

# Occupational Health: A Special Reference to Lung Disease in Petrochemical, Metal and Building Material Industrial Workers in Melur Taluk Madurai District

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## ABSTRACT

**Introduction:** Occupational health refers to the identification and control of the risks arising from physical, chemical, and other work place hazards in order to establish and maintain a safe and healthy working environment. Occupational respiratory disease is any lung condition humans get at work. Certain work places lend themselves to disease. The most common are coalmines and factories or areas with high amounts of toxic. Melur taluk located in the north eastern part of Madurai district was chosen as the study area. The study particularly attempted to determine whether individuals working in the metal and building material industries are at higher risks of air-related health effects as compared to those in other industries.

**Material and Methods:** The two important techniques used in the present study are statistical techniques and cartographic interpretation. It includes mapping of the study area using the GIS soft ware. For the primary data, the design involved, comprising a sample of 150 workers (study participants) from the metal, non-metal industries and Petrochemical Industrial workers. The factor analysis a well known techniques was used in the present study to analyze the occupational health in the work environment in Melur taluk.

**Results:** Lack of using protective measures leads to respiratory disease infection, Smoking habits worsen the health of workers. Workers who are working for a long duration (more than 8 hours) without any protective measures diagnose respiratory infection and most of this infected workers are in the age group of above 40.

**Conclusion:** The types of industry determine respiratory infection. Workers in metal and building material industries highly infected by respiratory infection than petrochemical industry. Educated people have knowledge about respiratory infection they use protective measures and they do not have any respiratory infection and most of them are working in management department

**Keywords:** Occupational Health, Industries, Lung Disease, Workers, Factor Analysis

and silica dust, as well as smoke, fumes, gases, and other particles<sup>2,3</sup>

The primary organs of respiratory system are the lungs; the human respiratory system is a series of organs responsible for taking in oxygen and expelling carbon –di- oxide.<sup>4</sup>

The lungs are protected by a series of defense mechanisms in different regions of respiratory tract. Dusts are tiny solid particles scattered or suspended in the air. Workers can be affected from a variety of illnesses caused by dust they inhale in their work environments.<sup>5</sup>

Detailed knowledge on the effects of air pollutants on human health is a prerequisite for the development of effective policies to reduce the adverse impact of ambient air pollution.<sup>6</sup>

Medical Geography is an important “new area of the health research that is a hybrid between geography and medicine dealing with geographic aspects of health and healthcare.<sup>7</sup> Medical Geography studies the effects of locale and climate upon health. It aims to improve the understanding of the various factors which affects the health of populations and hence individuals. It is also called health Geographies.<sup>8</sup>

The process of urbanization and industrialization has greatly led to the process of agglomeration of people and activities. Health challenges particularly evident in cities related to crowding, quality of drinking water, the conditions of sewage lines and their performance in different seasons, communicable diseases, routes and intensities of automobile traffic, the location of industries, the disposal of wastes, the urban facilities, their efficiencies, capacity and cost etc all have an effect on lifestyle that directly affect health.<sup>9,10</sup>

The symptoms of occupational respiratory disease vary. They depend on their work setting, type of disease, and state of health. Smoking can worsen their symptoms. Symptoms can be similar to those of a cold, the flu, or allergies, such as:

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**How to cite this article:** R. RahamathNisha, V. Saravanabavan. Occupational health: A special reference to lung disease in petrochemical, metal and building material industrial workers in Melur Taluk Madurai District. International Journal of Contemporary Medical Research 2020;7(7):G1-G6.

**DOI:** <http://dx.doi.org/10.21276/ijcmr.2020.7.7.12>



dry, scratchy, or sore throat, runny nose, cough, fever, tight chest, chest pain, muscle or body aches, breathing problems, such as shortness of breath or abnormal breathing.<sup>11</sup>

Medical or health geography is an area of research that incorporates geographic techniques into the study of health and the spread of diseases as the distribution of health services. To this end, it aims to provide an understanding of health problems and improve the health of people based on the various geographic factors influencing them. As a consequence, mapping plays a huge role in the field.<sup>12</sup>

A foremost British Medical Geographer in his paper read before the IGU commission on Medical geography defined it as 'an interdisciplinary field of study concerned with the areal variations of disease incidence as expressed by mortality with the demonstration of possible cause and effect relationships with elements of physical, biological and socio-cultural environments in space.'<sup>13</sup>

The social estimation of medicinal services has as of late underlined the natural way to deal with human wellbeing, as the human framework includes consistent change in accordance with disintegration in the social, biological and physical environment.<sup>14,15</sup>

The study particularly attempt to determine whether individuals working in the metal and building material industries are at higher risks of air-related health effects as compared to those in other industries. The present study discussed the relationship between environmental issues and the occupational health. A well known multivariate statistical technique "Factor Analysis" used in a number of infectious disease analysis<sup>16,17,18</sup> were also integrated in this present study. It will focus in the workplace that appears to have some detrimental effects on the occupational health of the workers in Melur taluk. The quality of the environment could play a critical role in the occupational health of workers. An employee operating within the metal and building material industries; for example, could suffer greater risks of respiratory diseases compared to individuals working in chemical industries.

## MATERIAL AND METHODS

For the primary data, the design involved, comprising a sample of 150 workers (study participants) from three diverse industries such as Petrochemical workers, building material workers and metal industry workers are the study participants respectively. The participants undergo study under different environmental-pollution exposure levels. In eliciting the information on the workers 'health status, the researcher applied questionnaires as the data collection tool. Each industry had a number of participants chosen under a random selection procedure from both the exposed and non-exposed worker groups. Eight dimensions were derived by using the statistical technique Factor analysis. Various cases studies from articles, academic journals and books were helping in gathering the secondary data.

### Inclusion criteria

- Respondents: Male
- Above 18 years

- Those who are willing to participate in the study

### Exclusion criteria

- Age below 18 years
- Those who were not willing to participate in the study

**Sample size:** Total 100 respondents were interviewed from the metal, the non-metal and petrochemical industries in melur taluk of Madurai district.

### Methods of data collection

Respiratory Infection in the work Environment have been collected by making use of a survey by direct observation method from the individual on stratified random sampling basis.

### Study tools

The two important techniques used in the present study are statistical techniques and cartographic interpretation. It includes mapping of the study area using the GIS soft ware.

## STATISTICAL ANALYSIS

Pre designed questionnaire was used to gather primary information and suitable statistical techniques were used to analyze the data collected from questionnaire survey. The factor analysis a well known techniques was used in the present study to analyze the occupational health in the work environment in Melur taluk.

## RESULTS

Melur taluk located in the north eastern part of Madurai district was chosen as the study area. Melur is a village panchayat located in Madurai district of Tamilnadu state, India. The Latitude 10.05 and Longitude 78.33 are the Geo- coordinates of the Melur. Melur is one of the largest constituencies of Madurai district (Fig-1). Melur is known in the world market for its white granite cutting and the same is exported to Southeast Asian countries. Other units like the textile mills, chemical, engineering and automobile industries and food products are located in the urban agglomeration areas of the district (fig-2).

The 26x26 correlation matrix of the present analysis has

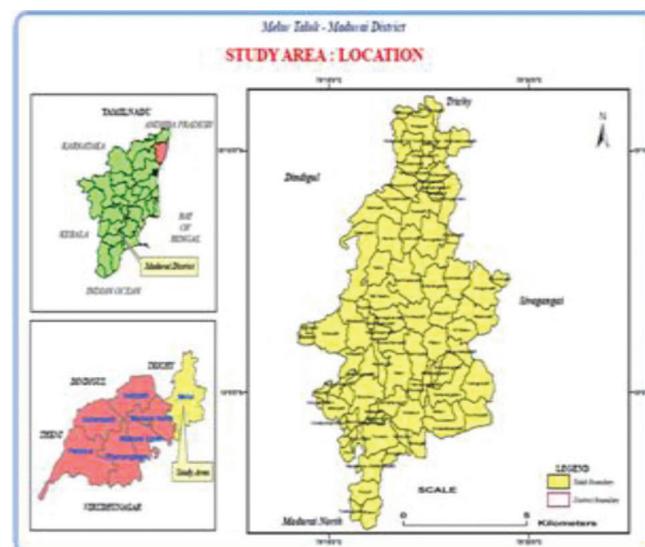


Figure-1: Study Area

been reduced into 26x8 taking into account the factors with their Eigen value greater than unity. Normal varimax rotated factors explained the simplified structure of respiratory infection in the work Environment in the form of factor loadings (table-1).

**Dimension-I Respiratory Infection And Lack Of Productive Measures**

In this first dimension high positive loading were seen in respiratory infection such as difficult to breath (0.44) difficult to swallow(0.43) heard wheezing sound in their breathing (0.42) Nasal congestion (0.39) Chest pain(0.34) Itchy and watery eyes (0.31) seasonal allergy (0.21) Coughing with blood leakage.(0.27).the high positively loaded variables are correlated into the negatively loaded variable using protective measures (-0.37) Lack of using protective measures. Such as mask, glows, gowns, respirators goggles and face shield etc leads to respiratory infection and most of them working in quarry and metal industries. In addition awareness of respiratory infection (0.13) low among them and smoking habit (0.16) worsen their health. Unsafe behaviors that can result in negative occupational health effects while working in an industry could involve failure to use the respiratory mask (table-2).

Of this study indicated the need for improving the work conditions to facilitate workers well-being. Industries should improve their awareness training programs among their workers in regards to the use of safety equipment as one of the preventive measures.

**Dimension-II Smoking Habits and Breathing Difficult**

Smoking is an important factor for developing Chronic Obstructive Pulmonary Disorder COPD.<sup>20</sup> In this second dimension high positive loaded variable seen in difficult to breath(0.40) It is correlated into the second high positively loaded variable Smoking (0.31).The workers who have smoking habits having breathing difficulty. In addition They do not use any protective measures(-0.30) such as mask, gloves, gowns, respirators, goggles and face shield etc., They do not have annual physician(-0.28) They do not take any X-ray(-0.14).This types of infected workers not having blood leakage while coughing (-0.14) and seasonal allergy(-0.13)because of young age (0.38). Smoking and lack of using protective measures causes Respiratory Infection. So, this dimension named as smoking habit and breathing difficulty (table-3).

**Dimension: III - Industrial Type and Respiratory Infection**

In this third dimension high positive loading were seen in Industry type (0.48) It is correlated into the second negatively loaded variable Using protective measures (-0.32) workers in Granite quarry and Metal industry do not use respirators or any other protective measures and their working hours was more than 8 hours (0.31) most of the workers are operating department(0.36) and they are male workers(0.16) people working in Petro chemical Industry. Each department workers use (0.32) protective measures (table-4). They have knowledge of Respiratory disease (0.16). some

S. N	Dimension	Eigen Values	Percentage Trace
1	Respiratory infection and lack of productive measures	3.04	9.42
2	Smoking habit and breathing difficulty	2.76	15.99
3	Industrial type and respiratory infection	2.27	20.61
4	Age and diagnosis of respiratory infection	1.69	35.10
5	Increasing working hours and respiratory infection	1.57	42.76
6	Rating air quality in work environment	0.94	56.47
7	Education and health status	0.68	69.12
8	Seasonal infection	0.67	82.48

Table-1: Factor solution

S.N	Variable no	Variable name	Factors loading
1	10	Difficult to breath	0.44
2	13	Difficult swallow	0.43
3	11	Wheezing sound when breath	0.42
4	12	Nasal congestion	0.39
5	16	Chest pain	0.34
6	14	Itchy and watery eyes	0.31
7	18	Seasonal allergy	0.21
8	22	Season	-0.24
9	25	Using protective measures	-0.37
10	7	Smoking	0.16
11	9	Know what respiratory disease	0.13
12	17	Coughing with blood leakage	0.27

EigenValue 3.04, Percentage Trace 9.42

Table-2: Respiratory Infection and Lack of Protective Measures

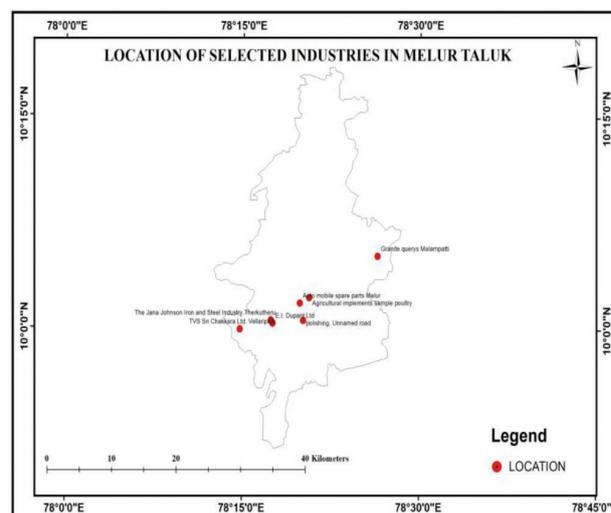


Figure-2: Industries location

of the workers having smoking habits (0.15) and majority of the workers have no breathing difficulty(-0.21)and They are male workers(0.32).this reveal that workers in quarry and metal industry are higher risk of respiratory infection compared to chemical industry.

**Dimension-IV- Age and Diagnosis of Respiratory Infection**

In this dimension high positive loading were seen in Diagnosis of white in X-ray (1.44).This shows that the respondents are highly affected by Respiratory Infection and they are mostly in the age group of above 40 years(0.28) and these people are stopped smoking (-0.16) before 10 years. This type of workers works in metal and building material industry (0.11).

They use protective measures (0.10).They do not take X-ray recently (-0.35). Respiratory infection high among above 40 -45 years age groups. Working in metal and building material industries for long period of time affects the respiratory system of the respondece and diagnosed in the age of 40 (table-5).

**Dimension-v-increasing working hours and respiratory infection**

Increasing working hours (0.10) leads to health problem. Employment type (0.13) such as permanent and contract workers works for more than 12 hours have diagnosed white in their X-ray (0.26). This shows workers are infected by lung scar tissue which makes parts of lungs appear white in their X-ray. Workers are also affected by itchy and watery eyes (0.19) and wheezing sound (0.18) in their breathing, they have annual medical check-up (0.16) to cure the infection. But these workers do not having smoking habits (-0.35). This dimension reveals lungs are also infected when workers working for a long duration of time in poor quality of air in the work environment. So, this dimension named as Increasing working hours and Respiratory infection (table-6).

**Dimension-VI-Rating air quality in work environment**

In this dimension positive loading were seen in Rating air quality (1.44).Respondent working in different types of industries (0.17) such as metal and building material industry have worst quality of air (1.44) than petrochemical industry. They do not smoke (-0.19) and they have Wheezing and breathing difficulties (1.20).The workers in metal and building material industries rating the quality of air is worst in their work environment in all season (1.17) (table-7).

**Dimension-VII- Education and Health Status**

In this dimension positive loading were seen in Education Status (0.10).It is negatively correlated into the variable Diagnosed respiratory disease (-0.10).Educated people do not have any respiratory infection and they use protective measures (1.3) to avoid polluted air inhalation in the work place. Most of the workers are permanent employees (0.15) and they are working in management, and maintenance department (0.02). Educated people have knowledge about respiratory infection they use protective measures and they do not have any respiratory infection (table-8).

**Dimension-VIII- Seasonal Infection**

This dimension highlights seasonal infection. People working in different types of Industry (0.12) having different types of Seasonal allergy (0.18) Such as asthma (0.11), Wheezing sound (0.11) etc. (table-9).

The Respondent diagnosis respiratory infection (0.10) highly in winter season. But they do not have smoking habit (0.11) Industrial workers highly affected by respiratory infection in a winter season. So, this dimension named

S.N	Variable no	Variable name	Factors loading
1	5	Industry type	0.48
2	25	Using protective measures	-0.32
3	26	Working hours	0.31
4	6	Working Department	0.36
5	23	Diagnosed disease	0.23
6	2	Sex	0.16
7	7	Smoking	0.15
8	9	Know what respiratory disease	0.16
9	10	Difficult to breath	-0.21
EigenValue 2.27 Percentage Trace 20.61			
<b>Table-4: Industrial type and Respiratory Infection</b>			

S.N	Variable no	Variable name	Factors loading
1	22	Latest X-ray	-0.35
2	8	Smoking period	0.14
3	7	Smoking	-0.16
4	21	Diagnosed white in x-ray	1.44
5	1	Age	0.28
6	5	Types of Industry	0.11
7	25	Using Protective measures	0.10
Eigen Value 1.69 Percentage Trace 35.10			
<b>Table-5: Age and Diagnosis of Respiratory Infection</b>			

S.N	Variable no	Variable name	Factors loading
1	14	Eyes itchy and watery	0.19
2	8	Smoking Period	-0.35
3	11	Wheezing when breathing	0.18
4	4	Employment type	0.13
5	26	Working hours	0.10
6	21	Diagnosed white in X-ray	0.26
7	20	Annual physician	0.16
EigenValue1.57 Percentage Trace 42.76			
<b>Table-6: Increasing working hours and Respiratory Infection</b>			

S.N	Variable no	Variable name	Factors loading
1	8	Smoking Period	-0.19
2	5	Industry type	0.17
3	25	Rating Air Quality	1.44
4	11	Wheezing when breathing	1.20
5	20	Season	1.17
EigenValue 0.94 Percentage Trace 56.47			
<b>Table-7: Rating Air Quality in work environment</b>			

S.N	Variable no	Variable name	Factors loading
1	3	Education status	0.10
2	4	Employment type	0.15
3	6	Working Department	0.02
4	23	Diagnosed Respiratory disease	-0.10
5	17	Protective Measures	1.3
EigenValue 0.68, Percentage Trace 69.12			
<b>Table-8: Education and Health Status</b>			

S.N	Variable no	Variable name	Factors loading
1	23	Diagnosed Respiratory disease	0.10
2	8	Smoking Period	-0.11
3	7	Wheezing sound	0.11
4	15	Asthma work place	0.11
5	5	Industry type	0.12
6	18	Seasonal allergy	0.18
7	20	Annual physician	1.45
EigenValue 0.67 Percentage Trace 82.48			
<b>Table-9: Seasonal Infection</b>			

as Seasonal Infection.

## DISCUSSION

Workers in metal and building material industries highly infected by respiratory infection than petrochemical industry. Respiratory infection high among above 40 -45 years age groups. Working in metal and building material industries for long period of time affects the respiratory system of the respondents and diagnosed in the age of 40. Similarly Isara AR et al.,<sup>3</sup> ascertain all respiratory symptoms assessed were higher among respondents who have worked 1- 5 years in quarries. The prevalence of cough, wheeze and nasal congestions was higher among quarry workers who cook indoors.

Smoking habit not significantly associated with respiratory infection among quarry workers.<sup>14</sup> But, in our study Smoking habit of the respondents significantly associated with the prevalence of respiratory symptoms our study recognize that workers who are working for a long duration (more than 8 hours) without any protective measures diagnose respiratory infection and most of this infected workers are in the age group of above 40.

The present study also identifies that workers in metal and building material industries exposed to asbestos and silica dust and they are infected by lung scar tissue, chest pain wheezing and breathing difficulties. The worker in metal and building material industries rating the quality of air is worst in their work environment. similarly Marino E<sup>21</sup> Urom<sup>22</sup> et al., Singh<sup>23</sup> et al., avowed chronic exposures to dust generated from crushing of granite rocks impairs lung function and causes some respiratory and non respiratory infection

Aigbokhaode<sup>24</sup> stated educational status of the workers influenced their awareness of safety measures in the quarries. Similarly the study result confirm that educated people have

knowledge about respiratory infection they use protective measures and they do not have any respiratory infection and most of them are working in management department.

Gadgil et al<sup>19</sup> recommended that industries should improve their awareness training programs among their workers in regards to the use of safety equipment as one of the preventive measures. Similarly this study result also indicates unsafe behaviors that can result in negative occupational health effects while working in an industry could involve failure to use the respiratory mask.

In our study people working in different types of industry had different types of seasonal allergy such as asthma wheezing etc., which are common respiratory problem (0.10) in winter season Industrial workers highly affected by respiratory infection in winter season. similar results were identified in number of studies Hyrkas et al<sup>25</sup> identifies cold weather causes functional disabilities among individuals with existing respiratory disease, Cruz et al<sup>26</sup>, Liener et al.,<sup>27</sup> stated that low temperature and accompanying low air humidity are likely to affect the respiratory epithelium and induce hyper responsiveness and narrowing of the airways. Cold weather may aggravate symptoms reporting and especially among those who have some underlying respiratory disease Harju et al.<sup>28</sup>

## CONCLUSION

Lack of using protective measures leads to respiratory disease infection, the workers who have smoking habits having breathing difficulties. Smoking habits worsen the health of workers. Workers who are working for a long duration (more than 8 hours) without any protective measures diagnose respiratory infection and most of this infected workers are in the age group of above 40. The types of industry determine respiratory infection. Workers in metal and building material industries highly affected by respiratory infection than petrochemical industry. Workers in metal and building material industries exposed to asbestos and silica dust and they are infected by lung scar tissue, chest pain wheezing and breathing difficulties. This reveals that workers in quarry and metal industry are higher risk of respiratory infection compared to chemical industry. Respiratory infection high among 40 -45 years age groups. Working in metal and building material industries for long period of time affects the respiratory system of the respondents and diagnosed in the age of 40. The workers in metal and building material industries rating the quality of air is worst in their work environment. Lungs are also infected when workers working for a long duration of time in poor quality of air in the work environment. Male workers are highly affected by respiratory disease. Industrial workers highly affected by respiratory infection in winter season. Educated people have knowledge about respiratory infection they use protective measures and they do not have any respiratory infection and most of them are working in management department. The present study with its limited objectives made an attempt to present its finding at taluk level. However at the same time it forms a stepping stone for expanding the horizons of further

research in studying Behavioral and Psychological aspects of disease and control and preventive measures.

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**Source of Support:** Nil; **Conflict of Interest:** None

**Submitted:** 06-05-2020; **Accepted:** 05-06-2020; **Published:** 09-07-2020