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Original Research Article

Sociodemographic characteristics and occupational health risks: a cross-sectional study of respiratory and musculoskeletal issues among brick kiln workers of Agartala

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ABSTRACT

Background: Occupational health is vital for both employees and employers, boosting productivity, reducing absenteeism, and enhancing job satisfaction. However, workers in industries and factories often face occupational hazards. Brick making, a labor-intensive occupation, exposes workers to various health risks, including respiratory, musculoskeletal, and locomotive problems. This study aimed to assess the prevalence of health morbidities among brick field workers in Agartala, providing valuable insights into their occupational health challenges.
Methods: This cross-sectional study involved 150 participants randomly selected from three brick kiln factories: Durga Bricks Industries, Ma Kali Bricks Industry, and Kali Mata Bricks Industry. Data was collected through structured questionnaires and recorded in an Excel sheet. Chi-square tests were used to analyze the association between health morbidities and sociodemographic parameters among the participants.
Results: Statistical analysis revealed significant associations between job category and respiratory, locomotive, and musculoskeletal morbidities. Additionally, locomotive problems increased with working duration, showing a significant correlation ($p<0.05$). Musculoskeletal issues were also significantly linked to age groups. However, no association was found between dermatological problems and sociodemographic parameters among the participants.
Conclusions: Worker health is compromised by factors like neglecting personal protective equipment and prolonged working hours. To mitigate this, implementing measures such as limiting heat exposure and improving working postures can significantly enhance worker health and also boost productivity.

Keywords: Brick field workers, Demographic profile, Health morbidities, Occupational hazards

INTRODUCTION

India's brick-making industry is notorious for its hazardous working conditions and significant environmental impact. Manual processes dominate the sector, which the Central Pollution Control Board (CPCB) considers one of the most polluting in small-scale industries. Workers face serious health risks, including respiratory issues, gastrointestinal problems, and musculoskeletal disorders, due to poor sanitation, inadequate training, and lack of safety equipment.[1] Prolonged exposure to hazardous conditions has led to higher rates of respiratory diseases and chest problems among brick kiln workers.[2]

The industry's workforce is substantial, with around 10 million workers employed in over 100,000 brick kilns across the country.[3] India is the second-largest brick producer globally, producing an estimated 150-200 billion bricks annually. Workers, including children, toil for long hours in harsh conditions, often carrying heavy loads and working near open fires. This has severe consequences for their health, well-being, and socio-economic status.

The study highlights the need for effective safety interventions that consider both health data and the socio-economic context of workers. By understanding the human behaviour and economic factors at play, policymakers, labor welfare organizations, and brick field management can design practical and sustainable solutions to improve workers' well-being.

The brick industry's grim statistics on workplace accidents and health issues underscore the urgency for reform. With thousands of injuries and over a hundred deaths reported annually in Indian factories, the brick-making sector requires immediate attention to protect the lives and livelihoods of its vast workforce.

By highlighting and analysing the health issues of brick workers, the present study aimed to evaluate the impact of brick kilns on working environment, socioeconomic conditions, associated risks and occupational hazards of each of the tasks and also suggests measures about both preventive and curative aspects of occupational well-being.

METHODS

Selection of the study area and population

It was a cross-sectional study that was carried out over 3 months from 21st January, 2025 to 24th April, 2025 from the Durga Bricks Industries, Ma Kali Bricks Industry and Kali Mata Bricks Industry which are located in margins of Belonia Town in the Chittamara Gram Panchayat area of Bharat Chandra Nagar Block, Belonia Subdivision, South Tripura District.

Survey instrument

The survey in this study mainly involves data collection method. A semi-structured interview was conducted to collect necessary primary data from the target individuals using various questionnaire patterns.The final questionnaire was developed by balancing the data requirements with the respondents' ability to provide accurate information. Key considerations included the type of data sought, collection method, respondent units, and processing and tabulation needs. Data collection was carried out through face-to-face interviews using the drafted questionnaire.

Sampling technique and size

Random sampling was done to collect the data of workers who were available at the fields. Though there was a defined population in the fields but no probability sampling technique is done for the data collection.

Selection criteria

The selection of subjects was based on the criteria of their job profile in their respective brick industries:

Molding: molding is the process in which clay is prepared by grinding, mixing with water, and a rectangular shape is prepared into clay brick form and those involved in the process are called brick molders. Most of the female workers belong to this category.

Carrying: carrying is the process in which mud is carried to the molders by rapping in sacks on a bicycle or trolley. After the molding shape is prepared, the mud is further carried to the kilns.

Burning: the molded bricks are processed in burning kilns at high temperatures, generating the high heat needed to fire and harden the bricks to finally prepare them fully. The workers involved in this burning process in kilns are firemen or burning workers.

Loading: After the bricks are fully prepared, brick loaders load the bricks from the kiln to make arranged stack of bricks, they further involved in loading the bricks to trucks and cantors to supply the brick customers.

Data collection procedures

A structured interview was conducted to identify the personal, demographic and socio-economic, and working category and conditions of the workers, including the information of their name, age, sex, marital status, literacy, working, working durations etc. were taken.

Then a detailed open-ended interview was conducted where the life style, living conditions and the worker's health and safety issues, concerns, their perceptions and attitudes regarding the brick filed work.

Finally, to evaluate the problems and diseases such as respiratory, dermatological, locomotive and musculoskeletal disorders the workers have been faced, a Nordic questionnaire pattern was prepared and then a statistical analysis has to be done.

Statistical analysis of the data

Data were put up in Microsoft Office Excel sheets and analyzed by statistical calculations through tables and plotting graphs. Chi-square analysis was used to determine the association between the socio-demographic variables, working condition variables and different morbidities of the brick field workers. $p<0.05$ was considered to be significant result.

RESULTS

To assess the socioeconomic condition of the workers different parameters are considered in the present study, namely; age, gender, religion, marital status, family member, the type of house, education, working designation, working experience, working hour per day and monthly income of the workers in the study area.

Table 1: Sociodemographic profile of brick field workers.

Category	Frequency	Percentage
Gender		
Male	123	82.00
Female	27	18.00
Age groups		
15-29	52	34.66
30-44	70	46.66
45-60	28	18.66
Marital status		
Married	118	78.66
Unmarried	27	18
Widow/Divorced	5	3.33
Castes		
General	34	22.66
OBC	7	4.66
SC	65	43.33
ST	44	29.33
Literacy		
Literate	62	41.33
Illiterate	88	58.66

Table 2: Job profile of the selected subjects of brick field workers (n=150).

Variables	Frequency	Percentage
Job category		
Molding	65	43.33
Carrying	29	19.33
Loading	31	20.66
Burning	25	16.66
Working days a week		
6 days	84	56.00
6 and half day	53	35.3
Every day	13	8.66
Working duration		
Recommended 8 hours	54	36.00
More than 8 hours	96	64.00
Total number of years working in the brick field		
<5	68	45.33
6 to 10	54	36
>10	28	18.66

The study was performed on 150 brick workers in 3 different brick fields; among them 82% subjects were male (123) and 18% were female workers (27). The subjects consist of different age groups from 15-60 years of age. The age groups were divided into 3 categories which consisting of 34.66% (52) of workers in the age group of 15-29 years, 46.66% (70) of workers in the age group of 30-44 years and 18.66% (28) of workers were of 45-60 years old. Highest percentage of workers working in the age group of 30-44 years of age. Most workers in this profession are married and lack formal education, relying entirely on this work for their livelihood. A significant majority (78.66%) of the brick field workers were married, while 18% were unmarried. A small fraction (3.33%) was widowed or divorced.

The study focuses on four categories of brick field workers in a selected brick kiln. The molding category had the highest percentage of workers, accounting for 43.33%, significantly outnumbering those in carrying (19.33%), loading (20.66%), and burning (16.66%) (Table 2). However, they face significant challenges, including extremely low salaries that make it hard to sustain themselves despite long working hours. Many workers exceed the standard 8-hour workday, often working daily without regular breaks or time off. Some are required to work six and a half or even seven days a week. Brick molders might get one full day off but work 12 to 18 hours on the other six days. In this study, we observed that 64% people working in more than 8 hours, a day. Moreover, they work weakly 6 days without any gap which may also one of the reasons for physical strain and stress. This grueling schedule yields meager monthly salaries ranging from ₹5,000 to ₹10,000 which was not sufficient for their daily expenditure.

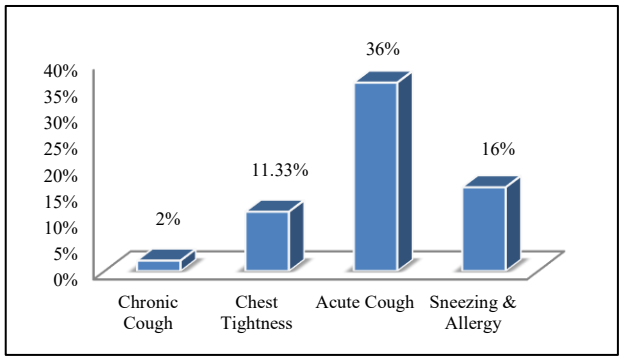

Figure 1: Respiratory problems.

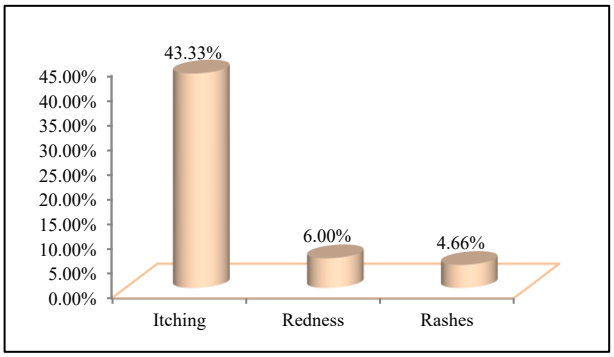

Figure 2: Dermatological problems.

Participants reported various health complaints, with 36% experiencing acute cough, a higher prevalence compared to other respiratory issues. Skin problems were also common, particularly itching (43.33%), likely due to prolonged exposure to UV rays, with fewer cases of redness and rashes. Additionally, workers reported musculoskeletal and locomotive issues, likely caused by

maintaining the same posture for extended periods those with the highest prevalence in the upper back (44%) and lower back (48.66%). Knee pain was also common, affecting 33.33% of workers, likely due to prolonged static postures. Shoulder and thigh pain were reported by 14% of workers, while smaller percentages experienced pain in the neck (6.66%), elbows (2.66%), and ankles (3.33%) (Figure 3).

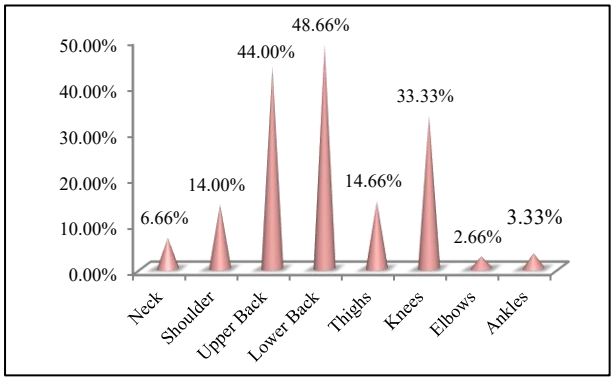

Figure 3: Musculo-skeletal morbidities in a specific area.

Locomotive issues were also prevalent, with 80.66% of workers exhibiting bent trunk posture, indicative of lower back pain. Other common issues included difficulties with sitting (56.66%), standing (51.33%), and heavy lifting (43.33%), with these problems occurring at relatively similar frequencies (Figure 4).

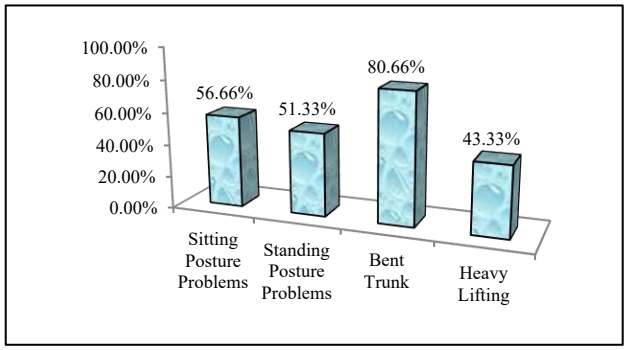

Figure 4: Locomotive problems.

Respiratory and dermatological morbidities

Brick field workers exhibited various respiratory issues, with acute cough being more prevalent. A significant link was found between respiratory problems and job categories, with results showing statistical significance ($p<0.05$). However, no notable connections were seen between respiratory symptoms and factors like gender, age, or work duration.[4,5] Additionally, workers reported dermatological issues, mainly itching, but the findings weren't statistically significant.

Table 3: Association of respiratory and dermatological morbidities with different socio-demographic parameters.

Working profile	Respiratory problems				Dermatological problems		
Type of work	**Chronic cough**	**Acute cough**	**Chest tightness**	**Sneezing and allergy**	**Itching**	**Redness**	**Rashes**
Moulding	1	18	1	10	22	3	3
Carrying	0	9	0	3	14	3	2
Loading	1	11	3	8	18	1	1
Burning	1	16	13	3	11	2	2
Chi-square	22.094				2.261		
P value	0.008				0.68		
Age groups (years)							
15-29	0	21	5	9	17	4	3
30-44	2	24	7	12	36	4	4
45-60	1	9	5	3	12	1	1
Chi-square	3.941				1.666		
P value	0.684				0.796		
Working duration							
Recommended 8 hours	2	21	10	8	27	5	5
More than 8 hours	1	33	7	16	38	4	3
Chi-square	3.681				1.748		
P value	0.297				0.417		
Gender							
Male	2	47	16	19	62	8	7
Female	1	7	1	5	3	1	1
Chi-square	2.786				1.214		
P value	0.425				0.544		

Table 4: Association of locomotive and musculoskeletal morbidities with different socio-demographic parameters.

Working profile	Locomotive problems		Musculoskeletal problems	
Type of work	**Yes**	**No**	**Yes**	**No**
Moulding	59	6	54	11
Carrying	20	9	16	13
Loading	24	7	19	12
Burning	18	7	20	5
Chi-square	8.213		10.711	
P value	0.041		0.0133	
Age groups (in years)				
15-29	26	26	29	23
30-44	67	3	53	17
45-60	28	0	27	1
Chi-square	48.231		15.762	
P value	3.363		0.0003	
Working duration				
Recommended 8 hours	35	19	35	19
More than 8 hours	86	10	74	22
Chi-square	13.594		2.6189	
P value	0.0002		0.105	
Gender				
Male	100	23	87	36
Female	21	6	22	5
Chi-square	0.176		1.288	
P value	0.674		0.256	

Locomotive and musculoskeletal morbidities

Locomotive and musculoskeletal issues significantly affect individuals as they age and due to varying postures. This study found that workers in the molding category experienced higher rates of these problems compared to those in other roles. Statistical analysis revealed that there was a significant association of different type of work with both locomotive and musculoskeletal issues (Table 4). Additionally, musculoskeletal problems were shown association with different age group, while locomotive morbidities were associated with working duration which means, with all findings being statistically significant ($p<0.05$).

DISCUSSION

From the results obtained in this study, it was observed that the brick field work is dominated by the males. It was found that 82% were male workers, whereas 18% were female. In four categories of brick work, the female workers mostly involved in molding category. Majority of molders were females though there was a significant population of male also but this category was dominated by females. Out of 27 female workers, 25 of them belongs to the molding category. The rest three categories- carrying, loading and burning which were completely dominated by the males.

Most of the workers were married, that is 79% of the total data, and due to high poverty and to sustain their livelihood, they were obliged to do this work of extreme labor where there were no guidelines, rules and regulations regarding the working duration and shifts of laborers. The majority of the workers work more than the recommended 8 hours of work, which is 64% of the total workers. The molding category workers have the longest working duration, their working duration ranges from almost 12 hours to 18 hours. Most of the molding category workers were entitled to a weekly holiday for rest, whereas the remaining category workers had to work for six and a half days. On Sundays, they were likely to been titled to a half-day leave. Among these three brickfields, the burning category workers had to work daily.

It was observed that rampant illiteracy was found among the workers. 58% of workers were fully illiterate, even unable to read or write, the rest 42% are very low educated and were school dropouts, either from the primary or elementary stage of schools.

Workers involved in brick field works, for instance, are frequently exposed to smoke, dust and ash, which are known to exacerbate or cause respiratory disorders. Occupational risk factors are a leading cause of chronic respiratory illnesses, second only to smoking. They account for 13% of COPD, 11% of asthma, and nearly all cases of silicosis, asbestosis, and pneumoconiosis

globally. Brick field workers experience a notably higher rate of respiratory issues, including chest tightness, chronic cough, breathing difficulties, sneezing, and allergy, with symptoms worsening significantly due to more exposure on the job. This is possible only when the exposure exceeds the normal limit (5.0 mg/m^3) as specified by OSHA.

Research by Myers found brick manufacturing workers often suffer from wheezing, shortness of breath, and chronic phlegm.[6] Similarly, a study on cement factory workers in a rapidly developing country reported high rates of breathing difficulties (21%) phlegm (25%), and cough (30%).[7,8] This study found that respiratory symptoms were highly impact the health of brick field workers and were significantly associated with different job categories. One of the important reasons for higher prevalence of respiratory symptoms was due to the absence of any personal protective devices while working in the brick kiln.

In this study, musculoskeletal and locomotive problems were also reported by the participants as an important morbidity faced by them. Working with raw materials using bent or twisted postures increases the risk of back pain in manufacturing industries that rely heavily on manual labor and materials handling. Some studies have shown that brick manufacturing workers often experience musculoskeletal issues, mainly due to awkward working positions, with lower back pain being the most common complaint, followed by wrist and hip pain.[2]

Prolonged squatting and forward bending while molding bricks can lead to numbness in the lower legs due to reduced blood flow and muscle compression, increasing the risk of musculoskeletal disorders and injuries. Women in brick manufacturing roles are more vulnerable to musculoskeletal issues, likely due to factors such as menstruation and childbirth that heighten their pain sensitivity.[9,10] This study revealed that musculoskeletal and locomotive issues are closely linked to specific brick manufacturing tasks like molding, carrying, loading, and burning. Both conditions are also influenced by age, with older workers facing more musculoskeletal problems. Furthermore, locomotive issues worsen with longer work durations, particularly for those working over 8 hours a day.

To boost worker health and productivity, recommendations include providing mechanical supports like arm and wrist rests for repetitive tasks, implementing task rotation, and adjusting workloads.[11]

Contrary to expectations; ‘gender’ was not significantly associated with any of the health problems. This may reflect that both male and female workers are subjected to similar environmental and occupational exposures in the brick fields. Although gender based physiological difference exists, the uniformity of tasks and exposure levels in this context might neutralize those distinctions.

CONCLUSION

The brick manufacturing is an efficient industry is one of the profitable businesses in India. The brick-kiln factory workers were more susceptible to occupational safety and health vulnerability. This study highlighted the multifaceted occupational health challenges faced by brick field workers, with a specific focus on respiratory, dermatological, locomotive and musculoskeletal morbidities which may be occur due to their working role, working duration and aging. In addition, working conditions, lifestyle, lack of proper awareness and knowledge, proper sanitation and hygiene also affect the health conditions of the workers. Excess of dusts and smoke with high temperature during daytime makes the working atmosphere more hazardous to the workers. If sufficient measures and guidelines are not adopted, a high percentage of workers may face serious illness and chronic disorders in near future.

To take sufficient measures for occupational safety and health, both central and state government, should appealed to implement the following recommendations and the owners of these brick fields to adopt and follow the recommended guidelines.

Recommendations

Based on the study findings, the following recommendations are proposed to mitigate health hazards in brick kilns:

To provide personal protective equipment (PPE), such as masks and gloves, particularly for workers involved in high-risk tasks like burning and loading. Reduce the working durations to minimize the risk of locomotive problems. Repetition of task improve work efficiency and productivity that can minimize the health issues. Traditional brick kilns such as fixed chimney Bull’s trench kilns (FCBTK) emit high levels of smoke and particulate matter, exposing workers to respiratory hazards, to mitigate this promote the use of zig-zag kilns or vertical shaft brick kilns (VSBK) which consume less coal and emit less particulate matter and more environment efficient. Introducing ergonomic measures like introducing mechanical aids like lifting devices, push carts etc. should reduce manual load and repetitive strain on the spine and joints. Compulsory requirement of regular medical checkup for brick field workers to minimize health issues early.

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