

# Chronic respiratory morbidity, musculoskeletal discomfort and other self-reported illnesses among migrant brick kiln workers in rural South India

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Date of submission: 03.05.2025

Date of acceptance: 22.07.2025

Date of publication: 01.10.2025

Conflicts of interest: None

Supporting agencies: None

DOI: <https://doi.org/10.3126/ijosh.v15i3.76575>



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## ABSTRACT

**Introduction:** Brick kiln workers face a higher risk of respiratory issues like Chronic Bronchitis and Asthma due to exposure to fine particulate matter. This study aimed to assess the prevalence of these conditions, along with musculoskeletal discomfort and other self-reported morbidities, among workers in a rural health center's field practice area.

**Methods:** This cross-sectional study included all men and women above 18 years of age (n=650) working in the 12 brick kilns in the study area. Out of 650, 580 workers gave consent for study participation. A standardized and validated questionnaire (ICMR-INSEARCH) along with Peak Expiratory Flow Rate (PEFR) was used to assess the prevalence of respiratory morbidity. Other morbidities were assessed by history taking and clinical examination of the participants.

**Results:** There were 580 workers, with a mean age of 36.47(SD 11.45) years. Of them, 66% were engaged in molding, 25% in carriage, and 6% in baking work. There were 15.2% smokers and 8.4% tobacco users. Chronic bronchitis was present in 37 (6.4%) and asthma in 12 (2.1%) workers. Higher age (>50 years) was associated with chronic bronchitis (p<0.05). Males and those who smoke less than 10 beedis daily had a higher PEFR (p<0.05). Musculoskeletal problems, low back ache (37%), neck pain (10.5%), and knee pain (9.5%) were the most common self-reported morbidities, followed by hypertension (9%) and gastritis (6%).

**Conclusion:** The brick kiln workers had a high prevalence of chronic bronchitis and bronchial asthma. Musculoskeletal problems, especially low backache, were the most common morbidity reported.

**Keywords:** Brick kiln workers, Chronic Respiratory morbidity, Musculoskeletal discomfort, South India

## Introduction

As per the WHO 2021 data, Chronic Obstructive Pulmonary Disease (COPD) kills 425 people every hour to become the fourth leading cause of death.<sup>1</sup> But in India, it is the second principal cause of morbidity, second only to ischemic heart disease,<sup>2</sup> and contributes close to one-third of total Disability Adjusted Life Years(DALYs) due to chronic respiratory diseases in the world.<sup>3</sup> Within

India, in the last two decades, the total deaths and DALYs due to chronic respiratory diseases has increased significantly. Air pollution, tobacco use, and occupational risks are the leading risk factors for chronic respiratory diseases DALYs in India.<sup>4</sup>

All three risk factors are simultaneously present in a brick kiln, increasing the risk of respiratory illness in an already poor, malnourished migrant

worker to a greater level. The brick kilns emit tons of particulate matter, Sulphur dioxide, carbon monoxide, carbon dioxide, and oxides of nitrogen, polluting the environment.<sup>5</sup> The habit of smoking and smokeless tobacco use is high among the brick kiln workers.<sup>6</sup> Since COPD is typically diagnosed based on symptoms, and individuals with low awareness often seek medical care late in the disease's progression, the condition is frequently underdiagnosed.<sup>7-9</sup>

The brick kiln workers are at a higher risk for not only respiratory illness but also a lot of physical and physiological stress, leading to musculoskeletal problems owing to their prolonged, frequent, and repeated heavy physical work, manual handling of materials, and awkward back postures.<sup>10</sup>

India is the second-largest producer of bricks globally, employing around 15 million workers.<sup>11</sup> In Tamil Nadu, brick kilns primarily operate with seasonal migrant laborers from economically backward districts. These workers, often paid in advance for the work period, are typically young and physically fit, as the job requires long hours of strenuous labor over a period of four to six months. Once they begin working at the kilns, many return year after year. However, most of these workers are illiterate or have low levels of education, belong to marginalized communities, and have limited health awareness.<sup>12</sup> Upon arriving at the brick kilns—usually located in remote areas far from urban centers—they face high exposure to dust, harsh working conditions, and limited access to healthcare.<sup>13</sup>

Brick kiln workers are known to suffer from a variety of Musculoskeletal discomfort, skin conditions, anemia, digestive problems, etc.<sup>14</sup> Majority of them are involved in molding, and a smaller proportion of them are in the carriage section. Those engaged in molding have to work for long periods in a squatting pose, bending and moving side to side the whole night, and those in carriage have to carry 10-12 bricks every time on their head, which leads to a tremendous amount of pressure on the neck, shoulder, and back muscles. These compounds with their poor health-seeking behavior, low access, and their inability to take leave or permission frequently to rest or seek treatment.<sup>9</sup> Many of them are known to take painkillers by over-the-counter purchase.

Hence, the current study primarily aimed to assess the prevalence of chronic respiratory morbidity and other morbidities among migrant brick kiln workers in the rural health Centre field practice

area of a medical college in South India.

## Methods

A cross-sectional survey was conducted among migrant workers employed at 12 brick kilns in the field practice of the Rural Health Centre, which is part of the Community Medicine Department of a medical college. Approximately 50 workers were assigned to each kiln, and they remained there for half of the year. A study from Nepal<sup>15</sup> showed the prevalence of chronic bronchitis among brick kiln workers to be 19%. Taking this as prevalence and 20% relative precision and 95% Confidence interval, the minimum sample size required was calculated to be 409.

After permission from the Brick Kiln Association of the district and the owners of the brick kilns, the workers in each brick kiln were assembled at one place. Although it was resting time for most of the workers, especially those involved in molding, a door-to-door visit was done to contact each one of them in each of the kilns. All the employees of the brick kilns were migrants from villages in the backward districts of Tamilnadu. They stayed within dwellings in the kilns, which were kachcha houses with poor lighting and ventilation. There were a total of 650 workers across all twelve kilns combined. But after repeated persuasion and explaining the benefits of the study, 580 workers agreed to participate in the study (response rate of 89%). Brick kiln workers (both males and females) who were more than 18 years of age were included in the study.

A pretested questionnaire was used for data collection. It had questions on background characteristics, personal habits, duration of stay and work in the kilns, their respiratory and other symptoms at the time of interview. Additionally, to determine the prevalence of chronic respiratory illnesses, a standardized and validated questionnaire developed for the Indian study on Epidemiology of Asthma, Respiratory Symptoms, and Chronic Bronchitis (INSEARCH), sponsored by the Indian Council of Medical Research (ICMR), was utilized.<sup>16</sup> Height and weight were measured.

The peak expiratory flow rate (PEFR) of study participants was measured using Wright's peak flow meter, a standardized, reliable apparatus used to assess pulmonary function in a non-invasive, objective manner. The normal PEFR value should be between 400 and 600 L/min. The study participants were informed about the measurement procedure, and after obtaining their consent and a review of their pulmonary history, they were asked to take a deep, calm breath, and

their nostrils were closed using a simple clip. Then, the PEFR apparatus, using a detachable disposable mouthpiece, was sealed completely into the participants' mouths, and they were asked to perform a single forceful blow. Depending upon the velocity of the air blown by the participant, the pointer present on the graduated scale of the PEFR apparatus moves manually. The value was noted, and the procedure was repeated three times. The best among the three values was taken as the participant's PEFR.

Ethics committee approval was obtained from the Institutional Ethics Committee II (excluding the clinical evaluation of drugs, procedures, devices, diagnostics, vaccines, and herbal remedies) of the

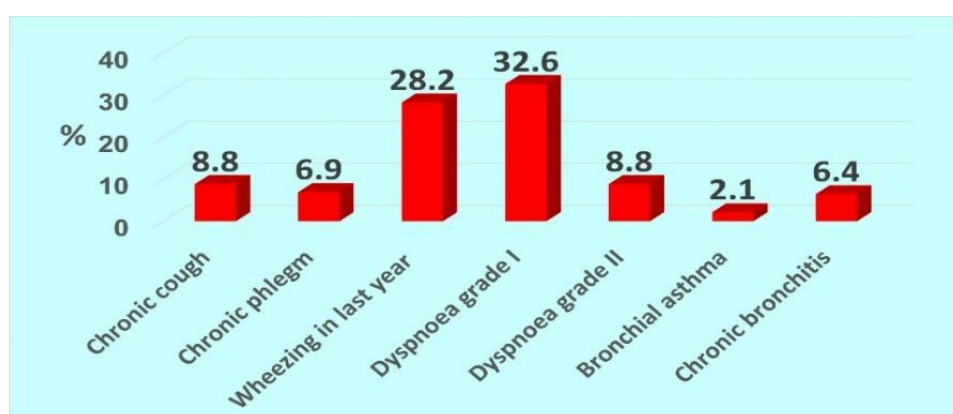
Sri Ramachandra Institute of Higher Education and Research (SRIHER) University. (Decision No: IEC-NI/16/AUG/55/66 and date: 18/01/2017). All participants were informed about the study before data collection, and written informed consent was obtained.

Descriptive statistics – proportions with 95% Confidence interval, mean with standard deviation were calculated for various parameters. For the association between two categorical variables, the Odds Ratio was calculated. Chi-square was used as a test of proportions, and the Student's t-test was used as a test of means. Statistical software used was SPSS Inc.16.0 and  $p < 0.05$  was taken for statistical significance.

## Results

Among the 580 workers who participated in this study, there was an almost equal number of males and females (284 vs. 296). The mean age of the participants was 36.47 years, with a standard deviation of 11.45. About 299 (52%) of the workers were illiterate, and another 99 (17%) had studied up to the 5th standard. Two-thirds of them, 381(66%) were involved in molding. (Table1) Around 125 (21%) were smokers. Among males, 119 (42%) were smokers and tobacco consumers, whereas 4 (1.4%) of females smoked, and up to 36 (12.2%) consumed tobacco. This was mainly used at night to be awake during the molding of bricks,

which they did from 9 pm till 5 am, usually. Most men, 114 (96%), used beedis for smoking. The prevalence of the different respiratory symptoms, as well as the chronic respiratory morbidities – Bronchial asthma and Chronic Bronchitis, as per the operational definition. Bronchial asthma was present among 12 people (2.1% with 95% CI 1.1-3.6) and Chronic bronchitis among 37 (6.4% with 95% CI 4.5-8.7) (Figure 1). The prevalence of chronic respiratory illnesses against the background characteristics and the Odds Ratio for cross tabulation among the different categories and the p-values (Table 1).



**Figure 1:** Prevalence of Respiratory Symptoms among brick kiln workers (n=580)

As shown in the table above, the prevalence of chronic bronchitis is higher among individuals over 50 years of age compared to the younger population, a statistically significant difference. Although smokers have a higher prevalence of chronic bronchitis than non-smokers, the difference is not statistically significant. However,

among smokers, a longer duration of smoking, more than 15 years, has shown a higher proportion of people to be affected by chronic bronchitis compared to those with shorter durations ( $p < 0.05$ ). Apart from this, the difference in proportion of the two morbidities is not significant among the other categories.

**Table 1:** Prevalence and association of Chronic Respiratory Morbidities among brick kiln workers with the background parameters (n=580)

Background Characteristics		Number (%)	Bronchial Asthma (n=12) N (%)	OR	P value	Chronic Bronchitis (n=37) N (%)	OR	P value
<b>Age</b>	Up to 50 years	514 (90.5)	10 (1.9)	1	0.505	29 (5.6)	1	0.028*
	>50 years	66 (9.5)	2 (3.2)	1.68		8 (12.9)	2.478	
<b>Sex</b>	Female	296 (51)	7 (2.4)	1	0.605	17 (5.8)	1	0.529
	Male	284 (49)	5 (1.8)	0.737		20 (7)	1.239	
<b>Nature of work</b>	Molding	380 (65.7)	7 (1.8)		0.071	28 (7.3)		0.473
	Carriage	144 (24.8)	3 (2.1)			7(4.9)		
	Baking	35 (6.0)	0 (0)			2 (5.7)		
	Others	20 (3.4)	2 (10)			0(0)		
<b>Smoking</b>	Non-smokers	455 (78.4)	10 (2.2)	1	0.675	25 (5.5)	1	0.098
	Smokers	125 (21.6)	2 (1.6)	0.722		12 (9.6)	1.822	
<b>Smoking Duration (n=124)</b>	≤ 15 years	52 (41.9)	1(1.4)	1	0.816	3(4.2)	1	0.015*
	>15 years	72 (58.1)	1 (1.9)	1.392		9 (17.3)	4.814	
<b>Smoking Times/ day (n=119)</b>	< 10	54 (41.9)	0(0)	1	0.316	4(9.8)	1.014	0.983
	≥ 10	65 (58.1)	2 (2.4)	1.025		8(9.6)	1	
<b>BMI</b>	Underweight	94 (16.2)	3(3.2)		0.421	9(9.6)		0.503
	Normal	371 (64.1)	5 (1.3)			20 (5.4)		
	Overweight	85 (14.7)	3 (3.5)			5 (5.9)		
	Obese	26 (4.5)	1 (3.8)			2 (7.7)		
<b>Duration of work</b>	<10 Years	294 (50.6)	6 (2.1)	1	0.793	19 (6.7)	1	0.626
	>10 Years	286 (49.4)	5 (1.8)	0.852		16 (5.8)	0.855	

The mean (SD) Peak Expiratory Flow Rate (PEFR) in L/min of the brick kiln workers with different characteristics is shown. The PEFR follows a normal distribution. It is seen that females had lower PEFR than males. ( $p < 0.05$ ) Smokers had higher PEFR values compared to non-smokers because non-smokers, who were predominantly females, had lower PEFR values, thereby pulling the mean value lower. Upon comparing the mean PEFR among males, smokers had a lower mean (325.86 with SD 83.54) compared to non-smokers (345.63 with SD 98.4); however, this difference was not statistically significant (not shown in the table). Smokers who smoked ten or more beedis per day

had a significantly lower PEFR. Though there was no statistical significance, participants with bronchial asthma and COPD were found to have lower PEFR. (Table 2).

Musculoskeletal problems were the most common among the brick kiln workers, especially low back ache, which was the most prevalent (37%). All the anemics were women. Gastritis was reported equally among males and females. Body aches were common among women (Table 3).

MSDs, including LBA, knee pain, and neck pain, were higher among participants aged 35 years or older compared to younger individuals (52% vs



40%,  $p = 0.003$ ). Low back ache was reported more frequently by males than females (41.5% vs 33%,  $p = 0.031$ ). Musculoskeletal discomfort, especially LBA, was more common among workers in molding, followed by carriage and then baking (42.5 vs 29 vs 29% -  $p 0.005$ ). The prevalence of

MSDs almost doubled when the duration of work exceeded 8 hours (26 vs 51% -  $p 0.000$ ). People who worked in brick kilns for 6 years or more reported MSDs less frequently compared to those who worked for 5 years or less (45 vs 77% -  $p 0.009^*$ ) (Table 4).

**Table 2:** Distribution of PEFR values among the brick kiln workers:

PEFR		Frequency	Mean (SD) L/min	P value
Population		580	296.2(91.26)	
Sex	Male	284	337.26 (92.78)	<0.001*
	Female	296	256.16 (69.47)	
Smoking	Yes	125	325.70(86.67)	<0.001*
	No	455	287.97 (90.90)	
Smoking duration (years)	< 15	52	323.55(84.09)	0.743
	≥ 15	72	328.79 (90.52)	
Smoking Times/day	<10	54	344.12 (100.48)	0.024*
	≥10	65	307.66 (70.44)	
Bronchial Asthma	Present	12	257.50 (58.8)	0.138
	Absent	568	297.05 (91.7)	
Chronic Bronchitis	Present	37	276.18 (109.49)	0.187
	Absent	543	297.5 (89.91)	

**Table 3:** Morbidity profile of the brick kiln workers (n=580)

Morbidity	No. (%)
<b>Musculoskeletal problems</b>	
Low back ache	215 (37.1)
Neck sprain	61 (10.5)
Knee Pain	55 (9.5)
Body ache	32 (5.5)
Headache	28 (4.8)
Shoulder ache	26 (4.5)
<b>Other self-reported morbidities</b>	
Gastritis/GERD	35 (6)
DM	5 (0.9)
White discharge	2 (0.3)
Urinary problems	2 (0.3)
Chest pain	2 (0.3)
Epilepsy	2 (0.3)
<b>Clinical Examination:</b>	
BP Systolic≥140 or Diastolic≥90 or known H/o Hypertension	53 (9.1)
Anemia	17 (2.9)
Pregnant	2 (0.3)

**Table 4:** Cross-tabulation of Musculo-skeletal Discomfort and Low Back Ache with background characteristics – Chi square test (n=580)

Background Characteristics		No.	MSD No.	%	p value	LBA No.	%	p value
Age	upto 35 yrs	300	119	40	0.003*	95	31.7	0.005*
	36 and above	280	145	52		120	43	
Sex	Male	284	131	46.1	0.801	118	41.5	0.031*
	Female	296	133	45.1		97	32.9	
Nature of work in brick kiln	Molding	381	190	49.9	0.005*	162	42.5	0.001*
	Carriage	143	58	43.6		41	28.7	
	Baking	35	13	37.1		10	28.6	
	Others	20	3	15		2	10.0	
Duration of work in brick kiln	>5 years	563	251	44.7	0.009*	202	35.9	0.001*
	< 5 years	17	13	76.5		13	76.5	
Work Hours daily	Up to 8 hours	119	31	26.1	0.000*	21	17.6	0.000*
	> 8 hours	455	232	51		194	42.6	

## Discussion

Occupations in certain sectors are associated with specific health hazards, commonly referred to as occupational health hazards. Brick kiln workers are exposed to various particulate matter, environmental stressors, and gases, which compromise their health status. Thus, the current study aimed to assess chronic respiratory morbidity, musculoskeletal discomfort, and other morbidities among brick kiln workers ( $n = 580$ ).

The current study reveals that nearly all the study participants (brick kiln workers) were from rural backgrounds, and the majority of them (52%) were illiterate, indicating that a lack of education may lead individuals to choose occupations in poor work environments with prolonged working hours.<sup>17</sup> As brick kiln work demands extreme manual work, a higher proportion of them were found in their young or middle adulthood phase of life.

A higher percentage of males were found to be involved in smoking, and due to poor socioeconomic status, they seem to have chosen beedi over cigarettes, considering the cost factor. Even a minimal percentage of females were found to chew tobacco, and the participants justified this by demanding that night shifts require them to be awake and alert.

Workers above 50 years of age had 2.478 times higher chances of developing chronic bronchitis than those less than 50 years and it was also found to be statistically significant. Also, those who had been smoking for more than 15 years were found to have almost five times higher chances of developing chronic bronchitis than their counterparts.<sup>18,19</sup>

Peak Expiratory Flow Rate (PEFR) is the maximum volume of air expelled forcefully in one single expiration and is a reliable objective marker for Pulmonary ventilation. A marked reduction in PEFR indicates airway obstruction, a key indicator of Obstructive Lung disease. In the current study, females were found to have lower PEFR than males and those who smoked more than 10 times per day were found to have higher PEFR.<sup>20</sup>

Brickkiln exposes individuals to workplace particulate matter, smokes, and gases that arise from combustible materials used during the brick-making process. These make an individual more prone to COPD, compromising lung function and hygiene.<sup>21</sup> The prevalence of chronic cough and phlegm in this study was 9% and 7% respectively

and that of chronic bronchitis was 6.4%. A similar study conducted among 692 brickkiln workers in Jammu showed that chronic cough was the most frequent symptom present in 23.5% of the workers, followed by phlegm in 23% and chronic bronchitis was present in 21% which are much higher compared to the present study. The prevalence of chronic bronchitis was significantly associated with the sex of the participants in that study, but in this study, the difference was not significant.<sup>21</sup>

PEFR was found to be higher in males due to physiological factors, such as increased lung volumes and greater respiratory muscle endurance. Also, those who smoked more than 10 times per day were found to have lower PEFR in this study. This finding was similar to the finding in a survey among brick kiln workers in Wardha district.<sup>22</sup>

Brick kiln involves manual labor, and a very high percentage of participants have reported low backache, followed by neckache, and knee pain. A brick kiln is a process where coarse soil is subjected to various methods and transformed into solid bricks. This involves handling, molding, and transferring the materials to different places. Additionally, brick kiln workers experience prolonged work hours, leading to excessive exertion and depletion of skeletal muscle tissues and nutrients. A study from West Bengal reveals that the prevalence of low backache and neck pain among brick kiln workers is nearly 90%.<sup>23,24</sup> Also, the findings that males had a higher prevalence of low back ache and those with less than 5 years' work experience had a lower reporting of MSDs were similar to the study done in Rajasthan.<sup>24,25</sup>

Brick kiln particulates, smoking, tobacco chewing, loss of sleep, stress, and advancing age trigger inflammation within the host, leading to hypertension as seen in 1/10th of the study participants. However, brick kiln workers are reported to have a lower prevalence of hypertension compared to the general population, which is consistent with our study findings.<sup>26,27</sup>

The strength of this study lies in its cross-sectional design, which encompasses all workers from 12 brickkilns, comprising nearly 600 subjects and thereby representing the morbidity profile and respiratory health of brickkiln workers in South India. The usage of a standardized questionnaire to estimate the prevalence of chronic respiratory conditions and measuring PEFR adds strength to the study.

## Limitations

The limitation of this study is that we could not use a standardized scale for measuring MSDs, as the time available for each worker to spare during any day was limited.

## Conclusion

The brick kiln workers in South India have a high prevalence of chronic respiratory morbidities, especially chronic bronchitis. Also, the prevalence

of musculoskeletal discomfort, especially low back ache and neck pain, anemia, and GERD is high among these workers, which affects their quality of life. Hence, adequate use of PPE, regulations for work hours, and periodic health checkups could help improve the health of brick kiln workers.

## Acknowledgment

Nil

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