Original Research Article

Lung Cancer: A Chronic Disease Epidemiology; Prevalence Study.

Abstract

Chronic lung diseases (CLD) including asthma or chronic obstructive pulmonary disease (COPD) are a leading cause of morbidity and mortality worldwide and their occurrence in multiple sclerosis (MS) remains of interest. Increasing awareness of the possible adverse effect of CLD on outcomes in MS, such as disability progression and mortality, has heightened the need to understand the relationship between these chronic conditions**.** Prevalence of Lung Cancer was discussed in this paper, with intend to; Investigate the number of patients and deaths affected with lung cancer, test the effect of sex on lung cancer incidence, test the effect of environment and educational level on lung cancer incidence, examine the trend in lung cancer, and measure the relative risk associated with lung cancer. Secondary data sourced from the records units of five different hospitals was used. Cross tabulation, Chi-square test for independence, Regression Analysis, Correlation Analysis and Odds Ratio were applied on the three year study. From the study, it was found that lung cancer cases are independent on environmental factor, educational level and sex. A strong linear relationship exists between Lung Cancer and death from such disease, implying that increase in the number of lung cancer cases has very high positive effect on the occurrence of death (r = 0.783), 61.4% of the variation in death occurrence is explained by lung cancer. The probability of dying from lung cancer is higher in patients 50 years and above than in younger patients (age < 50 yrs).

Keywords: *Lung cancer, chronic disease epidemiology, prevalence study, odds ratio, relative risk.*

1. Introduction

Lung cancer, also known as lung carcinoma,[1-3] is a malignant lung tumor characterized by uncontrolled cell growth in tissues of the lung. If left untreated, this growth can spread beyond the lung by process of metastasis into nearby tissue or other parts of the body [4-5]. Most cancers that start in the lung, known as primary lung cancers, are carcinomas that derive from epithelial cells. The main primary types are small-cell lung carcinoma (SCLC) and non-small-cell lung carcinoma (NSCLC). The most common symptoms are coughing (including coughing up blood), weight loss, shortness of breath, and chest pains.[6] The vast majority (85%) of cases of lung cancer are due to long-term exposure to tobacco smoke.[7] About 10–15% of cases occur in people who have never smoked.[8] These cases are often caused by a combination of genetic factors[9] and exposure to radon gas,[10] asbestos,[11] or other forms of air pollution,[12] including second-hand smoke.[11] Lung cancer may be seen on chest radiographs and computed tomography (CT) scans. The diagnosis is confirmed by biopsy [12] which is usually performed by bronchoscopy or CT-guidance. Treatment and long-term outcomes depend on the type of cancer, the stage (degree of spread), and the person's overall health, measured by performance status. Common treatments include surgery, chemotherapy, and radiotherapy. NSCLC is sometimes treated with surgery, whereas SCLC usually responds better to chemotherapy and radiotherapy.[13] Overall, 16.8% of people in the United States diagnosed with lung cancer survive five years after the diagnosis,[14] while outcomes on average are worse in the developing world. Worldwide, lung cancer is the most common cause of cancer-related death in men and women, and was responsible for 1.56 million deaths annually, as of 2012.[14] Signs and symptoms which may suggest lung cancer include; Respiratory symptoms: coughing, coughing up blood, wheezing, or shortness of breath, Systemic symptoms: weight loss, weakness, fever, or clubbing of the fingernails and Symptoms due to the cancer mass pressing on adjacent structures: chest pain, bone pain, superior vena cava obstruction, or difficulty swallowing If the cancer grows in the airways, it may obstruct airflow, causing breathing difficulties. The obstruction can lead to accumulation of secretions behind the blockage, and predispose to pneumonia.[15] Depending on the type of tumor, paraneoplastic phenomena—symptoms not due to the local presence of cancer—may initially attract attention to the disease.[16] In lung cancer, these phenomena may include hypercalcemia, syndrome of inappropriate antidiuretic hormone (SIADH, abnormally concentrated urine and diluted blood), ectopic ACTH production, or Lambert–Eaton myasthenic syndrome (muscle weakness due to autoantibodies). Tumors in the top of the lung, known as Pancoast tumors, may invade the local part of the sympathetic nervous system, leading to Horner's syndrome (dropping of the eyelid and a small pupil on that side), as well as damage to the brachial plexus.[17] Many of the symptoms of lung cancer (poor appetite, weight loss, fever, fatigue) are not specific.[18] In many people, the cancer has already spread beyond the original site by the time they have symptoms and seek medical attention.[19] Symptoms that suggest the presence of metastatic disease include weight loss, bone pain and neurological symptoms (headaches, fainting, convulsions, or limb weakness).[20] Common sites of spread include the brain, bone, adrenal glands, opposite lung, liver, pericardium, and kidneys.[20] About 10% of people with lung cancer do not have symptoms at diagnosis; these cancers are incidentally found on routine chest radiography.[21-22] Therefore in this paper, we intend to;

i. Investigate the number of patients and deaths affected with lung cancer
ii. Test the effect of sex on lung cancer incidence
iii. Test the effect of environment and educational level on lung cancer incidence
iv. Examine the trend in lung cancer.
v. Measure the relative risk associated with lung cancer.

2. Methodology

To achieve the set objectives, data pertaining the subject matter was obtained from the records unit of five different hospitals.

2.1 Chi-Square Test for Independence

This test was applied to investigate the agreement between the observed and expected frequencies;

$$X^2 = \sum_{i=1}^{r}\sum_{j=1}^{c}\frac{\left(o_{ij}-e_{ij}\right)^2}{e_{ij}}$$

And to test the hypothesis of independence
H_0: The Classification is independent
H_1: The Classification is dependent

2.2 Regression Model

Here we shall make use of the estimated model given by;

$$\hat{y} = a + bx$$

To determine the relationship between the number of lung cancer patients and their death cases where,

$$\hat{b} = \frac{(n\sum xy - \sum x \sum y)}{n\sum x^2 - (\sum x)^2}$$

$$\hat{a} = \bar{y} - \hat{b}\bar{x}$$

2.3 Correlation Coefficient ‘R’ and Coefficient Of Determination 'R^2'

$$\hat{b} = \frac{(n\sum xy - \sum x \sum y)}{(n\sum x^2 - (\sum x)^2)(n\sum y^2 - (\sum y)^2)}$$

$$R^2 = \frac{SS_Y - SS_E}{SS_{YY}} = 1 - \frac{SS_E}{SS_{YY}} \qquad for\ 0 < R^2 < 1$$

2.4 Odds Ratio

We employed this ratio to measure the risk of experiencing the outcome under study when the antecedent factor is present.

Table 1: Odd Ratio

	B	$\bar{B}$	Total
A	P_{11}	P_{12}	$P_{1.}$
$\bar{A}$	P_{21}	P_{22}	$P_{2.}$
Total	$P_{.1}$	$P_{.2}$	$P_{..}$

Therefore,

$$O_A = \frac{P_{11}}{P_{12}}$$

$$O_{\bar{A}} = \frac{P_{21}}{P_{22}}$$

$$O = \frac{O_A}{O_{\bar{A}}}$$

$$S.E\ (O) = \frac{O}{(n)^{1/2}} = \left(\frac{1}{P_{11}} + \frac{1}{P_{12}} + \frac{1}{P_{21}} + \frac{1}{P_{22}}\right)^{1/2}$$

Thus, the estimated odds ratio is;

$$RR = \frac{P(B/A)}{P(\bar{B}/A)}$$

3. Data Analysis and Result

3.1 Chi-Square Test for Independence of Sex on Lung Cancer Cases.

Table 2: Data Showing Age and Sex on Lung Cancer

Age	Sex		Total
	Male	Female	
< 50	26	5	31
≥ 50	22	8	30
Total	48	13	61

H_0: Lung Cancer cases are independent on Sex
H_1: Lung Cancer cases are dependent on Sex

Table 3: Age * Sex Cross tabulation

	Sex		
	Male	Female	Total

Age	< 50	Count	26	5	31
		Expected Count	24.4	6.6	31.0
	≥ 50	Count	22	8	30
		Expected Count	23.6	6.4	30.0
Total		Count	48	13	61
		Expected Count	48.0	13.0	61.0

Table 4: Chi-Square Test

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.010[a]	1	.315		
Continuity Correction[b]	.479	1	.489		
Likelihood Ratio	1.016	1	.313		
Fisher's Exact Test				.363	.245
Linear-by-Linear Association	.993	1	.319		
N of Valid Cases[b]	61				

From Table 4, we see that "$\chi^2_{cal} = 1.010$" this χ^2_{cal}value is less than the "$\chi^2_{0.05,1} = 3.841$" thus, we do not reject the null hypothesis and therefore conclude that lung cancer cases are independent on Gender.

3.2 Chi-Square Test for Independence Of Environment on Lung Cancer Cases.

Table 5: Data Showing Age and environment on lung Cancer

Age	Environment		Total
	Urban	Rural	
< 50	22	9	31
≥ 50	17	13	30
Total	39	22	61

H_0: Lung Cancer cases are independent on Environmental factor
H_1: Lung Cancer cases are dependent on Environmental factor

Table 6: Age * Environment Cross tabulation

	Environment		Total
	Urban	Rural	

Age	< 50	Count	22	9	31
		Expected Count	19.8	11.2	31.0
	≥ 50	Count	17	13	30
		Expected Count	19.2	10.8	30.0
Total		Count	39	22	61
		Expected Count	39.0	22.0	61.0

Table 7: Chi-Square Test

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.352[a]	1	.245		
Continuity Correction[b]	.803	1	.370		
Likelihood Ratio	1.358	1	.244		
Fisher's Exact Test				.293	.185
Linear-by-Linear Association	1.330	1	.249		
N of Valid Cases[b]	61				

From Table 7, we see that "$\chi^2_{cal} = 1.352$", this χ^2_{cal} value is less than the "$\chi^2_{0.05,1} = 3.841$" thus, we do not reject the null hypothesis and therefore conclude that lung cancer cases are independent on environmental factor.

3.3 Chi-Square Test for Independence of Educational Level on Lung Cancer Cases.

Table 8: Data Showing Age and Educational Level on Lung Cancer

Age	Educational Level			Total
	Tertiary	Secondary	Primary	
< 50	12	13	6	31
≥ 50	5	12	13	30
Total	17	25	19	61

H_0: Lung Cancer cases are independent on Educational Level
H_1: Lung Cancer cases are dependent on Educational Level

Table 9: Age * Educational Level Cross tabulation

			Educational Level			Total
			Tertiary	Secondary	Primary	
Age	< 50	Count	12	13	6	31

		Expected Count	8.6	12.7	9.7	31.0
	> 50	Count	5	12	13	30
		Expected Count	8.4	12.3	9.3	30.0
Total		Count	17	25	19	61
		Expected Count	17.0	25.0	19.0	61.0

Table 10: Chi-Square Test

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.486[a]	2	.064
Likelihood Ratio	5.634	2	.060
Linear-by-Linear Association	5.392	1	.020
N of Valid Cases	61		

From Table 10, we see that "$\chi^2_{cal} = 5.486$", this χ^2_{cal} value is less than "$\chi^2_{0.05,2} = 5.991$" thus, we do not reject the null hypothesis and therefore conclude that lung cancer cases are independent on educational level.

3.4 Regression Analysis on the Total Number of Lung Cancer Cases and Death from Such Cases

Table 11: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.783[a]	.614	.607	.968

Table 12: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.805	.372		.230	.042
	Lung Cancer Cases	.362	.037	.783	9.679	.000

Table 11 clearly shows a strong linear relationship exists between Lung Cancer and death from such disease, implying that increase in the number of lung cancer cases has very high positive effect on the occurrence of death (r = 0.783). Also, 61.4% of the variation in death occurrence is explained by lung cancer cases while 38.6% of the variation is due to other factors other than lung cancer. Table 12 shows that a unit increase in lung cancer cases results in an increase in the number of death occurrence (b = 0.362), implying that there is a direct relationship between the number of lung cancer cases and the number of death occurrence from the disease.

3.5 Calculation of Odds Ratio for Lung Cancer Cases.

Table 13: Age * State of Patient

Age		State of Patients		Total
		Death	Alive	
A	< 50	9	22	31
Ā	≥ 50	14	16	30
Total		23	38	61

Table 14: Proportions; Age * State of Patient

Age		State of Patients		Total
		Death	Alive	
A	< 50	0.15	0.36	0.51
Ā	≥ 50	0.23	0.26	0.49
Total		0.38	0.62	1

$$P(B/A) = 0.71$$
$$P(\bar{B}/A) = 0.55$$
$$O_A = 0.42$$
$$O_{\bar{A}} = 0.88$$
$$O = 0.47$$
$$RR = \frac{P(B/A)}{P(\bar{B}/A)} = 0.62$$

From the equations above, O_A is 5/12 implying that 5 out of every 12 lung cancer patients aged less than 50 years is expected to die. Similarly, $O_{\bar{A}}$ is 23/26 implying that 23 out of every 26 lung cancer patient aged more than 50 years is expected to die. Equation 5 revealed an odds ratio of 0.41 indicating that the odds of lung cancer patient aged less than 50 years dying is 51% lesser than those aged 50 years and above. Relative Risk of lung cancer patient dying is " $^{31}/_{50} \approx 0.62$ " times higher for patients aged 50 years and above when compared with those aged below 50 years of age.

4. Conclusion and Recommendation

Based on the findings so far, we hereby conclude that the prevalence of lung cancer is independent on sex, environment and educational level, this therefore implies that it depends on other factors not considered in the study, this may include; tobacco smoking, genetic factors and exposure to random gas, asbestos or other forms of air pollution. Also, lung cancer claims more life in Older patients (age ≥ 50 yrs) than in younger patients (age < 50 yrs). Therefore, the government should try as much as possible to eliminate tobacco smoking and the smoking of cessation. Policy interventions decreasing passive smoking in public areas such as restaurants and workplaces should be put in place. Also, the government to adhere to the World Health Organizations instructions to institute a total ban on tobacco advertising to prevent young people from taking up smoking.

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