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Climate Change and Kid Infections: Preparing for Vector-Borne Threats in Pediatrics

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ABSTRACT

Background: Climate change, driven by anthropogenic greenhouse gas emissions, is profoundly altering the epidemiology of vector-borne diseases (VBDs) by expanding vector habitats, prolonging transmission seasons, and introducing pathogens to previously unaffected regions. Children are disproportionately vulnerable due to immature immune systems, higher respiratory rates, increased outdoor play behaviors, and socioeconomic disparities that limit access to preventive measures. severe manifestations, including cerebral malaria, dengue hemorrhagic fever, congenital Zika syndrome, and neuroborreliosis.

Conclusion: The convergence of climate change and pediatric VBDs represents an escalating public health crisis that demands immediate integration of climate resilience into child health practice. Pediatricians must adopt climate-informed prevention, enhanced surveillance, equitable vaccine and vector-control strategies, professional education, and advocacy for rapid emissions reduction. Proactive, multidisciplinary action is essential to protect current and future generations from widening health inequities and irreversible harm.

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Introduction

Climate change, driven by anthropogenic activities, is reshaping the global landscape of infectious diseases, with vector-borne illnesses emerging as a critical concern in pediatric medicine. Vector borne diseases (VBDs), transmitted by arthropods such as mosquitoes, ticks, and fleas, include malaria, dengue fever, Zika virus, West Nile virus, and Lyme disease. These pathogens disproportionately affect children due to their developing immune systems, higher respiratory rates, and increased outdoor exposure. Rising global temperatures, altered precipitation patterns, and extreme weather events are expanding vector habitats, prolonging transmission seasons, and introducing diseases to new regions. According to recent analyses, climate change has already led to a 22.12% attributable fraction of vector-borne cases linked to heat extremes, with projections indicating further escalation if emissions continue unchecked (1).

Children, comprising a vulnerable demographic, face amplified risks. For instance, studies show that pediatric populations in temperate zones are increasingly exposed to tick-borne illnesses like Lyme disease, with incidence rates higher among 5-9-year-olds compared to other groups. This vulnerability stems not only from physiological factors but also from socioeconomic disparities, where low income families in urban or rural settings lack access to protective measures. As of 2025, the World Health Organization estimates that VBDs cause over 700,000 deaths annually, with climate change exacerbating this burden by facilitating pathogen-vector-host interactions. This article analyzes the mechanisms driving these changes, their specific impacts on pediatric health, current trends, and strategies for preparation in pediatric care (2).

The interplay between climate change and VBDs operates through multifaceted ecological disruptions. Warmer temperatures accelerate vector life cycles, reducing the extrinsic incubation period for pathogens within mosquitoes and ticks. For example, higher ambient heat shortens the time for dengue virus to become transmissible in Aedes mosquitoes, potentially increasing outbreak frequency. Changes in precipitation create more breeding sites; flooding expands mosquito habitats, while droughts concentrate water sources, intensifying human vector contact (3).

Geographic expansion is another key mechanism. Vectors like the Asian tiger mosquito (Aedes albopictus), a carrier of Zika and chikungunya, are migrating northward into Europe and North America due to milder winters. In the Arctic and peri Arctic regions, thawing permafrost and extended warm seasons are enabling tick populations to thrive, introducing diseases to immunologically naive populations. A narrative review from 2025 highlights how these shifts favor VBD proliferation, with climate acting as a multiplier for endemic and emerging infections (4). Ecosystem alterations further compound risks. Biodiversity loss from habitat destruction reduces natural predators of vectors, while urbanization creates "heat islands" that amplify transmission. Pathogen adaptation is evident; some viruses exhibit enhanced virulence under warmer conditions, potentially leading to more severe pediatric manifestations such as neurological complications in Zika-infected infants (2).

Children are uniquely susceptible to VBDs amplified by climate change. Their immature immune responses result in higher morbidity from infections like malaria, where Plasmodium parasites can cause severe anemia and cerebral complications in under-fives. Behavioral factors exacerbate exposure: kids spend more time outdoors, increasing bites from ticks during play in wooded areas, leading to rising Lyme disease cases. In 2024, experts noted that shorter winters correlate with extended tick activity, fueling babesiosis and other tick-borne illnesses in pediatric cohorts (5).

Inequalities amplify these threats. In low-resource settings, climate-driven displacement exposes children to new vectors, while malnutrition weakens defenses against diseases like dengue hemorrhagic fever. Urban poor face heightened risks from Aedes mosquitoes breeding

in stagnant water amid erratic rains. Recent studies indicate uneven impacts, with marginalized communities bearing the brunt due to limited healthcare access. For pregnant women and fetuses, vector-borne infections like Zika pose teratogenic risks, with climate change contributing to maternal fetal transmission dynamics. Mental health dimensions are emerging; climate anxiety intersects with disease fears, potentially leading to behavioral changes in children (6).

Global trends underscore escalating pediatric VBD burdens. In the U.S., Lyme disease cases in children have surged, with climate models predicting a 10-20% increase by mid century. Internationally, dengue outbreaks have intensified in Asia and Latin America, affecting millions of children annually. A 2025 study attributes nine infectious diseases, including VBDs, to climate extremes, with vector-borne showing the highest heat attributable fraction. Projections are dire: Unmitigated warming could expand malaria transmission to higher altitudes and latitudes, endangering 100 million more children by 2050. Hybrid threats, like co-infections with respiratory viruses, may rise as seasons overlap. Pediatricians must integrate climate-informed practices. Primary care can incorporate VBD prevention into routine visits, advising on repellents, clothing, and tick checks. Surveillance enhancements, including real-time climate disease modeling, enable early warnings. Vaccinations, where available (e.g., dengue vaccines), should be prioritized, alongside vector control like community larviciding (3).

Education is pivotal: Training pediatricians on climate-health linkages, as advocated by the American Academy of Pediatrics, fosters competency. "Greening" clinics reduces carbon footprints while modeling sustainability. Policy advocacy for emission reductions and equitable health resources is essential. Community research addressing disparities can tailor interventions (4).

Conclusion

The nexus of climate change and pediatric VBDs demands urgent, multidisciplinary action. By fortifying surveillance, education, and preventive care, pediatrics can mitigate these threats.

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Conflict of interest

The author declares no conflicts of interest.

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