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A Case Control Observational Study to Determine Relation between Indoor Air Pollution and Lung Cancer

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Abstract: ***To investigator indoor air pollution particular matter (PM) level and various indoor air pollution exposures, and to examine their relationship with risk of lung cancer in urban Indian. Population with a focus on non smoking. We conducted a case control of which 120 case and 200 controls were non smoker. Were measured using a particle mass monitor. Unconditional logistic models were used calculated adds ration (ORs) and 60% confidence intervals after adjusting for age, educational, kuppu swami scale and smoking. Among non smoking, lung cancer was strongly associated with multiple source of indoor air pollution.***

Keywords: Indoor air pollution; lung cancer; particulate matter; PM

Abbreviation

PM	Particulate matter
ETS	Environmental tobacco smoke
OR	Odds ratio
IAP	Indoor air pollution
PAH	Polycyclic Aromatic hydrocarbons

1. Background

Air pollution is a global issue. Indoor air quality is a part of air pollution that has a negative impact on human health. Indoor air pollution can cause respiratory diseases, cardiac diseases, allergic diseases, various types of cancers and premature mortality.[1] Humans spend a minimum of 8 hour of their life in the indoor environment. In our country urbanization is growing rapidly, which is increasing the indoor staying time of dwellers.[2] Indoor air pollution is because of outdoor and indoor sources, environmental conditions, housing characteristics and behavioral factors. outdoor air pollution concentration associated with manmade and natural resources. Such as road traffic, wildfire smoke, resuspension of dust can affect indoor air pollutant level.

Lung cancer is one of the leading causes of cancer related death accounting for 25% of all cancer deaths globally. Prevalence of lung cancer is second to prostate cancer in male and breast cancer in females. Lifetime risk is 1:15 male and 1:17 in female. Approximately 10 million people died in a tear because of cancer, it is nearly one in six deaths. Lung cancer is the leading cause of death amongst cancer (1.8 million deaths). Cancer is due to tobacco use, indoor air pollution, high body max index, alcohol consumption, low fruit and vegetable intake, infections like human papilloma virus and hepatitis.

Lung cancer is a type of cancer that starts in the lungs. People who smoke have the greatest risk of lung cancer, though lung cancer can also occur in people who have never smoked. According to WHO 2020 data India has 1.1 million people suffering with cancer. And 784,821 people died because of cancer. Tobacco is the major risk factor 17.4 % of lung cancer. Indoor air pollution is a risk factor for lung cancer. In 2018, 67 thousand people suffered from lung cancer and it is expected that this number will reach 1.19 lakh till year 2040.

So it is important to know the characteristics of indoor air pollution and understand which is the source of pollution, type of indwelling characteristic and crowding and to make a causative relationship with lung cancer.

Novelty- In India previously no study has been done to make a relation between indoor air pollution and lung cancer.

Study objectives
Determine relation between indoor air pollution and lung cancer

Primary objective
- To determine relation between indoor air pollution and lung cancer

Secondary Objective
- To see the indoor air pollution in smoker and non smoker family
- To see the indoor air pollution in Chullah/stoves using family
- To see the difference in indoor air pollution in rural and urban dwellings

2. Methodology

Hypothesis: Indoor air pollution is a key factor for development of lung cancer.

Study Design A case control study

Study participants
- Study will be conducted in King George's Medical University.
- Prior to the initiation of the recruitment, IRB approvals will be obtained from KGMU.
- Case recruitment: eligible cases will recruit from dept of respiratory medicine at king *george medical university, lucknow. Consent forms will be obtained before recruitment.*

Inclusion and exclusion criteria:

Inclusion criteria:

- Adult of both sex with age > 20 year
- known case of lung cancer
- Resident in area and same house for more than 10 year
- Those participants were included in the study if their parents/caregivers provided written informed consent.

Exclusion criteria:

- Resident in area and same house for less than 10 year
- Those patients were not ready to give consent.

Control Recruitment: Randomly selected from Lucknow and surrounding districts

Eligible controls

1) Age 20 year or more
2) Must lived in that house for more than 10 year
3) No history of cancer or any other serious chronic disease

Intervention: none

Setting: OPD & IPD of Department of Respiratory Medicine at KGMU, Lucknow

Sample Size

We will calculate the sample size-confidence level = 95%, standard deviation =.5, and margin of error = +/- 5%.

The Sample Size can be calculated as = $(\text{Z-score})^2$ * SD*(1-SD) / $(\text{margin of error})^2$
= $((1.96)^2$ x.5(.5)) / $(.05)^2$
= (3.8416 x.25) /.0025
=.9604 /.0025
= 384.16
=384
Case: control= 1:1

Data Management and Analysis:

Project Implementation Plan

Ethics Review- Ethical review applied to Ethical committee

Data collection & Statistical analysis plan

After getting participant permission, all patients will be interviewed at the hospital and all control will be interviewed in the community health care center and epidemiological data will be filled in a predefined questionnaire.

Data will be collected on a questionnaire that include demographic factors, residence, housing history, living habits, indoor activities, dietary and cooking habits, active and passive smoking history, alcohol drinking habits, occupational history and related exposure, physical activities and disease history. We will measure their home PM level(PM1, PM2.5, PM5, PM7.5) with the help of a particle mass monitor. Data analysis will be done using appropriate statistical tools. For the primary analysis, we will calculate Odds ratios and 95% confidence intervals for each variable. The association of indoor air pollution and lung cancer will analyze using unconditional logistic regression models. Wilcoxon rank sum test will be used to examine association between PM level and indoor risk factors and also to compare PM levels between case and controls.

RESULT WILL REPORTED AS THE CHANGES IN THE RISK OF LUNG CANCER PER 10 MCG/M3

Expected Outcome- we could get significant relation between indoor air pollution and lung cancer

3. Limitations of this Study

1) Indoor air pollution is variable throughout the year and collection of daily data for all patients is not feasible.
2) Future plans based on expected outcomes
   - We will see the impact of indoor air pollution on other diseases like COPD, Asthma, Diabetes etc.
   - We will conduct in future to look for factors that can reduce indoor air pollution.
   - We will conduct in future to look for respiratory infection women with chronic obstructive lung disease.
   - We will see the impact of indoor air pollution on other factors such as skin and eye problems.

Timelines: Time Schedule of activities giving milestones through BAR diagrams.

AIM	1st Year	2nd Year	3rd Year
Study duration			
Review of Literature			
Development of Interview Schedule			
Data collection			
Data compilation & Analysis.			
Report Writing			

Study duration 3 year
Review of Literature 3 month
Development of Interview Schedule 3 month
Data collection 24 month
Data compilation & Analysis 6 month
Report Writing 6 month

Institutional Support- Institution will support in diagnosis and management of lung cancer
Budget-

4. Literature Review

Investigate indoor particulate matter (PM) level and various indoor air pollution exposure, and to examine their relationship with risk of lung cancer in an urban and rural population with a focus on non- smoking women.

We conducted a case control study in lucknow, india consisting of 150 lung cancer cases and 280 control, of which 100 case and 130 control were female non-smokers, indoor PM concentration, including PM1, PM2.5, PM7, PM10, nitrogen dioxide (NO2), volatile organic compound (VOCs) and TSP, were measured using a particle mass monitor. Unconditional logistic regression models were used to calculate odds ratios (ORs) and 95% confidence intervals

after adjusting for age, education, annual income (kuppuswamy scale) and smoking.

Non smoking women, lung cancer was strongly associated with multiple sources of indoor air pollution 10 years ago, including heavy exposure to ETS at work (aOR=3.60), high frequency of cooking (aOR= 3.30), and solid fuel usage for cooking (aOR=4.0) and heating (aORcoal stove =2). Housing characteristics related to poor ventilation, including single-story, less window area, no separate kitchen, no ventilation and rarely having windows open, are associated with lung cancer. Indoor medium PM2.5 concentration was 68ug/m^3, and PM10 was 230ug/m^3. PM levels in winter are strongly correlated with solid fuel usage for cooking, heating and ventilators. PM1 levels in cases are more than 3-time higher than that in controls. Every 10ug/m increase in PM1 is associated with 45% increase risk of lung cancer. 73 studies reported indoor PM2.5, with mean concentration ranging between 1.7

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