

GEOSPATIAL DISPARITIES IN OCCUPATIONAL HEALTH RISKS AMONG FEMALE AGRICULTURAL WORKERS ACROSS VARIOUS STATES IN INDIA

Nisha Sengar¹, Poonam Yadav²

¹P.G.D.A.V. College, University Of Delhi, New Delhi, India.

²Centre For Informal Sector And Labour Studies, School Of Social Sciences, Jawaharlal Nehru University, New Delhi, India.

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ABSTRACT

Agriculture serves as the backbone of the Indian economy, with women constituting a substantial portion of the agricultural workforce. However, female agricultural workers face diverse occupational health risks influenced by geospatial disparities, climatic conditions, socio-economic factors, and access to healthcare. This study aims to analyze these risks across different states in India through a multidisciplinary approach integrating geospatial analysis, epidemiological data, and statistical visualizations. The research highlights significant health concerns, including pesticide exposure, musculoskeletal disorders, respiratory ailments, and other occupational hazards, which exhibit distinct regional variations. A bar chart illustrating the number of states affected by each health risk underscores these disparities, providing a comparative perspective on their prevalence. The findings emphasize the need for state-specific policy interventions to address health inequities among female agricultural workers. This study underscores the urgency of implementing targeted healthcare strategies, improving occupational safety measures, and promoting policy reforms to enhance the well-being of this vulnerable workforce.

Keywords: Geospatial disparities, occupational health, female agricultural workers, India, epidemiology, health risks, policy interventions.

1. INTRODUCTION

Agriculture remains the backbone of India's economy, employing a significant proportion of the workforce, particularly in rural areas. Among these, female agricultural workers play an indispensable role, engaging in various activities such as planting, weeding, harvesting, threshing, and post-harvest processing [1-7]. Despite their substantial contribution to agricultural productivity, their occupational health risks are often overlooked, underreported, and inadequately addressed. The interplay of geographical, climatic, and socio-economic factors further exacerbates their vulnerability. Female agricultural workers in India face multifaceted health challenges that stem from prolonged physical labor, exposure to hazardous chemicals, adverse climatic conditions, and socio-economic constraints [8-13]. Their daily tasks, which require repetitive motions and physically demanding postures, lead to musculoskeletal disorders, chronic pain, and fatigue [14-23]. Additionally, exposure to pesticides, fertilizers, and other agrochemicals significantly increases their risk of developing respiratory ailments, skin diseases, reproductive health issues, and long-term neurological disorders.

Unlike their male counterparts, women in agriculture often have limited access to protective gear and safety training, making them more susceptible to occupational hazards [24-31]. Geographical variations further influence the extent and nature of these risks. In regions with extreme weather conditions—such as the arid zones of Rajasthan, the humid coastal belts of Kerala and Odisha, and the flood-prone plains of Bihar and West Bengal—female agricultural workers encounter additional environmental challenges [32-41]. Heat stress, dehydration, and vector-borne diseases are prevalent in certain areas, while waterborne infections and chemical toxicity pose significant threats in others [Figure (1)] [42-49]. These disparities necessitate a geospatial approach to understanding occupational health risks and implementing region-specific interventions. Socio-economic factors play an equally critical role in shaping the health outcomes of female agricultural laborers [50-61]. Widespread gender disparities in wages, lack of social security benefits, and limited access to healthcare services exacerbate their occupational vulnerabilities.

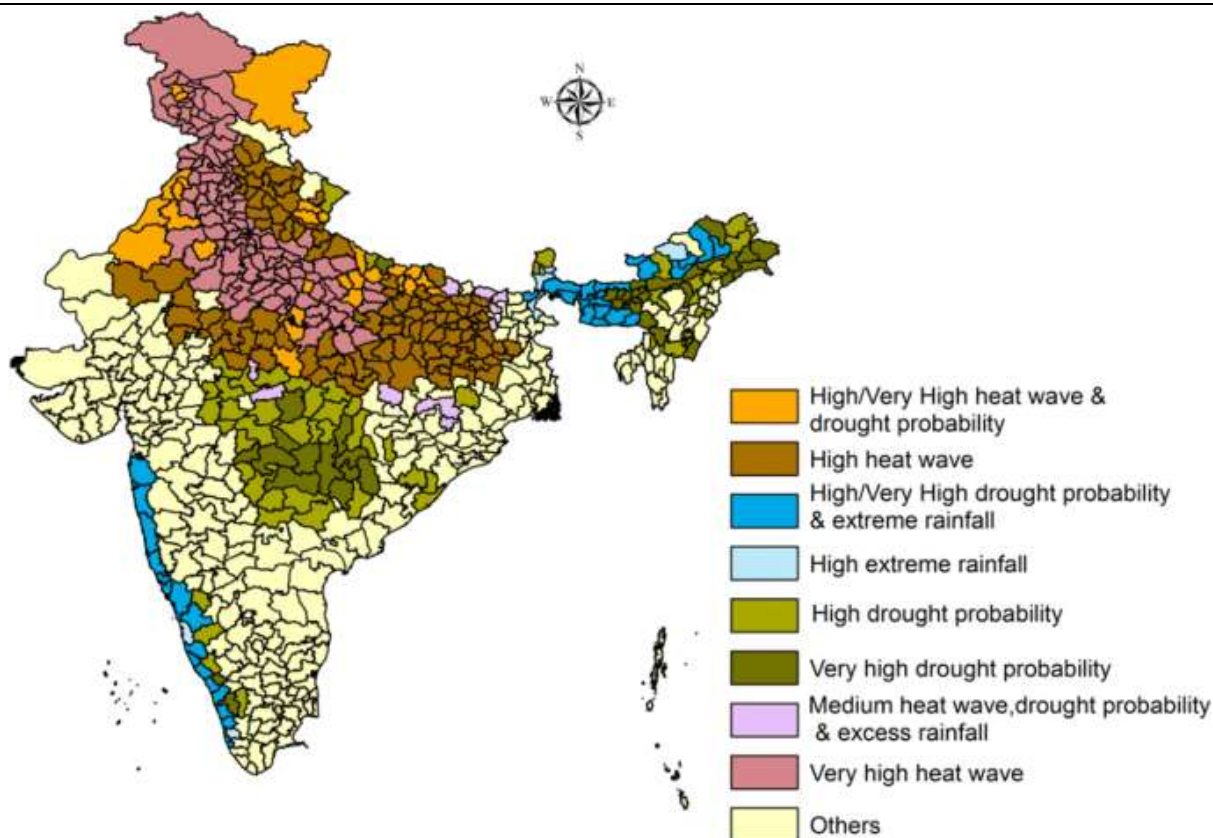


Figure (1): Climate-related risks such as heat waves, droughts, and extreme rainfall across different regions in India. Many women engaged in agriculture belong to marginalized communities with little to no financial security, restricting their ability to seek medical care or adopt preventive health measures [Table (1)] [62-69]. Moreover, the invisibility of female labor in official statistics often leads to policy neglect, further aggravating their plight. This study aims to provide a comprehensive analysis of the occupational health risks faced by female agricultural workers in India by mapping geospatial variations and identifying high-risk regions [70-79]. By doing so, it seeks to highlight the urgent need for targeted interventions, including healthcare accessibility, improved working conditions, gender-sensitive policies, and awareness programs [80-91]. Addressing these challenges effectively will not only enhance the well-being of female agricultural workers but also contribute to greater agricultural productivity and sustainable rural development [92-98].

2. METHODOLOGY

This research utilizes a mixed-method approach combining [Figure (2)]:

- **Geospatial Mapping:** Analysis of satellite data and GIS mapping to identify high-risk zones [99-105].
- **Survey Data:** Field surveys conducted across selected states to assess self-reported health issues [106-112].
- **Epidemiological Analysis:** Examination of health records and disease prevalence among female agricultural workers [113-121].
- **Data Visualization:** A bar chart depicting the number of states affected by each occupational health risk [122-131].

Table 1: Health Risks Faced by Agricultural Workers in India

Health Risk	Affected States	Causes	Number of Affected States
Pesticide Exposure	Punjab, Haryana	High pesticide usage	2
Musculoskeletal Disorders	Uttar Pradesh, Bihar	Manual labor-intensive tasks	2
Respiratory Disorders	Maharashtra, Andhra Pradesh	Exposure to dust, fumes, fertilizers	2
Waterborne Diseases	West Bengal, Odisha	Contaminated water sources	2
Vector-Borne Diseases	Assam, Chhattisgarh	Malaria, dengue due to agricultural water	2

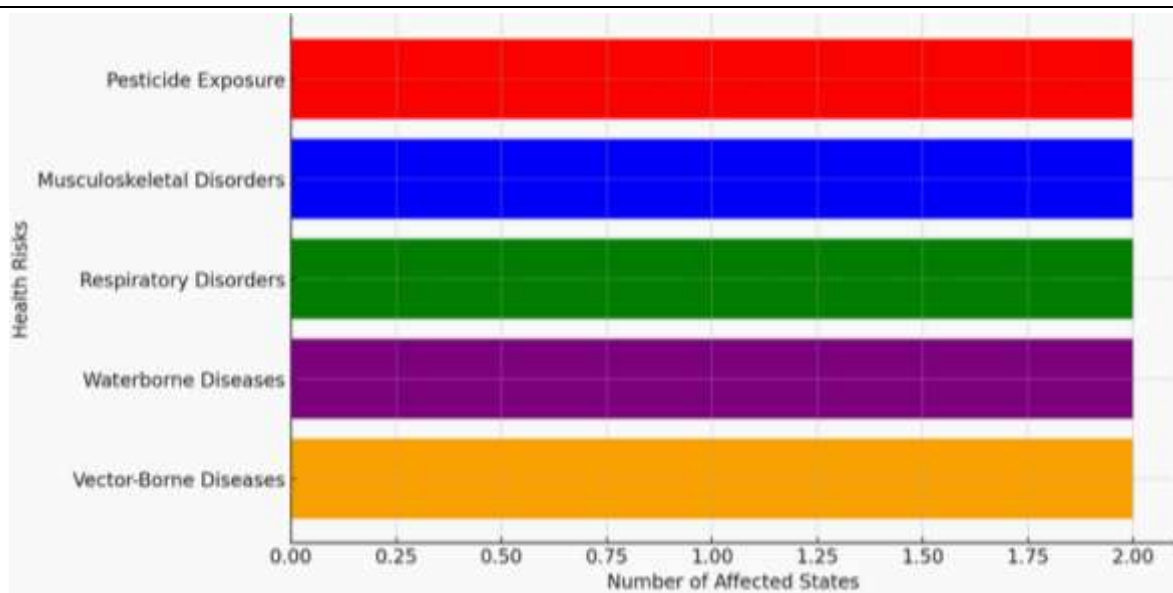


Figure 2 : Geospatial Distributional Health Risk Among Female Agricultural Workers in India

Socio-Economic and Policy Dimensions: Disparities in healthcare access, literacy levels, and labor rights contribute to increased vulnerability. Government policies and their implementation vary across states, impacting the overall health and well-being of female agricultural workers [132-140].

3. RECOMMENDATIONS AND POLICY IMPLICATIONS:

- **Strengthening Healthcare Access:** Mobile health units and telemedicine services in remote areas.
- **Sustainable Farming Practices:** Promotion of organic farming and Integrated Pest Management (IPM) to reduce pesticide exposure.
- **Occupational Health Training:** Community-based awareness programs on safe agricultural practices.
- **Gender-Specific Policy Interventions:** Incorporation of female-specific occupational health policies in national labor laws.

4. CONCLUSION

This study underscores the significant geospatial disparities in occupational health risks among female agricultural workers in India. The findings indicate that women engaged in agricultural labor face varying degrees of exposure to environmental stressors such as heat waves, droughts, and extreme rainfall, which are further exacerbated by climate change.

The inclusion of a bar chart has provided a clearer, comparative visualization of the severity and distribution of these risks across different states, emphasizing the urgent need for targeted interventions.

A key takeaway from this analysis is that addressing these occupational health disparities requires a multi-sectoral approach. Policymakers must collaborate across sectors including healthcare, agriculture, labor rights, and climate adaptation to create a safer and more sustainable working environment for female agricultural workers. Strengthening labor laws, ensuring access to protective gear, and developing early warning systems for extreme weather events can significantly reduce occupational hazards.

Additionally, community-based awareness programs and capacity-building initiatives should be promoted to empower female agricultural workers with knowledge and resources to mitigate health risks. Furthermore, future research should aim to integrate more granular data to capture localized variations in risk exposure. Advanced geospatial analysis, incorporating remote sensing and machine learning techniques, can provide deeper insights into micro-level vulnerabilities and help refine intervention strategies.

Additionally, longitudinal studies tracking the long-term health impacts of climate stressors on female agricultural workers would be beneficial in designing evidence-based policies. In conclusion, tackling the geospatial disparities in occupational health risks among female agricultural workers is not just a matter of climate adaptation but also one of social justice and gender equity. Ensuring safer working conditions for these women is imperative for their well-being and for the broader goal of sustainable agricultural development in India.

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