

Working Conditions and Mental Health of Mining Industry Workers During the Monsoon Season: A Study from Gora-Machhiya Granite Mining Area, Jhansi,

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Abstract

The monsoon season significantly alters working conditions in open-cast mining, potentially affecting the mental health of workers. This cross-sectional study aimed to assess the prevalence of depression, anxiety, and stress among granite mining workers and to examine their association with key monsoon-related working conditions. Data were collected from 85 workers in the Gora-Machhiya mining area, Jhansi, India, between July and September 2025 using the Depression Anxiety Stress Scale (DASS-21) and a structured questionnaire.

Water logging severity, drainage quality, and daily working hours were measured through self-reported measures. One-way ANOVA was used to examine associations between working conditions and mental health outcomes. Results showed moderate to severe levels of depression, anxiety, and stress among a substantial proportion of workers. Water logging was significantly associated with higher anxiety scores ($F(2,82) = 4.73, p = 0.011$). However, no significant associations were found between drainage quality and stress or between daily working hours and depression.

The findings indicate that direct environmental hazards, particularly water logging, contribute to increased anxiety during the monsoon season. Targeted interventions focusing on improved drainage, safety measures, and mental health support are recommended.

Keywords: Mining workers, mental health, monsoon season, working conditions, water logging, DASS-21, occupational health

Introduction

Workers are the backbone of the economic progress of any country. They provide impetus to industries by working in factories, production units, construction sites, mining sector and various production centre. But often the working conditions of these workers are extremely challenging. Workplace insecurity, precarious employment, inadequate wages, lack of health services, and lack of social security – all these factors seriously affect the mental health of workers. Specially every year during the season of monsoon, these conditions have changed drastically, which adversely affected their mental balance. The quality of the workplace directly affects the productivity, life satisfaction

and mental state of workers. In mining industrial sectors in India, workers have to work for 10 to 12 hours, in which lack of safety equipment and not getting wages on time is common. According to **Shyam Sundar**, “Uncertain work environment gives rise to mental insecurity, which in the long run can lead to depression, anxiety and social isolation.” Adverse workplace conditions such as long working hours, abusive behaviour of the boss, no leave and lack of family life are all the root causes of mental stress. According to the 2022 report of the World Health Organization (WHO)¹, Globally, poor working conditions are strongly linked to mental health problems. The World Health Organization (WHO) reports that approximately one in five workers experiences mental health issues, often related to excessive workload, job insecurity, and unsafe environments. The International Labour Organization (ILO) has highlighted how climate-related factors, including seasonal heavy rainfall, can exacerbate mental health risks among outdoor and manual workers. One in every five workers globally suffers from some mental health problem. The report specifically says that emotional instability, insecurity, excessive work pressure, and lack of cooperation from colleagues in the workplace lead to mental stress. The ILO 2023 report, states that continuous work, lack of adequate sleep, and lack of work-life balance have long-term effects on mental health. Women in particular who manage both home and workplace have to bear more stress.² Other studies have also shown that the symptoms of these two syndromes are distinct but both present interrelated negative moods³ as they present identical psychological states, such as weakness, hopelessness, and negative emotions which are accompanied by a complete absence of positive emotions⁴.

India's monsoon (June – September) typically lifts hydropower and agriculture but it also soaks mines, slows pit operations, clogs haul roads, and squeezes ports and rail. In 2024, the monsoon delivered 108% of the long-period average rainfall across India, reinforcing just how seasonal mining and logistics risks are. In 2025, utilities entered the rains with record coal stocks precisely to offset mining and transport slowdowns. That's your cue : monsoon risk isn't a “black swan” – it's an annual, predictable stress test you can plan around. Jhansi lies in southwest portion of Jhansi division of Uttar Pradesh state of India between 25°30' and 25°57' N latitude and 78°40' and 79°25' E longitude. The present area of the district according to survey of India is 5,024 km².⁵ Mining activity that provides the raw materials for infrastructural development and Jhansi is one of the important granite mining centers in the region. In Jhansi granite mining is done mainly through the open cast mining. Major area of mining industry is open and hard rock, and during the monsoon maximum area sunk in water and working condition is unfavorable and risky. Many mining sites are shut down due to condition and workers those are employed here now they are jobless.⁶

In India, open-cast mining operations in regions such as Jhansi are highly vulnerable to monsoon conditions. Water accumulation in mining pits and haul roads increases safety risks and can lead to temporary work stoppages, resulting in income insecurity. Despite the relevance of this issue, there is limited empirical research examining the specific impact of monsoon-related working conditions on the mental health of Indian mining workers.

This study seeks to address this gap by assessing the prevalence of depression, anxiety, and stress and exploring their associations with monsoon-specific working conditions in the Gora-Machhiya granite mining area of Jhansi.

Prior research

Working conditions surveys contribute evidence to the debate on major topics such as job quality⁷ and The absence of physical hazards that pose a risk to health and well-being is an acknowledged feature of job quality⁸. Mostly time downsizing's are clearly associated with increased insecurity for all workers including those who will remain in

¹ World Health Organization

² ILO 2023 report Ensuring Safety and Health at Work in a Changing Climate

³ Ahola K, et al. The relationship between job-related burnout and depressive disorders— results from the Finnish Health 2000 Study. *J Affect Disord.* 2005;88(1):55–62.

⁴ Maslach C, Jackson SE, Leiter M. The Maslach Burnout inventory manual. In: Zalaquett CP, Wood RJ, editors. *Evaluating stress: a book of resources*. 3rd ed. Palo Alto (CA): The Scarecrow Press; 1997. p. 191–218.

⁵ https://en.wikipedia.org/wiki/Jhansi#Geography_and_climate

⁶ <https://anupamfuels.com/2025/08/15/when-monsoons-disrupt-mines-how-to-build-a-rain-proof-raw-material-supply-strategy/>

⁷ Mariya Aleksynska et al (ILO), Monitoring working conditions research report ISBN 978-92-897-1843-1 doi:10.2806/951806 page n. 10

⁸ Mariya Aleksynska et al (ILO) Comparative overview ,research report ISBN 978-92-897-1843-1 doi:10.2806/951806 page 53.

employment.⁹ **Claire de Oliveira et al (2022)** found clear evidence that poor mental health, typically measured as depression and/or anxiety, was associated with lost productivity,¹⁰ and individual level, workers with mental health problems face issues regarding job retention, unemployment, potential for discrimination, and impaired quality of life.¹¹ **Verma Shikha & Sharad Chaudhary 2017** discuss the accident condition during the mining work are caused by unsafe human actions, particularly skill-based errors during underground mining operations. Workers aged 33–47 years with 6–10 years of experience were found more vulnerable to accidents, especially during the first work shift. Organizational failures and behavioral factors also contributed significantly.¹² **Sedarmayanti (2011)** states that the physical work environment is all physical conditions found around the workplace that can affect employees both directly and indirectly. The physical work environment can be divided into two categories, namely: Environment that is directly related to employees (such as: work centers, chairs, tables and so on). and Intermediary environment or general environment can also be called a work environment that affects human conditions, such as: lighting, temperature, humidity, air circulation, noise, mechanical vibration, odor, color management, decoration, music, security.¹³ **Paraskevi Theofilou et al 2023** discuss about the anxiety depression among health professionals is a crucial issue that must be carefully addressed after the COVID-19. It is also suggested that scheduled regular screening for mental disorders in workers, at a personal level, employees and to be able to carefully monitor the progress of the group.¹⁴

Objectives

1. To determine the prevalence of depression, anxiety, and stress among granite mining workers during the monsoon season.
2. To examine the association between specific monsoon-related working conditions (water logging, drainage quality, and daily working hours) and mental health outcomes (depression, anxiety, and stress).

Research Questions

1. What is the prevalence of depression, anxiety, and stress among mining workers during the monsoon season?
2. Which monsoon-related working conditions are associated with higher levels of poor mental health?

Hypotheses

- H1: Higher severity of water logging is associated with increased anxiety levels among mining workers.
H2: Poor drainage conditions are associated with higher stress levels.
H3: Longer daily working hours are associated with higher depression levels.

Methodology

Study Design and Setting

This cross-sectional quantitative study was conducted in the Gora-Machhiya granite mining area, Jhansi, Uttar Pradesh, India. Data were collected between July and September 2025.

⁹ Mariya Aleksynska et al (ILO) Comparative overview, research report ISBN 978-92-897-1843-1 doi:10.2806/951806 page 45.

¹⁰ Claire de Oliveira 2022: The Role of Mental Health on Workplace Productivity: A Critical Review of the Literature <https://pmc.ncbi.nlm.nih.gov/articles/PMC9663290/#CR1>

¹¹ AD LaMontagne, A Martin, KM Page, et al. Developing an integrated approach to workplace mental health <https://doi.org/10.1037/0000149-013>

¹² Verma Shikha & Sharad Chaudhary 2017 Safety of worker in Indian mines; Study, analysis and prediction <https://pmc.ncbi.nlm.nih.gov/articles/PMC5605840/#abs0010>

¹³ Sedarmayanti. (2011). Human resources and work productivity. Jakarta: Mandar Forward

¹⁴ Paraskevi Theofilou et al 2023 A cross-sectional study in Greece to investigate burnout, anxiety, and depression in health staff: the impact of occupational and demographic factors *Academia Medicine and Health* Volume 1; Issue 1 doi.org/10.20935/AcadMed6113

Participants

A convenience sampling technique was employed. Approximately 100 workers were approached, out of which 85 provided complete and usable responses and were included in the final analysis.

Measures

- **Mental Health Outcomes:** The Depression, Anxiety and Stress Scale (DASS-21), developed by Lovibond and Lovibond (1995), was used to assess depression, anxiety, and stress. The instrument consists of 21 items divided into three subscales of 7 items each. Higher scores indicate greater symptom severity. Standard cut-off scores were used to categorize severity levels.
- **Working Conditions:** A structured questionnaire was used to collect self-reported data on monsoon-related working conditions:
- **Water logging:** Measured on a 3-point scale (1 = mild, 2 = moderate, 3 = severe) based on workers' perception of water accumulation affecting their workplace.
- **Drainage quality:** Measured on a 3-point scale (1 = poor, 2 = average, 3 = good).
- **Daily working hours:** Recorded as the number of hours worked per day (categorized into 8, 9, 10, and 11 hours).

Data Analysis

Data were analyzed using SPSS version 26.0. Descriptive statistics (means, standard deviations, frequencies, and percentages) were computed. One-way Analysis of Variance (ANOVA) was used to examine differences in DASS subscale scores across categories of working condition variables. Pearson's correlation was also performed to assess linear relationships. A significance level of $p < 0.05$ was adopted. Effect sizes were reported using eta-squared (η^2).

Results

Prevalence of Mental Health Problems

A considerable proportion of mining workers reported moderate to severe levels of depression, anxiety, and stress during the monsoon season. The overall mean scores were:

- Anxiety: $M = 14.45 (\pm 5.12)$
- Stress: $M = 19.68 (\pm 7.89)$
- Depression: $M = 16.53 (\pm 7.21)$

Association between Working Conditions and Mental Health Outcomes

1. Water Logging and Anxiety

One-way ANOVA showed a statistically significant association between water logging severity and anxiety scores, $F(2, 82) = 4.73$, $p = 0.011$, $\eta^2 = 0.10$. Workers reporting severe water logging had higher anxiety levels compared to those with mild water logging. This finding supports Hypothesis 1.

Table 1: DASS-Anxiety Scores by Water Logging Severity

Water Logging	N	Mean	SD
Mild	43	15.44	4.75
Moderate	35	14.23	5.40
Severe	7	9.43	3.31
Total	85	14.45	5.12

2. Drainage Quality and Stress

No significant association was observed between drainage quality and stress scores, $F(2, 82) = 0.67$, $p = 0.517$, $\eta^2 = 0.02$. Hypothesis 2 is not supported.

Table 2: DASS-Stress Scores by Drainage Quality

Drainage Quality	N	Mean	SD
Poor	22	31.32	8.33
Average	46	18.91	7.65
Good	17	19.65	8.43
Total	85	19.68	7.89

3. Daily Working Hours and Depression

One-way ANOVA revealed no significant difference in depression scores across working hour categories, $F(3, 81) = 0.25$, $p = 0.86$, $\eta^2 = 0.01$. Hypothesis 3 is not supported.

Table 3: DASS-Depression Scores by Daily Working Hours

Working Hours	N	Mean	SD
8	17	17.12	8.27
9	26	17.31	6.83
10	22	15.36	7.38
11	20	16.30	7.73
Total	85	16.53	7.21

Discussion

This study found a high prevalence of depression, anxiety, and stress among granite mining workers during the monsoon season. Water logging emerged as a significant environmental stressor associated with increased anxiety. This finding is consistent with previous research linking immediate physical hazards and safety concerns with heightened psychological distress.

The lack of significant association between drainage quality and stress, as well as between working hours and depression, suggests that direct and visible hazards (such as water logging and slippery surfaces) may have a stronger psychological impact than infrastructural or routine workload factors in the monsoon context.

Limitations

The cross-sectional design limits causal inferences. The use of convenience sampling and self-reported measures may introduce response bias. The sample was drawn from a single mining area, which restricts generalizability. Future studies should employ larger, multi-site, and longitudinal designs with objective measures of working conditions where possible.

Conclusion

Mining workers in the Gora-Machhiya area experience considerable mental health challenges during the monsoon season. Water logging was found to be significantly associated with higher anxiety levels. These results highlight the need for improved monsoon preparedness, including better drainage systems, rapid water removal, provision of adequate personal protective equipment, regular mental health screening, and appropriate support mechanisms. Integrating occupational mental health into seasonal safety protocols can help protect the well-being and productivity of mining workers.

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