RESEARCH ARTICLE

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Geospatial Mapping the Prevalence of Interstitial Lung Diseases Identified in Tertiary Care Facility and Determining the Role of Occupation in the Occurrence: A Cross-sectional Study

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Abstract

Interstitial Lung Diseases (ILD) is a class of lung diseases involving diffuse parenchyma affecting alveolar, interstitial, and small airways which worsen quality of life and cause early mortality. It is important to comprehend how various occupations affect interstitial lung diseases. The purpose of this study was to determine the prevalence of ILD and the relationship between ILD and occupation. **Methods and Materials:** In June 2022, a retrospective analysis was carried out in a tertiary care facility. Using purposive sampling, 252 participants were chosen from the medical records. Occupation along with the duration, area of residence, and associated illness was evaluated using a questionnaire. The latitude and longitude of the areas were mapped using Q-GIS mapping and plotted on the map. **Results:** Among the 252 study participants, the majority of them (71%) were non-industrial workers and 29% were industrial workers. ILD affected 40% of the research patients. It was discovered that there were 86 cases of interstitial lung disease (84.3%) among industrial workers compared to 16 cases (15.7%) among non-industrial workers. This difference was statistically significant (p-value <0.05). In the Q-GIS Mapping, Clustering was found in Mysuru district, extension to Kerala, Tamil Nadu, and Andhra Pradesh. **Conclusion:** According to the Geospatial mapping of RespiratoryDisease cases from the past 5 years, the majority distribution is in and around Mysuru. There was a relationship between occupation and ILD was found in this study. Hence, further preventive measures are to be taken to prevent ILD in certain occupations.

Keywords: GIS Mapping, Interstitial Lung Diseases, Occupation, Respiratory Illness, Smoking

1. Introduction

Alveoli, interstitial, and small airways are all impacted by a set of diffuse parenchyma lung disorders known as Interstitial Lung Disesases[1]. More than a hundred lung disorders impact tiny airways, Pulmonary Interstitial Spaces, and Alveolar Structures[2]. Idiopathic Pulmonary Fibrosis presents high heterogeneity, which makes it very Since there has been an increase in Etiology-based cases, an Etiology-based classification of ILD will be very useful for managing the disease by removing the underlying cause or treating the cause[4].

The Pathogenesis of occupational and non-occupational ILDs is comparable, with both exhibiting Structural Abnormalities, Gradual Fibrotic Alterations, and similar Physiological consequences. These Illnesses

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can be distinguished from one another despite having similar outcomes because of the mechanisms that cause the Fibrosis[5].

One of the main issues with ILD is figuring out what causes the damage. Certain risk factors for ILD, such as Smoking, Hepatitis C, a history of Tuberculosis, a history of Pneumonia, and Chronic Obstructive Pulmonary Disease, were found to be strongly linked to the development of ILD by an International Retrospective Cohort Research conducted on a Population[6]. The lungs may become toxically affected by prolonged exposure to environmental or occupational agents such as organic and mineral dust, as well as harmful gases. Although there are many other types of exposure, silica, Asbestos, coal mine dust, Beryllium, and hard metals are the ones associated with the Disease most frequently. In addition to these, new exposures at work, like Indium, have been linked to Pathogenesis along with Infections, Medications, and Radiation; they have been recognized as unique occupational risks[7].

There is progressive accumulation of these toxins in the lung over a long period to start showing diagnostic characteristics. These conditions are typically accompanied by poor gas exchange, diffuse Lung Infiltrates, and Dyspnea, Fibrosis[8]. A deteriorating quality of life and early death are caused by the reduction in lung function. Interstitial Lung Disease has become a growing concern in developing countries such as India due to its high Mortality rate and Idiopathic nature[9].

Hence the current cross-sectional study will help determine the burden of Interstitial Lung Disease in the area. This will help in early diagnosis and treatment of patients coming from high-risk zones. This study will also give us an insight into the various occupations that pose a risk to Interstitial Lung Disease. This will help us primarily prevent the occurrence of Disease by encouraging the use of protective gear and limiting exposure[10].

2. Objectives

1. To determine the Prevalence of Interstitial Lung Disorders at a Mysore City Tertiary Care Facility.
2. To determine Whether Occupation and the Incidence of Interstitial Lung Illnesses Are Related.
3. Geospatial Mapping of Interstitial Lung Disease, which is Diagnosed in a Tertiary Care Hospital in Mysore City.

3. Methodology

A retrospective observational study was conducted among individuals diagnosed with respiratory illness and admitted in the last five-year period in JSS Hospital, Mysuru. The study was conducted over 3 months (June 2022-August 2022) and the protocol was approved by the institutional ethical committee and informed consent was obtained before the commencement of the study. According to a study done by *Sahajal Dhooria*, *et al.,* in a tertiary care center of a developing country, the prevalence of ILDs was found to be 70.5%. With a 95% confidence interval and an absolute precision of 6%, the sample size was determined to be 222. Considering the 10% of non-response rate, 252 samples are considered for the study. The data was gathered through the use of purposive sampling. Individuals diagnosed with ILDs in the past five years, whose valid contact numbers are available in the record, and individuals willing to participate in the study were included. Pediatric cases were excluded.

3.1 Method of Data Collection

For Individuals who have been diagnosed with Respiratory Disease and admitted to JSS Hospital in the past five years, the records were taken from the Medical Record Department (MRD) Section. The telephone contact number from the records was collected. A telephone interview was conducted using a pretested semi-structured questionnaire.

- Inquiries were made about Sociodemographic characteristics such as age, Gender, Education, Employment, Income, and Residential address in addition to past medical histories and a history of any other illnesses.
- Detailed history of occupation was asked: Type, place, duration of occupation when they had been diagnosed with Respiratory Disease, and if anyone from his/her colleagues in the workplace had a similar presentation/diagnosis.
- Geospatial mapping of the location of residence of study participants was done.

3.2 Data Analysis

The gathered data was input into a Microsoft Excel 2019 spreadsheet, and SPSS Version 26 (Statistical Package

for the Social Science) Windows version 26.0 was then used for analysis. (2019; IBM Corp. Released). Armonk, New York, USA: IBM SPSS Statistics. There was the use of descriptive statistics such as percentages and frequencies. Utilizing Inferential statistics, such as the Fishers' Exact test and Chi-square test, it was possible to determine the association between occupation and Respiratory Illness. The relevant figures and tables were used to illustrate the data distribution. P-values less than 0.05 were regarded as statistically significant.

4. Results

The mean age of the study participants was found to be 61.1+ 15.2 years. The age range of 51-70 years old accounts for 49% of the patient population. Of all the patients, 131(52%) were males and 121(48%) were females. Of the patients, 20% were industrial workers, while the remaining 80% were non-industrial workers (including teachers, farmers, homemakers, tailors, electricians, and managers) (Table 1). 82% were non-smokers and 18% had smoked in the past. Of the patients, 27.8% had diabetes mellitus and 18% of patients were hypertensives. Out of the 252 patients, 102 (40%) had an interstitial lung disease diagnosis, whereas 150 (or 60%) did not have an ILD diagnosis.

Table 1. Sociodemographic profile of study participants (n=252).

Variables	Category	Frequency[N(%)]
Age (in years)	30-50	53(21)
	51-70	124(49)
	71-90	75(30)
Gender	Male	131(52)
	Female	121(48)
Occupation	Non – industrial	202(80)
	Industrial	50(20)

Table 2 shows Interstitial Lung Diseases were found more among Industrial workers 86(84.3%) than among non-industrial workers 16(15.7%) and this association was found to be statistically significant (p-value <0.05).

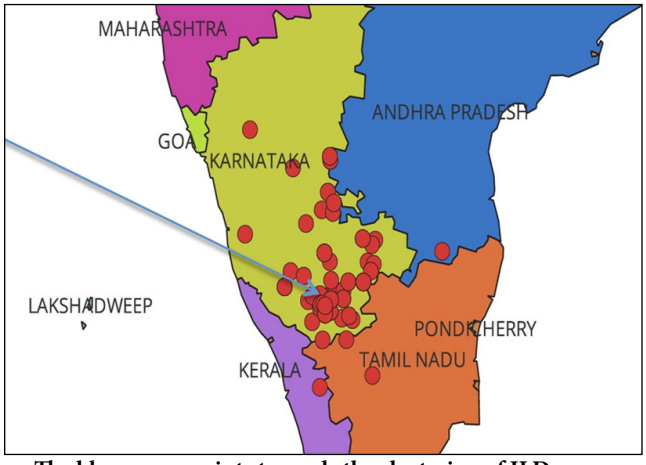
Table 3 Shows the risk factors among the study participants with ILD were found to be 28% with T2DM, 23% with COPD, and 19.4% with Pneumonia and Hypertension. 15% of the study participants were found to have COVID-19 disease.

Table 3. Distribution of risk factors present in the Interstitial Lung Disease patients (n=102)

Variable (Risk factor)	Number of participants having risk factor (%)*
Smoking	45 (17%)
Asthma	48 (19%)
Pneumonia	49 (19.4%)
COPD	58(23%)
T2DM	71(28%)
Hypertension	46 (19.4%)
COVID-19	38 (15%)

***Multiple responses**

The arrow pointing towards the population clustering with ILDs admitted in JSS Hospital is seen in and around Mysuru district and to the neighboring states Kerala, Tamil Nadu, and Andhra Pradesh (Figure 1).



The blue arrow points towards the clustering of ILD cases.

Figure 1. GIS mapping of the study population with ILD.

Table 2. Association of occupation with interstitial lung disease

Variable	Category	Interstitial Lung Disease (%) (n=102)	Chi-square value	P-value
Occupation	Industrial worker (n=50)	86 (84.3%)	14.691	0.000*
	Non-industrial worker (n=202)	16 (15.7%)		

*p value <0.05 considered to be statistically significant.

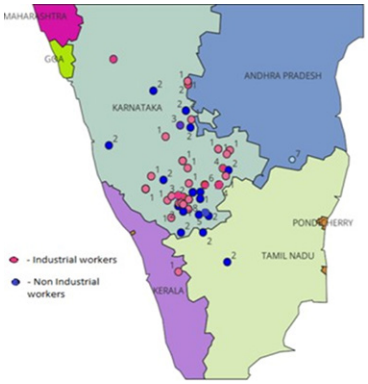


Figure 2. GIS mapping of the study population about their occupation.

Interstitial Lung Diseases were found more among Industrial workers 86(84.3%) than among Non-Industrial workers 16(15.7%).

5. Discussion

Interstitial lung diseases have become a growing concern that affects lung parenchyma. Due to its high mortality rate and bad prognosis, it has become an occupational hazard[9]. In the current study, an association of smoking-19.81%, COPD-7.54% was seen along with the occurrence of disease more commonly among men- 59%, and in the older age group, >60 years- 55.66%. But no association with Hepatitis C, Pneumonia, or Tuberculosis was appreciated.

That being said, Won-ll Choi's 9-year nationwide retrospective study included participants who self-reported having smoked cigarettes and were older than 40 at the time of cohort entry. The International Classification of Diseases codes were used to select the cases. Up till December 2013, 312, 519 patients were tracked in cohorts. His research revealed that during nine years, in 1972, 312, 519 patients had Interstitial Lung Disease. The development of interstitial lung disease was significantly correlated with smoking since, The histological Manifestation of build-up pigmented "Smoker's Macrophages" in the Respiratory Bronchioles and Alveoli is found in all smokers. These Macrophages contain granular, yellow-brow Cytoplasmic pigments. Smoking includes oxidative stress, increased Epithelial Apoptosis, and Dysregulated Immunological responses which makes it the biggest contributor of Interstitial Lung Diseases[10]. (HR: 1.2; 95% Confidence Interval [CI]: 1.1-1.4), Hepatitis C (HR: 1.6; 95% CI: 1.1-2.3), a history of tuberculosis (HR: 1.5; 95% CI: 1.1-1.9), a history of Pneumonia (HR: 1.6; 95% CI: 1.3-2.0), Chronic obstructive Pulmonary Disease (HR: 1.8; 95% CI: 1.6-2.1), and men (HR: 1.9; 95% CI: 1.7-2.1). The chance of developing Interstitial Lung Disease rises with age; in people over 70, the risk was 6.9 times higher (95% CI: 5.9-8.0) than in people in their forties.

Also, Idiopathic Pulmonary Fibrosis (IPF) and Chronic Obstructive Pulmonary Disease (COPD) showed a significant association that could be seen in the current study with a 10% prevalence[2]. Similarly, In the current study, a correlation between any kind of exposure and ILD could not be derived, whereas based on the study conducted by Pilar Rivera Ortega, Multiple factors such as environmental and occupational exposures, Infections, Drugs, Radiation, and Genetic predisposition have influenced the Pathogenesis of these conditions. Classic examples of occupational diseases are Pneumoconiosis caused by Asbestos (asbestosis), Silica (silicosis), and coal dust (coal worker's pneumoconiosis)[4], Along with new exposure to Silica, Byssinosis, Titanium dioxide, Indium, and Beryllium[7], Radiation was also seen to show a certain association in countries like India[17]. They are usually attributed to the steady build-up of harmful particles in the lungs. The pathophysiology of ILD, such as HP, chronic beryllium disease, or hard metal/cobalt/related lung disease, is primarily determined by individual vulnerability and/or immunological sensitization[4].

In the current study, 56% i.e., the majority of the study population were men, which according to Theodoros Karampitsakos, is proven that men are more prone than women.[10] The current study could not draw any conclusion on the association of sarcoidosis, rheumatoid arthritis, or any other connective tissue disorders with ILD. In the study conducted by Amy L Oslon, a subset of patients diagnosed with ILDs related to other occupational exposures showed the relation between connective tissue disorders, Rheumatoid Arthritis, Hypersensitivity Pneumonitis, sarcoidosis, and ILD[11]. The principal pathogenic mechanism entails the promotion of alveolar Type II cell dysfunction by these risk factors, which in turn sets off numerous downstream profibrotic pathways, such as inflammatory cascades. These cascades ultimately lead to lung fibroblast proliferation and activation, which in turn causes abnormal lung remodeling and repairs, ultimately culminating in interstitial pathology and lung fibrosis. One of the main causes is the deregulation of the inflammatory regulator pathways[12].

In the current study we have found 46% of ILDs had a history of COVID-19 infection, this result would have influenced the results of the study. COVID-19 was the new entity that was responsible for most of the ILDs during the pandemic and post-pandemic era.

Post-COVID-19 consequences mainly Pulmonary Fibrosis has the potential to seriously impair a patient's Pulmonary function and Quality of Life (QOL). Given that ARDS frequently results in Lung Fibrosis and that Viral Infection may be the cause of Chronic Fibrotic ILDs[13].

A study done by Han X and Fan Y shows that Six-month follow-up CT showed fibrotic-like changes in the Lung in more than one-third of patients who survived severe Coronavirus Disease 2019 Pneumonia[14]. This association might have masked the role of occupation in the occurrence of ILDs. The Geospatial Mapping was done to identify the Clustering of cases of Interstitial Lung Diseases and was found to have distribution in and around Mysore district.

6. Conclusion

The Geospatial Mapping of Respiratory Disease cases over the past five years highlights a Predominant distribution in and around the Mysuru district. This Spatial Clustering underscores the need for targeted public health interventions in these regions to address the burden of Interstitial Lung Diseases (ILDs). Additionally, our study identifies a significant association between occupation and ILD occurrence, with industrial workers exhibiting a higher prevalence than non-industrial workers. Even if interventions are in place, they might not be uniformly enforced across all workplaces. Enforcement mechanisms can be lax, and compliance with safety measures may vary among workers and employers. ILD and other occupational Lung diseases often have long latency periods, meaning Symptoms might not appear until years after exposure. This can make it difficult to directly link the disease to specific occupational exposures. Cases of ILD might be underreported due to various reasons such as lack of awareness among healthcare providers, Reluctance of workers to report symptoms, or Misdiagnosis of the condition. These findings emphasize the importance of occupational health monitoring and intervention strategies to mitigate the risk of ILDs in specific occupational settings. Addressing these challenges requires a multi-faceted approach involving improved enforcement of safety regulations, enhanced education and awareness programs, better Surveillance systems, and continued research into the underlying causes of ILD.Top of FormBottom of Form Further research and preventive measures are warranted to alleviate the impact of ILDs on affected individuals and communities.

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