

Climate-Driven Expansion of *Aedes aegypti* and Its Impact on the Changing Epidemiology of Dengue Fever

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INTRODUCTION & AIM

In the contemporary landscape of global public health, climate change has emerged as a primary and disruptive ecological determinant of vector-borne infectious diseases. Profound anthropogenic alterations, manifested through accelerated warming, altered precipitation patterns, and extreme weather events, exert major selective pressure on the biosphere. These macroclimatic fluctuations directly influence the geographic distribution, population density, and seasonal activity of the dipteran *Aedes aegypti*, the primary biological vector of dengue fever. This work provides a rigorous synthesis of global empirical evidence evaluating how climate variability drives vector expansion and systematically reconfigures dengue epidemiology on a planetary scale.

METHOD

To ensure scientific validity, a comprehensive systematic review of indexed literature was conducted within the reference databases PubMed, Scopus, and Web of Science for the period 2010–2026. The analyzed data corpus integrated longitudinal epidemiological studies, computational climate-model projections, entomological field surveys, and official outbreak reports. The evaluation focused on quantifying statistical associations between thermo-hydric indicators (such as temperature anomalies and humidity indices) and parameters of vector competence, colonization capacity, and clinical case incidence among exposed human populations.

RESULTS & DISCUSSION

The integrated data analysis reveals an unprecedented geographic expansion of *Aedes aegypti*, marked by significant poleward and altitudinal migration, with viable populations now documented at altitudes of 1000–1500 meters and in over 50 countries previously considered non-endemic. At the physiological level, rising mean temperatures and extended warm seasons accelerate vector metabolism, leading to higher adult survival rates, a drastically shortened extrinsic incubation period of the virus within the invertebrate host, and prolonged temporal windows for active transmission.

Consequently, the global burden has reached alarming proportions, causing approximately 390 million annual infections, of which circa 96 million progress to symptomatic clinical manifestations, supported by a 30% to 50% increase in reported cases across Asia and Latin America over the past decade. This climate-mediated expansion acts as a powerful catalyst for dengue emergence in temperate zones while intensifying outbreaks in hyper-endemic regions. These environmental modifications generate a synergistic overlap between expanding geographic barriers and heightened transmission intensity, exerting massive, unprecedented pressure on global healthcare systems.



CONCLUSION

In conclusion, the pressure exerted by climate change fundamentally reshapes the epidemiological architecture of dengue fever, transforming a regional threat into a multifocal global health crisis by facilitating the adaptation of *Aedes aegypti* to new ecological niches. Effectively confronting this emerging morbid burden requires abandoning traditional reactive strategies and immediately adopting resilient preventive paradigms. It is imperative to implement international early warning systems capable of correlating meteorological data with digitalized epidemiological surveillance in real time. Furthermore, public health sectors must optimize integrated vector management through sustainable techniques and formulate adaptive policies to strengthen community response capacity.

FUTURE WORK / REFERENCES

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