

EDITORIAL

ADVANCEMENTS IN DENGUE PREDICTION: A PATH TOWARDS EFFECTIVE PREVENTION AND MANAGEMENT

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Dengue fever, a mosquito-borne viral infection, continues to pose a significant public health challenge globally, particularly in tropical and subtropical regions. Dengue cases have risen dramatically around the world, with 70% of them occurring in Asia. Globally, the World Health Organization (WHO) estimates that 3.9 billion people – or half of the world’s population – are at risk of infection.

Bangladesh has seen regular outbreaks of dengue from the year 2000. Yet the recent outbreak has been surprising – not only did a surge in cases start earlier than usual (typically cases start during the June-October monsoon), but the disease has also spread beyond its previous concentration in Dhaka and Chattogram. In 2022, Dhaka city accounted for 63% of cases, while in 2023, 66% were reported from outside Dhaka and dengue is being reported from all 64 districts of the country.

Despite ongoing efforts to control its spread, the incidence of dengue fever remains alarmingly high, with millions of cases reported annually. Because of this, there is an urgent need to explore innovative approaches for dengue prediction and proactive measures to mitigate its impact on public health.

Traditionally, dengue prevention strategies have primarily focused on vector control measures, such as mosquito eradication programs and community education campaigns. While these efforts have undoubtedly helped reduce transmission rates, they often fall short in accurately predicting and preemptively addressing outbreaks. However, recent advancements in data analytics, epidemiological modeling, and artificial intelligence offer promising avenues for enhancing dengue prediction.

One notable approach involves the integration of environmental data, such as temperature, humidity, and rainfall patterns, with epidemiological surveillance data to develop predictive models for dengue outbreaks. By leveraging machine learning algorithms and real-time data streams, researchers can identify high-risk areas and forecast the likelihood of dengue transmission with greater accuracy. Additionally, the advent of digital surveillance systems and mobile health technologies enables timely reporting of dengue cases, facilitating prompt response and mitigation efforts.

Furthermore, the use of serological and molecular tools for dengue surveillance allows for early detection of the virus in both human and mosquito populations. Seroprevalence studies provide valuable insights into the immunity levels within communities, helping prioritize resource allocation for vaccination (as and when available) campaigns and targeted interventions. Similarly, molecular techniques, such as polymerase chain reaction (PCR) assays, enable rapid identification of dengue virus strains and their genetic diversity, aiding in tracking viral spread and monitoring potential outbreaks.

While significant progress has been made in dengue prediction, several challenges and opportunities lie ahead in this evolving field. Firstly, there is a critical need for interdisciplinary collaboration between epidemiologists, entomologists, data scientists, and healthcare professionals to develop comprehensive predictive models and decision support systems for dengue prevention and control. By harnessing collective expertise and resources, we can better understand the complex dynamics of dengue transmission and implement targeted interventions tailored to local contexts.

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Moreover, efforts should be intensified to strengthen public health infrastructure and surveillance capabilities in dengue-endemic regions. This includes enhancing laboratory capacity for rapid diagnostics, expanding access to vector control measures, and fostering community engagement through education and awareness campaigns. Additionally, investment in research and development of novel therapeutics and vaccines against dengue is essential to complement existing prevention strategies and reduce the burden of the disease on healthcare systems.

Furthermore, prioritizing equity and social justice in dengue control efforts is paramount to ensuring that vulnerable populations, such as low-income communities and marginalized groups, are not disproportionately affected by the disease. This necessitates a holistic approach that addresses underlying social determinants of health, promotes community empowerment, and fosters sustainable development practices.

The science of dengue prediction has witnessed significant advancements in recent years, offering new opportunities to strengthen prevention and control efforts. By leveraging innovative technologies, interdisciplinary collaborations, and community-driven approaches, we can improve our ability to predict,

prevent, and manage dengue outbreaks effectively. However, sustained investment, strong political commitment, and collective social action are essential to realizing the full potential of these advancements and achieving a world free from the burden of dengue fever.

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