International Scientific Journal of Engineering and Management (ISJEM) ISSN: 2583-6129
Volume: 05 Issue: 02 | Feb – 2026 DOI:10.55041/ISJEM05524
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata

Climate Change and Human Health: Emerging Diseases, Maternal Risks, and Ageing Challenges with Insights from India

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Abstract

Objectives: To synthesize global and India-specific evidence on how climate change affects three critical health domains: emerging infectious diseases, maternal health outcomes, and aging-related vulnerabilities.

Methods: A mixed-methods approach was adopted, combining a structured literature review and qualitative field interviews in India. Literature was sourced from PubMed, ScienceDirect, Google Scholar, IndMED, and Indian government databases. Ten in-depth interviews were conducted with older adults and middle-aged participants in Uttar Pradesh and Bihar to complement the review with local lived experiences.

Results: Global evidence demonstrates that climate change is expanding the geographic range of vector-borne diseases, increasing waterborne outbreaks, and worsening pregnancy risks through heat stress and nutritional deficits. Older adults are highly vulnerable to cardiovascular and respiratory complications during extreme events. In India, dengue and chikungunya have spread to new regions; floods in Bihar and Assam repeatedly disrupt maternal healthcare; and record-breaking heatwaves in Delhi and Uttar Pradesh raise mortality among elderly populations.

Conclusions: Climate change amplifies existing health inequities across vulnerable populations. India exemplifies how demographic pressures and climate extremes converge, underscoring the urgency for climate-resilient health systems, strengthened surveillance, and targeted adaptation policies.

Keywords: climate change, health risks, infectious diseases, pregnancy outcomes, older adults, climate adaptation, vulnerable populations, India

Introduction

Climate change refers to long-term alterations in temperature, rainfall, and extreme weather patterns. While climate variability has occurred naturally, the rapid pace of change in the last century is largely anthropogenic, driven by greenhouse gas emissions from fossil fuel use, deforestation, and industrialization.

Globally, climate change is recognized as one of the greatest health challenges of the 21st century. Its impacts include altered infectious disease patterns, adverse maternal outcomes, and increased health risks among aging populations. These effects are magnified in low- and middle-income countries where healthcare systems are already under strain.

India is considered one of the most climate-vulnerable nations, with over 1.4 billion people exposed to heatwaves, floods, erratic monsoons, and rapid urbanization. This makes India both a case example and a frontline state in the global climate-health crisis.

This review synthesizes evidence across three critical themes: (i) infectious diseases, (ii) maternal and pregnancy outcomes, and (iii) health challenges of older adults, with global scope and Indian case illustrations.

Methods

Study Design:

This study employed a **mixed-methods approach**, combining a structured literature review with qualitative field interviews in India. This allowed triangulation of global and India-specific evidence with real-life experiences of affected populations.

1. Literature Review:

- **Search Strategy:** Literature was sourced from PubMed, ScienceDirect, Google Scholar, IndMED, and government databases. Keywords included:

  - "climate change AND human health"
  - "climate change AND infectious diseases"
  - "extreme heat AND pregnancy outcomes"
  - "climate change AND older adults"
  - "climate change AND India"
- **Inclusion Criteria:**

  - Peer-reviewed journal articles, systematic reviews, and meta-analyses
  - Institutional reports (WHO, IPCC, Indian Council of Medical Research)
  - Studies linking climate variables to human health outcomes
- **Exclusion Criteria:**

  - Non-peer-reviewed commentaries
  - Pure climate modeling studies without health outcomes
  - Non-English language sources
- **Synthesis:** Findings were thematically categorized into infectious diseases, maternal health, and older adult vulnerabilities. India-specific examples were integrated where available.

2. Qualitative Field Study (India):

- **Study Sites:** Uttar Pradesh and Bihar, chosen due to high climate vulnerability and diverse health impacts.
- **Participants:** Ten in-depth interviews were conducted with older adults and middle-aged community members, selected using purposive sampling.
- **Data Collection:** Semi-structured interviews explored perceptions of climate variability, health impacts, coping strategies, and awareness of policies. Interviews were audio-recorded with consent.
- **Data Analysis:** Transcripts were coded thematically, identifying patterns related to rainfall changes, heat stress, disease transition, intergenerational vulnerabilities, and adaptive behaviors.

This **mixed-methods approach** ensured a comprehensive understanding of climate-related health risks, combining global literature evidence with grounded local experiences.

Results

1. Climate Change and Infectious Diseases

Globally, vector-borne diseases are highly climate-sensitive. Rising temperatures, altered rainfall, and humidity changes expand mosquito and tick habitats. Dengue, malaria, chikungunya, and Zika are spreading into regions previously unaffected. Flooding increases outbreaks of cholera and leptospirosis.

In India, dengue and chikungunya have expanded beyond endemic southern regions into Uttar Pradesh, Bihar, and hilly states. Recurrent floods in Assam and Bihar are linked to cholera and diarrheal outbreaks, reflecting how global trends manifest in local settings.

2. Climate Change and Pregnancy Outcomes

Pregnancy is physiologically vulnerable to heat and environmental stressors. Global studies show each 1°C rise in temperature raises preterm birth risk by ~5%. Flooding disrupts antenatal care, nutrition, and safe housing.

In India, heatwaves in Rajasthan and Maharashtra are associated with higher risks of stillbirth and preterm birth. Floods in Bihar and Assam disrupt access to maternal care and essential medicines. Coastal Odisha and Bengal face maternal health challenges from saline water intrusion, echoing similar findings in Bangladesh.

3. Climate Change and Older Adults

Older adults face heightened risks from climate extremes due to physiological decline, chronic illnesses, and reduced adaptive capacity. Heatwaves raise cardiovascular mortality; air pollution and wildfire smoke worsen respiratory diseases.

In India, heatwaves in Delhi, Uttar Pradesh, and Telangana have sharply increased elderly hospitalizations and deaths. Many older adults live in poorly ventilated homes without cooling, intensifying their vulnerability.

4. Qualitative Findings from Field Interviews (India)

To complement the structured review, ten in-depth interviews were conducted with older adults and middle-aged individuals in Uttar Pradesh and Bihar. Their lived experiences provide localized insights into climate variability and health.

Theme 1: Rainfall Decline and Seasonal Shifts
Respondents recalled earlier monsoons lasting 8–20 days continuously, compared to short, sporadic showers now. Dense fog and overcast skies were once common, but now the sun appears almost daily.

Theme 2: Rising Heat and Humidity
Most participants reported hotter summers. While hot winds (“loo”) were stronger in the past, the main challenge today is prolonged humidity. Winters are milder and shorter, no longer stretching for weeks without sunshine.

Theme 3: Disease Transition
Earlier diseases included cholera, plague, scabies, and boils. Today, dengue, typhoid, asthma, and cancer dominate. Traditional remedies such as onion in the pocket (to prevent heatstroke) or lentil broth for fever have been replaced by reliance on medicines and cooling devices.

Theme 4: Work Capacity and Intergenerational Contrast
Older men recalled carrying 50 kg loads or working full days in the sun without falling ill. Today’s youth, they observed,

develop fever or exhaustion after limited sun exposure. This was attributed both to harsher climate and reduced physical resilience.

Theme 5: Coping and Adaptation

Traditional methods (hand fans, raw mango, herbal drinks, reliance on natural shade) have shifted to modern coping strategies (fans, coolers, AC, pharmaceuticals). Respondents emphasized that people have become more dependent and less naturally resilient.

Theme 6: Perceived Drivers

Many attributed climate change to deforestation and pollution. Some also noted that aging influences perception of weather, with cold now "feeling stronger" in old age.

Integrated Analysis

The interviews reinforce documented climate-health linkages: rainfall decline, stronger heat and humidity, disease transitions, reduced work capacity, and coping shifts. These local narratives illustrate how climate change is experienced directly in communities, confirming its role as a "force multiplier" of health inequities in India.

Discussion

The findings confirm that climate change amplifies existing health risks across vulnerable groups. Emerging infectious diseases threaten public health systems worldwide. Maternal outcomes are particularly sensitive to heat and displacement. Older adults face disproportionate morbidity and mortality due to heat stress and pollution.

Global-India Comparison:

Indian experiences closely mirror global trends. Heatwaves trigger similar physiological stress and disease exacerbation worldwide (Hajat et al., 2014; Mora et al., 2017). Floods and erratic rainfall in India exacerbate waterborne diseases, similar to patterns reported in Southeast Asia and Sub-Saharan Africa (Hunter, 2003; Grace et al., 2015). Field interviews demonstrate that these challenges are perceived and felt at a personal and community level, providing rich context to quantitative evidence.

Intergenerational Dimensions:

A key insight is intergenerational disparity. Older adults experience chronic health deterioration due to repeated heat exposure, while younger populations, especially pregnant women, face acute reproductive risks. Traditional work capacity noted in older generations contrasts sharply with reduced resilience among today's youth, highlighting the need for policies that address both age-specific and generational vulnerabilities. Interview narratives underscore that prolonged heat, humidity, and exposure to vector-borne diseases affect daily productivity, schooling, and care responsibilities.

Maternal Health Blind Spot:

Both global and Indian literature often underrepresent maternal health in climate research. Despite clear evidence linking heat exposure to miscarriage, preterm birth, and low birth weight (Chersich et al., 2020; Kuehn & McCormick, 2017), few policies explicitly protect pregnant women during heatwaves or floods. Interviews confirm community awareness of maternal vulnerability, yet institutional mechanisms remain insufficient. Globally, maternal health is emerging as a "blind spot" in climate action plans, with the same observation evident in India, particularly in flood-affected Bihar and Assam (The Guardian, 2024).

Policy Gaps and Implementation Challenges:

India's frameworks, including the National Action Plan on Climate Change (NAPCC), Heat Action Plans (e.g., Ahmedabad model), and Disaster Management Guidelines, demonstrate early progress. Nevertheless, coverage is uneven, training for healthcare providers is limited, and rural implementation lags. Interviews highlighted that local health workers often lack

preparedness for managing maternal complications during extreme weather, and older adults remain underprotected during heatwaves. Social inequities further limit adaptive capacity, with poorer households relying on minimal cooling, inadequate shelter, or unsafe water sources.

Linking Field Insights with Literature:

The qualitative data provide lived experience context to structured review findings. The shift from traditional coping methods to dependence on technology, the perception of reduced physical resilience, and the localized spread of infectious diseases confirm and enrich documented pathways. Interview narratives also illustrate how heat, humidity, and rainfall variability intersect with socioeconomic factors, highlighting policy implementation gaps and the need for community-focused adaptation strategies.

Future Research Directions:

- Conduct longitudinal studies to track intergenerational health impacts and cumulative vulnerability.
- Integrate climate and health data for real-time surveillance and early warnings.
- Evaluate policy effectiveness for maternal and older adult protection during heatwaves and floods.
- Implement community-based participatory studies to assess local adaptation strategies.
- Examine economic impacts of climate-related health risks to inform resource allocation.

Limitations

This review relied on secondary literature and qualitative interviews. India-specific data remain fragmented, with limited longitudinal studies and inadequate surveillance integration. The field interviews, while illustrative, were restricted in sample size and geography.

Conclusions

Climate change is not merely an environmental issue but a profound public health crisis. Its effects on infectious diseases, maternal health, and older adults are interconnected and intensifying.

Globally, urgent action is needed to integrate climate into health planning, strengthen surveillance, and adapt health systems. India exemplifies how climate extremes, poverty, and demographic pressures converge to amplify health risks.

Protecting vulnerable groups—pregnant women, older adults, and populations in flood- and heat-prone areas—must be prioritized to build climate-resilient health systems.

Future Directions

- Strengthen climate-resilient health infrastructure, particularly maternal and elder-care facilities.
- Integrate climate and health data for real-time surveillance and early warnings.
- Expand longitudinal studies in India to track intergenerational health impacts.
- Promote public awareness on heat safety, vector control, and sanitation.
- Encourage cross-sector collaboration between health, environment, and urban planning.

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