

JHARKHAND HEATWAVE DYNAMICS

A Report on Heat Wave Scenario of Jharkhand



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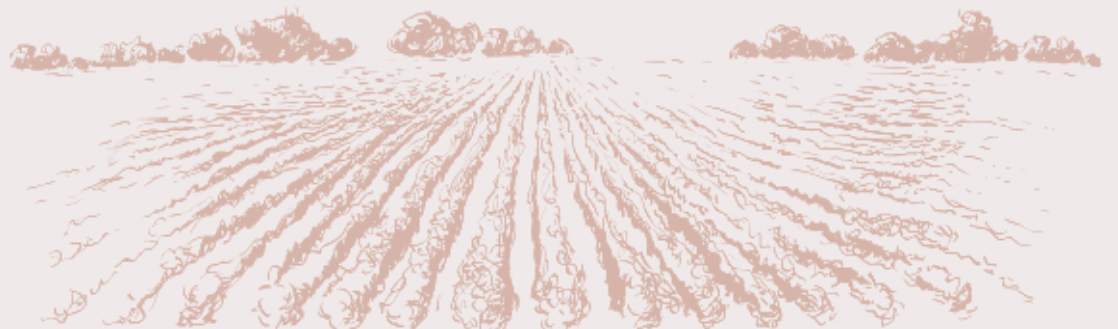
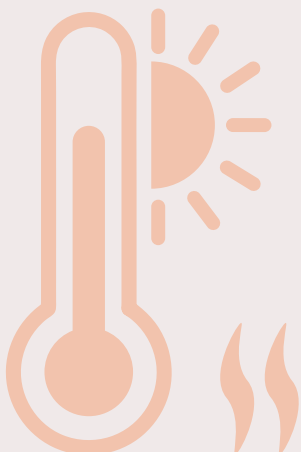
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INTRODUCTION

As April heralds the summer season in Jharkhand, residents are grappling with an oppressive heat wave exacerbated by low moisture levels. Industrial, mining and urban areas particularly bear the brunt of this scorching heat, indicating a potentially harsher season ahead for the state.

What is a Heat Wave?

IMD defines heat waves both qualitatively and quantitatively. As per the qualitative definition, a heat wave is a state when the temperature reaches a level that poses a significant risk to human health upon exposure. From the quantitative angle, heat wave condition is defined by specific temperature thresholds of a region, either in terms of actual temperature or its deviation from the normal temperature. Some countries define it in relation to the heat index, which factors in both temperature and humidity or by considering extreme temperature percentiles.

A heat wave is considered if the maximum temperature of a station reaches at least 40°C or more for Plains and at least 30°C or more for Hilly regions.

Declaration of Heat Wave condition Based on Departure from Normal is 4.5°C to 6.4°C.

Declaration of Heat Wave condition Based on Actual Maximum Temperature: when actual maximum temperature $\geq 4.5^\circ\text{C}$



AIMS AND OBJECTIVES

The aim of this study is to address the pressing issue of heatwaves in Jharkhand amidst the current intense summer. The objective is to comprehensively document past heatwave occurrences in the state, analyze the causes, and outline the detrimental impacts on health, agriculture, energy, the economy, and the environment. A primary survey on impact of heat waves is surveyed, to understand people's perception on heat waves. Drawing from these findings, the report offers a set of recommendations aimed at mitigating the adverse effects of heat waves.

PAST RECORD OF HEAT WAVE IN JHARKHAND

A DISTRICT-WISE VISUAL OF THE HEAT WAVE BETWEEN 1969 AND 2019 IN JHARKHAND

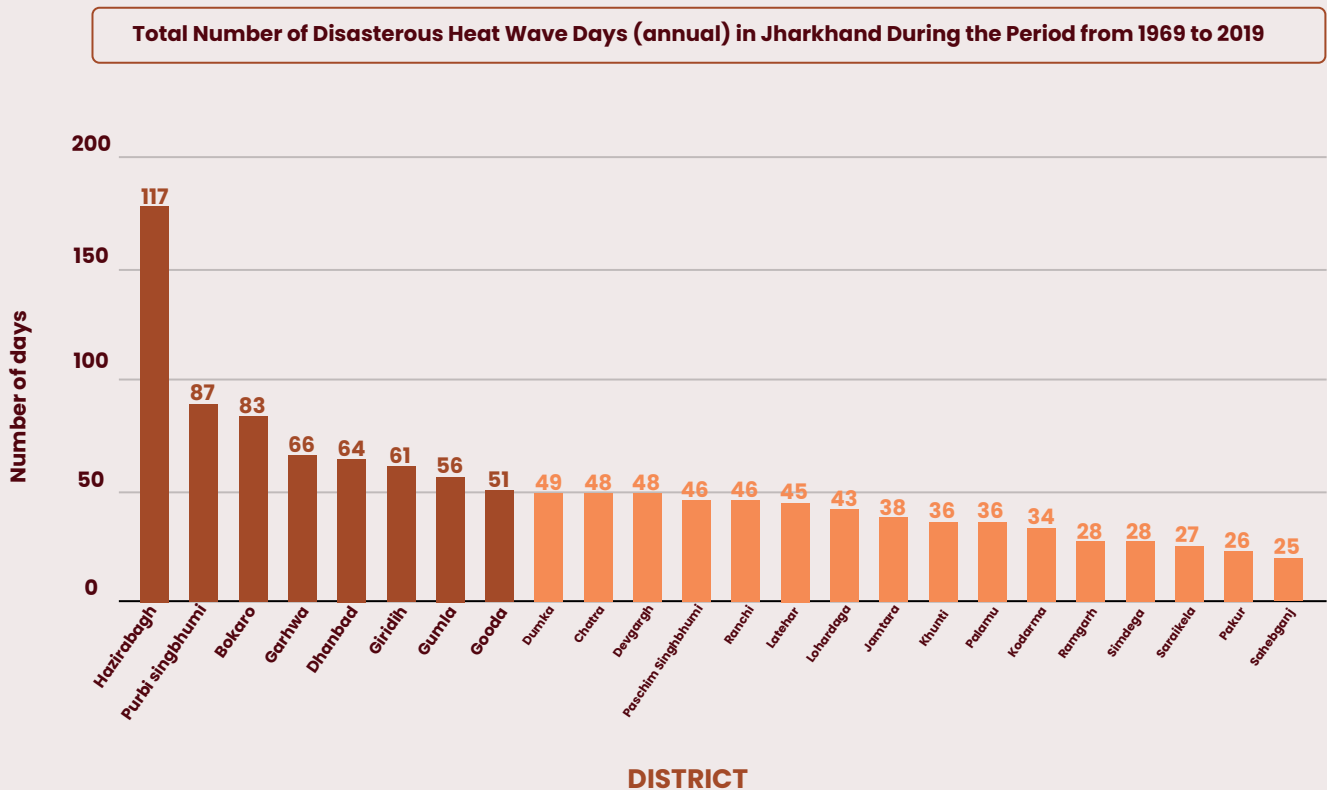





Figure 1: Annual Heat Wave Data Analysis for Jharkhand between 1969 and 2019

Data Source: <https://imdpune.gov.in/hazardatlas/heatnew.html>

Based on IMD Pune data, the following insights can be drawn from the district-based heat-wave analysis for the state of Jharkhand.

 Based on 50 years of dataset between 1969 and 2019, Hazaraibagh district is the most heat wave-stricken district in Jharkhand. 177 heat wave days have been experienced by this district only.

 However, the district had experienced a low normalised vulnerability index comprising 0.16 in this period.

 Ranchi, the capital district of Jharkhand has experienced 46 days of heat waves between 1969 and 2019, with a 0.04 low normalised vulnerability index

A DISTRICT-LEVEL VISUAL OF THE 40°C TEMPERATURE AND ABOVE BETWEEN 2019 AND 2023

Between 2019 and 2023, an analysis of heat days during the summer months was conducted using maximum temperature data obtained from the IMD Pune website. This analysis focused on identifying days with temperatures reaching 40°C and above in Jharkhand, specifically during April, May, June, and July. Through a mapped representation, the total count of days experiencing temperatures equal to or exceeding 40°C over the past five years (2019-2023) has been visually depicted.

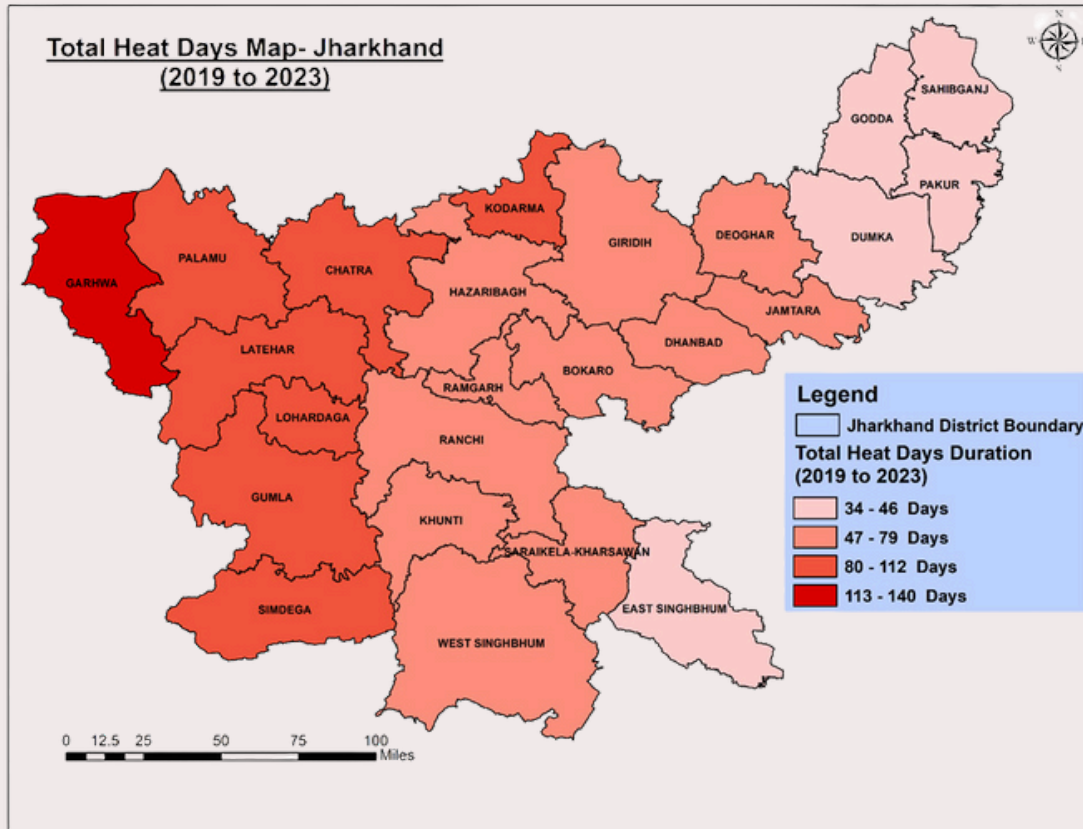


Figure 2: Annual Heat Day Map for Jharkhand between 2019 and 2023
 Data Source: https://www.imdpune.gov.in/cmpg/Griddata/Max_1_Bin.html

THE MAP VISUALLY REPRESENTS THAT-



There is a noticeable gradient of **decreasing total heat days from west to east across the state.**



Garhwa, the westernmost district of Jharkhand, recorded the highest number of days (115 to 161 days) with temperatures soaring to 40°C or higher between 2019 and 2023.



This indicates a consistent exposure to extreme temperatures, surpassing 40°C on multiple occasions.



Eastern districts like Pakur and East Singhbhum experienced fewer than 55 days with temperatures exceeding 40 °C.



Conversely, districts like Palamu witnessed 85 to 115 days of temperatures above 40°C.

IMPACT STUDY ON EFFECTS OF HEAT WAVES

A primary survey was conducted on **815 people** in the east Indian states (West Bengal, Jharkhand, and Odisha) in April 2024 to capture people’s perceptions of the current heatwave situation, how it has changed over the years, the problems people are facing due to the rising temperatures, and how their daily lives are affected. The Google form was shared via several platforms with people, and the responses were completely anonymous.

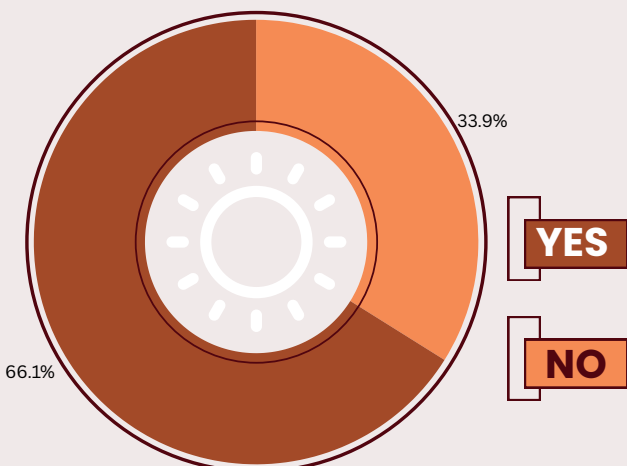
This report focuses on **116 responses from Jharkhand, where 67% were male and 33% female.** The survey exclusively targeted urban areas, engaging participants from diverse ages and occupational backgrounds.

Over 95% of the people surveyed reported that the severity of heat waves has increased over time.



PERCEPTION OF DEATH AND HEALTH EFFECTS FROM HEAT WAVES:

PERCEPTION OF DEATH AND HEALTH EFFECTS FROM HEAT WAVES



66% respondents said they know individuals who have succumbed to heat waves.

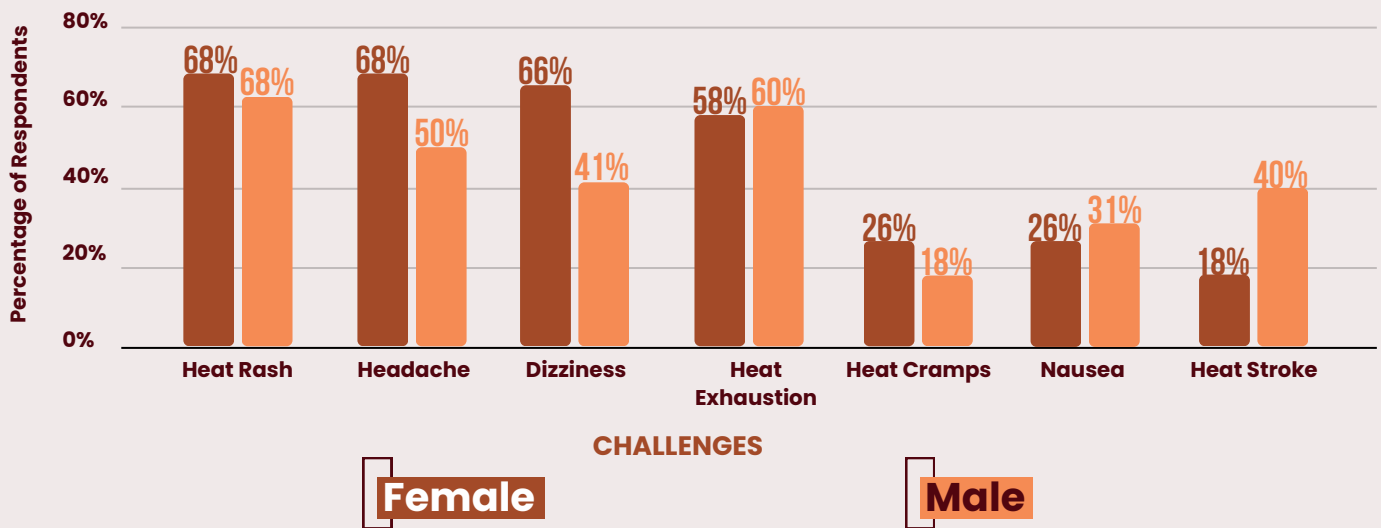


Irrespective of gender roles, heat rashes, headaches, dizziness and heat exhaustion are some of the commonly noticed health issues by the respondents from Jharkhand.

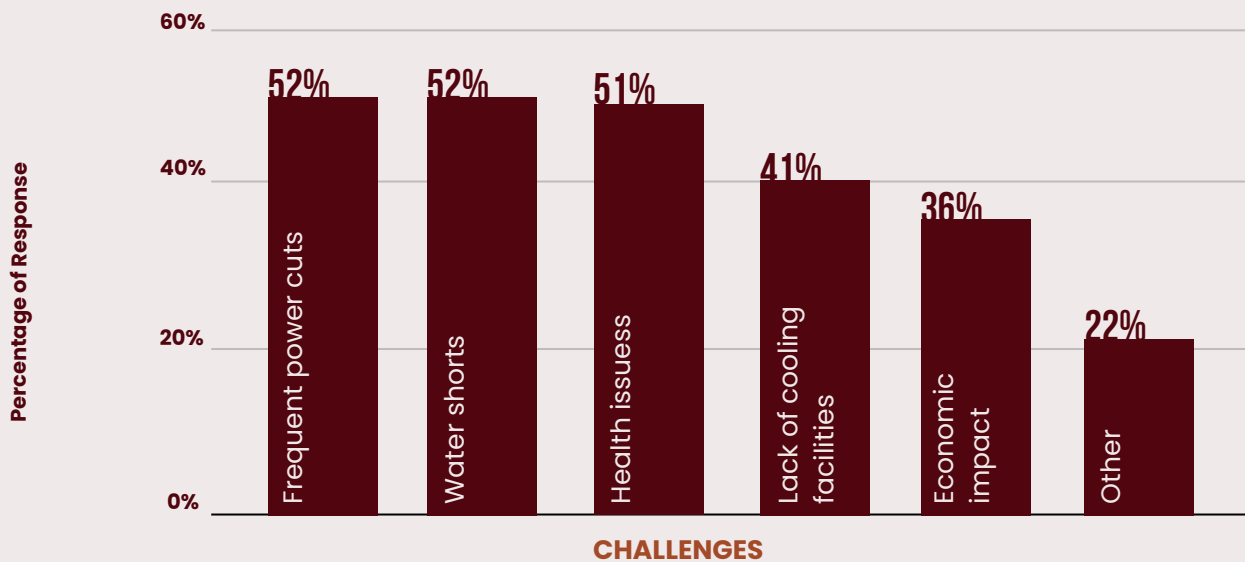


A majority of participants identified heat rash as the primary concern during heat waves. Specifically, **68% females and 62% males experienced heat rash during such conditions.**

FEMALE AND MALE HEALTH ISSUES DUE TO HEAT WAVE IN JHARKHAND



MAJOR CHALLENGES FACED BY PEOPLE DURING HEAT WAVE IN JHARKHAND



OTHER CHALLENGES



According to respondents in Jharkhand, the **most prevalent challenges during heat waves are frequent power outages and water shortages**. More than 51% of respondents encounter both of these issues during such conditions.



Health concerns during heat waves are identified as the second most significant obstacle. **Over half of the responses (50%) highlighted health issues as a major challenge during heat waves.**



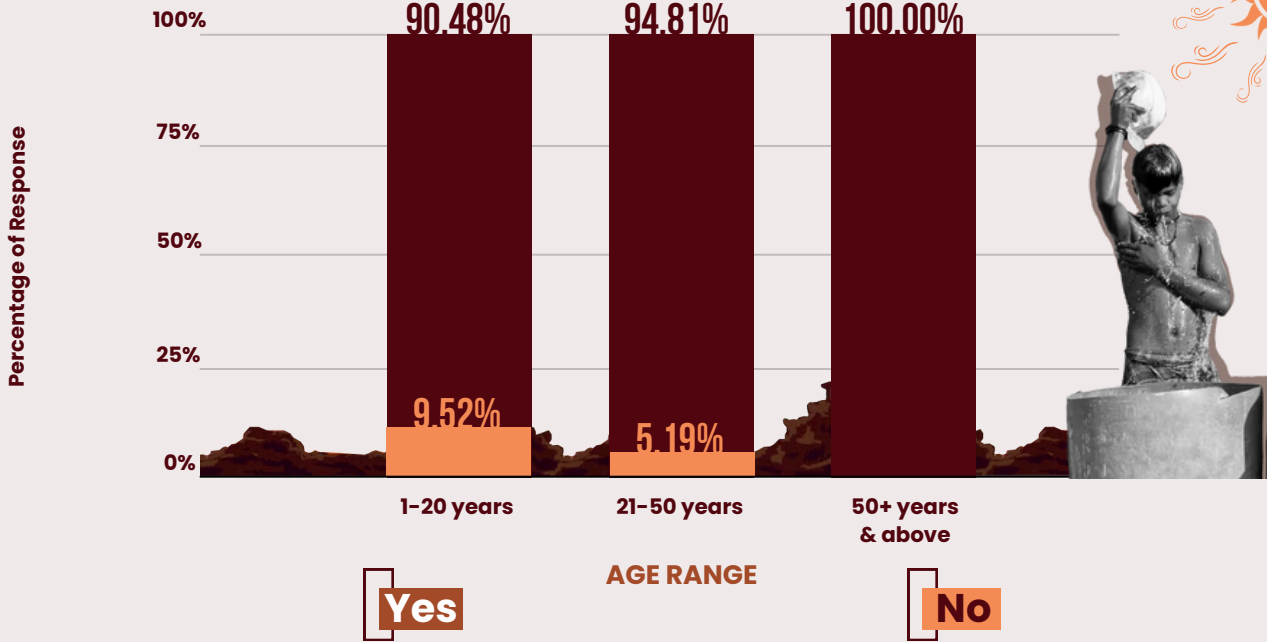
During extreme heat events, the availability of cooling facilities for people in the state is notably limited, as indicated by **41% of respondents identifying insufficient cooling infrastructure as a challenge.**



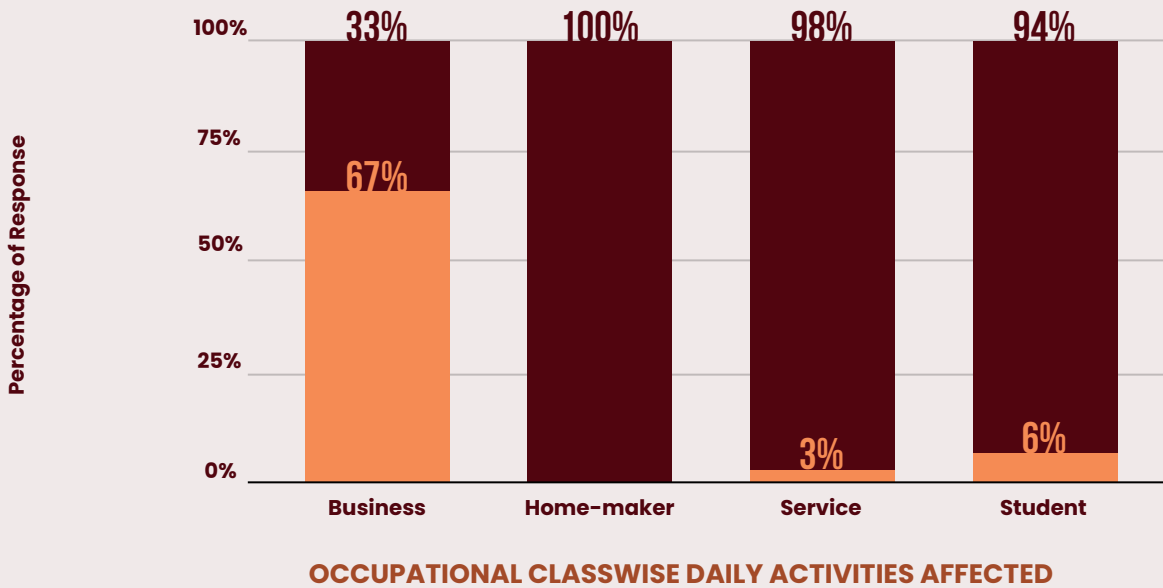
36% of respondents reported that heat waves have a substantial economic impact on them. This economic strain results in the population of Jharkhand experiencing health issues and facing various infrastructure challenges.

IMPACT ON DAILY ACTIVITIES

PEOPLES'S PERCEPTION ON HEAT WAVES AFFECTING DAILY IN JHARKHAND



HEAT WAVE AFFECTING DAILY ACTIVITIES OF THE PEOPLE OF JHARKHAND



OCCUPATIONAL CLASSWISE DAILY ACTIVITIES AFFECTED

Yes

No



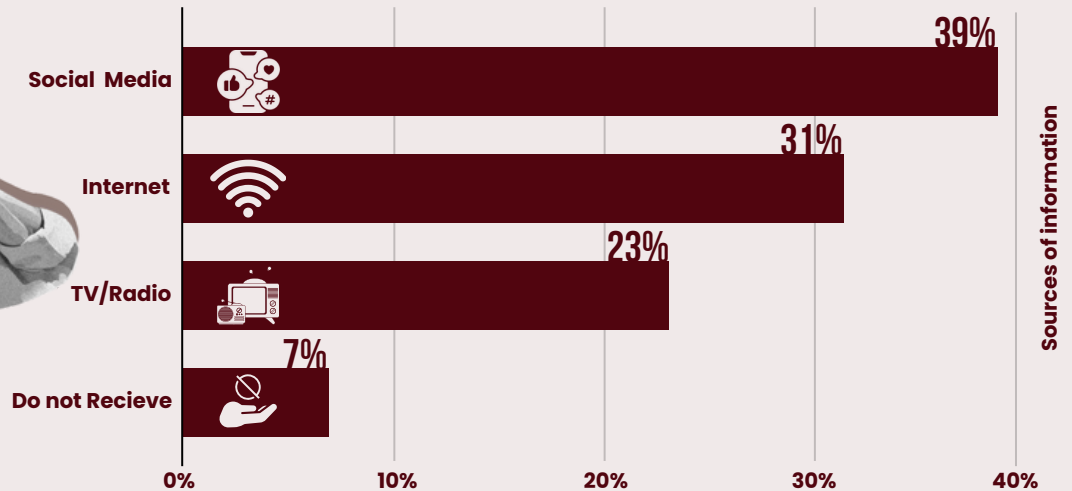
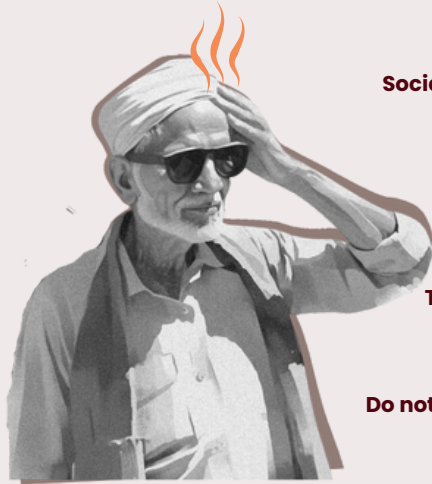
Regardless of age and gender, the day-to-day activities of Jharkhand's residents are disrupted by heat waves, except business persons (66% of businesspersons reported that they did not encounter any hindrances in their day-to-day activities due to heat waves).



The response pattern indicates that **indoor dwellers, particularly homemakers and retirees, bear the brunt of heat waves.**

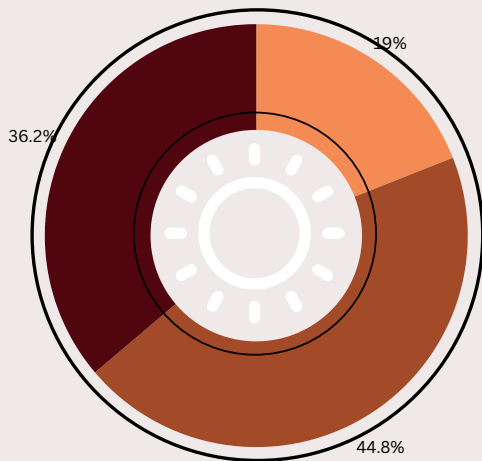
PEOPLE'S AWARENESS AND SOURCE OF INFORMATION

SOURCES OF HEAT WAVE - RELATED INFORMATIONS IN JHARKHAND



PERCENTAGE OF RESPONSES

AWARENESS AMONG PEOPLE ON THE PRESENCE OF HEATWAVE ACTION IN CITIES OF JHARKHAND



In regards to information regarding heat waves, the respondents opined that they **mostly get information about the heat wave through social media and internet sources.**



While **a small number of respondents cited a lack of information**, the overall scale of this issue is significant, warranting government attention to address the needs of this population.



Merely 38% of the surveyed population is cognizant of the government's heat wave action plan (HAP).



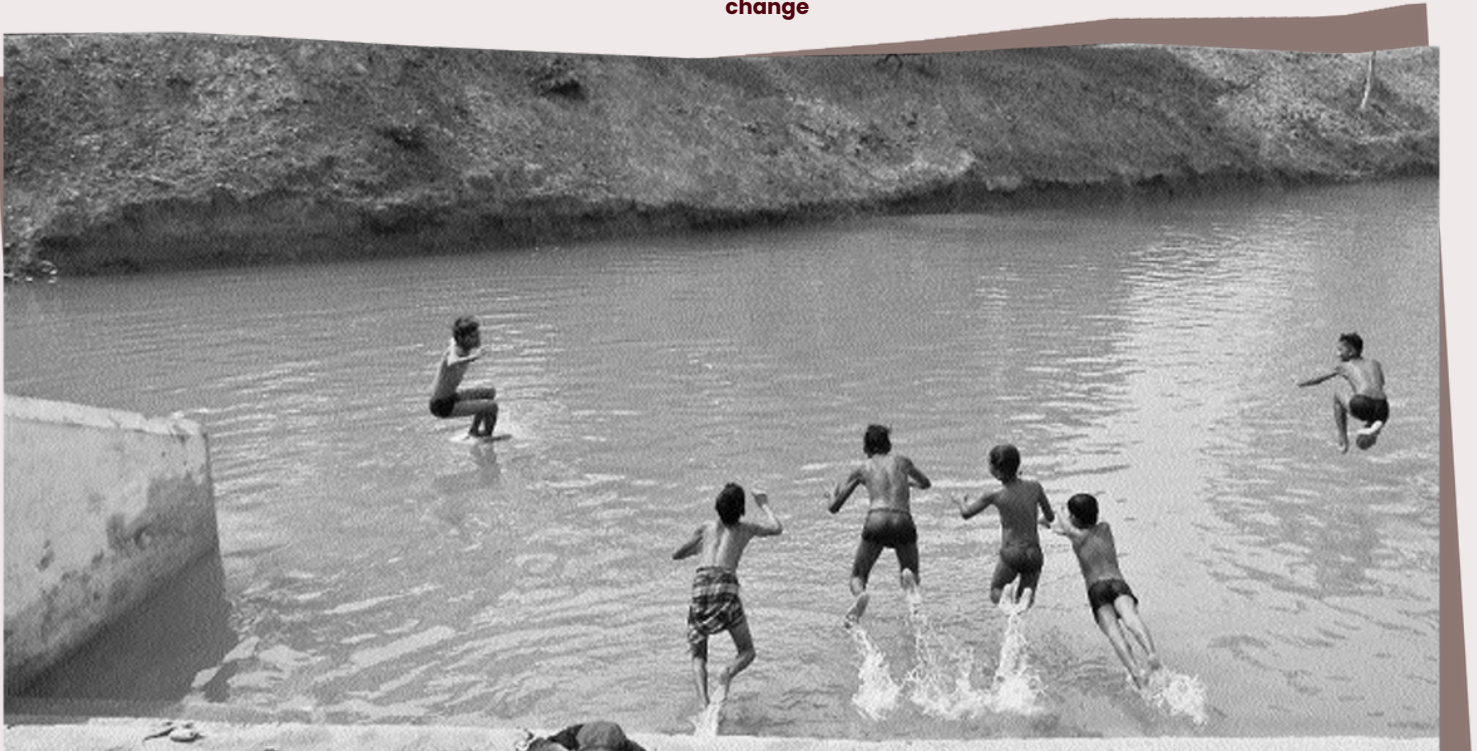
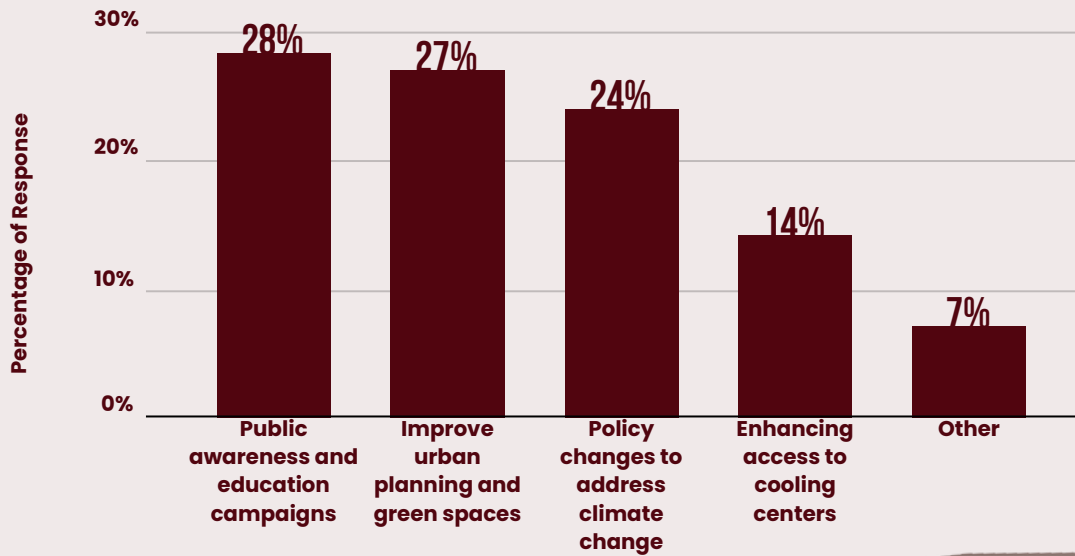
Of the remaining respondents, 44% are confident in the absence of such action plans in Jharkhand, while the remaining 19% lack awareness of their existence.

- DON'T KNOW**
- NO**
- YES**



PEOPLE'S SOLUTION

PEOPLE'S OPINION ON MITIGATION MEASURES OF HEAT WAVE IN JHARKHAND



The preferred solution among survey respondents is public awareness and education campaigns, with **28% of responses advocating for increased awareness about heat waves.**



Urban areas, which bear the brunt of heat waves, prompted approximately **26% of respondents to recommend modifying urban planning and enhancing green spaces** as measures to mitigate this extreme scenario.



According to respondents of the survey, **implementing policies to address climate change (23%) is another crucial measure** for mitigating heat waves.



99% of the respondents in Jharkhand think that the government authorities should take more action to address the impacts of heat waves



REASONS BEHIND THE HEAT WAVE

REASONS BEHIND HEAT WAVE IN JHARKHAND



Continental Location and Lack of Moisture: Jharkhand's inland position, distant from large water bodies, results in a climate lacking optimum moisture, leading to prolonged dryness and reduced rainfall. The absence of significant water bodies contributes to the state's overall dry weather conditions.



Tropic of Cancer: Jharkhand's location along the Tropic of Cancer (23 ½°s North) means that sun rays are nearly perpendicular, resulting in high solar insolation and elevated temperatures. The direct angle of the sun's rays contributes to the state's generally high temperatures.



Chhota Nagpur Plateau: A substantial portion of Jharkhand, including the Chhota Nagpur plateau, acts as a heat absorber, intensifying surface heat. The plateau's geographical features contribute to the retention and amplification of heat in the region.



Mining Activities and Deforestation: Mining activities in regions such as the Chhota Nagpur plateau and subsequent deforestation have exacerbated heat levels in Jharkhand. Deforestation diminishes the region's ability to regulate temperatures and contributes to the buildup of heat.



Rapid Urbanization and Pollution: The rapid urbanization of Jharkhand's cities, coupled with increasing pollution levels, further exacerbates heat conditions in the state. Urban areas experience the urban heat island effect, where heat-absorbing surfaces and pollution lead to elevated temperatures compared to surrounding rural areas.

CLIMATE INFLUENCES



Global Temperature Rise: WHO and WMO reports indicate a clear correlation between global temperature increase and the escalation of heatwaves, with each 0.5°C rise leading to intensified and more frequent heatwaves.



Human-Induced Climate Change: IPCC's Sixth Assessment Report underscores the role of human activities in exacerbating heatwaves since the 1950s, with continued warming projected to amplify their frequency and intensity.



El Niño Influence: Research highlights the influence of El Niño events on heatwaves in India, with El Niño years associated with higher heatwave occurrence due to delayed Indian Summer Monsoon onset and weakened south-westerlies in the Arabian Sea.



Marine Heatwaves: Studies by the Indian Institute of Tropical Meteorology demonstrate a significant increase in marine heatwaves in the western Indian Ocean and the Bay of Bengal, indicating the broader impact of climate change on ocean temperatures and potential implications for heatwave formation.

HUMAN INFLUENCES

Global climate change, fueled by human actions, has led to more frequent, intense, and prolonged heatwaves across India. Projections suggest a tenfold increase in heatwave risk under Representative Concentration Pathway (RCP) scenarios for the twenty-first century, impacting over 70% of Indian land areas. States like Himachal Pradesh and Kerala, previously less affected, now witness a higher frequency of extreme temperatures due to anthropogenic activities.



Greenhouse Gas Emissions: Human activities, notably greenhouse gas emissions, worsen the greenhouse effect, amplifying heat waves.



Land Use Changes: Alterations in land use patterns, and increasing built-up areas like industrial, and residential areas contribute to the intensification of heat waves, exacerbating their impacts.

EFFECTS OF HEATWAVES

Heatwaves are deadly events that take several lives every year. As per a [study by the University of Cambridge](#), the deadly heat waves of India fuelled by climate change are endangering the development of India in terms of health, production, infrastructure and environment.

EFFECTS ON HEALTH

Death of individuals due to heatwave is a common phenomenon in the entire subcontinent.



More than 24,000 deaths were attributed to heatwaves between 1992 and 2015 ([Ravindra et al. 2024](#)).



Deadly heatwaves fuelled by climate change in 2022 made almost 90% of Indians more vulnerable to public health issues, food shortages and increased risks of death ([Casciato, 2023](#)).



The spectrum of illnesses caused by heat waves spans from superficial and mild conditions that are easily manageable (such as prickly heat, heat-related swelling, heat cramps, and heat exhaustion) to those constituting a medical emergency, such as heat stroke. Heat stroke stands out as the most severe among heat-related illnesses, characterized by impaired brain function resulting from uncontrolled body heating, akin to a stroke ([Patel, 2024](#)).



As per IMD report-



Heatwaves can result in heat exhaustion and heat stroke, both of which pose life-threatening risks if not promptly treated. Symptoms may include nausea, dizziness, headache, rapid heartbeat, and confusion.



Elevated temperatures can induce dehydration when individuals do not intake sufficient fluids, leading to symptoms like headaches, fatigue, and assorted health complications. Furthermore, heatwaves can worsen respiratory issues like asthma by fostering the accumulation of air pollution, which can irritate the lungs. Additionally, heightened temperatures heighten the likelihood of cardiovascular problems such as heart attacks and strokes, particularly among those with preexisting cardiovascular conditions.



Heat waves can also impact mental health, leading to increased stress and anxiety, particularly for those who do not have access to air conditioning or other cooling measures.

EFFECTS ON FARMING

Heatwaves can significantly impact agriculture in India, posing serious threats to food security and the livelihood of farmers.



Firstly, they can result in **crop failure by causing crops to wilt and die**, reducing yields or leading to complete loss. High temperatures can also damage plant cells, hampering their ability to photosynthesize and produce food.



Secondly, heatwaves contribute to **reduced soil moisture through increased evaporation**, creating drought-like conditions that hinder crop growth.



Additionally, they **foster ideal environments for pests and insects**, necessitating increased pesticide use and causing further crop damage.



Livestock also face health challenges during heatwaves, experiencing **heat stress that reduces milk production, and fertility rates, and can even lead to death**.



Lastly, heatwaves exacerbate **water scarcity** issues by accelerating water source depletion and escalating irrigation demands, potentially sparking conflicts between farmers and other water users while impeding crop growth.



EFFECTS ON THE ENERGY SECTOR

Heatwaves have significant impacts on the energy sector, affecting the reliability of the energy grid, increasing costs, and potentially causing power outages and disruptions.



Firstly, they **lead to a surge in electricity demand as people rely more on air conditioning and fans** to combat the heat, straining the energy grid and risking blackouts or brownouts if the supply falls short.



Secondly, high temperatures reduce the efficiency of power plants, particularly those dependent on water for cooling, potentially leading to reduced output or shutdowns due to overheating.



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Thirdly, heatwaves can cause **transmission and distribution equipment failures**, resulting in power outages and decreased grid reliability, especially in equipment not designed to withstand high temperatures.



Additionally, **heatwaves heighten the risk of wildfires, which can damage energy infrastructure such as transmission lines and power plants**, necessitating costly repairs and causing further power disruptions.



Lastly, **energy prices may escalate during heat waves** due to increased demand and constrained supply, resulting in higher bills for consumers and businesses.

EFFECTS ON ECONOMY

As per [Greenpeace](#) organisation following are the effects on the economy due to the heat wave



Economic Risk: McKinsey Global Institute predicts a 2.5–4.5% GDP risk by 2030 due to increased lost labour hours from rising heat and humidity.



Monetary Equivalent: This risk translates to approximately \$150–250 billion in potential losses, highlighting the substantial economic impact of heat waves.



Crop Production Impact: Heatwaves have already affected wheat production, with India projecting a potential decrease to 105 million tonnes this year due to heatwave conditions.



Global Workforce Impact: The **International Labour Organization estimates that by 2030, over 2% of total working hours worldwide could be lost annually due to extreme heat**, hindering productivity.



Labour Efficiency: Heatwaves not only make it too hot to work but also force workers to operate at a slower pace, further exacerbating productivity losses.

RECOMMENDATIONS ON MITIGATIVE MEASURES TOWARDS SUSTAINABILITY

ADAPTATION MEASURES



Awareness Campaigns: Launch government-led awareness campaigns to educate the public about the risks of erratic weather and how to safeguard themselves from climate vulnerabilities through public service announcements, billboards, and outreach efforts.



Cooling Shelters: Establish cooling shelters and water stations in areas most affected by heatwaves, particularly in urban regions, to mitigate heat-related illnesses and exhaustion among the populace.



Uninterrupted Power Supply: Collaborate with electricity companies to ensure consistent power supply by enhancing infrastructure and implementing measures to manage energy demand during peak hours.



Water Infrastructure: Install roadside water filters, hand pumps, and tube wells, and prepare for rainwater harvesting to bolster water availability and resilience to water scarcity.



Cyclone Preparedness: Establish cyclone warning centres and evacuation plans to relocate residents during cyclones, along with mechanisms for delivering accurate forecasts and timely warnings to citizens.



Tree Planting: Actively plant oxygen-rich trees and saplings to enhance green cover and combat air pollution, thereby improving public health and climate resilience.



Greenhouse Gas Reduction: Implement policies to reduce greenhouse gas emissions and promote renewable energy sources like electric vehicles, solar power, and other sustainable technologies to mitigate climate change impacts.



MITIGATION MEASURES



Reiterating Existing Laws and Action Plans: Enforce existing laws like the Air (Prevention and Control of Pollution) Act, 1981, and the National Clean Air Action Plan to combat air pollution and alleviate Kolkata's health burden.



Reducing Vehicular Emissions: Reduce private vehicle usage during high Air Quality Index (AQI) days and promote public and electric vehicles with government support to curb vehicular emissions.



Government Advisory: Disseminate flyers, leaflets, and advisories educating the public on recognizing, preventing, and managing extreme weather conditions.



Establishing Expert Committee: Form an expert committee comprising government and non-government stakeholders, medical professionals, epidemiologists, and environmentalists to develop comprehensive guidelines.



Promoting Sustainable Transportation: Designate Sundays as Bicycle Days to encourage cycling and promote electric and CNG vehicles for reduced fossil fuel consumption and healthier lifestyles.



Solar Energy Adoption: Expand the use of solar panels to accelerate the transition to renewable energy, reduce coal dependence, and mitigate mining-related land degradation.



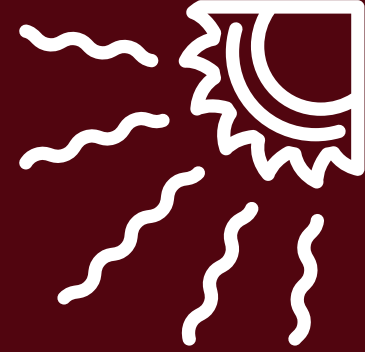
Nature-Based Solutions: Implement afforestation initiatives and build water canals in villages to prevent desert encroachment and mitigate flooding through rainwater harvesting techniques.



Government Support for Adaptation: Advocate for a variety of adaptation solutions, including nature-based approaches, national adaptation plans, early warning systems, and climate-resilient livelihood strategies.

CONCLUSION

The heatwave scenario in Jharkhand presents a significant challenge exacerbated by environmental and socio-economic factors. Historical data and a 2024 survey highlight increasing heatwave occurrences and their adverse impacts on health, agriculture, energy, and the economy. Recommendations emphasize awareness campaigns, infrastructure development, and policy interventions to mitigate these effects. Despite challenges, there's a strong consensus on the need for proactive measures. Collective action involving government, civil society, and communities can build resilience and foster sustainability. Jharkhand's future hinges on implementing these measures to combat escalating temperatures and ensure a more resilient society.



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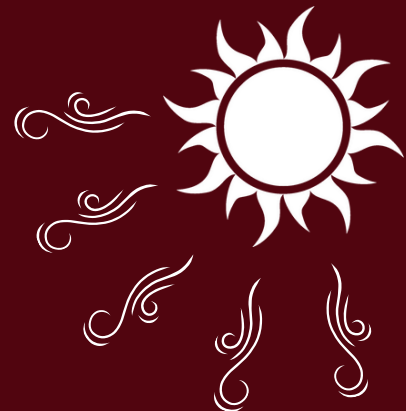
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