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Climate Change and Public Health in the Thar Desert: Analysis of Heatwave-Related Morbidity and Mortality Patterns

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Abstract: ***The Thar Desert of Rajasthan is one of the world's most heat-stressed regions, where extreme temperatures, prolonged dry spells, and recurrent heatwaves have intensified due to climate change. Rising temperatures and changing atmospheric dynamics have significantly impacted human health, leading to increased morbidity and mortality from heat-related illnesses. This paper examines the relationship between climate change and public health in the Thar Desert by analyzing patterns of heatwaves, health vulnerabilities, socio-economic determinants, and spatial variations across districts such as Jaisalmer, Barmer, Bikaner, Churu, Jodhpur, and Nagaur. Using a medical-geographical framework, the research integrates climatic data, epidemiological findings, field observations, and district-level spatial patterns to evaluate how environmental and socio-economic factors shape heat-related health risks. Results show that the frequency, intensity, and duration of heatwaves have markedly increased post-2000, with severe impacts on marginalized communities, elderly populations, outdoor workers, women, and individuals with pre-existing illnesses. The paper concludes with a set of public health recommendations and adaptation strategies necessary to build resilience in the Thar Desert.***

Keywords: Thar Desert; climate change; heatwaves; morbidity; mortality; public health; medical geography; Rajasthan; environmental health; hot desert climate.

1.1 Introduction

The Thar Desert, spanning western Rajasthan, is an arid region characterized by extreme temperatures, scarce rainfall, high wind velocity, and persistent drought conditions. Climate change has intensified these characteristics, making the region increasingly vulnerable to heatwaves and associated health risks. Global warming has resulted in rising temperatures, disrupted atmospheric circulation, increased frequency of El Niño events, and prolonged dry spells — all contributing to severe heat stress in the Thar Desert.

Heatwaves in Rajasthan have historically been documented, but their frequency, severity, and spatial coverage have expanded significantly in the past decades. Several studies (Rao, 2008; Singh & Rathore, 2014; Sharma, 2016) indicate that extreme heat poses a major threat to public health, especially for those living in desert environments. The Thar Desert — particularly districts such as Jaisalmer, Barmer, Bikaner, Churu, and Jodhpur — experiences some of India's highest temperature records, often exceeding 50°C.

Medical geography provides an analytical lens to understand how climate change impacts human health across space and time. By linking climatic variability with disease occurrences, vulnerability patterns, and socio-economic conditions, medical geography enables holistic assessment of heat-related health impacts.

This paper adopts a medical-geographical perspective to examine the public health implications of climate change in the Thar Desert, with special focus on heatwave-related morbidity and mortality.

1.2 Objectives

1. To analyze the relationship between climate change and heatwave patterns in the Thar Desert.

2. To examine the spatial distribution of heat-related morbidity and mortality across Thar Desert districts.

3. To identify socio-economic, demographic, and environmental vulnerabilities influencing health outcomes.

4. To assess adaptation strategies and coping mechanisms used by desert communities.

5. To propose policy recommendations for improving public health resilience.

1.3 Methodology

The research follows a multidisciplinary methodological approach:

I. Secondary Data Collection

1. Climate data from the Indian Meteorological Department (IMD).

2. Epidemiological studies, medical journals, and classical literature.

3. District-level reports on heatwave-related deaths (2000–2017).

4. Environmental and socio-economic literature on Rajasthan.

II. Spatial Analysis

1. Mapping of districts most affected by heatwaves: Barmer, Jaisalmer, Bikaner, Jodhpur, Churu.

2. Identification of vulnerable clusters using medical-geographical interpretation.

III. Field Observations (Literature-Based)

Observations derived from previous field studies (Singh, 2014; Sharma, 2016) on:

1. daily routines of desert populations

2. water availability

3. occupational hazards

4. heat exposure patterns

IV. Epidemiological Approach

1. Classification of illnesses: heat stroke, heat exhaustion, dehydration, vector-borne diseases, renal complications.

2. Analysis of morbidity patterns across age and occupational groups.

V. Analytical Framework

Used the medical geography model integrating:

1. environmental exposure

2. population vulnerability

3. access to healthcare

4. climatic variability

1.4 Study Area

The Thar Desert covers approximately 200,000 square kilometers, with about 60% located in Rajasthan. The study focuses on the western districts:

1. Jaisalmer

One of the hottest districts in India; temperatures often exceed 49°C.

2. Barmer

Severe droughts, sandstorms, and high mortality during heatwave years.

3. Bikaner

Large rural population with inadequate cooling infrastructure.

4. Churu

Known for extreme temperature variability, recording 50°C on several occasions.

5. Jodhpur

Large urbanizing desert district with high outdoor labor population.

6. Nagaur and Pali (semi-arid transition zone)

Face combined effects of desert climate and rising urban temperatures.

These districts represent core heatwave-prone zones of the Thar Desert.

1.5 Observations

Observations compiled from climate records, field studies, and public health analyses include:

1. Increasing temperature trends with mean summer maxima rising by 0.5°C to 1.0°C per decade (IMD estimates).

2. Heatwaves lasting longer, sometimes 8–12 consecutive days.

3. Night temperatures remaining high, reducing physiological recovery.

4. Occupational exposure is extremely high among farmers, laborers, animal herders, and miners.

5. Limited access to water, with some villages reliant on tankers.

6. High prevalence of heat exhaustion among migrant workers.

7. Elderly, infants, and chronically ill individuals disproportionately affected.

8. Women suffer from both heat exposure and domestic workloads involving firewood cooking.

9. Low literacy rates limit awareness of heat safety measures.

10. Urban heat island effect intensifies temperatures in Jodhpur and Bikaner.

1.6 Discussion

I. Climate Change and Heatwave Intensification

Studies by Rao (2008) and Singh & Rathore (2014) indicate a steady increase in extreme temperature days. Climate change amplifies desert heat through:

1. atmospheric warming

2. reduced moisture content

3. delayed monsoon onset

4. increased El Niño frequency

II. Physiological Impact of Extreme Heat

Prolonged exposure leads to:

1. dehydration and electrolyte imbalance

2. renal failure

3. heat cramps, exhaustion, and stroke

4. cognitive impairment

III. Morbidity Patterns

Heat-related illnesses have risen significantly since 2000:

1. Heat exhaustion is most common.

2. Heatstroke has a high fatality rate.

3. Chronic kidney disease is growing due to dehydration.

4. Vector-borne diseases increase where water storage becomes necessary.

IV. Mortality Trends

Historical reports indicate:

1. Churu recorded extremely high mortality during 2010 and 2016 heatwaves.

2. Barmer and Jaisalmer show highest rural deaths due to occupational exposure.

V. Socio-Economic Dimensions

Heat impacts are amplified by:

1. poverty

2. inadequate housing

3. dependence on outdoor labor

4. low access to medical care

5. Women and children face specific vulnerabilities due to:

6. nutritional deficiencies

7. indoor heat exposure

8. limited autonomy in seeking healthcare

VI. Spatial Inequalities

Districts with poor healthcare infrastructure show higher heatwave mortality:

1. Barmer

2. Jaisalmer

3. Bikaner

Urban slums also experience high morbidity due to overcrowding and lack of ventilation.

VII. Cultural and Traditional Adaptation Strategies

Communities traditionally use:

1. mud houses

2. whitewashing

3. early-morning work routines

4. cooling foods (bael, buttermilk)

But modern lifestyles limit these protective mechanisms.

7. Results

1. Heatwaves have increased in duration and frequency after 2001.

2. Highest morbidity observed in outdoor laborers, farmers, herders, and miners.

3. Highest mortality recorded in Churu, Barmer, and Jaisalmer.

4. Elderly individuals and infants are most physiologically vulnerable.

5. Urban heat islands add 2–3°C to major desert towns.

6. Limited access to water significantly worsens health outcomes.

7. Climate change is directly linked with increased heat-related illnesses.

8. Conclusion

Climate change has transformed the Thar Desert into one of India's most heat-vulnerable regions. Rising temperatures, prolonged heatwaves, dry atmospheric conditions, and limited access to healthcare have significantly increased morbidity and mortality. Vulnerable groups — including elderly, women, low-income households, outdoor workers, and children — face the greatest risk. The medical-geographical approach reveals that health outcomes are shaped by a combination of climate exposure, socio-economic disadvantage, and spatial inequalities in healthcare access.

9. Recommendations

1. Heat Early Warning Systems using local radio, panchayat alerts, and mobile messaging.

2. Cooling centers in villages, hospitals, and public buildings.

3. Occupational heat protection laws for farmers, laborers, and outdoor workers.

4. Expanded drinking water schemes and decentralized water storage.

5. Green roofing and heat-resistant housing for rural settlements.

6. Public awareness programs on heat illness prevention.

7. Strengthening healthcare in desert districts, including mobile clinics.

8. Urban heat island mitigation through plantation, reflective roofs, and stricter urban zoning.

9. Special protection for elderly and chronically ill individuals through community health workers.

References

[1.]Bhadra, D., & Sen, S. (2012). Heatwaves and public health impacts in arid regions. Indian Journal of Environmental Health, 14(3), 210–219.

[2.]Chaudhary, R., & Chauhan, G. (2010). Climate variability and heat stress in Rajasthan. Journal of Climatology Studies, 8(2), 145–159.

[3.]Rao, V. P. (2008). Climate change and heatwave trends in India. New Delhi: Concept Publishing.

[4.]Sharma, K. (2016). Environmental changes and health vulnerability in western Rajasthan. Journal of Desert Studies, 11(1), 55–72.

[5.]Singh, O., & Rathore, M. S. (2014). Heatwave conditions in Rajasthan: A statistical analysis. Mausam, 65(4), 545–558.

[6.]Sharma M.K. et.al. (2011). Chikitsa eyam Sawasthay Bhoogol, Sahityagar, Jaipur

[7.]Sharma M.K. et.al. (2012). Disease Ecology. M. D. Publication, Jaipur

[8.]Sharma M.K. et.al. (2012). Chikitsa Bhoogol. M. D. Publication, Jaipur

[9.]Sharma M.K. et.al. (2022). Geography of Hot Waves. Woar Journals

[10.]Sharma M.K. et.al. (2022). Disease Ecology in Hindi. Woar Journals

[11.]Sharma M.K. et.al. (2022). Communicable Disease Ecology in Hindi. Woar Journals

[12.]Sharma M.K.(2011) Distribution of Geo- Pathologic Region of Malaria Disease in Rajasthan in Hindi, Journal - Water and Land Use Management, Volume-(3), Issue- 1-2 (Jan. –Feb. 2011), 0975-704X, p.21-36.

[13.]Sharma M.K.(2014) Geo-medical contribution of Dominant Air Born Communicable diseases in Ajmer District, Rajasthan, Journal -Sanchayka, Volume-(7), Issue-1(Jan.- Mar. 2014) , 2231-3001, p.35-41.

[14.]Sharma M.K.(2019) Heat Stroke (Loo)- A Geoenvironmental Crisis in Rajasthan, Journal -Parisheelan, Volume-(15), Issue- 2, April-June.2019, 0974-7222, p.390-396

[15.]World Health Organization. (2003). Heatwaves and health risks. WHO Technical Series.