



Socioeconomic insecurities among brick kiln workers: A study in Sangrampur Shibati GP, Basirhat-I CD Block

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Abstract:

Brick manufacturing remains one of the most labour-intensive sectors in India, providing seasonal employment to thousands of rural and migrant workers, yet exposing them to persistent socio-economic vulnerabilities. This study investigates the socio-economic profile, health hazards, and gender-based discrimination among brick kiln workers in Sangrampur Shibati Gram Panchayat, Basirhat-I CD Block, North 24 Parganas, West Bengal. Using primary data collected from field surveys and interviews, supported by secondary sources, the study examines the precarious living and working conditions faced by labourers, many of whom are engaged without contracts or legal protections. Findings highlight that workers endure low wages, irregular employment, and unsafe working conditions, with a high prevalence of occupational health problems, particularly respiratory and musculoskeletal disorders. Women workers, while forming a crucial part of the workforce, face additional challenges of wage inequality, excessive workloads, and limited access to healthcare facilities. The study concludes that systemic exploitation, lack of regulation, and entrenched gender disparities continue to undermine the social and economic well-being of kiln workers in the region. The research contributes to the broader discourse on informal labour in India. It underscores the urgent need for policy interventions that ensure social security, wage regulation, and gender equity within the brick kiln industry.

Keywords:

Brick kiln, socio-economic status, gender role, health hazard

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Introduction

Brick manufacturing is one of the oldest known industries in West Bengal, with roots tracing back to the earliest phases of civilization. Globally, brick production dates to ancient Mesopotamia, around 500 BCE. Archaeological evidence from the Indus Valley Civilization, particularly the ruins of Mohenjo-Daro and Harappa, dating back over 4,000 years, demonstrates that brick making was a well-developed craft in the Indian subcontinent (Sharma, 2013; Roy, 2018).

Bricks have long remained an indispensable component of India's construction industry, serving as the foundational element in the development of rural and urban infrastructure. India ranks as the second-largest producer of clay-fired bricks globally, accounting for over 15% of the world's brick production (TERI, 2017). The Indian brick manufacturing sector is predominantly informal, comprising approximately 45,000 small and cottage-scale kilns that collectively produce around 51 billion bricks annually (Das, 2020). Despite its significant contribution to both the economy and employment, the sector continues to operate in a decentralized, unregulated manner, often under conditions that reinforce socio-economic inequities and labour exploitation.

In India, the informal sector constitutes a dominant segment of the Indian economy, contributing substantially to national growth. Both rural and urban areas exhibit a high concentration of unorganized labour across agricultural and non-agricultural activities. Nonetheless, working conditions for rural labourers tend to be more vulnerable than those of their urban counterparts. Key factors such as wage disparities and employment insecurity outside the agricultural sector intensify this vulnerability. In rural contexts, workers are frequently engaged in domestic or ancillary tasks, which are often voluntary in nature and inadequately compensated. As a result, the rural workforce experiences persistent challenges of low income, reduced productivity, and widespread poverty, which further drive patterns of labour mobility and migration (Joseph et al., 2022).

However, this informal and unorganised sector of the brick kiln industry, with migrant workers forming the predominant share of its labour force (Kayal et al., 2024). These workers, typically engaged on a seasonal basis between November and June, face difficult working conditions that highlight the industry's dependence on their labour. As a labour-intensive sector, brick production is marked by systemic exploitation, particularly of women and children (Kayal et al., 2024). The living conditions of brick kiln workers are highly precarious, often characterized by makeshift, shanty-like shelters with minimal amenities (Naik, 2017). Despite established government wage standards, kiln owners frequently disregard official rates, leaving workers underpaid and economically vulnerable. Consequently, brickfield labourers continue to endure acute financial distress and deplorable living conditions (Das, 2014). A significant proportion of the workforce belongs to economically and socially marginalized communities, with nearly half comprising women who are subjected to extreme poverty, malnutrition, and persistent inequality compared to men. Occupational heat exposure disproportionately affects women, resulting in physiological strain, diminished productivity, and reduced earnings

(Sett & Sahu, 2014). Within this context, women endure exploitation, deprivation, and limited recognition of their labor. Importantly, the brick industry ranks as the second-largest employer for impoverished women and other marginalized groups seeking livelihood opportunities through migration (Kayal et al., 2024).

The geographical conditions of West Bengal, particularly the silt-rich alluvial plains of its riverine delta, have historically been well-suited for brick production. In earlier times, the high-quality clay soil of South Bengal served as a readily available and inexpensive raw material. Additionally, the region's extensive network of inland waterways facilitated the low-cost transportation of both raw materials and finished bricks (Mukherjee, 2015). As Kolkata expanded during the colonial era, the surrounding districts of Howrah, Hooghly, and North and South 24 Parganas emerged as prominent hubs for brickfields, catering to the city's growing demand for construction materials (Chakraborty, 2020).

Basirhat-I C.D. Block, located in the North 24 Parganas district of West Bengal, has been chosen as the study area due to its prominence as one of the largest brick-kiln clusters in the state. The block contains the highest concentration of brick kilns in the district, with approximately 120 units identified through manual verification using Google Earth Pro. This dense concentration of brick-manufacturing units makes the region highly suitable for examining the socio-economic conditions of brick-kiln workers.

The study area's location further strengthens its relevance. Positioned about 70 km from Kolkata and adjacent to Basirhat Municipality, the region supplies a significant volume of bricks for urban construction activities. The bricks produced here are renowned for their superior quality, which has led to their use in major infrastructure projects, such as the Gangasagar guard wall.

Additionally, the area boasts strong transport connectivity, with brick consignments being exported via both road and waterways, which supports its role as a strategic production hub. Sangrampur Shibati Gram Panchayat and Basirhat Municipality lie on opposite sides of the Ichamati River, connected by the Basirhat Ichamati Bridge. This geographical setting highlights a clear rural–urban contrast, making it valuable for understanding disparities in access to education, healthcare, and communication services.

Given these characteristics, Basirhat-I C.D. Block provides an ideal context for assessing the actual socio-economic conditions of brick-kiln workers in Sangrampur Shibati and for exploring the broader structural factors shaping their livelihoods.

Currently, West Bengal is home to approximately 3,500 brick manufacturing units, which officially employ over 0.7 million workers, many of whom come from rural agrarian backgrounds (Government of West Bengal, 2021). The industry plays a significant role in generating rural employment, creating around 50 jobs per investment of ₹0.1 million, compared to only 7 jobs in other small-scale industries and 2 jobs in large-scale industries (Singh & Ghosh, 2019). Despite being a significant contributor to the state's economy and rural employment, it continues to function under largely informal and exploitative conditions. Occupational health, as jointly defined by the International Labour

Organization (ILO) and the World Health Organization (WHO), emphasizes the promotion and maintenance of the highest possible standard of physical, mental, and social well-being of workers in all occupations (Koh & Jeyaratnam, 2001; ILO & WHO, 1995). Workers, especially women, are subjected to long working hours, inadequate wages, poor living conditions, and minimal access to healthcare or social protection. Most brickfield workers are seasonal migrants engaged on a casual basis, often without formal contracts or job security.

The primary objective of this research study is to investigate the socio-economic profile of brick kiln workers in the study area, with a particular focus on the intersectional challenges of gender-based discrimination and occupational health hazards

Materials and methods

This research employs a methodological framework that encompasses the identification of the study location and target population, the development of a sampling strategy and determination of sample size, the creation of survey tools, the design and formulation of the questionnaire, the approach to data collection, and the subsequent steps for data processing and analysis.

1 Selection of the study area and population: North 24 Parganas is one of the 23 districts in the eastern Indian state of West Bengal, with its administrative headquarters located at Barasat. According to the most recent census, it is the second most populous district in India (District Census Handbook, 2011). Geographically, the district is characterised by a striking contrast: while its southern part extends into the riverine landscape of the Sundarbans, its western fringe merges with the rapidly expanding urban agglomeration of Kolkata. Administratively, North 24 Parganas is divided into five subdivisions Barasat, Barrackpore, Bidhannagar, Basirhat, and Bangaon. The present research focuses on Basirhat-I Community Development Block, located at approximately 22.66°N latitude and 88.87°E longitude. The block lies within the new alluvium sub-region of the Lower Gangetic Plain, considered one of the most fertile areas for agricultural production. The soil composition ranges from sandy-to-sandy clay loam, with the latter being the dominant type. Basirhat-I shares its eastern boundary with Bangladesh across the Ichhamati River and is bounded by Baduria and Deganga to the north, Haroa to the west, and Hasnabad and Hingalganj to the south (District Census Handbook, 2011). Demographically, Basirhat-I exhibits a population density higher than the rural average of North 24 Parganas. The relatively high density can be attributed to its proximity to Kolkata and improved accessibility (District Human Development Report, 2010). The block also represents a typical riverbank linear settlement, shaped by agricultural activity and the brick-making industry. In recent decades, brick manufacturing has emerged as a significant economic sector in Basirhat-I, providing livelihoods to a substantial proportion of the local population. Today, it stands as the third largest contributor to the local economy, following agriculture and aquaculture (District Human Development Report, 2010).

2 Sampling technique and sample size: To ensure both depth and representativeness in the data, a stratified purposive sampling technique was employed. Stratification was based on variables such as gender and work roles (e.g., moulding, loading, firing), allowing for inclusion of both male and female respondents across different labour categories. This approach ensured that diverse socio-economic perspectives were captured while focusing on kilns with high labour intensity and variation in worker demographics.

Out of the 20 brick kilns currently operational in the study area, three kilns (Friend, Provat 1, and Purobi), constituting 15% of the total, were purposively selected for in-depth investigation. These kilns collectively employed approximately 350 workers, from whom a sample of 150 individuals (42.86%) was drawn. When compared to the estimated total workforce of 1,400 brick kiln labourers in the broader region, the selected sample accounts for 10.71% of the population

Metric	Total (N)	% Of Total	Sample (N)	% Of Total
Total Brick Kilns	20	100	3	15
Total Workers	1,400	100	150	10.71
Workers In 3 Selected Kilns	350	100	150	42.86
Source – Primary Survey				

Table 1. Sample Description

3 Survey instrument: A semi-structured questionnaire was employed to collect both quantitative and qualitative data from 150 brick kiln workers. The instrument included a mix of closed- and open-ended questions covering key areas such as demographic characteristics, nature of employment, income and wages, occupational health, living conditions, and gendered domestic responsibilities.

Age	Male %	Female %	Total Frequency	Combined %
Below 20	8	32	24	16
20 - 40	68	48	92	61.33
40- 60	20	20	30	20
Above 60	4	0	4	2.67
Total	100	100	150	100
Source – Primary Survey				

Table 2. Distribution of respondents by age and sex

4 Construction of the questionnaire: The questionnaire was designed to assess the socio-economic conditions and health-related vulnerabilities of brick kiln workers of

the study area. Following an initial pilot interview with twenty respondents, the final tool was refined to align with both the research objectives and the respondents' ability to provide reliable information.

Structured as a semi-formal schedule, the questionnaire combined closed and open-ended questions. It covered key themes including personal and household demographics, employment type, income, health issues, working conditions, access to services, and gender-specific roles. Additional segments targeted female workers and 'fired workers' to explore their unique challenges in greater depth.

Practical considerations, including clarity, respondent comprehension, and ease of tabulation, guided the design process. All data were collected through face-to-face interviews and focus group discussions (FGD) in Bengali to accommodate low literacy levels and ensure accurate responses.

5 Data collection method: Semi-structured interviews were adopted as a methodological choice for this study, considering the limited availability of workers who are frequently occupied and closely monitored by supervisors and senior colleagues. To navigate these constraints, a combination of semi-structured interviews and self-administered questionnaires was utilised, designed with questions directly aligned with the study's objectives. To complement the survey data, two Focus Group Discussions (FGDs) were conducted, one with fire workers and another with a mixed group of male and female workers. Each FGD comprised between 6 and 14 participants.

6 Data processing and analysis: The collected data were processed and analysed using Microsoft Excel (Version 2007) and SPSS Statistics (Version 23.0). Descriptive statistics, such as frequencies and percentages, were applied to summarize key variables. Cross-tabulations were performed to examine the distribution of subcategories across different demographic and occupational groups. For specific variables, such as Gender-Wise Analysis of Health Issues, means and standard deviations, and Spearman's rank correlation were calculated to assess central tendency, variability, and to measure the strength and direction of a monotonic relationship between male and female workers.

Results

1 Socioeconomic realities of brick kiln workers: The socio-economic profile of brick kiln workers of the study area reveals a complex interplay of marginalisation, low income, and high vulnerability. Religion-wise, most workers were Muslim (70%), with female representation in this group (80%) notably higher than that of males (65%). Hindus constituted 30% of the total, with a greater share among males (35%) compared to females (20%). This skew likely reflects community-specific labour recruitment patterns within brick kiln operations.

Marriage was the predominant status among respondents (83.3%), with males (86%) slightly more likely to be married than females (78%). The small proportion of widowed or

divorced respondents (1.4%) was all female, suggesting possible gender-linked vulnerabilities in marital stability and subsequent employment dependency.

Household size patterns indicated that most respondents lived in families of five to six members (44.67%), followed by households with four or fewer members (37.33%). Larger households (≥ 7 members) were less common (13.33%), but the combination of moderate-to-large family sizes and low wages indicates a high dependency ratio and potential financial strain.

Housing conditions were predominantly poor, with 69.33% living in kaccha houses, a proportion significantly higher among females (80%) than males (64%). Access to pacca housing was limited overall (19.33%) and skewed towards males (25%) over females (8%), reflecting both income disparities and possible differences in property ownership or rental arrangements.

Educational attainment was low, with 14.67% illiterate and a majority (56.67%) completing only primary education. Illiteracy was more prevalent among females (34%) compared to males (5%), and males were far more likely to achieve secondary education or higher (33% vs. 10%). This gap suggests that socio-cultural norms and limited access to education for girls in rural settings may contribute to their concentration in low-skill brick kiln tasks.

Occupational segregation was evident, soft mud moulding was the dominant work type (66.67%), with higher female participation (76%) than male (62%), likely due to the task's alignment with household-based manual skills. In contrast, roles such as brick arranging, loading/unloading, fireman, and Thikadar were male-dominated, reflecting gendered divisions of labour and possible differences in physical task allocation or employer perceptions of capability.

Work experience data showed that 40% of workers had more than 12 years in the sector, with higher rates among males (45%) than females (30%). Shorter tenure (< 4 years) was much more common among females (24%) than males (4%), possibly due to greater turnover among women resulting from household responsibilities, marital migration, or seasonal work patterns.

Working hours were long for most, with 68.67% working 8–12 hours per day, heavily concentrated among males (91%) compared to females (24%). Women were more likely to work fewer than eight hours daily, potentially due to concurrent domestic duties or employer decisions to allocate shorter shifts.

Income patterns reflected these disparities: nearly half of the respondents (48%) earned between ₹6,000–₹12,000 per month, but this income bracket included a higher proportion of males (54%) than females (36%). Low-income earners ($< ₹6,000$) were disproportionately female (56%) compared to males (26%). Only 16% of workers earned above ₹12,000, with male representation (20%) far outpacing female (8%).

Variables		Total Frequency	Combined %	Female %	Male %
Religion	Hindu	45	30	20	35
	Muslim	105	70	80	65
	Others	0	0	0	0
Marital Status	Married	125	83.3	78	86
	Unmarried	23	15.3	18	14
	Widow/Widower/ Divorced	2	1.4	4	0
Family Member	≤4	56	37.33		
	5-6	67	44.67		
	≥7	20	13.33		
Type Of House	Pacca	29	19.33	8	25
	Semi-Pacca	17	11.33	12	11
	Kaccha	104	69.33	80	64
Education	Illiterate	22	14.67	34	5
	Primary Level	85	56.67	56	62
	Secondary & Above	43	28.67	10	33
Working Designation	Soft Mud Moulding	100	66.67	76	62
	Brick Arranging	12	8	0	12
	Loading/Unloading	30	20	24	18
	Fireman	6	4	0	6
	Thikadar	2	1.33	0	2
Working Experience	<4		10.67	24	4
	4 To 8	33	22	22	22
	8 To 12	41	27.33	24	29
	> 12 Years	60	40	30	45
Working Hour Per Day	Bellow 4	12	8	24	0
	4 To 8	14	9.33	22	3
	8 To 12	103	68.67	24	91
	Above 12	21	14	30	6
Monthly Income (Rupees)	Below 6,000	54	36	56	26
	6,000-12,000	72	48	36	54
	Above 12,000	24	16	8	20
Source – Primary Survey					

Table 3. Distribution of respondents by religion, marital status, family member, the type of house, education, working designation, working experience, working hour per day and monthly income (n=150).

Overall, the data indicate that brick kiln work is characterized by low educational attainment, gendered job allocation, poor housing, long hours (particularly for men), and low pay conditions, likely shaped by entrenched socio-economic constraints, limited

alternative employment opportunities, and the seasonal, labour-intensive nature of the brick industry. Gender disparities in income, housing, and education appear rooted in both structural inequalities and the traditional division of labour within rural communities.

2 Gender Equity and the Division of Labour across Economic and Domestic Domains:

Gender equity refers to ensuring fairness in treatment between women and men, based on their respective needs. This can involve either identical treatment or differentiated treatment that is equivalent in terms of rights, benefits, responsibilities, and opportunities (UNESCO, 1995). The data reveal a clear pattern of gender-based occupational segregation within the brick kiln sector. Women are concentrated almost exclusively in Soft Mud Moulding (76%) and Loading/Unloading, while positions such as Brick Arranging, Fireman, and Thikadar (Contractor) remain the exclusive domain of men. Wage disparities further reinforce this divide: in moulding, women earn ₹4,450 compared to men's ₹6,650, and in loading/unloading, women receive ₹5,000 while men earn ₹7,000. Such differences underscore structural gender inequalities, wherein women are confined to lower-paying, physically demanding roles (Sen & Ghosh, 2020).

Categories of Labourers	Gender Distribution		Estimated Average Income / Month in Rs.		Remarks
	Male Labourers (%)	Female Labourers (%)	Male	Female	
Soft Mud Moulding	62%	76%	6650	4450	Female And Child Workers Are Dominant
Loading/Unloading	18%	24%	7000	5000	Male Dominated System Where Women Are Used to Paid
Brick Arranging	12%	0%	5500	0	Only Male Are Engaging In This Activity
Fireman	6%	0%	1800 0	0	
Thikadar (Contractor)	2%	0%	2500 0	0	
Source – Primary Survey					

Table 4. Differences in Job Roles by Gender and Average Income

An analysis of daily work patterns highlights additional gender disparities in both productive and domestic spheres. In income-generating activities within brick kilns, men work longer hours (10.06 hours) compared to women (8.1 hours). However, in home-based income activities, women contribute more time (3 hours) than men (1.5 hours).

The imbalance is more pronounced in domestic responsibilities: women devote nearly twice the time (4 hours) compared to men (2 hours). Cumulatively, while men work a total of 13.56 hours per day, women exceed this with 15.1 hours, reflecting their dual burden of paid and unpaid labour.

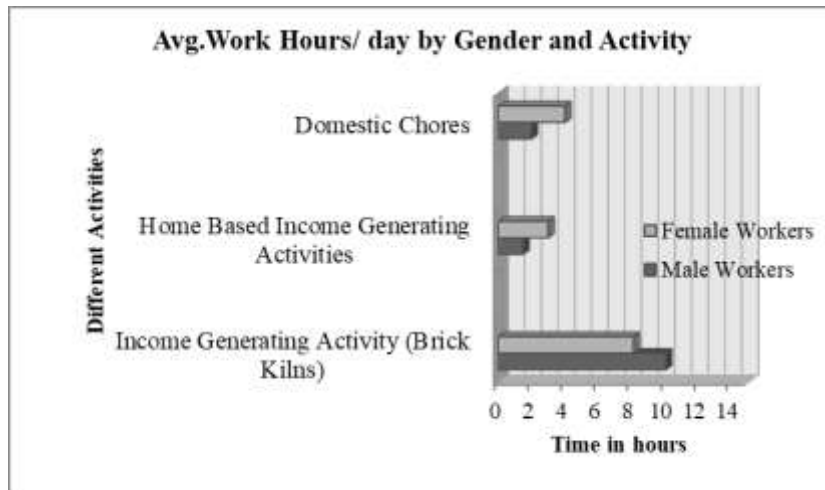


Figure 1. Avg. Work hours /day

Within home-based income-generating activities, gendered patterns of participation are also evident. Among women, goat and sheep rearing is the most common activity (44%), followed by kitchen gardening (32%), while embroidery is practiced by only a small fraction (2%). Men, by contrast, show slightly higher participation in goat and sheep rearing (49%) but limited involvement in embroidery (6%) and poultry farming (25%). Notably, 14% of women reported no engagement in home-based economic activities, suggesting restricted opportunities and access.

The disparity becomes even more pronounced in the realm of domestic chores, where women bear the primary responsibility. Cleaning is performed by 80% of women but only 25% of men; cooking by 72% of women compared to 20% of men; and organizing household matters by 82% of women in contrast to just 6% of men. Similarly, tasks such as fetching water (76% women, 29% men) and childcare (56% women, 10% men) further highlight the unequal distribution of domestic labor tasks. These patterns confirm that women's participation in domestic and care-related activities is consistently higher than men's, thereby compounding their workload and reinforcing the dual burden identified earlier.

To examine the relationship between the occupational and socio-economic variables of male and female workers, Spearman's rank correlation was computed. The ranks assigned to seven key variables, monthly income, duration of work, health issues,

education, safety, reproductive activity, and home-based activity, were compared between males and females.

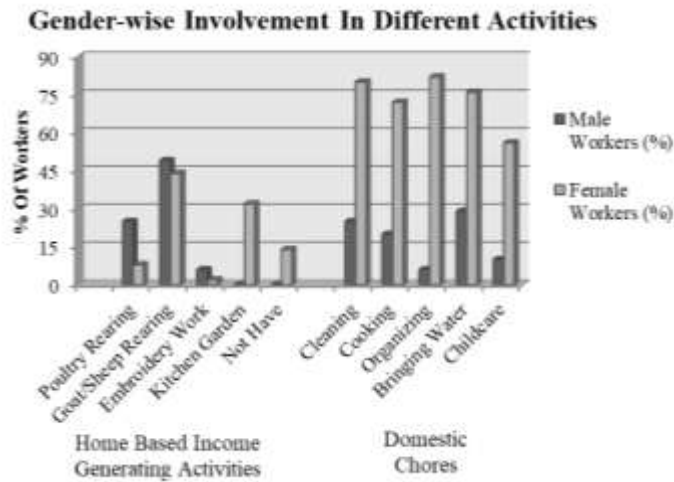


Figure 2. Gender wise Involvement in Different Activities

Spearman’s rank correlation coefficient:

$$r = 1 - \left\{ \frac{6\sum d^2}{n(n^2 - 1)} \right\}$$

$n = 7$ (number of pairs)

$$\sum d^2 = 84$$

$$r = 1 - \{6(84)/7(72 - 1)\}$$

$$r = 1 - (504/336)$$

$$r = 1 - 1.5$$

$$r = -0.5$$

The calculation yielded a correlation coefficient of $\rho = -0.5$, suggesting a moderate inverse relationship between male and female rankings. This implies that the factors prioritized by male workers (e.g., income, safety, and work duration) tend to hold lower priority for females, while variables such as domestic chores and home-based income-generating activities rank much higher for females compared to males.

Variable	Male (X)	Rank X(R1)	Female (Y)	Rank Y(R2)	d = (R1-R2)	d ²
Monthly Income	75	1	30	4	-3	9
Duration Of Work Time	60	3	16	6	-3	9
Health Issues	33	4	52	3	1	1
Education	15	5	14	7	-2	4
Safety	70	2	24	5	-3	9
Domestic Chores	14	6	64	2	4	16
Home-Based Activity	12	7	70	1	6	36
Source – Primary Survey						

Table 5. Rank correlation coefficient analysis (Spearman's method)

This negative correlation highlights gendered differences in occupational and social experiences. Male workers emphasize work-related and economic dimensions, while female workers are more strongly affected by the work environment and productivity. The calculation yielded a correlation coefficient of $\rho = -0.5$, suggesting a moderate inverse relationship between male and female rankings. This implies that the factors prioritized by male workers (e.g., income, safety, and work duration) tend to hold lower priority for females, while variables such as domestic chores and home-based income-generating activities rank much higher for females compared to males.

This negative correlation highlights gendered differences in occupational and social experiences. Male workers emphasize work-related and economic dimensions, while female workers are more strongly affected by the work environment and productivity.

3 Health Hazard and Occupational Vulnerabilities among Brick Field Workers: Brick manufacturing is a multi-stage process involving distinct categories of work, primarily the preparation of green bricks and the subsequent firing process. These tasks demand a range of physical skills and are heavily reliant on manual labour, with the legs and hands serving as the principal tools for both adolescent and adult workers. Such intensive physical engagement predisposes workers to locomotor difficulties. The posture adopted, the location of the load, and its weight influence the mechanical forces acting on the lumbar spine, thereby impacting muscle strain and the compressive load on intervertebral discs (Chaffin & Anderson, 1987; McGill & Norman, 1985). Prolonged squatting during clay preparation, along with activities such as trolley loading, carrying, and pushing, has been identified as a major contributor to these musculoskeletal issues. Similar patterns of locomotor disorders have been documented among brick kiln workers in other studies (Trevelyan & Haslam, 2001; Qutubuddin et al., 2013; Bijetri & Sen, 2014; Vikrant et al., 2016; Inbaraj et al., 2013; Shewale et al., 2013; Patil et al., 2017; Das, 2015c). In addition to musculoskeletal strain, brick workers are frequently exposed to respiratory hazards. Factors such as age, the overall

working environment, the use of low-quality fuels in out-dated kilns, airborne dust, the physical demands of the job, and tobacco consumption are significant predictors of respiratory illness (Torres-Duque et al., 2008; Forey et al., 2011; Bijetri & Sen, 2014; Shaikh et al., 2012). The prevalence of symptoms in the present study aligns with previous research on dust- and smoke-exposed workers across various occupations (Neghab & Choobineh, 2007; Fidan et al., 2005; Croitoru & Sarraf, 2012; Rafeemanesh et al., 2015; Al-Neaimi et al., 2001; Vikrant et al., 2016; Shewale et al., 2013; Das, 2015b; Patil et al., 2017; Inbaraj et al., 2013). In many South Asian brick kilns, particularly in Bangladesh, fuels such as wood and coal are supplemented or replaced by plastic and discarded tires. This practice considerably elevates exposure to toxic emissions, thereby exacerbating health risks. Occupational asthma prevalence in similar dusty and smoky environments has been reported to range between 6% and 14% (Friis et al., 1999; Shaikh et al., 2012). Smoking further compounds these risks, being a well-established determinant for chronic bronchitis (Shaikh et al., 2012; Salvi & Barnes, 2009). Brick kiln environments present multiple overlapping risk factors for worker health, operating under hazardous conditions throughout the day. In the study area, the most prominent contributors to health risks include poor sanitation, persistent air pollution, and extreme heat exposure. The health survey data reveal the pervasive nature of occupational hazards: 63% of workers reported experiencing general weakness, making it the most prevalent complaint, followed by headaches (51%), back pain (38%), and body aches (37%). Collectively, musculoskeletal disorders affect nearly 75% of the workforce, underscoring the cumulative strain of repetitive heavy lifting, sustained awkward postures, and inadequate ergonomic safeguards (Kumar et al., 2020). Beyond musculoskeletal strain, respiratory ailments (23%) and digestive disorders (17%) point toward environmental and hygiene-related risks, likely linked to prolonged dust exposure, poor sanitation facilities, and irregular meal patterns (Sharma & Singh, 2019). Alarmingly, only 13% of workers reported being free from any health problem, meaning that 87% experience at least one chronic condition. This high prevalence reflects a systemic failure to provide even basic occupational health protections (International Labour Organization [ILO], 2018). A gender-based breakdown of the data reveals striking disparities in the nature of health issues reported. Female workers exhibited notably higher rates of chest pain (42% compared to 0% in males), respiratory ailments (34% vs. 18%), and digestive disorders (32% vs. 10%), indicating greater vulnerability to internal and systemic health complications. Conversely, male workers reported much higher rates of general weakness (81% vs. 26%) and headaches (60% vs. 34%), suggesting greater susceptibility to symptoms of extreme fatigue and physical overexertion. Musculoskeletal issues such as back pain (38% in both genders) and body aches (34–38%) remain common across the workforce. However, the complete absence of chest pain among male respondents, in contrast to its significant prevalence among females, raises concerns about gender-specific occupational exposures and physiological responses (Desai et al., 2017). These findings highlight not only the differentiated physical demands placed on male and female workers but also the

interplay of psychosocial stressors and environmental hazards that uniquely shape health outcomes in each group.

Health Problem	% Female	% Male	Total Cases (N=150)	Combined %
Back Pain	38	38	57	38
Respiratory Problems	34	18	35	23
Body Ache	34	38	55	37
Chest Pain	42	0	21	14
Digestive Disorders	32	10	26	17
Headache	34	60	77	51
Weakness	26	81	94	63
No Health Problems	10	14	19	13
Source : Primary Survey				

Table 6. Table For Condition of Major Health Issues

The prevalence of health-related issues has been examined across seven specific categories. The gender-disaggregated analysis was presented and further substantiated through statistical measures of mean and standard deviation (SD)

Female Workers (n=50)

Included Problems (7 categories):

Back Pain (38%), Respiratory (34%), Body Ache (34%), Chest Pain (42%), Digestive (32%), Headache (34%), and Weakness (26%)

Step I: Convert % to Decimal

[0.38, 0.34, 0.34, 0.42, 0.32, 0.34, 0.26]

Step II: Calculation of Mean (Quantifies the *average* burden)

Sum = 0.38 + 0.34 + 0.34 + 0.42 + 0.32 + 0.34 + 0.26 = 2.40

Mean = 2.40 / 7 = 0.3429 (34.29%)

Step III: Calculation of SD (Measures inequality in how burdens distribute)

Squared differences:

$$(0.38 - 0.343)^2 = 0.0014$$

$$(0.34 - 0.343)^2 = 0.0000$$

$$(0.42 - 0.343)^2 = 0.0059$$

$$(0.32 - 0.343)^2 = 0.0005$$

$$(0.26 - 0.343)^2 = 0.0069$$

Sum of squares = 0.0166

$$\text{Variance} = 0.0166 / 7 = 0.00237$$

$$\text{SD} = \sqrt{0.00237} = 0.0487 \text{ (4.87\%)}$$

Male Workers ($n = 100$)

Included Problems (7 categories):

Back Pain (38%), Respiratory (18%), Body Ache(38%), Chest Pain (0%), Digestive (10%), Headache (60%) and Weakness (81%)

Step I: Convert % to Decimal

[0.38, 0.18, 0.38, 0.00, 0.10, 0.60, 0.81]

Step II: Calculation of Mean (Quantifies the *average* burden)

$$\text{Sum} = 0.38 + 0.18 + 0.38 + 0.00 + 0.10 + 0.60 + 0.81$$

$$= 2.45$$

$$\text{Mean} = 2.45 / 7 = 0.3500 \text{ (35.00\%)}$$

Step III: Calculation of SD (Measures inequality in how burdens distribute)

Squared differences:

$$(0.38 - 0.35)^2 = 0.0009$$

$$(0.18 - 0.35)^2 = 0.0289$$

$$(0.00 - 0.35)^2 = 0.1225$$

$$(0.10 - 0.35)^2 = 0.0625$$

$$(0.60 - 0.35)^2 = 0.0625$$

$$(0.81 - 0.35)^2 = 0.2116$$

$$\text{Sum of squares} = 0.5034$$

$$\text{Variance} = 0.5034 / 7 = 0.07191$$

$$\text{SD} = \sqrt{0.07191} = 0.2682 \text{ (26.82\%)}$$

Although the mean health burden is nearly identical between male (35.00%) and female (34.29%) workers, the distribution patterns reveal stark contrasts. Female workers exhibit tightly clustered health issue rates (SD \pm 4.9%), all falling within a narrow 26–42% range. This indicates a consistently high but evenly distributed exposure to multiple health risks, likely arising from persistent environmental and systemic stressors in the brick kiln setting. Male workers, on the other hand, demonstrate much greater variability in health outcomes (SD \pm 26.8%). Certain health problems such as weakness (81%) are extremely prevalent, while others like chest pain (0%) are entirely absent. This pattern suggests that male workers may be more affected by specific task-related hazards, whereas female workers experience broader, more uniformly distributed health risks. These findings, when read alongside the earlier prevalence analysis, underscore the urgent need for gender-sensitive occupational health interventions. For female workers, interventions should address the wide-ranging but consistently present hazards, while for male workers; preventive strategies should focus on mitigating the impact of specific, high-

burden conditions. This targeted approach could significantly reduce the overall health burden within the brick kiln workforce (Sarkar & Chattopadhyay, 2021).

4 Preference of Healthcare Provider: The majority of workers prefer government hospitals (36%) and village doctors (30%), highlighting a strong reliance on accessible and affordable healthcare services. Strikingly, none of the respondents reported consulting MBBS-qualified doctors (0%), likely due to cost, distance, or perceived inaccessibility. Private hospitals (4%) and chemist shops (12%) were infrequently utilized, while homeopathic practitioners (10%) and other providers (8%) were moderately preferred. This reliance on informal and public health systems points to significant gaps in specialist healthcare utilization, raising concerns about the adequacy and reach of formal medical services in rural or marginalized communities (Bhat & Jain, 2022).

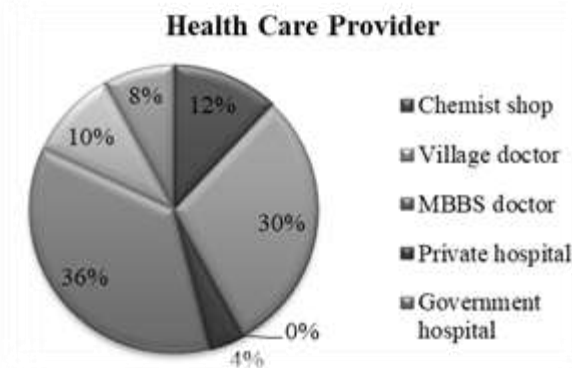


Figure 3. Health Care Providers, Primary Survey

5 Perception of Brick Kiln Life among Male and Female Workers: Understanding how workers perceive their working conditions is essential for evaluating workplace welfare. The use of weighted mean scores based on a 5-point Likert scale allows for a quantitative summary of subjective satisfaction levels

Category	Weightage	Female (%)	Male (%)
Very Good	5	2	0
Good	4	12	0
Moderate	3	44	32
Bad	2	36	68
Very Bad	1	6	0
Source – Primary Survey			

Table 7. Perception of Brick Kiln Life

Mean Satisfaction Score (Likert scale approximation)

Using a Likert scale (Very Good = 5 to Very Bad = 1):

Weighted Mean (Female):

$$(5 \times 2 + 4 \times 12 + 3 \times 44 + 2 \times 36 + 1 \times 6) \div 100 = 2.62$$

Weighted Mean (Male):

$$(5 \times 0 + 4 \times 0 + 3 \times 32 + 2 \times 68 + 1 \times 0) \div 100 = 2.32$$

To derive a mean measure of perceived satisfaction, a 5-point Likert scale was applied where 'Very Good' = 5 and 'Very Bad' = 1. The **mean satisfaction score for females was 2.62**, while for males it was **2.32**, both indicating general dissatisfaction with kiln life. Notably, male responses skewed more negatively, reflecting more severe perceptions of hardship. This quantification supports the qualitative insights from the categorical distributions and highlights a gender disparity in perceived well-being

Recommendations and Suggestions

Based on the results and findings of the study, several measures are recommended to improve the socio-economic conditions of brick-kiln workers in the study area. So, the first and principal sense of duty of our Government is to pay attention to the well-being of the community.

To enhance the socio-economic well-being and health security of brick kiln labourers, they must be formally brought under the welfare framework of the West Bengal Unorganised Sector Workers Welfare Board. Kiln workers should be enrolled in schemes such as the State Assisted Scheme of Provident Fund for Unorganised Workers (SASPFUW) and the West Bengal Unorganised Sector Workers' Health Security Scheme so that they receive essential benefits like provident fund support, medical assistance, and basic financial protection. Their inclusion under the Bina Mulya Samajik Suraksha Yojana (BM-SSY) and Swasthya Sathi are also vital, as these scheme extends comprehensive social security coverage ranging from health benefits and educational support for children to maternity assistance specifically designed for unorganised workers. Migrant workers from other states who are not eligible for West Bengal Govt. schemes may further be motivated to join the Pradhan Mantri Shram Yogi Maan-Dhan Yojana (PM-SYM), which guarantees a monthly pension of ₹3000 after they reach 60 years of age. On the other Pradhan Mantri Jan Arogyo Yojana (PMJAY) and Ayushman Bharat scheme also aims to cater affordable healthcare facilities. It is necessary to enforce the "Inter-State Migrant Workmen Act" and "Contact Labour Act" to check the bungling in the recruitment procedure and working conditions. The Labour Department should come forward to prevent physical-mental torture, sexual harassment and molestation of the working women engaged in the brick kiln factories. For Regular awareness drives at kiln locations, organised by Regional Labour Offices, would help workers understand these schemes, complete their registrations, and receive benefits

without delay. Maintaining proper worker records, issuing identity cards, and ensuring coordination between kiln owners and labour officials will significantly improve access to welfare measures and contribute to long-term social and economic security for brick kiln workers.

Conclusion

This study reveals the entrenched socio-economic vulnerabilities of brick kiln workers in Sangrampur Shibati, Basirhat-I, reflecting the broader dynamics of the informal brick industry in West Bengal. Workers endure exploitative conditions marked by low wages, insecure employment, inadequate housing, and widespread health hazards. Women face a disproportionate burden due to occupational segregation, wage discrimination, and their dual role in both productive and domestic spheres. Health risks, including musculoskeletal disorders, respiratory ailments, digestive issues, and chronic fatigue, are pervasive, exacerbated by poor workplace safety, environmental exposures, and limited healthcare access. Perceptions of kiln life, measured through satisfaction scores, confirm overall dissatisfaction, with men reporting harsher experiences due to physically intensive tasks. At the same time, structural inequalities and unpaid domestic responsibilities shape women's experiences.

Together, these findings demonstrate that brick kilns function within a cycle of systemic exploitation, gender inequity, and inadequate regulation, underscoring the urgent need for targeted interventions. To improve the conditions of brick kiln workers, policies should prioritise wage and employment protections by enforcing minimum wage laws, ensuring timely digital payments, and introducing formal contracts for seasonal and migrant labourers. Gender-sensitive measures, such as equal pay initiatives and women's access to higher-paid roles, should be coupled with skill development programs in tailoring, dairy, and poultry to diversify livelihoods. Occupational health and safety can be enhanced through modern kiln technologies, protective gear, ergonomic training, and regular health check-ups. Additionally, worker housing schemes with access to safe water, sanitation, electricity, and childcare facilities are essential for improving living conditions. Meanwhile, healthcare access must be strengthened through mobile clinics, community health workers, and insurance coverage for occupational diseases.

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Conflict of interest

The authors have not declared any conflict of interest.

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