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Occupational Health Risks Among Mine Workers in Rajasthan: A Geo-Medical Perspective

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Abstract: ***Mining is one of the most significant economic activities in Rajasthan, employing thousands of workers across districts such as Makrana, Jodhpur, Bhilwara, Udaipur, and Rajsamand. Despite its economic contribution, the mining sector poses severe occupational health threats, especially due to silica dust exposure, unsafe working environments, poor ventilation, inadequate protective equipment, and high accident rates. This study provides a comprehensive medical-geographical assessment of occupational health risks among mine workers in Rajasthan. Using secondary literature, field-based observations, district-level spatial differentials, and epidemiological patterns, the research identifies major diseases such as silicosis, tuberculosis, musculoskeletal disorders, dermatological ailments, noise-induced hearing loss, and heat stress. The study area focuses on major mining belts of Rajasthan, exploring environmental determinants, workplace conditions, and the spatial distribution of health outcomes. Results reveal that inadequate safety regulations, lack of medical surveillance, socio-economic vulnerability, and environmental hazards significantly influence morbidity among miners. The paper concludes with recommendations emphasizing stricter policy implementation, improved surveillance programs, and integration of spatial-health data for targeted interventions.***

Keywords: Rajasthan; mining; occupational health; medical geography; silicosis; tuberculosis; mine workers; environmental hazards; spatial analysis; Rajasthan mining belts.

1.1 Introduction

Mining is an integral part of Rajasthan's economy, contributing significantly to employment and revenue. Rajasthan possesses over 79 types of minerals, with major mining industries situated in districts such as Makrana (marble), Jodhpur (sandstone), Bhilwara (mica), Rajsamand (granite), Udaipur (zinc and copper), Chittorgarh (limestone), and Barmer–Jaisalmer (lignite and gypsum). While economically crucial, mining is simultaneously one of the most hazardous occupations worldwide. In Rajasthan, miners often work in unregulated environments with poor ventilation, intense dust exposure, limited access to safety equipment, and inadequate medical services.

Medical geography provides a spatial perspective on occupational health risks by examining how environmental, socio-economic, and workplace factors interact to shape disease patterns. This article uses a medical-geographical lens to explore the spatial distribution of occupational diseases among mine workers in Rajasthan, linking health outcomes with geographical determinants.

Occupational health risks such as silicosis, tuberculosis, respiratory complications, hearing loss, skin infections, musculoskeletal problems, and heat-related illnesses are widespread in the region. Previous studies (Mishra, 2014; Gupta & Sharma, 2011; Jain, 2016) have documented severe health burdens among miners, yet comprehensive spatial analyses remain limited.

The present study fills this gap by offering a detailed analysis of occupational hazards among Rajasthan's mine workers, grounded in medical geography and supported by classical studies up to 2018.

1.2 Objectives

1. To identify major occupational health risks faced by mine workers in Rajasthan.
2. To examine spatial patterns of mining-related diseases using a medical-geographical perspective.
3. To analyze environmental, socio-economic, and workplace factors influencing health hazards.
4. To document field observations regarding safety practices, working conditions, and health vulnerabilities.
5. To propose health, policy, and management strategies for reducing occupational hazards.

1.3 Methodology

This study employs a mixed-method approach integrating:

I. Secondary Data Review

Peer-reviewed articles, government reports, epidemiological surveys, and classical publications (pre-2018) were reviewed, including works on occupational health, silicosis epidemiology, medical geography, and mining practices.

II. Spatial–Geographical Analysis

District-level mapping of mining belts (Makrana, Jodhpur, Bhilwara, Rajsamand, Udaipur, Jhunjhunu, Sikar) was used to examine disease clusters.

III. Field Observations

General observations collected from various mining belts, focusing on:

1. Working conditions
2. Use of equipment
3. Exposure to dust and chemicals
4. Access to medical facilities

IV. Qualitative Interviews (Literature-Based)

Narratives documented in earlier studies (e.g., Dave 2013; Jain 2016) were used to understand miner experiences.

IV. Medical-Geographical Framework

The study interprets disease distribution through:

1. environmental factors
2. socio-economic factors
3. spatial accessibility to healthcare
4. workplace ecology

1.4 Study Area

Rajasthan is India's largest state by area and a major hub of mineral resources. The study focuses on key mining belts:

1. Makrana (Nagaur District)

World-famous for white marble; high silica exposure.

2. Jodhpur District

Known for sandstone mining; severe dust-related health risks.

3. Bhilwara District

Mica, felspar, quartz; workers face respiratory complications.

4. Rajsamand District

Granite, marble; exposure to heavy machinery and blasting.

5. Udaipur District

Zinc, lead, and copper mining; chemical exposure significant.

6. Jhunjhunu & Sikar (Khetri Copper Belt)

Copper mining; associated with heavy metal exposure.

7. Chittorgarh & Bundi

(a.) Limestone; high cement-industry dust.

These regions collectively form the primary mining zones of Rajasthan, representing diverse geology and occupational health risks.

1.5 Observations

1. Dust exposure is universal; miners inhale fine silica particles throughout working hours.
2. Protective equipment (masks, goggles) is rarely used or unavailable.
3. Ventilation is poor in underground mines; open quarries expose workers to extreme heat.
4. Long working hours increase susceptibility to exhaustion and chronic illness.
5. Medical facilities are often located 10–50 km from mine sites.
6. Awareness levels regarding occupational hazards are extremely low.
7. Child and elder labor historically noted in small mines (before stricter regulations).
8. Accidents due to explosives and landslides frequently reported in newspaper archives.

1.6 Discussion

I. Respiratory Diseases

1. Silicosis is the most documented occupational disease among miners in Rajasthan. Inhalation of silica dust causes lung fibrosis, breathlessness, chronic cough, and reduced capacity. Studies by Dave (2013), Mishra (2014), and Jain (2016) highlight high prevalence rates in Makrana, Jodhpur, and Bhilwara.
2. Silicosis enhances vulnerability to tuberculosis, creating a deadly comorbidity known as silico-tuberculosis.

II. Musculoskeletal Disorders

Repetitive lifting, hammering, drilling, and carrying heavy loads cause:

1. chronic back pain
2. shoulder and knee disorders
3. vertebral degeneration

III. Noise-Induced Hearing Loss

Exposure to drilling machines, blasting operations, and crushers exceeds safe decibel levels.

IV. Heat Stress

Rajasthan's high temperature exacerbates dehydration, heat exhaustion, and long-term renal complications.

V. Dermatological Diseases

Prolonged exposure to dust, contaminated water, and chemicals causes:

1. skin infections
2. dermatitis
3. allergic reactions

VI. Spatial Health Inequality

Remote mining villages lack:

1. hospitals
2. ambulance services
3. health insurance
4. clean drinking water
5. social security

6. Medical services are unevenly distributed, creating geographical barriers.

VII. Socio-Economic Vulnerabilities

Miners often belong to economically weaker sections with limited bargaining power. Many lack formal contracts, insurance, or compensation mechanisms.

1.7 Results

The study reveals:

1. Silicosis and TB are the dominant occupational diseases in Rajasthan's mining belt.

2. Spatial concentration of cases is highest in:

(a.) Makrana

(b.) Jodhpur

(c.) Bhilwara

(d.) Rajsamand

3. Environmental conditions such as dry climate and frequent dust storms intensify exposure.

4. Socio-economic factors—poverty, low literacy, lack of awareness—worsen disease risks.

5. Medical infrastructure is insufficient near mining clusters.

6. Workplace safety compliance is extremely low.

7. Mortality rates due to chronic lung disease are higher than the national average in mining districts.

1.8 Conclusion

Mining in Rajasthan plays a crucial economic role, but the health burden on mine workers is severe. The medical-geographical approach reveals strong spatial inequalities in health outcomes, driven by environmental hazards, socio-economic marginalization, and inadequate medical services. Silicosis, tuberculosis, musculoskeletal disorders, noise-induced hearing loss, dermatological ailments, and heat stress are widespread. The combination of occupational exposure, poor safety measures, and limited healthcare access makes mine workers extremely vulnerable.

1.9 Recommendations

1. Regular medical screening for miners, especially for silicosis and TB.

2. Mandatory dust-control technologies such as wet drilling and water spraying.

3. Strict enforcement of workplace safety regulations.

4. Establish mobile health units in remote mining belts.

5. Awareness training on occupational hazards and safety measures.

6. Provision of PPE (protective masks, helmets, gloves).

7. Compensation schemes should be easily accessible and transparent.

8. Spatial health mapping should guide targeted interventions.

9. Alternative livelihoods for families affected by chronic occupational disease.

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