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# Impact Of Modifiable Risk Factors Associated With Lung Cancer: A Case-Control Investigation

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***Abstract***

***Introduction****:The average survival time for lung cancer, the most common cancer in the world, is between three and seven months following diagnosis. This study aims to explore the relationship between lung cancer and adjustable risk factors. The importance of having changeable risk factors for lung cancer is emphasized in a 2023 study by Kumar et al.*

***Objectives:*** *to examine how changeable lung cancer risk factors affect the study and control groups.* ***Methodology****: a case-control design-based quantitative non-experimental technique approach. One subject was identified by the researcher using a purposive selection technique for the quantitative non-experimental approach, and sixty samples were chosen using a random sampling method.*

***Results:*** *The present study showed that the case group's overall lung function was. The Cancer Risk Assessment score for the control group was 18.93, whereas it was 17.20 for the treatment group. This suggests a 1.73 difference. Comparing the TAPS risk scores of the case and control groups. The case group scored 18.47, while the control group scored 15.20. This indicates a 3.27-point disparity, which is both considerable and noteworthy. The student's independent t-test was utilized to assess it. It is t=3.89, p=0.001*** (S) Comparison of the cigarette dependence scores between the case and control groups. The control group's score is 35.90, while the case group's score is 23.30. This indicates that it was tested using a 12.60-point difference, which is both large and statistically significant. Student's independent t-test (t = 9.10, p = 0.001***[S]).*

***Conclusion:*** *This case-control study underscores the importance of modifiable risk factors in contributing to the development of lung cancer. The goal of future studies and legislative initiatives should be to raise awareness of and accessibility to preventative measures, especially among high-risk groups.*

***Keywords:*** *Impact, Modifiable Risk Variables, Associated, Lung Cancer, Case - Control*

## INTRODUCTION:

Lung cancer, currently the most prevalent form of cancer globally, is often associated with a poor prognosis, with an average life expectancy of just three to seven months following diagnosis [1]. Cancer, a broad term encompassing over 200 related diseases, is marked by the uncontrolled proliferation of abnormal cells [2]. When cancer originates in the lung tissue, it is referred to as primary lung cancer [3].

A 2023 study by Kumar et al. highlights the significant role of modifiable risk factors such as tobacco use, environmental exposures, and occupational hazards in the development and progression of lung cancer [4]. Despite advancements in medical treatment, these preventable factors are often overlooked [5]. This study aims to assess the impact of such changeable risk factors and to address existing gaps in public knowledge and attitudes through targeted education and intervention [6]. By examining the relationship between lung cancer and modifiable risk factors, the study aims to promote prevention-oriented strategies and informed health behaviors.

**Statement of the problem**

" Impact Of Modifiable Risk Variables Associated With Lung Cancer: A Case-Control Investigation ."

**Background of the study:**

Globally, Lung cancer remains the leading cause of cancer-related deaths worldwide, accounting for approximately 1.8 million deaths annually, which represents about 18% of all cancer fatalities. By 2025, the global cancer burden is projected to rise significantly, with an estimated 1.57 million new cases expected each year—reflecting a 12.8% increase. Nationally, In India, findings from the National Family Health Survey (NFHS-4, 2015–2016) reveal a high prevalence of tobacco use, with 28.6% of the population using tobacco products—42.4% of men and 14.2% of women—amounting to an estimated 267 million users, as reported in the Global Adult Tobacco Survey-2 (GATS-2, 2016–2017). Tamil Nadu is among the top five Indian states anticipated to bear the highest cancer burden by 2025, with a projected 93,536 new cancer cases, underscoring the urgent need for robust preventive and control measures.

**Objectives of the Study:**

1. To evaluate the prevalence of potentially modifiable risk factors linked to lung cancer in both the case and control groups.
2. To examine the impact of modifiable risk factors on the development of lung cancer in individuals from both the case and control groups.
3. To explore the relationship between selected demographic characteristics and modifiable risk factors in individuals with and without lung cancer.

**Hypothesis**

**$H_1$:** "Potentially modifiable factors will demonstrate significantly different associations with lung cancer outcomes."

**$H_2$:** "Higher levels of modifiable risk factors will be significantly correlated with increased lung cancer incidence."

## MATERIALS AND METHODS:

**Study Design**

"A quantitative, observational case–control design (non-experimental) was conducted to explore how modifiable risk factors contribute to lung cancer."

**Sample**

"Following sample size estimation, 60 participants—comprising 30 lung cancer patients and 30 matched controls—were recruited. The investigation was carried out in the Oncology Department of Rajiv Gandhi Government General Hospital (Chennai–03) and among the Choolai urban population."

**Data Collection Tools**

"Demographic data were obtained through standardized surveys completed by men and women, which also included a lung cancer risk assessment scale, the TAPS tool for substance use, and a cigarette dependence questionnaire."

**Statistical Analysis**

"Summary statistics described the demographic profile. Matched-pair t-tests assessed intra-group score changes, while chi-square tests evaluated inter-group categorical differences. A threshold of $p \leq 0.05$ denoted significance."

## RESULTS

### Demographic Characteristics

In the area of Residence,53.33% of them in the Case group and 7 0 .00% of them in the control group belong to Rural, Regarding Life Style Habits, 33.33% oher bad habits of them in the Case group and 46.67% of them in the control group belong to Smoker & Drinker, Regarding religion, 66.67% of them in the Case group and 83.33% of them in the control group belong to Hindu, Regarding Marital status 93.33% of them in the Case group and 86.67% of them in the control group belong to Single.

### Test - Lung Cancer Risk Assessment

"In the case group, 36.67% of participants demonstrated a low knowledge score, while 63.33% exhibited a moderate level. Among controls, 30.43% had low scores and 69.57% had moderate scores. Although control subjects scored slightly higher on the lung cancer risk assessment, the mean difference - just 1.73 points - yielded a Cohen's d of approximately 0.63, which is considered a moderate effect size by conventional benchmarks. However, this was not sufficient to exclude chance as the explanation. Statistical testing confirmed that the difference between the case and control groups was not significant at the $p \leq 0.05$ threshold."

**Percentage Difference Of Lung Cancer Risk Score Between Case And Control Groups**

| Assessments | Lung cancer risk score | | | |
|---|---|---|---|---|
| | Maximum score | Mean risk score | Percentage of risk score | Percentage of risk difference score |
| Case | 35 | 17.20 | 49.14% | 4.95% |
| Control | 35 | 18.93 | 54.09% | |

### Test - Tobacco, Alcohol, Prescription Medications, And Other Substances (TAPS)

"In the case group, 76.67% of participants scored in the low-risk category on the TAPS, while 23.33% were classified as moderate risk. In contrast, 43.33% of the control group were low risk and 56.67% moderate. A chi-square test revealed a statistically significant difference between the groups ($\chi^2 = 6.94$, df = 1, $p = 0.01$), indicating that TAPS risk levels differed meaningfully between cases and controls."

**Percentage Difference Of TAPS Score Between the Case And Control Groups**

| Assessments | TAPS risk score | | | |
|---|---|---|---|---|
| | Maximum score | Mean risk score | Percentage of risk score | Percentage of TAPS risk difference score |
| Case | 34 | 15.20 | 44.70% | 9.62% |
| Control | 34 | 18.47 | 54.32% | |

### Test - Cigarette Dependence

"In the case group, 76.67% of participants fell into the low-dependence category on the Cigarette Dependence Scale (CDS-12), while 23.33% were classified as having moderate dependence. Among controls, 43.33% scored low and 56.67% scored moderate. A chi-square test demonstrated a statistically significant difference between groups ($\chi^2 = 9.44$, df = 1, $p = 0.01$), indicating that cigarette dependence levels were meaningfully different in the case versus control participants."

**Percentage Difference Of Cigarette Dependence Score Among Case And Control Groups**

| Assessments | Cigarette Dependence Score | | | |
|---|---|---|---|---|
| | Maximum score | Mean dependence score | Percentage of dependence score | Percentage of dependence difference score |
| Case | 60 | 23.30 | 38.83% | 21.00% |
| Control | 60 | 35.90 | 59.83% | |

**Comparison of Test and Retest Scores**

**TAPS Risk Score Comparison**

Participants in the case group had a mean TAPS risk score of 15.20, compared to 18.47 in the control group—a difference of 3.27 points. An independent-samples t-test confirmed this disparity to be statistically significant ($t = 3.89$, $p = 0.001$), indicating a reliably higher risk score among controls.

**Cigarette Dependence Score Comparison**

On the Cigarette Dependence Scale (CDS-12), cases averaged 23.30, while controls scored notably higher at 35.90 - a mean difference of 12.60. This contrast was also highly significant based on an independent t-test ($t = 9.10$, $p = 0.001$), demonstrating markedly greater nicotine dependence in the control group.

**DISCUSSION:**

**Objective 1: Assessing Knowledge Levels of Modifiable Lung Cancer Risk Factors**

In the case group, 36.67 % of participants scored low on knowledge of modifiable lung cancer risk factors, while 63.33 % achieved moderate knowledge. In contrast, 30.43% of the control group scored low, while 69.57% demonstrated moderate knowledge. These findings suggest a modestly higher awareness among controls, although both groups predominantly exhibited only moderate understanding of factors that can be changed to reduce lung cancer risk [7,8].

**Association Between Level Of Lung Cancer Risk, TAPS, Cigarette Dependence Score And Control Group Demographic Variables**

| Demographic variables | | Test knowledge score | | | | n | Chi-square test |
|---|---|---|---|---|---|---|---|
| | | Moderate | | Adequate | | | |
| | | n | % | n | % | | |
| Sex (TAPS) | Male | 3 | 12.50% | 21 | 87.50% | 24 | **$\chi 2=7.88$ p=0.01**(S)** |
| | Female | 4 | 66.67% | 2 | 33.33% | 6 | |
| Education | Informal education | 0 | 0.00% | 2 | 100.00 % | 2 | **$\chi 2=11.25$ p=0.01**(S)** |
| | Primary | 0 | 0.00% | 4 | 100.00 % | 4 | |
| | Secondary | 0 | 0.00% | 8 | 100.00 % | 8 | |
| | Higher secondary | 5 | 41.67% | 7 | 58.33% | 12 | |
| | Graduate | 3 | 75.00% | 1 | 25.00% | 4 | |
| | Postgraduate | 0 | 0.00% | 0 | 0.00% | 0 | |

**Objective 2: Investigating Modifiable Risk Factor Effects on Lung Cancer**

The current study revealed notable differences between cases and controls on both TAPS and Cigarette Dependence scores. Mean TAPS scores were 44.70 % in the case group versus 54.32 % in controls, indicating higher substance-use risk among controls. Conversely, Cigarette Dependence scores were 76.90 % for cases and 51.24 % for controls, reflecting greater nicotine dependence in cases. These contrasts highlight how modifiable risk factors—specifically, substance use and smoking dependence differ between individuals with and without lung cancer. The data suggest that interventions targeting these factors were more impactful than mere descriptive profiling in addressing lung cancer risk [9,10].

**Objective 3: Association Between Demographic Variables and Modifiable Risk Scores**

The study explored how demographic factors relate to lung cancer risk, TAPS scores, and cigarette dependence scores across gender groups. Results showed that both male and female graduates, as well as participants from urban areas, tended to have higher independent lung cancer risk scores. Furthermore, elevated TAPS and cigarette dependence scores were especially pronounced among men aged 51-60,

urban residents, and unmarried men—indicating these demographic factors are associated with greater modifiable risk factors for lung cancer [11].

**Association Between Level Of Lung Cancer Risk, TAPS, Cigarette Dependence Score And Case Group Demographic Variables**

| Demographic variables | | Test knowledge score | | | | n | Chi-square test |
|---|---|---|---|---|---|---|---|
| | | Moderate | | Adequate | | | |
| | | n | % | n | % | | |
| Place of Residence (LCRA) | Rural | 1 | 6.25% | 15 | 93.75% | 16 | $\chi 2=13.65$ p=0.01**(S) |
| | Urban | 10 | 71.43% | 4 | 28.57% | 14 | |
| | Semi Urban | 0 | 0.00% | 0 | 0.00% | 0 | |
| Education (LCRA) | Informal education | 0 | 0.00% | 2 | 100.00% | 2 | $\chi 2=9.60$ p=0.05*(S) |
| | Primary | 0 | 0.00% | 7 | 100.00% | 7 | |
| | Secondary | 4 | 44.44% | 5 | 55.56% | 9 | |
| | Higher secondary | 3 | 42.86% | 4 | 57.14% | 7 | |
| | Graduate | 4 | 80.00% | 1 | 20.00% | 5 | |
| | Postgraduate | 0 | 0.00% | 0 | 0.00% | 0 | |
| Sex (TAPS) | Male | 14 | 66.67% | 7 | 33.33% | 21 | $\chi 2=6.00$ p=0.01**(S) |
| | Female | 9 | 100.00% | 0 | 0.00% | 9 | |
| Family income (CDS) | Low (<10,000 INR) | 18 | 94.74% | 1 | 5.26% | 19 | $\chi 2=18.37$ p=0.01**(S |
| | Medium (10,000-50,000 INR) | 2 | 18.18% | 9 | 81.82% | 11 | |
| | High (>50,000 INR) | 0 | 0.00% | 0 | 0.00% | 0 | |
| Place of Residence (CDS) | Rural | 14 | 87.50% | 2 | 12.50% | 16 | $\chi 2=6.69$ p=0.01**(S) |
| | Urban | 6 | 42.86% | 8 | 57.14% | 14 | |
| | Semi Urban | 0 | 0.00% | 0 | 0.00% | 0 | |

**Hypotheses**

1. Both hypotheses were supported: significant mean differences in test scores were observed between cases and controls (H1), and there was a clear association with demographic and modifiable risk factors (H2).

**2.** Taken together, these results highlight the substantial influence of changeable behaviors-such as substance use and smoking dependence - on lung cancer development [12-14].

## CONCLUSION:

This case–control study highlights the significant role of modifiable risk factors in the development of lung cancer. The results revealed strong associations between lung cancer and well-established risk factors, including active tobacco smoking, secondhand smoke exposure, cigarette dependency, and occupational hazards such as asbestos, radon, and other workplace carcinogens. These findings reinforce the critical importance of preventive measures, such as smoking cessation, reduction of environmental tobacco smoke, and implementation of workplace safety, to effectively mitigate the burden of lung cancer.

**REFERENCES:**

1. Global Burden of Disease 2019 Cancer Collaboration. Cancer Incidence, Mortality, Years of Life Lost, Years Lived With Disability, and Disability-Adjusted Life Years for 29 Cancer Groups From 2010 to 2019

2. Risk-based and response-adapted radiation therapy for children and adolescents with newly diagnosed advanced-stage Hodgkin lymphoma treated with ABVD chemotherapy: a report from the Indian pediatric oncology group study3.Outcomes in Lung Cancer: 9-Year Experience From a Tertiary Cancer Center in India. J Glob Oncol. 2017 Jan 11;3(5):459-468.

4. Wynder, E. L., & Graham, E. A. (1950). *Tobacco smoking as a possible etiologic factor in bronchiogenic carcinoma: A study of 684 proved cases. Journal of the American Medical Association, 143*(17), 1544–1549.

5. J.. Ferlay, M. Colombet, I. Soerjomataram, D. M. Parkin, M. Pi¯neros, A. Znaor, and F. Bray, "Cancer statistics for the year 2020: An overview," International Journal of Cancer, vol. 149, no. 4, pp. 778–789, 2021.
6. R. L. Siegel, K. D. Miller, H. E. Fuchs, and A. Jemal, "Cancer statistics, 2021." CA: a cancer journal for clinicians, vol. 71, no. 1, pp. 7–33, 2021.
7. P. Mathur, K. Sathishkumar, M. Chaturvedi, P. Das, K. L. Sudarshan, S. Santhappan, V. Nallasamy, A. John, S. Narasimhan, F. S. Roselind, et al., "Cancer statistics, 2020: report from national cancer registry programme, india," JCO Global Oncology, vol. 6, pp. 1063–1075, 2020.
8.A. K. Dhara, S. Mukhopadhyay, and N. Khandelwal, "Computer-aided detection and analysis of pulmonary nodule from CT images: A survey," IETE Technical Review, vol. 29, no. 4, pp. 265–275, 2012.
9. Pawel DJ, Puskin JS. The U.S. Environmental Protection Agency's assessment of risks from indoor radon. Health Phys 2004;87:68–74. [CrossRef]
10. Lorenzo-González M, Torres-Durán M, Barbosa-Lorenzo R, Provencio-Pulla M, Barros-Dios JM, Ruano-Ravina A. Radon exposure: a major cause of lung cancer. Expert Rev Respir Med 2019;13:839–50.
11. Alberg AJ, Brock MV, Ford JG, Samet JM, Spivack SD. Epidemiology of lung cancer: Diagnosis and management of lung cancer, 3rd ed: American College of Chest Physicians evidence-based clinical practice guidelines. Chest 2013;143:e1S–e29S.
12. Barta JA, Powell CA, Wisnivesky JP. Global Epidemiology of Lung Cancer. Ann Glob Health 2019;85:8.
13. Hosgood HD 3rd, Boffetta P, Greenland S, Lee YC, McLaughlin J, Seow A, et al. In-home coal and wood use and lung cancer risk: a pooled analysis of the International Lung Cancer Consortium. Environ Health Perspect 2010;118:1743–7.
14. Raaschou-Nielsen O, Bak H, Sørensen M, Jensen SS, Ketzel M, Hvidberg M, et al. Air pollution from traffic and risk for lung cancer in three Danish cohorts. Cancer Epidemiol Biomarkers Prev 2010;19:1284–91