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Comments

Climate, urbanization, and infectious disease: Environmental drivers of Foshan's chikungunya outbreak

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The chikungunya outbreak in Foshan, Guangdong, China, highlights critical linkages between environmental factors and public health vulnerability. Initiated by imported viruses through international travel, transmission was amplified by climate change, unsustainable urbanization, and inadequate sanitation, expanding the habitat of the *Aedes* mosquito. Advanced surveillance technologies, including breeding-site mapping, real-time risk modeling, and environmental monitoring for early warnings, are urgently needed to guide larval control and community clean-ups. Long-term prevention requires a One Health Approach, featuring vector-control regulation enforcement, climate-resilient infrastructure investment, and integrated monitoring systems. This crisis reveals the inseparable bond between planetary and human health.

The recent chikungunya outbreak in Foshan, Guangdong, China, indicates critical links between environmental conditions, human activity, and public health. First detected on July 8, the outbreak involved over 4000 cases by July 27, 2025 [1]. While addressing the acute illness mechanism remains urgent, understanding the environmental drivers is also essential for preventing future escalation. Transmitted primarily by *Aedes aegypti* and *Aedes albopictus* mosquitoes, chikungunya virus has caused over 1 million cases globally since its 2004 re-emergence [2]. Infection typically causes high fever and debilitating joint pain that can persist for months or years, creating chronic morbidity and straining healthcare systems despite relatively low mortality [3,4].

The emergence of the outbreak reflects both environmental and anthropogenic factors (Fig. 1). Climate change stands as a key driver. As reported on July 27, 2025, Foshan recorded 13 days in July with maximum temperatures exceeding 36 °C, more than 9 days in 2024 and 10 days in 2023 [5]. These conditions expand the habitable range for the primary local vector, *Aedes albopictus*. In addition, extreme rainfall during the 2025 El Niño event reached 284.70 mm in July, higher than historical data (215.90 mm in 2024 and 156.00 mm in 2023), creating ideal breeding sites for mosquitoes. Urbanization patterns further amplified these transmission risks. Aging drainage systems in established communities create permanent water stagnation, sustaining chronic mosquito reservoirs. Construction sites act as outbreak ignition points due to transient water accumulation in excavations. Poor sanitation, particularly in transitional communities, elevated transmission risk through numerous water containers and waste accumulation. These environmental conditions collectively enhanced mosquito proliferation and chikungunya transmission potential [6]. Local communities like Lecong and Beijiao town, identified as epicenters, exhibited particularly hazardous conditions. Older urban communities in these areas showed high Breteau Index values due to persistent groundwater accumulation and inadequate sanitation management, promoting mosquito-human contact risk [7]. Crucially, viral importation through Foshan's international trade networks introduced Southeast Asia strains, establishing endemic transmission cycles. While advanced urbanization can mitigate disease spread through improved infrastructure, the city's uneven development, combined with favorable climate conditions, allowed a high-risk environment to persist. This enabled the outbreak through a combination of imported pathogens and locally amplified environmental hazards.

Environmental scientists and epidemiologists must immediately implement targeted interventions to disrupt transmission chains and reduce epidemic risk. Priorities include developing rapid and sensitive techniques to identify breeding sites, such as Unmanned Aerial Vehicle-based (UAV) photogrammetry. This can generate real-time risk maps integrating rainfall forecasts with community-reported water accumulation data, a cost-effective approach demonstrated during a recent dengue response [8]. Similarly, wastewater-based epidemiology (WBE) should be implemented to detect viral RNA in sewage, providing early warnings as successfully used before clinical diagnosis in recent COVID-19 outbreaks [9]. These efforts require interdisciplinary collaboration to translate environmental and epidemiology data into

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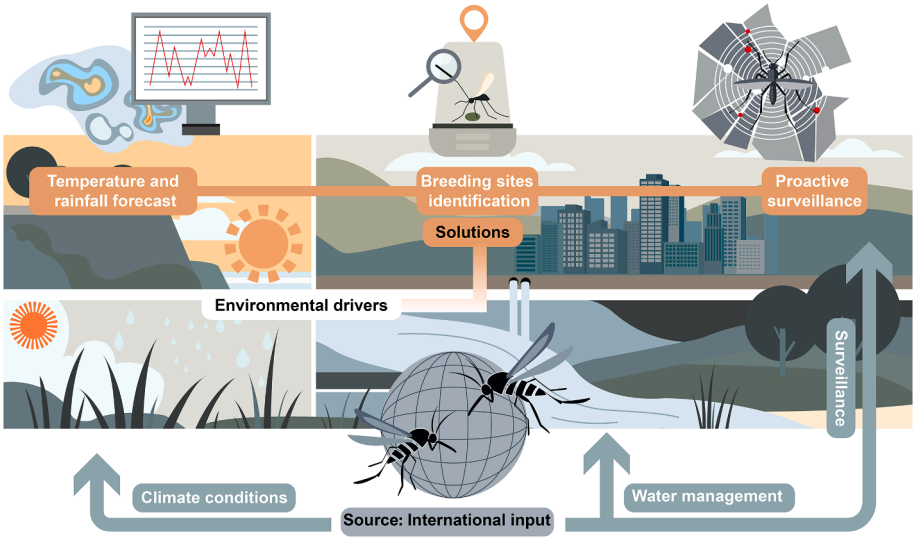

Fig. 1. Foshan chikungunya outbreak: Environmental drivers and solutions.

actionable strategies for policy makers, such as emergency larval control in identified water accumulation hotspots, and community mobilization for container elimination campaigns [10]. Currently, scientists should establish integrated data platforms bridging meteorological, entomological, and clinical surveillance to dynamically allocate resources. While long-term strategies like health impact integrated urban planning remain essential, this proposed rapid-response package, combining integration high-resolution remote sensing, environmental monitoring, and real-time risk maps, can break transmission cycles within weeks, buying time for systemic reforms.

The Foshan outbreak serves as an environmental warning, revealing vulnerabilities at the nexus of climate change, unsustainable urbanization, and fragmented surveillance. Preventing recurrence needs a One Health Approach with a stringent regulatory framework, including mandating environmental health assessments for development projects, enforcing water storage and waste management regulations, investing in climate-resilient drainage infrastructure, and establishing integrated surveillance combining environmental, entomological, and clinical data [11]. Proactive environmental management, guided by science and enforced through governance, is key to outbreak prevention, where the health of human populations stays deeply connected to planetary health.

CRediT authorship contribution statement

Chang He: Writing – original draft, Investigation, Conceptualization. **Guiying Li:** Writing – review & editing, Methodology. **Taicheng An:** Writing – review & editing, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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