer were estimated and they were 121,680 for men and 112,350 for women, for a total of 234,030, the equivalent of 641 lung cancers per day.

## Introduction

Tobacco smoking is life threatening. Over 4000 chemicals each cigar contains which it has been improved over the past 30 years. Many of them are toxic, poisonous, and invincible enough to cause different types of lung cancer either in a benign or malignant condition, followed by a high probability of fatal conditions. The most common cause of cancer death in men and second most common in women after breast cancer is lung cancer or lung tumor [1]. Worldwide in 2012 lung cancer resulted in 1.6 million deaths. Among the tremendous amount of chemicals found within a cigar, there are crucial chemicals that have been considered the top carcinogenic agents of tobacco smoking. The highly addicted chemical component Nicotine is originally derived from tobacco plants, the nightshade family. Tobacco natively grows in North and South America, back to the age of indigenous peoples of the Americas which are commonly known as the American Indians. In 1 B.C., American Indians were the first people used the tobacco plants in several different ways such as medical purposes. Tobacco at that age was believed that it was a cure medication for many diseases. As the new world was discovered, on the 15<sup>th</sup> of October 1492, an Italian explorer called Christopher Columbus was gifted from the American Indians dried tobacco leaves, which soon after, tobacco was brought to Europe by sailors due to its medical uses. As the world has developed, tobacco plants were used in miserable conditions rather than health conditions such as involving in it the nicotine chemical substance which contains nitrogen that leads to the addiction status [1].

In addition to nicotine, a hazardous, poisonous, colorless gas called carbon monoxide which is inhaled into the lungs, binding to hemoglobin on red blood cells (RBC) making a stable complex called carboxyhemoglobin (COHb) which is transported instead of oxygen diminishing the oxygen-carrying capacity in the bloodstream. Carbon monoxide is tending to be faster in binding with hemoglobin than oxygen due to its high affinity; however, it takes slower process to be exhaled throughout the lungs. Induction in the amount of oxygen in RBCs will force the cardiac muscles in the heart to work harder to distribute oxygen around the body. Other hazardous chemicals included are: *acetaldehyde* which it's a chemical used in resins and glues, *ammonia* which causes elevated blood pressure and asthma, *benzene* which is used in gasoline causes cancers such as leukemia, *cadmium* which known as a carcinogenic

agent and causes damage to vital organs such as the brain and kidneys, *chromium* which is known to cause cancers such as lung cancer, *cresol* which causes throat, nasal, and upper respiratory irritation when it is inhaled, *formaldehyde* which damages the digestive system, lungs, and skin, *lead* is used in metal alloys and paint, it will damage the nerves in the brain, as well as the reproductive system, and *nitric oxide* which scientists are saying that is linked to higher risk of Alzheimer's disease, Parkinson's disease, and asthma. Many diseases are lined by all of those toxic components and many people are not cognizant of this habit, as its deteriorating and progressing along the years especially between teenagers [2].

The aim and the purpose of this report is to discuss the sequence process of how tobacco smoking can cause terrifyingly different types of lung cancers and how the addiction process is working as many people are not aware and informative with it, as our ambition is to try to help people to quit tobacco use and reduce the rates of smokers especially ages between 15-24, as it had been estimated between year 2000-2015 a marked reduction.

## **Materials and Methods**

According to World Health Organization (WHO), in 2018 a whole global report on trends in prevalence of tobacco smoking between years 2000-2025 had been settled and estimated. By using a specific type of method, the estimate for the indicator of tobacco smoking was modeled. The consequence of the model is a set of trend lines for each country that summarize prevalence between 2000 and 2015 and project trends to 2025. Separately, the model was fitted for men and women, along with age specific rates. Between 1990 and 2015, prevalence rates were sourced from nationally representative household surveys in a dataset. The model was run for all countries with surveys, except the countries that have insufficient or no survey data; however, by assuming that the prevalence are the same as the average for the United Nations sub-region, they were included in global and regional results. In different countries, a wide variety of types of tobacco use were monitored, also 146 countries had collected information on smoking behavior more than once among people aged  $\geq 15$  years [2].

## Results

In all age groups between 2000 and 2015, the prevalence of tobacco smoking decreased gradually, and during 2015-2025 the reduction is expected to continue in all age groups. People aged 45-54 years are the highest among the prevalence of tobacco use in all periods and they are highly threatened by developing lung cancer. This is clearly shown in table 1 below.

**Table 1: Estimated prevalence of different ages [2].**

Age group (years)	Estimated prevalence (%)				Projected prevalence (%)	
	2000	2005	2010	2015	2020	2025
15-24	19.1	17.1	15.7	14.3	13.1	12.3
25-34	27.0	24.3	21.9	20.2	18.8	17.2
35-44	32.0	29.0	26.5	24.1	22.0	20.6
45-54	33.2	30.1	27.4	25.4	23.5	21.5
55-64	29.6	26.8	24.6	22.7	21.1	19.9
65-74	24.4	22.1	20.0	18.4	17.3	16.2
75-84	19.4	17.4	16.0	14.7	13.6	12.7
≥ 85	15.3	14.0	12.4	11.5	10.7	10.0

In almost all regions of the world, the prevalence of the tobacco smoking appears to be decreasing, except for the WHO African and East Mediterranean regions. Only one region is on the track to reach the 2025 target of a 30% reduction among both genders are the Americas. This is clearly shown in table 2 below.

**Table 2: Estimated prevalence of WHO regions [2].**

Sex	WHO Region	Estimated prevalence (%)				Projected prevalence (%)		2025 Target (%)	Gap*
		2000	2005	2010	2015	2020	2025		
Both	All	26.9	24.3	22.1	20.2	18.7	17.3	15.5	-1.8
	African	12.6	11.5	10.6	10.0	9.4	9.0	7.4	-1.6
	Americas	28.0	23.8	20.3	17.4	15.0	13.0	14.2	1.2
	Eastern Mediterranean	19.3	18.4	18.1	18.1	18.3	18.7	12.6	-6.1
	European	37.3	34.5	32.0	29.9	28.0	26.3	22.4	-3.9
	South-East Asian	24.1	21.2	18.9	17.2	15.8	14.7	13.2	-1.5
	Western Pacific	29.9	27.9	26.2	24.8	23.5	22.3	18.4	-3.9
Males	All	43.0	39.6	36.6	34.1	31.9	30.0	25.7	-4.4
	African	20.8	19.6	18.5	17.7	17.0	16.4	13.0	-3.5
	Americas	33.4	28.9	25.1	22.0	19.2	16.9	17.6	0.7
	Eastern Mediterranean	32.6	32.6	33.1	33.9	34.9	36.2	23.2	-13.0
	European	49.3	45.4	41.9	38.7	36.0	33.5	29.3	-4.2
	South-East Asian	41.3	37.6	34.5	32.1	30.0	28.2	24.2	-4.0
	Western Pacific	55.0	51.7	48.9	46.4	44.2	42.1	34.2	-7.8
Females	All	10.9	9.0	7.5	6.4	5.4	4.7	5.3	0.6
	African	4.4	3.5	2.8	2.3	1.9	1.5	1.9	0.4
	Americas	22.6	18.6	15.4	12.9	10.8	9.1	10.8	1.7
	Eastern Mediterranean	6.1	4.2	3.0	2.3	1.7	1.3	2.1	0.8
	European	25.2	23.6	22.2	21.0	20.0	19.1	15.6	-3.6
	South-East Asian	7.0	4.8	3.3	2.3	1.6	1.2	2.3	1.1
	Western Pacific	4.7	4.1	3.5	3.1	2.8	2.5	2.5	0.0

\* The target gap is calculated from (2025 target – 2025 projected prevalence). The values are affected by rounding.

However, beyond all the results that marked a reduction in the number of tobacco smokers, worldwide in 2018 estimated 2 million new cases of lung cancer which were expected to be diagnosed, accounting approximately 11% of total cancer diagnoses, and estimated more than 1.7 million deaths each year [3]. The WHO estimated that the number of lung cancer deaths will continue to increase over the coming years as a result of a long-term tobacco smokers specifically ages between 45-54 years, as they are not just harming themselves but also harming people around them (passive smoking), and harming environmentally the whole globe.

## Discussion

The longer you smoke, the longer it takes you to quit, putting you in a high risk for developing lung cancer, especially the long-term smokers. So, what actually drives people to hardly quit smoking once they try it? It's the dependence of nicotine as

there are three phases characterize it: *Maintenance and acquisition of behavior of nicotine intake*: The administration of nicotine through tobacco smoking in humans produces a pleasurable mild rush, mild euphoria, increased arousal, decreased fatigue, and relaxation. In the initiation and maintenance of tobacco smoking, these reinforcement effects play a crucial role, especially as a beginner. *Withdrawal symptoms upon cessation of nicotine intake*: Nicotine use induces neuroadaptations in the brain's reward system that result in the development of nicotine dependence. Thus, nicotine dependent smokers must continue nicotine intake to avoid distressing somatic and effective withdrawal symptoms [4]. Smokers experience symptoms such as depressed mood, anxiety, irritability, bradycardia, and insomnia. Exhibiting a nicotine withdrawal syndrome includes both somatic signs and negative effective state. The somatic signs of nicotine withdrawal include jumping, rearing, shakes, chewing, scratching, abdominal constrictions, and facial tremors. The negative effective state of nicotine withdrawal is characterized by decreased responsiveness to previously rewarding stimuli, a state called anhedonia. *Vulnerability to relapse*: Abstinent smokers remain prone to relapse for weeks, months, or even years after cessation of tobacco smoking. Resumption of smoking, like relapse to other drugs of abuse, often occurs upon exposure to people places, objects, or other stimuli that individuals have learned to associate with the positive rewarding effects of the drug. Stress of cigarette smoking itself can also precipitate resumption of habitual smoking [5].

Followed by the Inhalation of tobacco smoke particles, the lungs are one of the vital organs in the body for breathing, and they are the main parts of the respiratory system. During the tobacco smoke, the smoke gradually lapses and irritates three sections along its contamination process. As tobacco smoke is getting inhaled for a long period through the oral cavity, a black, sticky substance that is highly toxic and carcinogenic called tar coats the teeth and damages its enamel, discoloring them and making them more sensitive with mild pain. Gums also get coated in tar, as time pass by, they become black and recede with bleeding. As the particles are traveling along the upper respiratory tract, serious conditions take place. The upper respiratory tract is made of pseudo-stratified columnar epithelium layer, which the striated part is the protective part against any harmful foreign bodies. Long periods of tobacco smoking irritates and damages this lining of the trachea, which it's also coated by cilia (microscopic hair-like structures) that have a rhythmic waving that sweeps and cleans the mucus

dirt in the picture of a voluntary or involuntary act called tussis (cough) [6]. Once it is damaged it will lead to smokers to cough severely as the remaining cilia are struggling to clear out the tar and all of the other toxic foreign substances. After travelling through the upper respiratory tract (trachea), the smoke diffuses into the lungs. In the lungs, there are tiny air balloon shaped sacs called alveoli which they exchange oxygen and carbon dioxide (diffusion process). The alveoli pick up tremendous amount of oxygen due to its large surface area (energy intake) in an inhalation process and releases out the carbon dioxide (waste product) in an exhalation process.

Lung cancer arises from the cells of the respiratory epithelium and it is divided according to its histo-pathologic condition into two broad categories. A highly malignant, aggressive tumor derived from cells exhibiting neuroendocrine characteristics and an account for 15% of lung cancer cases is the small cell lung cancer (SCLC). It metastasizes early in the disease process. Non-small cell lung cancer (NSCLC), which accounts for the remaining 85% of cases, is further subdivided into three pathologic types: adenocarcinoma, squamous cell carcinoma, and large cell carcinoma. The incidence of *adenocarcinoma* in the past several decades has increased greatly; replacing squamous cell carcinoma as the most prevalent type of NSCLC and it precisely develops from a particular type of cell which produces mucous, which lines the airways [7]. NSCLC grows and spreads more slowly than SCLC and it's often found in the periphery of the lungs. Few specific symptoms are associated with the disease in its early stage; therefore approximately more than 60% of cases are not diagnosed until the disease reaches its advanced stage due to the aggressive symptoms such as persistent cough, coughing up phlegm with signs of blood along with chest pain and dynamic changes that start to develop within the patient in many different ways, leading limited chances for treatment and cure with low probability of surviving as the cancer has spread all over the lungs and to other parts of the body [7]. *Squamous cell carcinoma* develops from cells that line the airways. Near the center of the lungs in one of the main airways, the squamous cell carcinoma takes place and develops either in the right or left bronchus. Regarding the two typical different locations that adenocarcinoma and squamous cell carcinoma develops, *large cell carcinoma* cells can develop in any part of the two lungs as they appear large and round under a microscope. Depending on the type, stage, size, and position of the cancer in the lung, treatment is provided. Treatments



included are chemotherapies, radiotherapies, biological therapies (monoclonal antibodies, gene therapies, and vaccines), and surgery. Biological therapies are relatively a new line cancer treatment that targets specific biological processes essential to tumor growth and it may potentially be more beneficial and effective than the other types of treatments and less toxic to healthy cells [8].

## Conclusion

Ultimately, even though a high percentage of smokers had quit the tobacco use, on the other hand there are still a high percentage of continuous smokers; in addition, the new generation is deviating through this habit which its leading them to adapt impropriety behavior, along with a high risk developing lung cancer which may increase the mortality of this condition. It's to be hoped in 20 years, we observe a noticeable, marked decline in this issue that concerns the whole globe as the amount of written reports, articles, leaflets, and public education nowadays will help people to realize the danger of this bad habit.

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