# Intersecting Vulnerabilities: Health Challenges Among Tribal Women in the Iron Ore Mining Region of West Singhbhum, Jharkhand

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Abstract—Tribal women residing near iron ore mining sites in Manoharpur and Noamundi blocks of West Singhbhum, Jharkhand, face intersecting vulnerabilities rooted in socio-economic marginalization, gender inequality, and environmental hazards. This descriptive quantitative study, based on structured questionnaires administered to purposively selected respondents, reveals widespread health issues such as malaria, skin infections, cholera, and typhoid. These are largely attributed to poor access to clean water, sanitation, and inadequate healthcare infrastructure. Despite their proximity to mining companies, women lack access to healthcare services and often depend on informal providers. Respondents also link mining-related environmental degradation to declining physical and mental health. The study underscores the compounded impact of poverty, limited health awareness, and pollution on tribal women's well-being. To address these disparities, it recommends integrated policies that strengthen healthcare access, improve water and sanitation infrastructure, promote disease prevention, and enhance community-level health education to ensure sustainable development and improved health outcomes.

*Index Terms*—Iron ore Mining, Tribal Women, Mining and Health, Environmental Health Risk

#### I. INTRODUCTION

The iron ore mining belt of West Singhbhum district in Jharkhand is home to a large indigenous (tribal) population that faces multidimensional vulnerabilities. Tribal communities in this region, predominantly the Ho and other groups, often live in remote rural villages adjacent to mining sites, where they experience socioeconomic marginalisation and environmental degradation. Women living close to mining regions bear a disproportionate burden of health challenges stemming from the intersection of gender, indigeneity, poverty, and ecological hazards. The expansion of iron ore mining in blocks like Manoharpur and Noamundi has led to deforestation, dust pollution, and water contamination, threatening fundamental needs like clean air and drinking water (Kumar, 2019). These conditions exacerbate existing public health issues and heighten risks for illnesses. Moreover, tribal women's health is crucial for community well-being, yet it often receives insufficient attention in research and policy (Gupta, 2025). This study seeks to investigate the health challenges faced by tribal women in miningaffected areas of West Singhbhum using a descriptive quantitative design. Focusing on women from villages near mines in Manoharpur and Noamundi, the research socio-demographic how examines factors. environmental exposures, and limited healthcare access intersect to impact their health. The findings aim to fill a gap in gender and tribal health literature and inform policy measures to address these "intersecting vulnerabilities."

## II. REVIEW OF LITERATURE

Tribal women living near iron ore mines in West Singhbhum experience a high prevalence of anaemia and malnutrition, particularly in areas like Kiriburu and Meghahatuburu. A cross-sectional study found that 85% of the general population in these regions suffered from anaemia, with more than half experiencing moderate to severe forms, especially among women. Moreover, undernutrition was prevalent in 24.2% of the population, and 70% of adolescent girls had moderate to severe anaemia (Dhatrak et al., 2017). Mining-related dust exposure is a primary concern for women, who spend significant time collecting water and firewood and managing outdoor chores. For instance, in mining-affected villages, women who gather forest produce or work in fields near mines have reported skin rashes and other illnesses from exposure to polluted soil and water (Kumar, 2019). A study from Singhbhum's mining zones reported atmospheric dustfall rates as high as 76.99 g/m<sup>2</sup>/month during summer, with high levels of hematite and quartz that can impact respiratory health (Mahato & Singh, 2020). Air quality modelling in the Saranda Forest region showed that mining transport routes cause high PM2.5 and PM10 levels, with particularly hazardous impacts near mining leasehold areas. This exposure is significant for nearby women and children (Chaulya et al., 2019).

A qualitative study by D'Souza et al. (2013) in an Indian mining community highlighted how early marriage, closely spaced pregnancies, and limited decision-making power adversely affected women's reproductive health and overall well-being. Women reported that domestic violence and husbands' alcohol use further contributed to poor mental and physical health. In many tribal societies, women have low literacy and are economically dependent, constraining their access to healthcare and information. Health infrastructure in many tribal-dominated, resource-rich areas is inadequate. Government health centres are few and often poorly staffed in remote villages, while company-run hospitals often prioritize employees and may be distant from tribal settlements. As a result, tribal populations tend to rely on informal providers or traditional healers. A recent assessment in a mining block observed that villagers frequently consulted unqualified local practitioners ("quacks") for ailments due to the absence of easily accessible formal healthcare (Aggarwal & Ghosh, 2020).

In summary, existing research indicates that tribal women in mining regions lie at the convergence of multiple vulnerabilities. Environmental health risks from mining aggravate the already precarious health situation created by poverty and social marginalisation.

#### III. RESEARCH METHODOLOGY

The research encapsulated in this paper is driven by two primary objectives. The first is to assess the health status, disease burden, and access to basic services among tribal women living in iron ore mining-affected villages of West Singhbhum, Jharkhand. The second aims to explore the perceived impact of mining on their physical and mental health, highlighting systemic barriers to care. This study employed a descriptive research design with a quantitative approach to assess health challenges among tribal women in mining areas. The study was carried out in two blocks of West Singhbhum district - Manoharpur and Noamundi, which are known for extensive iron ore mining. Within these blocks, villages in close proximity to mines were purposively selected, as residents here are most likely to experience the impacts of mining. Purposive sampling was used to identify 120 respondents (aged approximately 18-59) living in mining-affected villages. All participants gave informed consent, and the study was explained in the local language to ensure understanding. Data were collected through face-toface interviews using a structured, closed-ended questionnaire, allowing for quantitative analysis. The data were analysed using MS Excel to generate frequencies and percentages, with results presented through tables and charts for clarity.

## IV. FINDINGS AND DISCUSSION

Socio-Demographic Characteristics of the Respondents

The socio-demographic characteristics of the women respondents living around iron ore mining sites in West Singhbhum district, Jharkhand, reveal that most respondents are aged between 31 and 50 years (51.7 per cent), and a large majority are married (86.7 per cent). Educational attainment is low, with 40 per cent being illiterate and only 4.1 per cent having higher secondary education or above (Table 1). The predominant occupation is the collection and sale of non-timber forest products (NTFPs) (64.2 per cent), while 92.5 per cent reside in kutcha (temporary or mud) houses. Economically, 77.5 per cent have an annual income between  $\gtrless10,000$  and  $\gtrless30,000$ , indicating a high poverty level.

Table 1: Socio-Demographic Characteristics of the Respondents

Variables		Frequenc	Percentag
		У	e
	Below 30	39	42.5
Age	31 to 50	74	51.7
	51 to 59	7	5.8

Maulta1	Married	104	86.7
Status	Unmarried	4	3.3
Status	Widow	12	10.0
-	Illiterate	48	40.0
	Primary (1-	36	30.0
	5)		
	Middle (6-	20	16.7
	8)		
Education	High	11	9.2
	School (9-		
	10)		
	Higher	5	4.1
	Secondary		
	and Above		
	Agriculture	11	9.2
	Collection	77	64.2
	and Selling		
	of NTFP		
Occupatio	Daily Wage	22	18.3
n	Labourer		
11	Other	10	8.3
	(Small scale		
	Business,		
	Homemake		
	r)		
Housing	Kutcha	111	92.5
Structure	Semi Pucca	9	7.5
Annual	Nil	6	5.0
	Rs 10,000 –	93	77.5
Income	Rs 30,000		
meonie	Rs 30,001 –	21	17.5
	Rs 50,000		

The socio-demographic profile reveals that tribal women in mining-affected areas face educational deprivation, insecure livelihoods, and poor living conditions. These socio-economic and structural challenges are closely linked to poor health outcomes among indigenous women. Educational deprivation has been widely recognized as a barrier to health awareness and care-seeking behaviour. Limited literacy reduces the ability to comprehend health information and engage with health services, particularly in remote tribal areas (Kickbusch et al., 2013). The predominance of informal occupations, such as forest product collection and wage labour, reflects gendered patterns of labour where women work in unregulated and hazardous environments, often without protective equipment or healthcare benefits. Such labour arrangements have been associated with chronic health conditions and increased exposure to environmental pollutants in mining zones (Lahiri-Dutt, 2011; Lund & Srinivas, 2010). Poor housing conditions further expose these women to airborne particulate matter, especially in regions affected by mining, where dust inhalation has been linked to increased incidences of respiratory disorders (Ghose & Majee, 2007).

Economic insecurity is central to limiting access to adequate nutrition, clean water, and healthcare, all essential to maintaining physical and mental health. Persistent poverty has a cumulative impact on health across the life course, with tribal communities often facing systemic barriers to government welfare schemes (Marmot et al., 2008). For tribal women, these vulnerabilities are magnified due to the intersectionality of gender, indigeneity, and geographic exclusion. Studies have consistently shown that tribal women in mining regions bear the dual burden of environmental exposure and systemic neglect in health policy and service delivery (Meher, 2009; Stephens et al., 2006).

## V. SELF-REPORTED HEALTH STATUS OF RESPONDENTS

Among the respondents, none reported excellent health, while 6.6 per cent rated their health as good, 66.7 per cent as fair, and 26.7 per cent as poor (Table 2). Regarding disease prevalence over the past decade, 64.2 per cent had suffered from malaria, 60.0 per cent from skin diseases, 31.7 per cent from cholera, 22.5 per cent from typhoid, 14.1 per cent from jaundice, and 5.0 per cent from tuberculosis.

Health Condition		Frequency	Percentage
Cumont	Excellent	0	0.0
Health	Good	8	6.6
Status	Fair	80	66.7
	Poor	32	26.7
Diseases	Malaria	77	64.2
Suffered	Typhoid	27	22.5
Over the	Jaundice	17	14.1
Past	Cholera	38	31.7
Decade	Tuberculosis	6	5.0

Table 2: Self-Reported Health Status of Respondents

Skin	72	60.0
Disease		

This subjective assessment indicates that almost all respondents recognise some health issues, with over a quarter feeling unhealthy. Prolonged exposure to mining operations increases environmental pollution, which has been shown to contaminate local water sources and contribute to outbreaks of diseases like cholera and jaundice (Addo et al., 2023; Opare et al., 2012; Naik, 2015; Ojha et al., 2021). Malaria and skin infections are frequently reported in tribal belts due to stagnant water bodies and lack of vector control measures near mining regions, which are often overlooked in rural public health planning (Yapabandara & Curtis, 2004; Dao et al., 2021). Moreover, poor housing, environmental degradation, and nutritional deficiencies compromise immune increase susceptibility to function and both communicable and non-communicable diseases (D'Souza et al., 2013; Ullikashi & Kulkarni, 2021). The low self-assessment of health status among respondents may also reflect limited access to quality healthcare services, cultural and logistical barriers in accessing care, and lack of confidence in institutional health systems, as reported in similar tribal settings in mining-affected regions of India (Mishra et al., 2015).

## VI. ACCESS TO AND USAGE OF HEALTH SERVICES

The availability of services and social factors constrain these women's healthcare access. When asked where they usually seek care when ill, none of the respondents reported using a government or companyrun hospital except in a major health emergency. Instead, 58.3 per cent said they go to government health clinics, and the remaining 41.7 per cent rely on informal providers or "quacks" (Table 3). Government health clinics typically refer to the health sub-centres or primary health centres (PHCs) in or near the villages. Regarding the frequency of seeking healthcare, 65 per cent of respondents said they visit health services "frequently", while 35 per cent do so "sometimes". Frequent healthcare visits here do not imply adequate care, as many rely on quacks, often receiving substandard treatment. The high visit rate likely reflects ongoing exposure to environmental

hazards like contaminated water, dust, and poor sanitation.

Table 5. Recess to and Usage of Health Services			
Health Service Aspects		Frequenc	Percentag
		у	e
Healthcare	Governmen	0	0.0
Provider	t/Company		
Usually	Hospital		
Visited When	Governmen	70	58.3
I11	t Health		
	Clinics		
	Quacks	50	41.7
Frequency of	Frequent	78	65.0
Health Service	Sometimes	42	42.0
Visit	Sometimes		

Table 3: Access to and Usage of Health Services

The healthcare access scenario reflects both geographical and socio-cultural barriers. The heavy reliance on government clinics is somewhat positive, as they are part of the formal system - they likely provide basic care, immunizations, and referrals. However, PHCs in many mining-affected blocks of Jharkhand are under-resourced; reports have noted deficits in primary healthcare infrastructure in West Singhbhum's mining areas (Centre for Science and Environment, 2018). This can result in overcrowding or limited services, pushing people to seek alternatives (hence the quack usage). D'Souza et al. (2013) and Leo et al. (2024) highlighted that tribal women often rely on informal or unqualified health practitioners due to limited mobility, poor awareness, and systemic barriers to formal healthcare access (D'Souza et al., 2013; Leo et al., 2024). (2011) emphasized that tribal populations across India suffer from chronic underprovision of basic medical services, with structural issues such as poor transportation, inadequate staffing, and non-functional health centres contributing to low utilization rates of formal care. Guimbeau et al. (2023) argued that proximity to mines can sometimes enhance women's access to public services through shared royalties and infrastructure investment. However, these benefits are unevenly distributed and may bypass the most vulnerable subgroups, including tribal women.

## VII. ACCESS TO BASIC AMENITIES

Access to clean drinking water and sanitation is fundamental for health, yet our data reveal serious deficiencies in these amenities (Table 4). Only 18.3 per cent of respondents said they "always" have access to clean drinking water, whereas the vast majority (81.7 per cent) said they only have it "sometimes." This implies that clean water is not consistently available for most women – it might be seasonal or dependent on distant sources or irregular supply. During parts of the year or certain times, they likely resort to unclean water (from ponds, rivers, or shallow wells), which can expose them to pathogens and pollutants. Table 4: Access to Basic Amenities

Amenity		Frequency	Percentage
Access to	Always	22	18.3
Clean Drinking	Sometimes	98	81.7
Water	Bathroom	10	83
Access to	Datifi00111	10	0.5
Sanitation	Toilet	38	31.7
Facility	Both	10	8.3

Sanitation access is even more challenging. Half of the women (approximately 51.7 per cent) have no sanitation facilities at home, meaning no toilet or dedicated bathroom. Among those who do have something, 31.7 per cent have a toilet only (but no bathroom), 8.3 per cent have a bathroom only (but no toilet), and only 8.3 per cent have both toilet and bathroom. This indicates that open defecation is common for the majority and bathing is done in open spaces or rivers.

A study by Alam and Prasad (2015) in Jharkhand found that mining-related contamination significantly reduced water quality in tribal regions, leading to acid mine drainage, high levels of heavy metals, and poor sanitary conditions. These environmental changes resulted in increased rates of waterborne diseases and overall health deterioration among local communities. Environmental studies in mining areas have indeed found that water sources can be polluted by mining effluents (e.g., high iron and other metals), forcing communities to choose between unsafe local water or no water at all (Kumar, 2019). Poor sanitation is a known driver of diarrheal diseases, parasitic infections, and even women's safety issues (as they often go out before dawn or after dusk for privacy). The high rate of open defecation among these tribal households is in line with known gaps in rural sanitation in parts of India. However, national programs like Swachh Bharat Abhiyan have aimed to reduce it.

## VIII. AWARENESS AND PERCEPTION REGARDING HEALTH AND MINING

When asked about their awareness of health programmes (such as government health schemes, maternal health initiatives, or possibly any mining company CSR health camps), none of the women reported being "very aware." The majority, 84.2 per cent, said they were "moderately aware," while 15.8 per cent were "not at all aware" (Table 5). This suggests that some information is reaching them (hence moderate awareness), but the depth of knowledge is lacking. They may have heard of specific programs but not enough to fully utilize them. The lack of high awareness could be due to literacy barriers and limited outreach - for example, if health education materials are not in their local language or there are no effective communication campaigns in these remote villages.

 Table 5: Awareness and Perception Regarding Health

 and Mining

Aspect of Health		Frequenc	Percentag
Awareness and Perceived		у	e
Impact			
	Very	0	0.0
Awareness	Aware		
of Health	Moderatel	101	84.2
Programme	y Aware		
S	Not at All	19	15.8
	Aware		
	Impact on	70	58.3
	Physical		
Reported	Health		
Health	Impact on	29	24.2
Impacts	Mental		
	Health		
	Not at All	21	17.5
Perceived	Positive	0	0.0
	Neutral	67	55.8
impact of	Negative	53	44.2

Mining or	1	
Health		

Regarding perceived health impacts, 58.3 per cent of respondents believed that mining impacted their physical health, citing issues like more frequent illness, cough or breathing trouble from dust, body weakness, etc (Table 5). Meanwhile, 24.2 per cent felt an impact on their mental health, describing stress, anxiety, or despair related to the mining (perhaps due to environmental destruction or worries about family health and livelihoods). On the other hand, 17.5 per cent said "not at all," perceiving no direct impact of mining on their health. The fact that the majority perceive a physical health impact aligns with the tangible exposures (dust, polluted water, etc.) they face. Fewer identifying mental health impact could be because mental health is less understood or acknowledged; however, one in four feeling mental stress is still notable – they might be referring to things like noise disturbance, fear of accidents, or the strain of coping with illnesses and economic uncertainties exacerbated by mining.

Finally, when directly asked about the overall impact of mining on health, none of the respondents viewed it as "Positive." About 55.8 per cent said the impact was "Neutral," and 44.2 per cent said "Negative" (Table 5). The absence of any positive perception is telling mining, in their view, has not brought health benefits. A "neutral" perception from the slight majority could mean that they are not sure or do not attribute their health issues specifically to mining; they might see diseases as a regular part of life or due to other factors like fate or general hardship. The 44.2 per cent who see it as negative clearly connect mining with worsened health – likely due to the dust, water issues, or perhaps the lack of improvement in healthcare services despite the mines. It is possible that those who said neutral might also be experiencing problems, but have not linked cause and effect explicitly.

#### IX. CONCLUSION

Tribal women in the iron ore mining region of West Singhbhum, Jharkhand, experience profound health challenges arising from the intersection of socioeconomic marginalization, gender inequalities, and environmental health hazards. The study's descriptive quantitative analysis of 120 respondents revealed alarmingly low health status – with virtually all

women reporting fair or poor health - and a high prevalence of communicable diseases such as malaria, water-borne infections, and skin ailments. These health issues are intricately linked to inadequate access to clean water and sanitation, undernutrition, and limited healthcare services. Furthermore, the impacts of mining activity, including pollution and ecological disruption, have percolated into the daily lives of these communities, contributing to illness and a perceived decline in well-being. Despite living in proximity to lucrative iron ore mines, these women have not reaped health benefits; instead, they continue to lack basic healthcare infrastructure and knowledge of health programs. The findings underscore the notion of "intersecting vulnerabilities" - how tribal identity, gender, poverty, and environmental exposure combine to place these women at a particular disadvantage in terms of health outcomes. Addressing such multifaceted issues requires an integrated approach that spans public health, social welfare, and corporate responsibility. Below are key policy recommendations drawn from the study's insights:

Policy Recommendations

- Strengthen healthcare delivery by upgrading health sub-centres and Primary Health Centres in mining-affected villages, ensuring each has adequate staff and equipment. Deploy mobile clinics to regularly reach remote areas with services like antenatal care, immunization, and disease screening. Mining companies must invest in local health infrastructure using funds from their Corporate Social Responsibility (CSR) initiatives and the District Mineral Foundation (DMF). Training tribal women as ASHAs can improve service uptake and community trust.
- Implement a targeted WASH program in mining-0 affected blocks to ensure safe drinking water through bore wells, filtered community tanks, or rainwater harvesting, funded by DMF resources. Promote 100% toilet coverage using Swachh Bharat Mission incentives and provide technical support for challenging terrains. In areas lacking household toilets, community toilets and bathing spaces for women should be set up as a temporary solution. Support housing upgrades from kutcha to semi-pucca structures to reduce overcrowding exposure. These interventions and can significantly lower the disease burden by addressing fundamental health determinants.

- Strengthen disease prevention by distributing insecticide-treated bed nets, conducting regular indoor spraying, and training village-level malaria workers for early diagnosis and treatment. Address water-borne diseases through water testing, chlorination drives, and prompt medical responses to outbreaks. Expand nutrition programs like ICDS and PDS to ensure women and children get iron, folic acid, and protein supplements. Hold anaemia screening camps and provide deworming and supplements, especially in high-risk areas. Promote kitchen gardens and traditional crops to enhance food security and reduce disease vulnerability.
- Promote health education through culturally relevant campaigns using local dialects, folk songs, village theatre, and pictorial posters to share messages on hygiene, disease prevention, and maternal care. Train women's groups and youth as health ambassadors to spread awareness and build trust. Use verbal and visual methods to explain government health schemes and how to access them, considering low literacy levels. Encourage health literacy to reduce dependence on informal care and improve timely clinic visits.
- To reduce mining's health impacts, enforce dust control measures like water spraying and green buffers around mining sites. Conduct regular environmental audits, share air and water quality data with communities, and provide alternative safe water if contamination is found. Establish health monitoring through DMF to detect miningrelated illnesses early and offer treatment.
- Design gender-sensitive health interventions by 0 ensuring the presence of female healthcare providers and offering services like gynaecological check-ups, anaemia camps, and counselling for domestic violence or mental stress. Integrate these into women's self-help groups for better outreach. Encourage and support women's livelihoods beyond NTFP collection, as economic empowerment can improve health outcomes. Support women's economic empowerment through skill training activities or health work, enhancing their control over healthrelated decisions. Promote education for tribal girls with targeted incentives to break the cycle of illiteracy.

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