RESPIRATORY ILLNESS AMONG BRICK KILNS WORKERS  
- A CROSS-SECTIONAL STUDY

Dr. Bal Rakshase  Ph.D. Associate Professor and Chairperson
Centre for Health, Policy, Planning and Management, School of Health Systems Studies, Tata Institute of Social Sciences, Mumbai
Email: bal.rakshase@tiss.edu

ABSTRACT

Respiratory illnesses involve multiple parts of the respiratory system and include ear infections, sinusitis, upper respiratory illnesses, asthma, pneumonia, influenza and chronic obstructive pulmonary disease (COPD). Many individual factors and extrinsic factors such as exposure to environmental stimuli, different allergens, air pollution, exposure to dust, various particulate matter and tobacco smoke also contributes to respiratory illness.

Air pollution from small and large-scale industrial areas have been considered dangerous to human health. Small-scale industries play a prominent role in environmental pollution. Amongst the small sectors, the bricks kilns industry is growing very fast due to the rapid urbanization. In Asian countries, the workers are treated as bonded labourers, and they are working in conditions similar to slavery.

The present study aimed to find out the extent of occupational hazards in terms of respiratory disorders among workers working at traditional and advanced brick kilns. The researcher took the cross sectional data, conducted on 251 samples from traditional and advanced types of brick kilns from Maharashtra, state of India.

The study found strong relationship between hazardous environmental conditions and the physical and respiratory health of brick kiln workers. The findings of the study indicate that most of the brick kiln workers are at higher risk of experiencing occupational hazards in the form of respiratory illness.

KEYWORDS: - Respiratory illness, brick kiln workers, clamp types, advanced kilns.
INTRODUCTION

Respiratory diseases are defined as a disease of the airways and other structures of the lung, most common among are asthma, chronic obstructive pulmonary disease (COPD), occupational lung diseases, and pulmonary hypertension (WHO, 2014). Respiratory diseases can arise from inhalation of toxic agents, accidents, and harmful lifestyles, such as smoking and dust. Asthma is a severe disease with the symptom of breathlessness and wheezing. Its frequency and severity are different from person to person. COPD is a terminology used to describe different lung diseases. Its symptom includes Excessive sputum production, chronic cough, and breathlessness. According to the World Health Statistics, it is predicted that chronic obstructive pulmonary disease will be the third most significant cause of the death and lower respiratory infections will be the fourth cause of the death by 2030 (WHO, 2008, 2011 & Jindal, 2006). Besides asthma and COPD, there are many other chronic respiratory diseases like allergic rhinitis, sinusitis, bronchitis, and pulmonary hypertension.

Respiratory illness involves multiple parts of the respiratory system and includes ear infections, sinusitis, upper respiratory illnesses, asthma, pneumonia, influenza and COPD. Many individual factors such as gender, age, and genetic background are the major contributors to the illness; however extrinsic factors such as exposure to environmental stimuli, different allergens, air pollution, exposure to dust, various particulate matter and tobacco smoke also contributes to respiratory illness. Air pollution from small and large-scale industrial areas have been considered dangerous to human health. It contributes to the development of pulmonary diseases (asthma, bronchitis, emphysema, etc.) and non-pulmonary diseases including myocardial infarction (MI), stroke and cancer (Nielsen et al., 2011).
According to the Brick Kilns assessment report by the Shakti Sustainable Energy Foundation in April 2012, India is the second largest brick producing country (Noll, 2015), accounting for 10 percent of the global bricks production (http://www.americanchemistry.com). India has an estimated more than 100,000 brick kilns with more than 10 million people working in brick production (15 million according to March 2013 report by the SSEF). The brick industry mostly depends upon manual labor work with very little mechanization. The production of bricks involves three steps; raw clay moulding with water, drying in sunlight and firing or baking it in the kiln. In most of the bricks industries, clay (Poyata, rural name in Maharashtra) has been used for bricks production. In most of the industries, they use traditional methods of moulding, firing, and use of fuel. Indian brick industry is the third largest coal consumer industry after power and steel industry (Maithel & Uma, 2000).

The kilns are operating in the remote areas they mostly remain unregulated and wages paid are very often less than the statutory minimum wages. The wage payment systems are different for different processes, and the labour contractors are usually paid a commission through a simple deduction from the labourer’s wages. There are varied natures of problems the brick workers are facing now.
They have no unions or legislation to protect them. There are no proper drinking water or sanitation facilities. They are also exposed to health hazards like water-borne, skin diseases and even respiratory disorders. Millions of men, women, young boys, young girls, and children get paid meagre amounts that allow them to subsist merely. In many brick kilns in India, bonded laborers working in near slavery conditions, are on average paid around Rs.150 to produce over 1,500 bricks during a 12 hour-workday. They are paid in advance and are allowed to leave, along with their children suffering from severe respiratory problems only after six months. The child laborers are extensively used in India’s brick kiln industry. Human Rights Watch describes work in brick kilns as bonded labor. This perception of workers involved in brick kiln activities stems from the strong interrelation that exists between the credit system and the labor market. Indeed, brick kiln workers take advances before they begin to work.

In the remote parts of Maharashtra, most manufacturers use the clamp kilns to manufacture the bricks. It is the basic type of brick kiln which requires no permanent structure. The kiln also follows the basic steps of manufacturing like clay moulding with water, drying in natural sunlight, and then baking in the kiln. During the moulding they mix a variety of burnable material like small particles of coal, coal dust, breeze, and sawdust, etc. it accounts 10 to 15 percent mixture with clay, and it reduces some expenditure on main fuel. The clay dust contains various organic and inorganic compounds like free particles of silica, calcium carbonate, magnesium carbonate, calcium sulphate, iron oxide, etc. (Shaikh et al., 2012). During the moulding of bricks with clay, the workers are exposed to the clay dust. These workers are mainly women and children. After drying in sunlight, these green bricks are baked in the kilns with biomass fuel. These biomass fuels increase the exposure to gases including sulphur dioxide, carbon dioxide, carbon monoxide, hydrogen sulphide, and other PM.

HEALTH PROBLEMS OF BRICK KILN WORKERS

Emission of an enormous quantity of toxic elements from brick kilns is causing severe health hazards amongst brick kiln workers in China, India, Pakistan, Bangladesh and Nepal (Croitoru& Sarraf, 2012; Le & Oanh, 2010; Skinder, Sheikh, Pandit, & Ganai, 2014). The brick kilns emit toxic fumes containing suspended particulate matters rich in carbon particles and a high concentration of carbon
monoxides and oxides of sulphur (SOx) that are harmful to the eye, lungs, and throat. Work-related musculoskeletal disorders have become a significant problem in many brick kiln industrialized countries (Hagberg et al., 1995). These disorders cause considerable human suffering and economic loss because of reduced working capacity and production. Work-related musculoskeletal disorders have a wide range of inflammatory and degenerative diseases and disorders that result in pain and functional impairment (Kilborn et al., 1996). It affects the body's soft tissues, including damage to the tendons, tendon sheaths, muscles, and nerves of the hands, wrists, elbows, shoulders, neck, and back (Saldana, 1996). Among such disorders, pain in the neck and shoulders often causes work disability among employees and is frequently associated with long periods of disability and sick leave (Westerling & Johnson, 1980). The musculoskeletal disorders have found with numerous occupational 'risk factors' including physical work, load factors such as force, posture, manual handling, repetitive work and vibration (Gerr et al., 1991).

Manual material handling and lifting are significant causes of work-related low back pains and impairments with other factors such as bent and twisted position (http://issu.com). The job-related risk factors associated with injury risk associated with the manual material handling of loads. Horizontal and vertical location of the load to the workers with an increase in horizontal distance the external joint pressures will increase, and workers will use a significant portion of their strength capacity. Distance load in reduced strength and higher energy expenditures. The frequency of lifting increases, metabolic demands are higher, and the onset of physical fatigue is more rapid. The weight and size of the load can affect the required strength and postural stress and metabolic demands. The work-related postures typically include reaching behind, twisting, working ahead, wrist bending, kneeling, stooping, forward and backward bending and squatting. Such attitudes are related to injuries that are incurred during tasks that are static. The following factors contribute for respiratory illness;

**Occupation and environmental factors:** Long-term exposure to some toxins or pollutants leads to severe lung damage. Workers who routinely inhale silica dust (silicosis), asbestos fibres (asbestosis) or hard metal dust and coal dust powders are especially at risk of debilitating lung disease, but chronic
exposure to a wide range of substances, many of them organic, also can damage lungs. The bacterial or fungal overgrowth in poorly maintained humidifiers and hot tubs can cause lung damage.

**Infections:** viral infections such as cytomegalovirus, are a particular problem for brick kiln workers with compromised immune systems & bacterial infections, including pneumonia, fungal infections such as histoplasmosis and parasitic infections.

**HEALTH EFFECTS OF AIR POLLUTION**

Air pollution in the brick kiln is produced both through the stack emission, as well as the fugitive emissions, though the stack emissions are not excessive but are somehow affecting the health of the workers. Emissions from brick kilns are comprised of fine dust particles, hydrocarbons, Sox, NOx, fluoride compounds, CO and a small number of carcinogenic dioxins (Environment Improvement Programme, 1995). SO2 is a water-soluble, irritant gas, which predominantly affects the upper airways. Infiltration of the air pollutants is more massive through mouth inhalation than with nose inhalation. Sulfuric acid has been classified as a group-1 carcinogen by the International Agency for Research on Cancer (IARC, 1992; Scott, 1998). Acute exposure to SO2 produces instant bronchial constriction, contraction of the airways, amplified pulmonary resistance, increased airway reactivity and changes in metabolism while as chronic exposure consequences in inflammation of the mucosal tissues and increased secretions (WHO, 1979; Amdur, 1978). Exposure to sulphur dioxide in the ambient air has been linked with reduced lung function, increased prevalence of respiratory symptoms and diseases, irritation of the eyes, nose, and throat and early mortality. Children, the elderly and those previously suffering from respiratory ailments, such as asthmatics, are
mostly at risk. Health impacts appear to be linked mainly to short exposures to ambient concentrations above 1,000 $\mu$g/m$^3$ (acute exposures calculated over 10 min) (World Bank, 2011).

A qualitative study conducted by Sharma (2013) on ‘clinical-social problems of brick kiln workers in Anand Gujarat. The brick kilns serve as a source of livelihood for thousands of unskilled labour. The seasonal nature of work attracts migrant labour, landless farmers for employment. People move primarily for economic reasons to address their needs, they live and work in poor conditions and no care for health. The result shows that all the workers were migrant and marginal workers. They work in the brick kiln for eight months then go back and do farm labour work in their native place.Qutubuddin (2013) examined the musculoskeletal problems and physical disorder amongst brick kiln workers in North Karnataka. Musculoskeletal Disorders have become a significant problem in brick kiln Industries in India. Manual brick manufacturing in India is currently an extremely hazardous occupation. In China, India, Bangladesh, Nepal, and Pakistan whereas mechanization was introduced, but various studies show that the workers working in the brick manufacturing units suffer from musculoskeletal problems.

**THE RATIONALE OF THE STUDY**

The objective of the present study is to investigate the prevalence and the determinants of the respiratory illness among the workers in the brick kiln industry. The workers on the brick kilns are one of the most unorganized labourers with low socio-economic status and education.

A large number of people are involved in brick kilns in India. The working environment at brick kilns is evidently hazardous to the labours working there. It is a common notion that people working at traditional brick kilns are more prone to
have respiratory disorders as compared to advanced brick kilns. However, there is vast and in-depth information to justify this claim. The current study aims to find out prevalence of respiratory disorders among traditional as well as advanced brick kilns in India. The results of the study would enable policy makers and implementers to understand the burden of respiratory disorders among workers at traditional as well as advanced brick kilns. This will eventually help policy makers and implementers to formulate appropriate policy and programmes to address critical issues affecting health of workers. Some safety guidelines could be formulated to prevent workers from acquiring respiratory disorders. The finding will also help to direct brick kiln owners to adopting preventive and promotive measures for workers. Ultimately the health and safety and thereby productivity of workers could be upgraded using key findings of the study.

Objectives of the study:

1. To find out the extent of occupational hazards in terms of respiratory disorders among workers working at traditional and advanced brick kilns.
2. To find out the extent of occupational hazards in terms of respiratory disorders in male and female workers of traditional and advanced brick kilns.

Design of the study:

*This research study is based on the cross-sectional survey method.*

Sample: A purposive sampling technique was used in this research study. The sample consisted of 251 brick workers from two districts namely Akola and Parbhani from Maharashtra, India. Out of the sample of 251 workers, 58 were
enrolled from the Akola district working at advanced brick kilns. Remaining 193 samples were enrolled from clamp types of kilns from Parbhani district. The demographic characteristics of respondents are as mentioned in the table No 3.1 below. Attempts were made to have equal proportion of respondents from both types of brick kilns with equal number of male and females. However, due to insufficient cooperation by brick kiln owners we could enrol only 251 respondents from advanced and clamp brick kilns.

Table No. 1. Sample

<table>
<thead>
<tr>
<th></th>
<th>Advanced Kiln (Akola District)</th>
<th>Clamp Kiln (Parbhani District)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>18</td>
<td>111</td>
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<td></td>
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TOOLS OF DATA COLLECTION

The standardized questionnaire (Check List) developed by American Thoracic Society (Partial) was used as a reference for designing the semi structured interview schedule. The questionnaire includes demographic information, past and present medical history, respiratory symptoms and substance abuse. This questionnaire was translated in the regional language i.e. Marathi for better communication and understanding of the respondents.

DATA COLLECTION

Most of the brick kilns are located in rural areas far away from the main population. It is a seasonal work which is generally undertaken during the months December to May. Hence, data collection was carried during December to May months.
Predominance of respiratory illnesses among the workers in advanced and clamp types of brick kilns

Table No. 2. Respiratory illness amongst brick kiln workers

<table>
<thead>
<tr>
<th></th>
<th>Cough</th>
<th>Phlegm</th>
<th>Wheeze/Whistling</th>
<th>Short of breath</th>
<th>Chest illness</th>
<th>No Complaints</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>15%</td>
<td>20%</td>
<td>6%</td>
<td>7%</td>
<td>4%</td>
<td>8%</td>
<td>60%</td>
</tr>
<tr>
<td>Female</td>
<td>14%</td>
<td>11%</td>
<td>4%</td>
<td>3%</td>
<td>0%</td>
<td>8%</td>
<td>40%</td>
</tr>
<tr>
<td>Total</td>
<td>29%</td>
<td>31%</td>
<td>10%</td>
<td>10%</td>
<td>4%</td>
<td>16%</td>
<td>100%</td>
</tr>
</tbody>
</table>

A majority of the respondents (86%) had some complaints associated with respiratory disorders at the time of data collection. This indicates high prevalence of respiratory complaints among people working at brick kilns. Nearly an equal proportion of respondents (30 & 31%) had cough and phlegm at the time of data collection. About (11%) of the respondents were having whistling chest. Slightly less than 10% of the respondents had shortness of breath and 5% reported clinically diagnosed any chest illness.

Respiratory illness between male and female brick kiln Workers
The gender wise comparison of predominance of respiratory complaints indicates that male brick kiln workers are more prone to have any respiratory complaints as compared to its counterpart. The data suggest that though cough was equally common among male and female respondents (15% & 14% respectively), however, almost double proportion of males (20%) were having phlegm than female respondents (11%). Similarly, whistling of chest and breathlessness was found to be more among male (6% & 7% respectively) than female respondents (4% & 3% respectively). Further, none of the female respondent was found to be having any clinically diagnosed chest illness while 4% of the male respondents reported clinically diagnosed chest illness.

**DISCUSSION**

The brick kiln workers are a heterogeneous group of people/families coming from different states; the intrastate migration was reported to be higher than the interstate migration, while the census found that Maharashtra receives the highest number of migrants amongst all other states (Census, 2001). In the present study it was found that the migrants from Bihar and Uttar Pradesh were second to those from other parts of Maharashtra. It was found that majority of brick kiln workers belonged to Scheduled Castes and OBCs; the families who migrated for employment in brick kilns reside to lower economic quintiles. The study by Bhagat (2008) argued that the migration might not be aggravated by the increased mobility of the people belonging to scheduled castes. However, present study suggests that people from scheduled caste and poor quintiles of the society make them likely to be engaged in the occupationally hazardous jobs. The researcher had focused on the demographic characteristics of the respondents, the literacy status of adults, the living and working condition of the brick kiln workers, income level, etc. It is found in this study that poor and marginalized people are more prone to be involved in vulnerable occupations nationwide. Findings of the current study also resemble a study conducted in Pakistan by Shiraz et al (2012), where almost one third of the workers (33.5%) coughed 4–6 times a day at the time of survey, 30.9% workers expectorated phlegm at least twice a day at the time of survey. 19.4% of workers reported experiencing wheeze on exposure to smoke. One third (34.4%) said mild Grade 1 dyspnoea, 17.1% met the criteria of suffering from Chronic Bronchitis while 8.2% reported having been diagnosed by the doctor as an asthmatic.
CONCLUSION

The study puts forth a strong relationship between hazardous environmental conditions and the respiratory health of brick kiln workers. The findings of the study indicate that most of the brick kiln workers are at higher risk of experiencing occupational hazards in the form of respiratory illness. Cough and Phlegm were found to be the significant respiratory complaints experienced by the brick kiln workers in traditional and advanced brick kilns from two study districts. The findings of the study indicate that even brick kiln workers perceive themselves as vulnerable to occupational diseases such as a cough, phlegm, and chest whistling complaints. Similarly, the proportion of respondents having phlegm is more among those working at advanced kilns (38%) than conventional kilns (29%). However, chest whistling and shortness of breath were found to be more common among traditional brick workers (11% and 11%) than that of advanced kilns (7% and 5%) respectively. Wheezing is a whistling sound from the chest on breathing out. Wheeze is a classic sign of asthma which is chronic respiratory disorder. Thus, it could be concluded that people working at traditional brick kilns are more prone to develop asthma as compared to workers of advanced brick kilns. The gender wise comparison of the predominance of respiratory complaints indicates that male brick kiln workers are more prone to have any respiratory complaints as compared to its counterpart.

Following are some of the recommendations to improve the living and working condition of workers at both traditional and advanced brick kiln setting:

- The workers must be provided with safety goggles and masks to protect themselves from dust particles along with a supply of hand gloves, shoes and caps
- There should be provision of safe drinking water and sanitation facilities
- Medical and first aid facilities and to keep reserve one doctor for the workers.
- The residential arrangement of workers should be away from brick kilns to avoid exposure to polluted air
- Provision for children’s education and crèche facilities
- Security of girls and women at work site
- Periodical medical check-ups of brick kiln workers. And health awareness services.


