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Letter to the Editor

Re-emergence of Eastern equine encephalitis: A looming threat in the era of climate change

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Eastern equine encephalitis (EEE) is a rare but severe mosquito-borne disease, posing significant health risks to humans and animals [1]. Caused by the Eastern equine encephalitis virus (EEEV), a member of the *Alphavirus* genus, it is primarily maintained through a cycle involving *Culiseta melanura* mosquitoes and avian hosts, typically found in freshwater hardwood swamps. Human and equine infections occur when bridge vectors, such as *Aedes*, *Coquillettidia*, and *Culex* species, bite infected birds and subsequently feed on mammals. Clinical manifestations of EEE include the sudden onset of high fever, headache, vomiting, and neurological symptoms like seizures, disorientation, and coma.

In recent years, particularly in the northeastern United States, the incidence of EEE has increased, raising concerns about more frequent outbreaks driven by environmental changes, notably climate change (Table 1) [1,2]. In 2024, a noticeable rise in both the incidence and geographic spread of EEE was reported, with 16 neuroinvasive human infections across multiple states, including Massachusetts, New Hampshire, and new reports from states like Vermont, New York, and North Carolina [1]. The neuroinvasive form of EEE is particularly dangerous, with a mortality rate of about 30 %, and survivors often suffer long-term neurological damage [1]. The reappearance of EEE in states like New Hampshire and the emergence of cases in states where the disease was previously unreported suggest the virus's geographic range may be expanding, likely influenced by rising temperatures and altered precipitation patterns [3].

Warmer temperatures accelerate mosquito development, increase biting rates, and shorten the virus's incubation period within mosquitoes, potentially leading to more frequent and widespread outbreaks [4]. Public health responses have included mosquito control measures, such as aerial and truck-based spraying of insecticides in high-risk areas, but these are not foolproof, highlighting the need for more sustainable solutions. In Massachusetts, the re-emergence of EEE has led to public health restrictions, including park closures and the cancellation of outdoor activities during peak mosquito hours. However, these necessary measures have faced resistance, particularly after recent COVID-19 restrictions, underscoring the importance of effective communication strategies that balance public safety with community activities.

Surveillance data, while invaluable for tracking EEE, have limitations. Underreporting, especially of non-neuroinvasive cases, can lead to an underestimation of the disease burden and hinder accurate comparisons across regions and time periods. Additionally, surveillance data are often reported by the county of residence rather than the location of exposure, which can obscure our understanding of transmission dynamics. A rare but significant aspect of EEE transmission involves documented cases where the virus was spread through organ transplantation, raising concerns about the need for rigorous screening of organ donors in areas where EEE is prevalent [1].

The re-emergence of EEE, driven by climate change, presents a major public health challenge. The evolving transmission routes, including organ transplantation, add complexity to its management. Resistance to public health measures complicates protection efforts, emphasizing the need for adaptive strategies. Prioritizing robust surveillance and vaccine development is essential due to the disease's high mortality and long-term effects. A One Health approach, integrating human, animal, and environmental health, is vital for effective management and mitigation [5].

CRediT authorship contribution statement

Amogh Verma: Writing – review & editing, Writing – original draft, Supervision, Project administration, Conceptualization. **Vinay Suresh:** Writing – review & editing. **Manvinder Brar:** Writing – review & editing. **Amit Varma:** Writing – review & editing, Writing – original draft. **Sanjit Sah:** Writing – review & editing, Writing – original draft. **Mahendra Pratap Singh:** Writing – review & editing, Writing – original draft, Validation. **Rachana Mehta:** Writing – review & editing. **Ashok Kumar Balaraman:** Writing – review & editing. **Sakshi Pandey:** Writing – review & editing. **Sai Gautham Kanagala:** Writing – review & editing, Writing – original draft, Validation.

Informed consent

Not required as no patient data was collected or analyzed in this study.

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Table 1
Human Eastern Equine Encephalitis Cases by State and Year of Onset in the United States (2003–2024). Data sourced from the CDC and state health departments. Note that the 2024 data is current as of October 15, 2024. [*As of September 4, 2024].

Year	Massachusetts	New Hampshire	Vermont	New Jersey	New York	North Carolina	Rhode Island	Wisconsin	Total Cases	Neuroinvasive Cases	Deaths
2003–2023	75	5	3	7	0	0	0	0	90	65	35
2024	4	5	2	1	1	1	1	1	16	16	1*
Total	79	10	5	8	1	1	1	1	106	81	36

Declaration of financial interests

The authors declare to have no financial interests relevant to this study to disclose.

Declaration of non-financial interests

The authors declare to have no non-financial interests relevant to this study to disclose.

Ethical approval

Not required.

Declaration of funding

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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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