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Letter to the Editor

Climate change, urbanization and resurgence of dengue in Bangladesh

Dear Editor,

Dengue fever, a mosquito-borne infectious disease, has emerged as a global public health concern, placing over half of the world's population at risk. Its impact has been profound, with the disease spreading to 125 countries and causing an estimated 400 million infections and 40,000 fatalities annually [1]. This escalating health crisis is particularly pronounced in tropical and subtropical regions, where dengue has become endemic. Over 100 countries become dengue endemic, with South and Southeast Asia experiencing the brunt of this global burden, collectively accounting for 70 % of cases [1]. Bangladesh, where dengue was first reported in 1964, has consistently faced outbreaks, became dengue endemic. The most devastating outbreak occurred in 2019, and the repercussions persist, with each subsequent year witnessing the continuation of this alarming trend [2].

Climate variability including temperature, rainfall and humidity promotes the dengue disease transmission cycle. The primary vector of dengue, *Aedes Aegypti*, is closely linked to favorable conditions such as high humidity, high temperatures, and rainfall. These climatic factors support the mosquito's survival, development, and breeding, ultimately facilitating the transmission cycle of the dengue virus [3]. Bangladesh has been facing a complex nexus of climate change, population growth and resurgence of Dengue fever. The country has a tropical monsoon climate with mean temperature of 29 °C that is favorable for dengue transmission. In recent years, the South Asia region, including Bangladesh, has been facing increasingly frequent and intense temperature fluctuations due to significant climate warming— which is likely to continue in the future. Coinciding with these environmental shifts, there is a notable surge in dengue cases in the country, attributed to the changing climate fostering the proliferation of *Aedes aegypti* mosquitoes [2].

Over the past decade, Bangladesh has witnessed a substantial increase in the incidence of dengue cases, with approximately 35-fold growth. In 2013, the reported cases were minimal, with only 1749 identified dengue patients and only 2 reported casualties. However, by the year 2022, the situation had intensified significantly, recording 61,098 cases and more than 200 deaths. This trend continued to escalate in 2023, marking a critical turning point as the country experienced an unprecedented surge in dengue cases, reaching an all-time high of 296,503, accompanied by more than 1000 fatalities. The progression of cases displayed a clear seasonality, particularly during the monsoon season, characterized by elevated humidity and precipitation levels. The surge, starting in June and extending through September, aligns with the onset and persistence of the monsoon season. Fig. 1 illustrates this pattern, emphasizing the correlation between climatic conditions, notably high temperature and increased rainfall, and the prevalence of dengue fever in Bangladesh. This seasonal trend is consistent with previous years, highlighting the significant impact of climate change on the incidence of dengue in the region.

The heightened impact of dengue in Bangladesh is exacerbated by the increasing population density in the country. Over the past decade, the population density increased to 1.26-fold [4]. Such increase in population density results in inadequate management of wastewater systems, thereby creating favorable conditions for the spread of the primary vector responsible for transmitting dengue fever. Furthermore, the unregulated urbanization patterns observed in densely populated areas contribute to increased human mobility, emerging as a significant factor amplifying the risk of dengue transmission [5].

The integration of climatic factors into early warning systems holds significant potential for enhancing dengue forecasting, vector management, and control. Adherence to the WHO's Integrated Vector Management (IVM) system is crucial for effective vector control, involving regulation of breeding areas, environmental management, reduction of stagnant water zones, and the use of larvicides, fogging, fumigation, and proper waste and wastewater treatment. Proper knowledge is a fundamental need to prevent dengue [2]. Educational campaigns on dengue by both government and non-government organizations can play a vital role to enhance public awareness. Climate resilient health infrastructure has become essential to deal with diseases. Besides, preparedness for disease outbreak and response plan needs to be taken into account. Public-private partnership for dengue vaccine development can be considered by the government in this region. Political commitment and supporting funds are also necessary to face the situation. Future research should prioritize investigations based on climate variability, incorporating socioeconomic and biophysical indicators to comprehensively address the issue.

CRediT authorship contribution statement

Marvina Rahman Ritu: Writing – review & editing, Writing – original draft, Validation, Methodology, Investigation, Data curation, Conceptualization. **Dana Sikder:** Writing – review & editing, Writing – original draft, Data curation, Conceptualization. **Muhammad Mainuddin Patwary:** Writing – review & editing, Visualization, Supervision, Project administration, Methodology, Formal analysis, Conceptualization. **Ashiqur Rahman Tamim:** Writing – review & editing, Writing – original draft, Data curation, Conceptualization. **Alfonso J. Rodriguez-Morales:** Writing – review & editing.

Declaration of competing interest

Dr. Rodriguez-Morales declared being consultant/speaker of Takeda. The rest of authors declare no competing interests.

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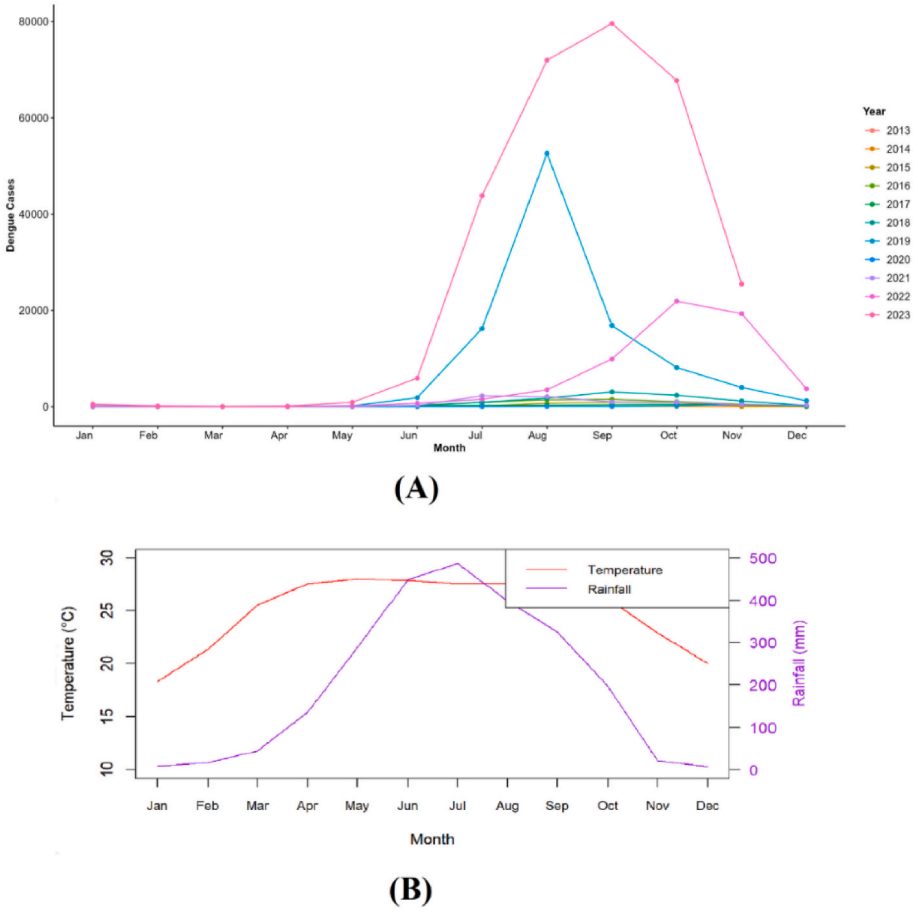

Fig. 1. Monthly dengue cases (A) and climatic variables (B) during 2013–2023 in Bangladesh.

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Marvina Rahman Ritu, Dana Sikder, Muhammad Mainuddin Patwary*, Ashiqur Rahman Tamim
Environment and Sustainability Research Initiative, Khulna, 9208, Bangladesh
Environmental Science Discipline, Life Science School, Khulna University, Khulna, 9208, Bangladesh

Alfonso J. Rodriguez-Morales
Clinical Epidemiology and Biostatistics, Universidad Cientifica del Sur, Lima, Peru
Gilbert and Rose-Marie Chagoury School of Medicine, Lebanese American University, Beirut, P.O. Box 36, Lebanon

* Corresponding author. Environment and Sustainability Research Initiative, Khulna, 9208, Bangladesh.
E-mail address: raju.es111012@gmail.com (M.M. Patwary).
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