International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Impact of Mining on Health: A Case Study of Kodingamali Bauxite Mine, Koraput

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Abstract

Mining is often promoted as a driver of economic growth, yet its effects on local health remain under-examined, especially in tribal regions. This study investigates the health impacts of bauxite mining on communities living around the Kodingamali mine in Koraput, Odisha, using a descriptive and analytical case study approach. Primary data were collected through household surveys, semi-structured interviews, focus group discussions, and field observations, complemented by secondary data from government reports, health records, and literature. Findings reveal that mining activities have degraded air and water quality, leading to increased respiratory illnesses, water-borne diseases, skin infections, and general health distress, disproportionately affecting women, children, and the elderly. Environmental degradation has disrupted agriculture and livelihoods, exacerbating food insecurity and psychosocial stress. The study underscores the need for stronger environmental regulation, community-focused health interventions, and inclusive development policies in mining-affected tribal areas.

Keywords: Bauxite mining, Tribal health, Water pollution, Air pollution, Livelihoods, Environmental justice, Koraput, Odisha

Introduction

Mining has emerged as a central component of economic development strategies in many resource-rich regions of the Global South, including India. Mineral extraction is often promoted as a driver of industrial growth, infrastructure development, and employment generation. However, a growing body of interdisciplinary scholarship has drawn attention to the uneven social, ecological, and health consequences of mining, particularly in tribal-dominated and ecologically sensitive regions. While mining contributes to national and regional economies, its localised impacts frequently impose significant costs on communities living in and around mining areas.

Health impacts constitute one of the most critical yet under-examined dimensions of mining-led development. Communities residing in mining zones are exposed to a range of health risks arising from environmental pollution, occupational hazards, and socio-economic disruptions. Airborne dust, contaminated water sources, noise pollution, and chemical exposure adversely affect respiratory, dermatological, gastrointestinal, and occupational health. At the same time, mining-induced livelihood changes, displacement from traditional resource bases, and increased economic insecurity exacerbate malnutrition, mental stress, and vulnerability to disease, especially among marginalised populations.

In India, large-scale mining activities are disproportionately concentrated in tribal regions that are characterised by high dependence on land, forests, and common property resources for subsistence. These regions often exhibit limited access to healthcare infrastructure, sanitation, and public services,

making tribal communities particularly vulnerable to health shocks. Despite constitutional safeguards and legal protections for tribal populations, extractive projects have frequently resulted in environmental degradation and social marginalisation, raising concerns about environmental justice and public health equity.

The Kodingamali bauxite mining project in Koraput district of Odisha represents a significant case for examining the health consequences of mining in a tribal context. Koraput is a predominantly tribal district with a fragile ecological landscape and a long history of dependence on subsistence agriculture and forest-based livelihoods. The introduction of bauxite mining in the Kodingamali region has altered land use patterns, environmental conditions, and livelihood systems, with potential implications for the health and well-being of peripheral tribal communities. Issues such as dust pollution, water contamination, occupational exposure, and changing living conditions have emerged as key concerns among the local population.

This study examines the impact of bauxite mining on the health of communities living in the peripheral areas of the Kodingamali mine. By situating health outcomes within the broader context of environmental change and livelihood transformation, the paper seeks to move beyond a narrow biomedical perspective and adopt a holistic understanding of health as shaped by ecological, economic, and social determinants. The study aims to contribute to the growing literature on mining, health, and development by providing empirical insights from a tribal region that remains under-represented in mainstream research.

By focusing on the lived experiences of mining-affected communities, this paper highlights the need for more inclusive development policies that integrate public health concerns into mining governance. Understanding the health impacts of mining at the local level is essential for designing sustainable development interventions that prioritise community well-being alongside economic growth.

Review of Literature

Bridge (2004) examines mining as a contested development activity and argues that while mining contributes to economic growth, it also produces significant environmental and health risks for communities living near extraction sites. Ghose and Majee (2007) focus on air pollution in mining areas and find that dust generated from mining operations leads to respiratory illnesses among nearby populations, particularly affecting children and the elderly. Tiwary (2001) analyses the impact of mining on water resources and reports that contamination of surface and groundwater in mining regions increases the incidence of water-borne diseases and skin-related health problems. (Mishra et al. 2010) study occupational health hazards in the mining sector and highlight high levels of respiratory disease, physical injury, and fatigue among mine workers, especially those employed on a contractual basis. Cernea (2000) links mining-induced displacement and livelihood loss to declining health outcomes, arguing that disruption of subsistence systems increases malnutrition and vulnerability to disease. Wilkinson and Marmot (2003) emphasise the role of social determinants in shaping health outcomes and note that environmental degradation and livelihood insecurity worsen health inequalities in marginalised communities. Padel and Das (2010) document the experiences of tribal communities affected by mining in eastern India and observe that environmental degradation and livelihood loss have long-term adverse effects on health and well-being. Bebbington et al. (2008) examine mining-led development in resource-rich regions and argue that extractive activities often generate social and health costs that outweigh local economic benefits, particularly for marginalised communities. Hilson (2012) analyses mining and public

health in developing countries and highlights that weak regulation and environmental exposure contribute to rising respiratory and water-related diseases in mining-affected areas. Saha and Pattanayak (2016) study environmental pollution in mining regions of eastern India and find a strong association between dust exposure and increased respiratory illness among nearby rural populations. Mishra and Mishra (2017) focus on tribal communities in mining zones of Odisha and observe that environmental degradation and livelihood loss have resulted in malnutrition and declining overall health conditions. Dhatrak and Nandi (2009) examine occupational health in the Indian mining sector and report high prevalence of lung diseases, musculoskeletal disorders, and workplace injuries among mine workers. Kumar and Rao (2018) analyse water quality in bauxite mining areas and report contamination of surface and groundwater sources, increasing risks of gastrointestinal and skin-related diseases. Roy and Singh (2019) explore the social determinants of health in mining-affected villages and note that poverty, livelihood insecurity, and poor access to healthcare intensify health vulnerability.

UNDP (2020) highlights that mining-induced environmental change disproportionately affects indigenous communities and calls for integrating health and livelihood concerns into extractive development planning.

Fernandes (2006) argues that mining-induced displacement disproportionately affects women by increasing nutritional insecurity and unpaid care burdens, negatively impacting maternal and child health. Lahiri-Dutt (2011) finds that women in mining areas face “invisible” health risks due to daily exposure to polluted water, dust, and degraded environments through domestic responsibilities. Rao (2014) observes that the shift from subsistence livelihoods to mining-based wage economies marginalizes women economically, weakening food security and overall health conditions. Kalluri (2008) notes that environmental degradation in mining regions increases women’s workload in collecting water and fuel, heightening physical strain and exposure to contamination. Padel and Das (2010) highlight that livelihood loss and social disruption in tribal mining areas intensify psychosocial stress among women, affecting their physical and mental well-being.

Methodology

This study adopts a qualitative case study approach to examine the health impacts of bauxite mining in villages surrounding the Kodingamali Bauxite Mine in Koraput, Odisha. The research is exploratory and aims to capture the lived experiences, perceptions, and health realities of tribal communities affected by mining operations. Fieldwork was conducted over four months (June–September 2025), covering both pre-monsoon and monsoon periods to observe seasonal variations in water quality, dust exposure, and agricultural conditions.

Primary data were collected from 120 households across six peripheral villages, selected through purposive sampling to include those most affected by mining activities. Participants included adult men and women, elderly residents, youth, village leaders, and local health workers, ensuring diverse perspectives. Data collection involved semi-structured interviews to explore individual health experiences, household surveys to document demographics and access to water, sanitation, and healthcare services, focus group discussions to capture community-level narratives, and direct field observations of environmental conditions such as air quality, water sources, agricultural land, and proximity to mining operations.

All interviews and discussions were transcribed, coded, and analysed using thematic analysis, which helped identify recurring patterns and key themes related to water and air pollution, respiratory and

water-borne illnesses, psychosocial stress, and livelihood disruption. Field observations were used to triangulate and validate participants' accounts. Ethical principles were strictly observed throughout the study; informed consent was obtained from all participants, confidentiality was maintained, and participation was entirely voluntary.

Area of Study

The study was conducted in the peripheral villages surrounding the Kodingamali Bauxite Mine located in the Koraput district of Odisha, India. Koraput is a predominantly tribal district situated in the southern part of the state, characterised by hilly terrain, forest cover, and rich mineral deposits. The region forms part of the Eastern Ghats and is ecologically sensitive, with a significant dependence of local communities on natural resources for their livelihoods. Kodingamali hill range is known for its substantial bauxite reserves, and mining operations have been undertaken in recent years as part of industrial development initiatives. The villages selected for the study are situated within proximity to the mining site and are primarily inhabited by Scheduled Tribe communities. Agriculture, forest produce collection, wage labour, and livestock rearing constitute the main sources of livelihood. The area has witnessed environmental changes due to mining activities, including increased dust pollution, alteration of water sources, and changes in land use patterns. Given the socio-economic vulnerability of the tribal population and their dependence on local ecological resources, the region provides a significant context for examining the health implications of mining-induced environmental transformation.

Results and Findings

This section presents the empirical findings of the study based on field data collected from the peripheral villages of the Kodingamali Bauxite Mine. The results are derived from household surveys, interviews, and field observations conducted during the study period. The analysis focuses on the major health issues reported by respondents, perceived changes in environmental conditions after the commencement of mining activities, and the overall impact on community well-being. The findings are organised thematically to highlight the relationship between mining-induced environmental changes and emerging health problems in the study area.

Water Pollution and Water-Borne Diseases

Water pollution has emerged as one of the most serious health concerns in the Kodingamali mining region of Kodingamali Bauxite Mine, located in Koraput. Villagers consistently described Kodingamali as the "lifeline of water" for the surrounding communities. The foothill region contains numerous small and large watersheds, including rivers and seasonal streams, which have traditionally supported local livelihoods. These water sources enabled the cultivation of paddy, pulses, vegetables, and spices, and sustained fishing activities such as the collection of fish, crabs, and water-based vegetables throughout the year. As villagers explained, "we could cultivate three times a year because water was always available."

However, respondents reported that these water bodies have gradually declined since the introduction of mining activities. Blasting and deep excavation have disrupted underground water flows, while wastewater discharge, mining dust, soil erosion, and chemical runoff have polluted surface water sources. During rainfall, runoff carrying mineral particles and sediments flows into streams, wells, and

ponds, making the water muddy and unsuitable for drinking. Many households observed changes in the colour, taste, and smell of water, stating that "the water no longer tastes the same and smells different." Villagers further reported that rivers and streams once used for fishing are now contaminated, leading to the death of fish and crabs. In some cases, surviving aquatic life appeared visibly affected. As one villager noted, "the crabs have turned red and cannot even be recognised." These ecological changes have directly affected food availability and supplementary livelihoods dependent on aquatic resources.

Residents of Jhalaguda explained that the village derives its name from "Jhala," meaning wetland, because water once flowed throughout the year. Before mining began, Jhalaguda was known as a major vegetable-producing village supplying produce to the Laxmipur market. Traders regularly visited the village, and vegetables were transported by trucks for sale. Villagers reported that after mining activities intensified, agricultural land became increasingly dry and infertile, and water sources diminished significantly.

A 48-year-old man from Jhalaguda shared an incident involving a village pond located at the centre of the settlement, where he cultivated fish such as Bakur, Rahi, and Deshi varieties. He stated that each fish usually grew to 1–1.5 kg. However, after a night of heavy rainfall, polluted runoff carrying mining dust overflowed into the pond, resulting in the death of approximately "one and a half quintals of fish in a single night." This incident not only caused economic loss but also symbolised the growing environmental vulnerability faced by the community.

Water pollution has further aggravated health vulnerabilities in mining-affected villages. Streams, ponds, and seasonal water channels used for drinking, cooking, bathing, washing clothes, and cleaning utensils have been increasingly contaminated. The consumption of polluted water has been associated with diarrhoea, gastrointestinal infections, stomach disorders, skin rashes, and fever, particularly during the monsoon season. A case from Marbaiguda involved a 13-year-old schoolgirl who bathed in a local stream and later developed severe skin lesions. According to villagers, "her body was covered with large marks, and other children avoided her." She was eventually taken home for treatment.

Women and elderly people were identified as the most affected groups. In several villages, drinking water is now available only at two or three locations. Women must walk long distances often 800 metres to one kilometre and wait in queues to collect water, usually early in the morning and again in the late afternoon. A 28-year-old mother from Talakaipadar explained, "If I am late, I have to wait in the queue, my baby cries, cooking is delayed, and our farming work also suffers." Continuous physical strain and lack of rest have affected her health. Elderly villagers similarly reported hardship, noting that before mining, water for bathing was easily accessible even during summer, whereas many streams now dry up due to blasting and deep excavation.

During the rainy season, overflowing water bodies often carry red, contaminated runoff. As an alternative, some households collect rainwater from rooftops, filter it, and use it for drinking and cooking. Villagers expressed a deep cultural and emotional connection to their water sources, stating that "we never needed aqua guards or cooled water." Stream and river water was described as naturally cool and refreshing, providing relief during extreme summer heat. Many recalled that earlier the water "tasted like mother's milk," whereas now it has become "suspicious and unsafe to drink."

These narratives demonstrate that mining-induced water contamination has led not only to environmental degradation but also to increased water-borne illnesses, livelihood disruption, gendered burdens, and heightened health vulnerability. Thus, water pollution in the Kodingamali mining region is

not merely an ecological issue; it represents a profound crisis affecting everyday life, community well-being, and public health.

Air Pollution and Respiratory Problems

Before the establishment of mining activities around the Kodingamali Bauxite Mine in Koraput, villagers in the peripheral settlements recalled living in a relatively clean and healthy environment, where major illnesses were uncommon and dependence on formal healthcare was minimal. As one respondent noted, "earlier we lived freely, the air and water were clean, and we did not fear sickness." However, following the initiation of bauxite extraction, residents have reported a marked deterioration in air quality across nearby villages.

Mining operations such as blasting, drilling, excavation, crushing, and the continuous movement of heavy trucks generate substantial amounts of dust. Villagers repeatedly described how mining dust remains suspended in the air and settles on houses, cooking spaces, food items, and water containers. According to residents, "the dust flies day and night and sits on our food, walls, and roofs." This airborne dust also contaminates nearby wells, ponds, streams, and small rivers that serve as primary sources of water for drinking and domestic use, thereby linking air pollution with broader environmental and health risks.

Residents of Biriguda and Talakaipadar, located close to the mining foothills, reported that dust and particles from blasting operations directly reach their settlements. Many described the dust as having a "poisonous smell," particularly during the summer season. During this period, houses, trees, agricultural fields, and water sources appear covered with a reddish layer of mining residue. As villagers expressed, "in summer our whole village turns red," illustrating the intensity of particulate deposition in the area.

Such environmental conditions have generated deep emotional distress and a sense of helplessness among the villagers. Several respondents expressed that they are "living a miserable life" under the constant exposure to dust, pollution, and uncertainty. Some even stated that it feels "better to die than to live with this tension," reflecting the severity of their psychological burden. Villagers further argued that if the government or mining company intends to establish projects in their area, meaningful consultation with the community should take place beforehand. In a symbolic expression of anguish, a few remarked that authorities should be ready "to take poison or stand in front of the trucks with us" to understand their suffering. They emphasised that mining not only affects the present generation but also threatens the future of their children. As they explained, natural resources such as land, water, and forests were once their lifeline; with these resources now being destroyed by mining, they question how they will survive and what will remain for the upcoming generation.

Mobility and everyday life have also been affected. Access to forests, agricultural land, nearby markets, and workplaces has become more difficult due to poor visibility and heavy truck movement. The main road connecting the villages to the Laxmipur block headquarters is now frequently congested with mining vehicles. Respondents recalled that "earlier it took thirty minutes to reach Laxmipur, now it takes nearly one hour," and several identified the route as accident-prone during peak mining hours. These changes have increased not only physical risks but also stress and uncertainty in daily routines.

Air pollution has further impacted livestock and domestic animals. Grazing lands and forest-based fodder are often covered with mining dust and residues, which animals consume along with contaminated water. Villagers reported that "our cows and goats fall sick after eating dust-covered grass." Additional concerns were raised about the disposal of food waste by mining workers, particularly

plastic-wrapped leftovers thrown in open areas, which animals ingest, leading to digestive problems and occasional deaths. Despite verbal complaints and written petitions to the company, respondents stated that "no action was taken."

Environmental concerns were also linked to unhygienic practices at mining sites, including reports of open defecation and sewage runoff mixing with nearby water bodies. Such practices have compounded local perceptions of environmental degradation and health vulnerability. In 2020, the Laxmipur Business Association reportedly organised a strike against mining truck movement, as dust contamination affected cooked food, drinking water, fruits, and other goods sold in the market, indicating that the impact of air pollution extends beyond villages to nearby commercial spaces.

Health complaints associated with deteriorating air quality were widely reported. Villagers from Biriguda described frequent chest pain, body aches, persistent cough, and breathing discomfort. Many expressed fear and anxiety regarding long-term health consequences, stating, "sometimes our chest pains and we feel something bad may happen." In the absence of adequate healthcare facilities, some respondents reported psychological distress and reliance on religious faith, noting that "we pray to our gods that nothing serious happens."

Taken together, these findings indicate that mining-related air pollution has produced interconnected environmental, physical, and psychosocial impacts in the Kodingamali region. Dust exposure not only contributes to respiratory problems and bodily discomfort but also disrupts mobility, livelihoods, livestock health, and community well-being. Thus, air pollution in the Kodingamali mining area represents not merely an environmental disturbance but a significant public health and social vulnerability issue requiring systematic policy attention and regulatory oversight.

Agricultural Decline and Environmental Degradation

Mining activities around the Kodingamali Bauxite Mine have resulted in visible land degradation and ecological imbalance across surrounding villages in Koraput. Respondents consistently highlighted the loss of forest cover, including trees, wild fruits, leafy vegetables, tubers, and medicinal plants that previously formed an integral part of subsistence, nutrition, and indigenous healthcare practices. Forests once functioned not only as ecological buffers but also as food banks and pharmacies for local communities. Their gradual depletion has weakened traditional food systems and reduced access to locally available herbal remedies.

Excavation, overburden dumping, blasting, and the continuous movement of heavy vehicles have accelerated soil erosion and altered the natural drainage pattern of the region. Farmers reported that topsoil has either been washed away during monsoon runoff or compacted due to dust deposition, leading to declining soil fertility. Several respondents observed that agricultural land which previously supported paddy, pulses, millets, and seasonal vegetables has become less productive. Crop yields have reportedly decreased, and some marginal lands have become unsuitable for cultivation altogether. These changes have increased dependence on market-based food items, thereby raising household expenditure and reducing dietary diversity.

Environmental degradation has also affected irrigation sources. As streams and seasonal water channels decline or become polluted, irrigation cycles have been disrupted. Farmers who once cultivated multiple crops annually now struggle to maintain even a single cropping season in some areas. The shift from subsistence-oriented agriculture to partial wage labour and market reliance reflects a broader transformation in livelihood patterns.

An important but less visible consequence is the erosion of traditional ecological knowledge. Elderly villagers noted that younger generations are no longer familiar with seasonal forest foods, medicinal herbs, and traditional farming practices. The weakening of this knowledge system has reduced community resilience in times of environmental stress. Earlier, forest-based foods supplemented nutrition during crop failure or lean seasons; with their decline, vulnerability to food insecurity has increased.

Thus, agricultural decline and environmental degradation are not merely ecological concerns but have direct and indirect health implications. Reduced food diversity affects nutritional intake, soil and water contamination influence food safety, and livelihood insecurity contributes to psychosocial stress. In this context, environmental degradation undermines the ecological foundations of tribal livelihood and intensifies long-term health vulnerabilities in mining-affected communities.

Psychosocial Stress and Community Health

Mining-related environmental degradation in the villages surrounding the Kodingamali Bauxite Mine in Koraput has generated significant psychosocial stress alongside physical health problems. Respondents frequently described feelings of anxiety, uncertainty, and emotional exhaustion linked to declining natural resources, pollution, livelihood insecurity, and fear of future illness. Continuous exposure to dust, contaminated water, reduced agricultural productivity, and economic strain has intensified mental distress within households. Several villagers expressed a persistent sense of insecurity, stating that they live "under tension," uncertain about their health and their children's future. Such expressions reflect not only environmental disruption but also a deep psychological burden associated with perceived loss of control over their surroundings.

Community health in the region is therefore shaped not merely by disease incidence but by broader social and environmental pressures. Recurrent respiratory discomfort, water-borne illnesses, physical fatigue, and financial stress collectively contribute to declining well-being. Women, elderly persons, and economically vulnerable families appear particularly affected, as they bear the dual burden of environmental exposure and caregiving responsibilities. In the absence of stable livelihoods and ecological security, health becomes intertwined with social vulnerability.

These psychosocial stresses are further compounded by limited access to healthcare and a weak institutional response. Primary Health Centres are located at considerable distances, and transportation during emergencies is often inadequate. Respondents reported irregular availability of doctors and shortages of essential medicines in public facilities, which reduces confidence in the formal healthcare system. As a result, many households depend on private clinics or informal practitioners, increasing out-of-pocket expenditure and financial strain. Despite ongoing mining operations, corporate social responsibility (CSR) initiatives related to sustained healthcare support were perceived as minimal and irregular. Community members reported that they traditionally practised an ethno-medicinal healthcare system; however, many of the medicinal plants they relied upon are gradually declining, which they associate with mining-related dust and chemical exposure.

Villagers also raised concerns regarding the absence of systematic health monitoring and environmental health assessments in mining-affected areas. The lack of regular medical screening, transparent reporting, and community participation in decision-making processes reinforces perceptions of institutional neglect. Consequently, psychosocial stress in the Kodingamali region is not only a response to environmental change but also to governance gaps and limited healthcare infrastructure.

Taken together, the intersection of environmental degradation, livelihood insecurity, mental distress, and inadequate institutional support highlights the complex nature of community health in mining-affected areas. Psychosocial stress in this context emerges as both a symptom and a consequence of broader structural and ecological transformations.

Conclusion

This study finds that mining activities in the Kodingamali region are associated with changes in water, air, land, and community life that have implications for local health. Water pollution has increased concerns about water-borne diseases and skin problems. Air pollution from dust is linked to respiratory difficulties among residents. Agricultural decline and environmental degradation have reduced food production and affected livelihood security, which may influence overall health and nutrition. In addition, livelihood uncertainty and environmental changes have contributed to psychosocial stress within the community. Overall, the findings suggest that the impact of mining on health is not limited to one factor but is connected to environmental and social conditions. Strengthening environmental management and improving access to healthcare services may help reduce health risks in mining-affected areas.

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