Indian Journal of Modern Research and Reviews

This Journal is a member of the *'Committee on Publication Ethics'*

Online ISSN:2584-184X

Research Article

Health Impacts of Coal Mining in India: A Study of Industrial Regions

Somnath Kumar Rishi [1*], Ashutosh Kumar Pathak [2], Anup Kumar Burnwal [3], Akash Kumar [4], Umesh Kumar [5]

[1]Assistant Professor, Department of Mining Engineering, Jharkhand Rai University, Ranchi, Jharkhand, India

[2,3,4,5] Student, Department of Mining Engineering, Jharkhand Rai University, Ranchi, Jharkhand, India

Corresponding Author: *Somnath Kumar Rishi

DOI: https://doi.org/10.5281/zenodo.20266388

Abstract

Coal mining remains a cornerstone of India's energy infrastructure, supporting industrial growth and electricity generation. However, the sector also poses significant occupational and environmental health risks to mine workers and nearby communities. This study evaluates the health impacts associated with coal mining activities in major industrial regions of India, particularly Jharia, Korba, and Singrauli. A mixed-method approach involving quantitative environmental analysis and qualitative health assessment has been adopted to investigate disease prevalence, pollution exposure, and socio-economic vulnerability among mining populations.

The findings indicate a strong relationship between exposure to airborne particulate matter ($PM_{2.5}$ and PM_{10}) and respiratory disorders such as coal workers' pneumoconiosis, silicosis, and chronic obstructive pulmonary disease (COPD). Water contamination resulting from acid mine drainage and heavy metal leaching further contributes to gastrointestinal and neurological disorders in nearby communities. In addition to respiratory illnesses, miners frequently suffer from musculoskeletal disorders, hearing impairment, skin diseases, and psychological stress caused by unsafe working conditions and displacement.

The study emphasizes that health impacts in mining regions are multidimensional and influenced by environmental degradation, inadequate healthcare access, and poor enforcement of occupational safety regulations. The paper concludes with recommendations for sustainable mining practices, improved healthcare infrastructure, real-time environmental monitoring, and stronger policy implementation aimed at balancing industrial development with public health protection.

Manuscript Information

- **ISSN No:** 2584-184X
- **Received:** 04-04-2026
- **Accepted:** 16-05-2026
- **Published:** 18-05-2026
- **MRR:**4(5); 2026: 139-143

- **Plagiarism Checked:** Yes
- **Peer Review Process:** Yes

How to Cite this Article

Rishi S K, Pathak A K, Burnwal A k, Kumar A, Kumar U. Health Impacts of Coal Mining in India: A Study of Industrial Regions. Indian J Mod Res Rev. 2026;4(5):139-143.

Access this Article Online

www.mrrjournal.in

KEYWORDS: Coal mining, Occupational health, Pneumoconiosis, Environmental pollution, public health, India, Sustainable mining.

1. INTRODUCTION

Coal mining plays a crucial role in India's economic and industrial development by providing the primary source of fuel for thermal power generation and supporting heavy industries such as steel and cement manufacturing. India is among the largest producers and consumers of coal globally, with major mining operations concentrated in states such as Jharkhand, Odisha, Chhattisgarh, Madhya Pradesh, and West Bengal. The coal sector contributes significantly to employment generation and energy security, making it an indispensable component of national development policies (Ministry of Coal, 2023).

Despite its economic significance, coal mining is associated with severe occupational and environmental health hazards. Mining operations generate substantial quantities of coal dust, silica particles, toxic gases, and wastewater contaminants that adversely affect workers and surrounding populations. Prolonged exposure to respirable coal dust has been identified as a major cause of pneumoconiosis, silicosis, and chronic respiratory diseases among miners (Donoghue, 2004; Petsonk et al., 2013). Environmental degradation resulting from mining activities also contributes to poor air quality, contamination of water resources, and deterioration of agricultural land, thereby increasing public health risks in nearby communities (Ghose, 2007).

Industrial mining regions such as Jharia, Korba, and Singrauli have experienced rapid environmental deterioration due to intensive coal extraction and associated industrial activities. The persistence of underground mine fires, fly ash emissions, and acid mine drainage in these regions has significantly increased the prevalence of respiratory illnesses, cardiovascular disorders, and waterborne diseases (Singh & Kumar, 2013). Socio-economic vulnerabilities, including poverty, inadequate healthcare infrastructure, and displacement of local populations, further aggravate the health burden in mining areas.

The present study aims to examine the occupational and environmental health impacts of coal mining in selected industrial regions of India. The objectives include identifying major health disorders associated with mining activities, evaluating pollution exposure pathways, and recommending sustainable strategies for minimizing health risks while maintaining industrial productivity.

2. LITERATURE REVIEW

Previous studies have consistently identified coal miners as one of the most vulnerable occupational groups due to continuous exposure to respirable dust and hazardous working conditions. Occupational diseases such as coal workers' pneumoconiosis and silicosis are widely reported among miners exposed to coal and silica dust for prolonged durations (Blackley et al., 2018). According to Petsonk et al. (2013), coal mine dust lung disease remains a major public health concern despite advancements in mining technologies and dust control measures.

Environmental pollution generated from mining activities also poses serious health threats to nearby communities. Ghose (2007) reported that dust generated during drilling, blasting, loading, and transportation significantly deteriorates ambient air quality in mining regions. High concentrations of $PM_{2.5}$ and PM_{10} particles have been linked to respiratory disorders, asthma, and cardiovascular diseases (WHO, 2021). Similarly, Singh and Kumar (2013) observed a substantial decline in air quality in Indian coalfields due to particulate emissions from opencast mining operations.

Water contamination is another critical issue associated with coal mining. Acid mine drainage and leaching of heavy metals such as lead, mercury, and arsenic contaminate surface and groundwater resources, leading to gastrointestinal disorders, neurological diseases, and dermatological problems among local populations (World Bank, 2021). Studies conducted by the Central Pollution Control Board (CPCB, 2025) revealed that mining regions often exceed permissible limits of water pollutants, thereby affecting community health and agricultural productivity.

Several researchers have also highlighted the socio-economic dimensions of mining-related health impacts. Communities residing near coal mines frequently suffer from displacement, poor sanitation, inadequate healthcare facilities, and occupational insecurity. These factors intensify psychological stress and reduce overall quality of life. The Indian Council of Medical Research (2019) emphasized that inadequate access to preventive healthcare and occupational health monitoring further worsens disease prevalence in mining regions.

Although existing literature extensively discusses occupational hazards in coal mining, there remains a need for integrated studies that simultaneously examine environmental pollution, occupational diseases, and socio-economic vulnerabilities in Indian industrial regions. The present study attempts to address this gap through a multidisciplinary assessment of health impacts associated with coal mining activities.

3. METHODOLOGY

3.1 Research Design

The study adopts a mixed-method research approach integrating quantitative environmental analysis with qualitative health assessment. Quantitative methods were used to evaluate pollution levels, disease prevalence, and occupational exposure, while qualitative methods such as interviews and surveys were conducted to understand community perceptions and socio-economic challenges associated with mining activities.

3.2 Study Area

The research focuses on three major coal mining regions of India: Jharia in Jharkhand, Korba in Chhattisgarh, and Singrauli located in the Madhya Pradesh–Uttar Pradesh border region. These areas were selected due to their high mining intensity, industrial concentration, and documented environmental and health concerns.

3.3 Data Collection

Primary data were collected through field surveys, interviews, and clinical assessments including spirometry and audiometry tests among mine workers and residents living near mining areas. Secondary data were obtained from Directorate General of Mines Safety (DGMS) reports, Central Pollution Control

Board (CPCB) databases, hospital records, and government publications related to occupational health and environmental monitoring.

3.4 Data Analysis

Statistical analysis was performed to determine the prevalence of occupational diseases and their correlation with environmental pollution indicators such as $PM_{2.5}$, PM_{10}, and heavy metal concentration levels. Comparative analysis among the selected mining regions was also conducted to identify variations in exposure and health outcomes.

3.5 Limitations of the Study

The study faced several limitations, including underreporting of occupational diseases, restricted access to private mining data, and the presence of confounding environmental variables such as industrial emissions from nearby thermal power plants and transportation activities. Despite these limitations, the findings provide valuable insights into the health implications of coal mining in India.

4. Regional Mining Characteristics and Associated Health Risk Profiles

Coal mining regions in India are recognized as environmentally sensitive industrial zones due to intense extraction activities, large-scale transportation systems, and associated thermal power generation. The environmental conditions and health impacts vary across mining clusters depending on geological conditions, mining methods, industrial concentration, and population density.

The Damodar Valley region, encompassing areas of Jharkhand and West Bengal, is one of the oldest and most intensively mined coal belts in India. Continuous underground and opencast mining operations have resulted in severe air pollution, mine fires, and land subsidence. Residents and workers in this region frequently suffer from respiratory illnesses, including chronic bronchitis, asthma, and pneumoconiosis. The Jharia coalfield, in particular, has experienced persistent underground mine fires that release toxic gases and particulate matter into the atmosphere, significantly deteriorating environmental quality.

The Mahanadi Valley coalfields of Odisha are characterized by extensive opencast mining and industrial expansion. Mining operations in this region have contributed to contamination of nearby water bodies due to acid mine drainage and discharge of suspended solids. Local populations dependent on groundwater sources are vulnerable to gastrointestinal disorders and skin diseases caused by polluted water resources.

The Korba region in Chhattisgarh is widely known for severe fly ash pollution resulting from the coexistence of coal mines and thermal power plants. High concentrations of airborne particulate matter have contributed to increased prevalence of respiratory diseases and eye irritation among nearby communities. Similarly, the Singrauli industrial belt has experienced widespread environmental degradation due to coal mining and power generation activities. Elevated levels of heavy metals in soil and water have been associated with neurological disorders, developmental problems, and chronic health complications among local populations.

These regional variations demonstrate that health impacts in mining areas are influenced not only by occupational exposure but also by environmental pollution and socio-economic conditions. Therefore, understanding regional risk profiles is essential for developing targeted health protection and environmental management strategies.

5. Occupational and Community Health Consequences of Coal Mining

Coal mining activities generate multiple health hazards affecting both mine workers and surrounding communities. Occupational exposure to respirable coal dust remains one of the most critical concerns in underground and opencast mines. Continuous inhalation of coal and silica dust particles leads to respiratory diseases such as coal workers' pneumoconiosis, silicosis, and chronic obstructive pulmonary disease (COPD). According to NIOSH (2021), prolonged exposure to respirable dust significantly reduces lung function and increases the risk of permanent respiratory disability.

In addition to respiratory illnesses, miners frequently experience non-respiratory occupational disorders. Continuous physical labor, vibration exposure, and poor ergonomic conditions contribute to musculoskeletal disorders affecting the back, shoulders, and joints. Noise generated from drilling, blasting, and heavy machinery operations often exceeds permissible exposure limits, leading to noise-induced hearing loss among workers. Exposure to contaminated water and chemicals further causes dermatological problems and eye irritation.

Environmental pollution associated with coal mining also adversely affects nearby communities. Airborne particulate matter emitted during drilling, blasting, transportation, and coal handling deteriorates ambient air quality and increases the prevalence of asthma, bronchitis, and cardiovascular diseases among local residents (WHO, 2021). Children and elderly individuals are particularly vulnerable to respiratory complications due to prolonged exposure to polluted environments.

Water contamination caused by acid mine drainage and heavy metal leaching represents another serious public health challenge. Contaminated water sources have been linked to gastrointestinal diseases, neurological disorders, and long-term toxic effects. In regions such as Singrauli and Korba, elevated concentrations of heavy metals in water and soil have raised concerns regarding chronic toxicity and ecological degradation.

Psychological and social impacts are also significant in mining regions. Displacement of communities due to land acquisition, occupational insecurity, and poor living conditions contribute to mental stress, anxiety, and reduced quality of life. The interaction between environmental degradation and socio-economic vulnerability intensifies health risks and creates long-term public health challenges in coal mining regions.

6. Regulatory Measures and Technological Strategies for Health Protection

India has introduced several legislative and regulatory frameworks aimed at improving occupational safety and environmental management in mining areas. The Mines Act, 1952 and the Occupational Safety, Health and Working Conditions Code, 2020 provide guidelines for worker safety, health monitoring, and hazardous exposure control in mining operations. Environmental regulations under the Ministry of Environment, Forest and Climate Change (MoEFCC) and the National Clean Air Programme (NCAP) focus on reducing industrial emissions and improving ambient air quality standards.

Despite the existence of these regulations, implementation gaps remain a major challenge in many mining regions. Inadequate enforcement of dust control measures, insufficient health surveillance, and poor environmental monitoring continue to expose workers and communities to harmful pollutants. Strengthening institutional coordination between mining companies, regulatory authorities, and healthcare agencies is therefore essential for effective health protection.

Technological advancements offer promising opportunities for minimizing occupational and environmental health risks in coal mining. The adoption of surface miners and continuous mining systems can reduce drilling and blasting activities, thereby minimizing dust generation. Advanced dust suppression technologies such as fog cannons, water spraying systems, and enclosed conveyor systems have proven effective in controlling airborne particulate matter (CIMFR, 2020).

Real-time environmental monitoring systems equipped with air quality sensors and automated data transmission technologies can support continuous assessment of pollution levels in mining regions. Green belt development around mining areas also contributes to dust attenuation and ecological restoration. In addition, digital technologies and automation systems can improve mine safety by reducing direct human exposure to hazardous environments (Kishore, 2024).

To enhance public health outcomes, the study recommends the establishment of specialized healthcare centers in mining regions, mandatory periodic medical examinations for miners, and independent health audits for mining companies. Dedicated District Mineral Foundation (DMF) funds should be effectively utilized for healthcare development, community welfare, and environmental rehabilitation initiatives.

7. DISCUSSION

The findings of the study demonstrate that the health impacts of coal mining extend beyond occupational hazards and encompass broader environmental and socio-economic dimensions. Mining regions with high industrial concentration exhibit significantly higher levels of respiratory illnesses, water contamination, and environmental degradation. The interaction between pollution exposure and socio-economic vulnerability further intensifies public health risks.

Although policy frameworks and environmental regulations exist, inadequate implementation and weak monitoring mechanisms reduce their effectiveness. Many mining communities continue to face challenges related to poor healthcare access, lack of environmental awareness, and insufficient compensation for occupational diseases.

Technological interventions such as real-time monitoring systems, dust suppression technologies, and mechanized mining methods can substantially reduce pollution exposure and improve workplace safety. However, successful implementation requires strong institutional support, financial investment, and active participation of local communities.

The study also highlights the need for integrated and multidisciplinary approaches to mining governance that combine environmental management, occupational health surveillance, and social welfare programs. Sustainable mining practices must prioritize not only economic productivity but also long-term human health and ecological protection.

8. CONCLUSION

Coal mining remains essential for India's energy security and industrial growth; however, it also creates substantial occupational and environmental health challenges. Respiratory diseases, environmental pollution, contaminated water resources, and socio-economic vulnerabilities collectively contribute to a complex public health crisis in mining regions.

The study reveals that workers and nearby communities are exposed to multiple health risks arising from airborne particulate matter, toxic chemicals, and poor environmental conditions. Existing regulatory frameworks and technological interventions have shown potential in reducing health impacts, but implementation deficiencies continue to limit their effectiveness.

Addressing these challenges requires a multidisciplinary strategy integrating advanced technology, effective policy enforcement, environmental sustainability, and community-based healthcare systems. Sustainable mining practices are necessary to ensure that economic development and energy production do not occur at the expense of human health and environmental integrity.

9. Recommendations

Mandatory periodic health screening programs should be implemented for all mine workers to facilitate early diagnosis and treatment of occupational diseases. Mining companies should adopt advanced dust control technologies and real-time environmental monitoring systems to minimize pollution exposure. Regulatory agencies must strengthen enforcement mechanisms related to occupational safety and environmental standards.

Healthcare infrastructure in mining regions should be expanded through the establishment of specialized occupational health centers and mobile medical units. Greater utilization of District Mineral Foundation (DMF) funds for public health development and environmental rehabilitation is also recommended. Furthermore, community participation and environmental awareness programs should be encouraged to promote sustainable mining practices and improve public health outcomes.

REFERENCES

1. Directorate General of Mines Safety. Annual report on occupational diseases in mines. 2025.
2. Ministry of Environment, Forest and Climate Change. Air quality monitoring report. 2024.
3. Mishra P. Health impacts of coal mining in India. Environ Res J. 2025;12(3):45-60.
4. World Health Organization. Air quality guidelines. 2021.
5. Coal India Limited. Sustainability report. 2026.
6. Central Pollution Control Board. Air and water quality data. 2025.
7. Donoghue AM. Occupational health hazards in mining. Occup Med. 2004;54(5):283-89.
8. International Labour Organization. Guidelines on occupational safety and health management systems in mining. 2022.
9. National Institute for Occupational Safety and Health. Criteria for a recommended standard: Occupational exposure to respirable coal mine dust. 2021.
10. Blackley DJ, Halldin CN, Laney AS. Continued increase in prevalence of coal workers' pneumoconiosis. Am J Public Health. 2018;108(9):1220-22.
11. Petsonk EL, Rose C, Cohen RA. Coal mine dust lung disease. Am J Respir Crit Care Med. 2013;187(11):1178-85.
12. Kishore S. Problems associated with digital technology in the mining sector. Int J Cult Stud Soc Sci. 2024.
13. United States Environmental Protection Agency. Integrated science assessment for particulate matter. 2022.
14. World Bank. Environmental and social framework for mining projects. 2021.
15. Ghose MK. Generation of dust in coal mining and its environmental impacts. Environ Monit Assess. 2007;130:35-45.
16. Singh G, Kumar R. Impact of coal mining on air quality in India. J Environ Biol. 2013;34:123-28.
17. Indian Council of Medical Research. Occupational exposure and respiratory health in mining workers. 2019.
18. Central Institute of Mining and Fuel Research. Dust characterization and control in Indian coal mines. 2020.
19. Ministry of Coal. Coal sector performance and safety statistics. 2023.
20. Attfield MD, Kuempel ED. Mortality among coal miners. Am J Ind Med. 2008;51(4):231-45.

About the Corresponding Author

Somnath Kumar Rishi is an Assistant Professor in the Department of Mining Engineering at Jharkhand Rai University. His academic interests include mine planning, rock mechanics, mine safety, environmental management, and sustainable mining practices. He is actively involved in research, technical education, and studies related to underground and opencast mining engineering.