UNIVERSITY OF BARISHAL

Project Title

"Evaluating the Factors that Contributing to Dengue Outbreaks in Bangladesh: Strategies for Sustainable Prevention and Control"

Applied Course: Computer Fundamentals & Office Applications

Course Level: Basic

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Introduction:

Figure: Aedes aegypti mosquito

Dengue fever, a mosquito-borne viral disease, has emerged as a significant public health concern in Bangladesh. With its tropical climate, rapid urbanization, and dense population, the country provides a conducive environment for the proliferation of Aedes mosquitoes, the primary vectors of dengue. Over recent years, the frequency and severity of dengue outbreaks have escalated, leading to substantial morbidity and mortality and imposing a severe burden on the healthcare system.

This topic is of paramount importance because dengue not only affects public health but also has far-reaching social and economic consequences. During outbreaks, hospitals become overwhelmed with patients, while families face emotional and financial stress due to treatment costs and lost productivity. Furthermore, the lack of awareness, inadequate vector control measures, and insufficient urban planning exacerbate the problem.

By evaluating the factors contributing to dengue outbreaks—such as environmental conditions, urbanization patterns, public health infrastructure, and socio-behavioral practices—this research aims to identify actionable strategies for sustainable prevention and control. Understanding these dynamics is crucial for developing targeted interventions, minimizing the impact of future outbreaks, and promoting long-term public health resilience in Bangladesh.

Background

In Bangladesh, the disease has transitioned from sporadic outbreaks to an annual epidemic, with record-breaking cases reported in recent years. Bangladesh's vulnerability to dengue outbreaks can be attributed to several interrelated factors. Climatic conditions, including high temperatures, prolonged monsoons, and increasing humidity, create ideal breeding environments for *Aedes* mosquitoes. Rapid and unplanned urbanization has led to poor waste management, stagnant water accumulation, and overcrowded living conditions, which further exacerbate mosquito proliferation.

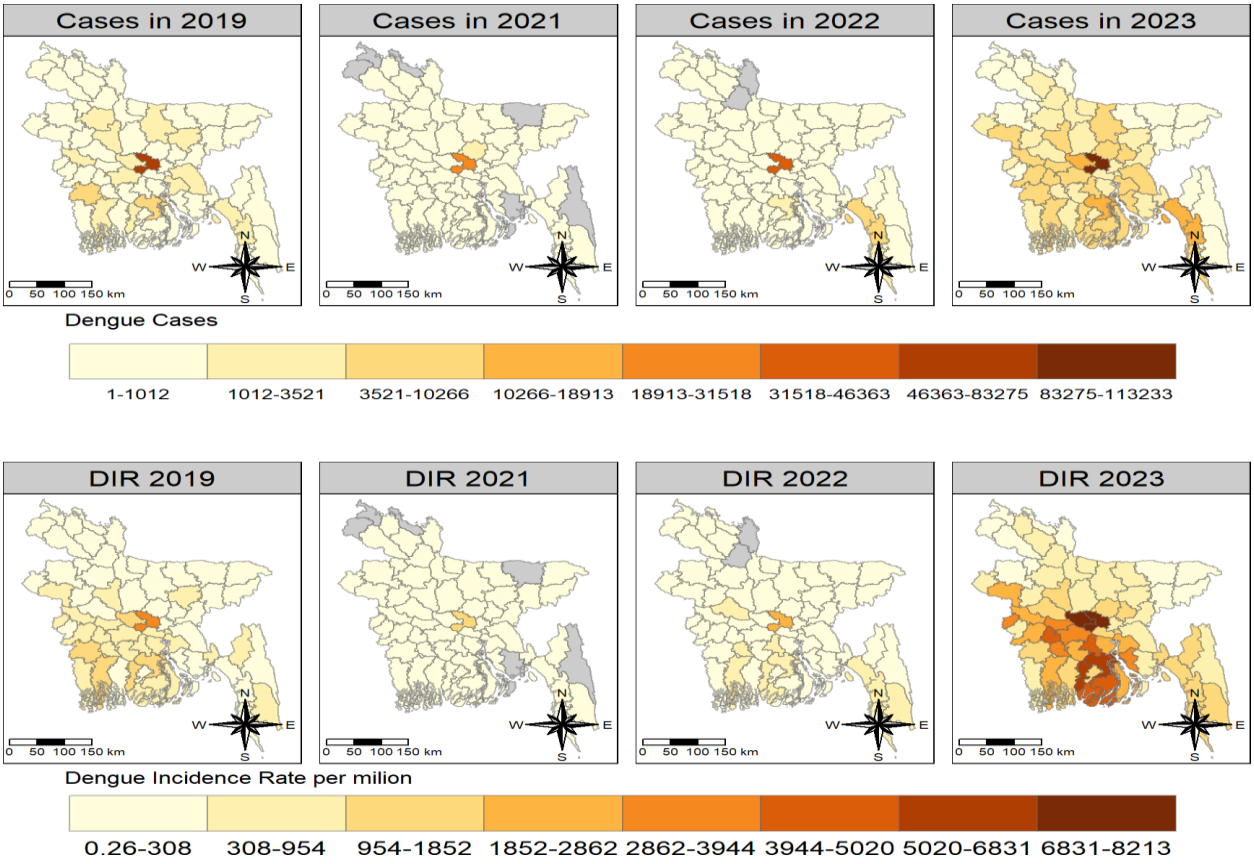


Figure: The spatial distribution of districtwide dengue cases and dengue incidence rate (DIR) per million in Bangladesh in 2019–2023.

Additionally, the country faces challenges in its public health response. Limited healthcare infrastructure, insufficient public awareness, and gaps in vector control programs hinder effective dengue management. The lack of coordinated urban planning and insufficient enforcement of environmental health regulations compound the problem.

Temporal patterns of dengue in Bangladesh during 2019 to 2024:

Dengue fever in Bangladesh has shown significant temporal and spatial variability between 2019 and 2024. This study analyzes the seasonal, monthly, and regional patterns of dengue outbreaks, identifies contributing factors such as climatic changes and urbanization, and proposes targeted control strategies. By leveraging epidemiological data, the research emphasizes the need for adaptive and region-specific interventions to curb future outbreaks

Implications for targeted control strategies:

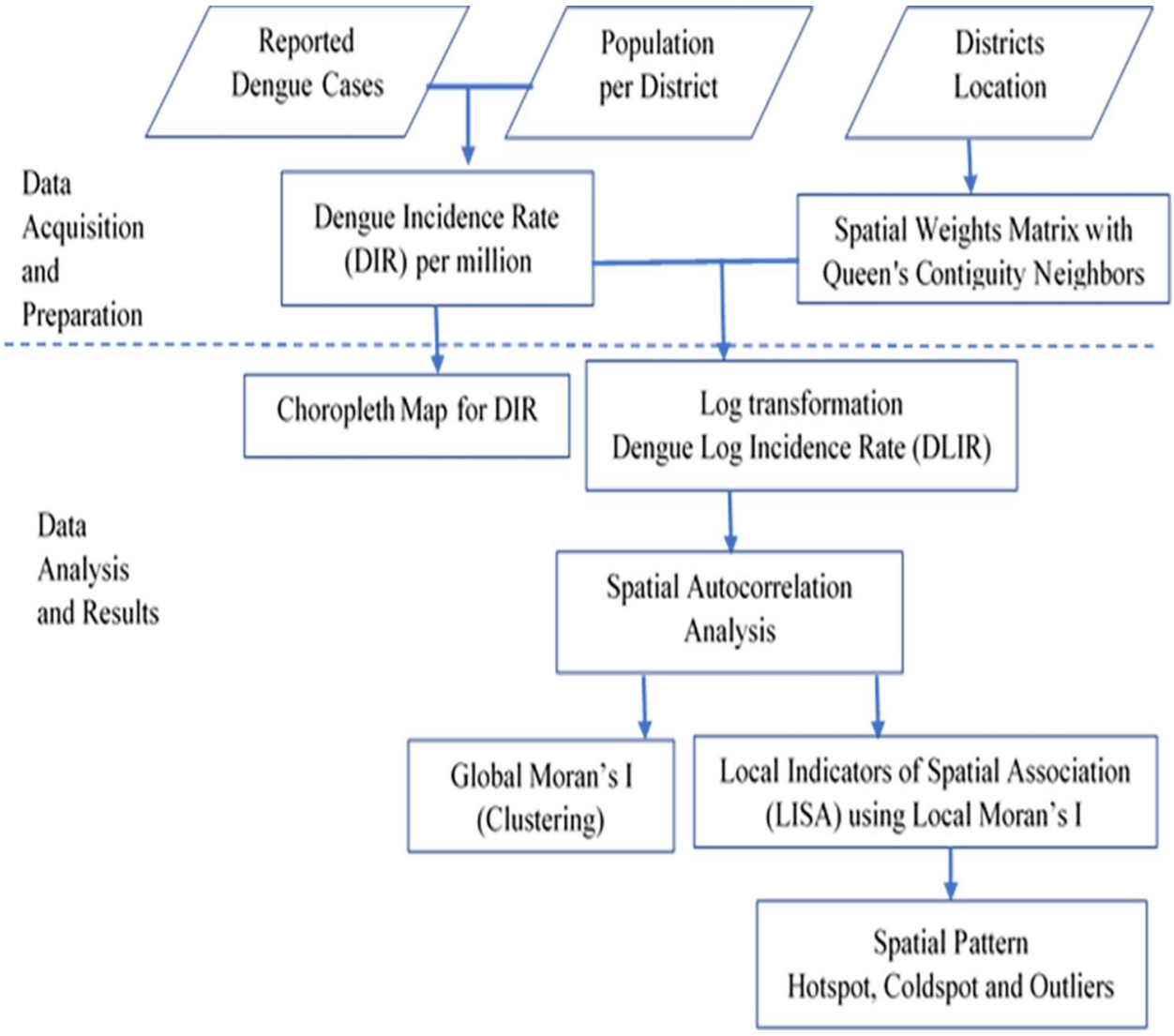


Figure: Flowchart of Methodology.

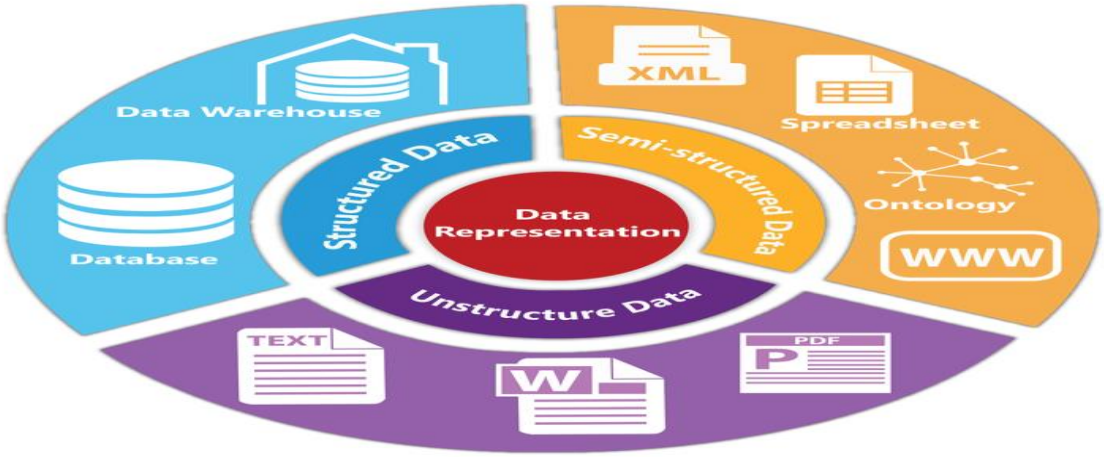
Data collection:

A cross-sectional survey was carried out among 14 - >60 (up to 75) years old randomly selected 1,010 peoples in nine administrative regions **(Dhaka, Comilla, Chittagong, Barisal, Khulna, Rajshahi, Rangpur, Mymensingh and Sylhet**) of Bangladesh between July and November 2024. An assumption of 50% prevalence of good KAP and an absolute precision of 5% were taken for calculating the minimal sample size which was found 385.

Figure: Map of the objective regions of Bangladesh

Popular data representation techniques for dengue information:

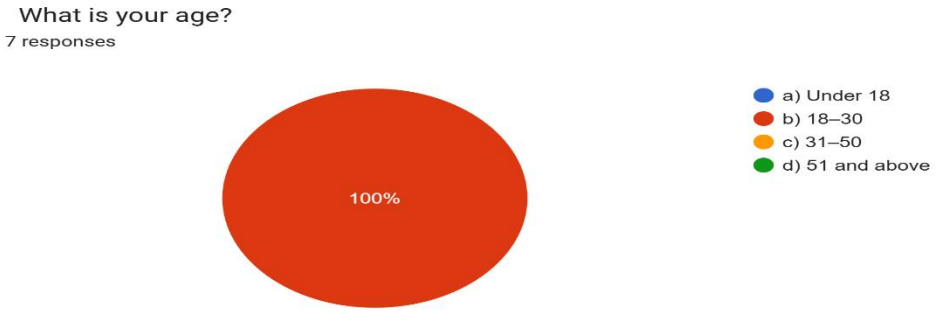
Unstructured, Semi-structured, and Structured data.

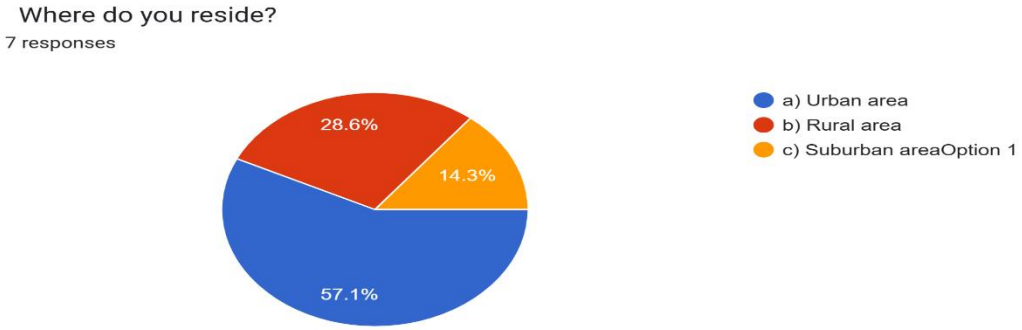


Results

Socio-demographic characteristics

A total of 1000 individuals were approached, only 900 were interviewed completely, giving a response rate of 91.82%. The profile of the respondents is given below in both Pie Chart and Table that summarizes:





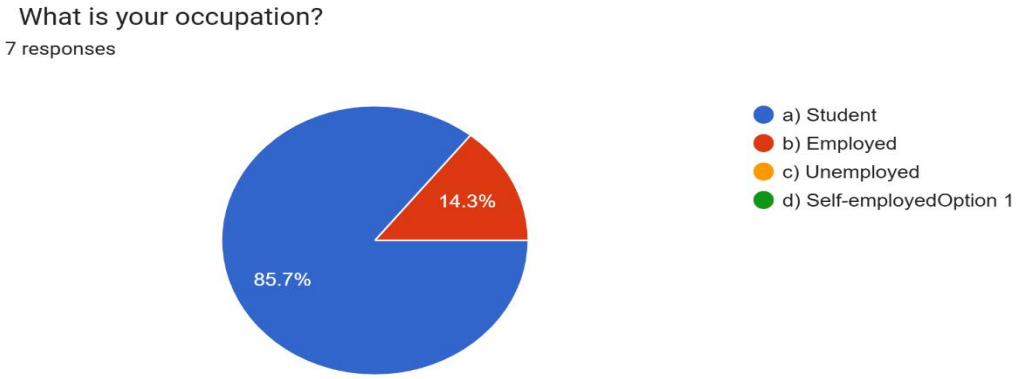
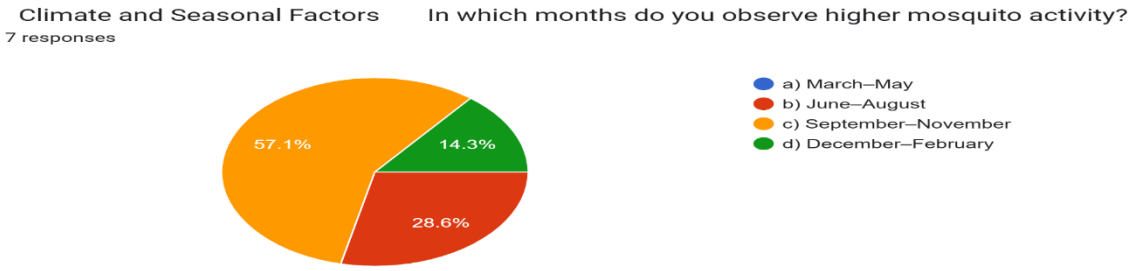


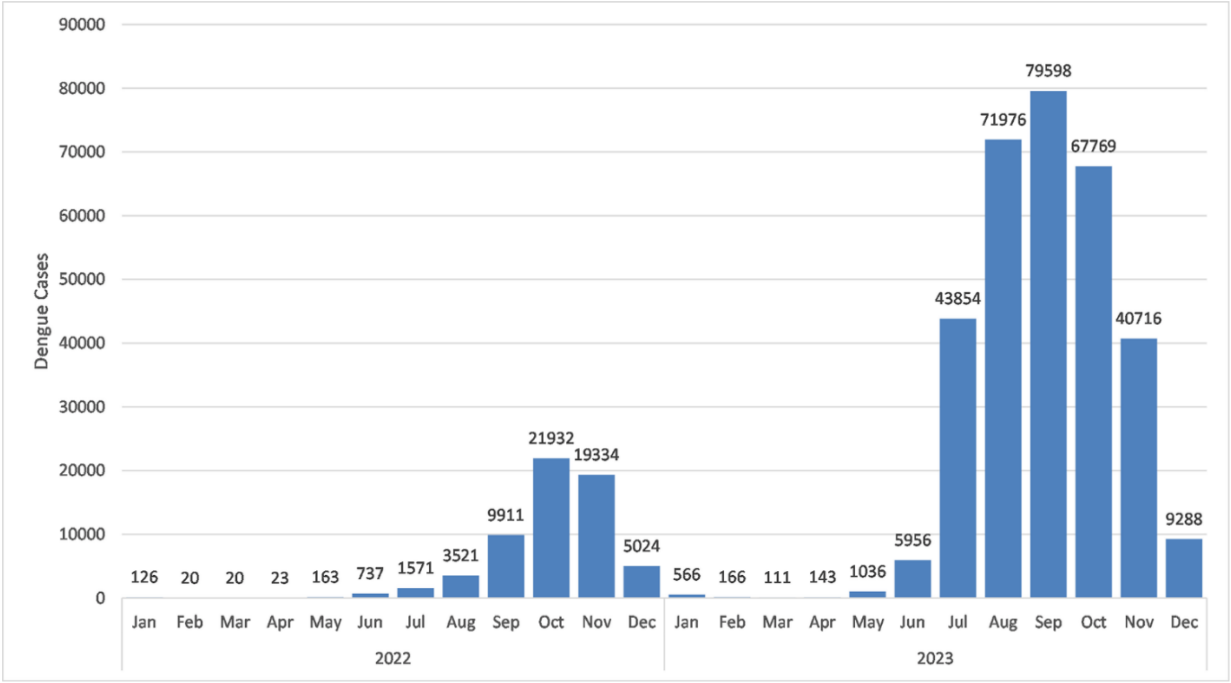
Table: Socio-demographic characteristics of the respondents in Bangladesh.

Characteristics	n (%)
Gender	
Male	506 (50.1)
Female	504 (49.9)
Age (year)	
1–15	38 (3.8)
16–30	551 (54.6)
31–45	249 (24.7)
46–60	124 (12.3)
61–75	48 (4.8)
Mean ± SD*	**31.96 ±13.8**
Living place	
Village	545 (54.0)
Semi Town	269 (26.6)
City	196 (19.4)
Literacy status	
No formal schooling (illiterate)	127 (12.6)
Primary	172 (17.0)
Secondary	258 (25.5)
Intermediate	227 (22.5)
Graduate	180 (17.8)
Post Graduate	46 (4.6)
Employment status	
Job holder	88 (8.7)
Teacher	75 (7.4)
Businessman	107 (10.6)
Farmer	53 (5.2)
Student	347 (34.4)
Laborer	49 (4.9)
Housewife	213 (21.1)
Nothing as mentions	38 (3.8)
Others	40 (4.0)
Family income (Taka/month)	
<15,000	411 (40.7)
<30,000	344 (34.1)
<50,000	187 (18.5)
>50,000	68 (6.7)
Socio economic status	
Lower	163 (16.1)
Lower middle	303 (30.0)
Middle	474 (46.9)
Upper middle	70 (6.9)

Monthly distribution of dengue cases across Bangladesh in 2022–2024:

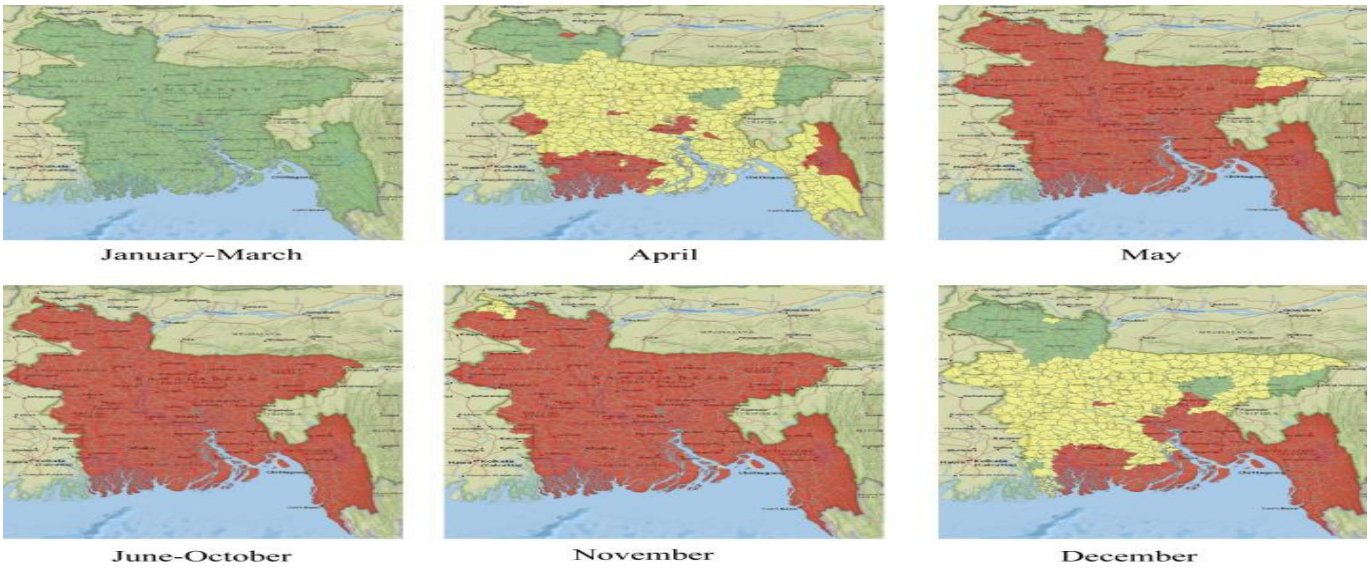
It is evident from Survey that months between January and March are poorly suited for dengue transmission. In April, some southern parts of the country, as well as the capital city of Dhaka, become highly suitable. Other parts of the country, except the northern most corner, become moderately suitable. Starting from May, the whole country becomes highly suitable, and the situation remains similar until **November**. The most northern part of the country becomes poorly suitable, whereas the capital and southern part stay highly suitable in **December**. After December, the whole country becomes poorly suited again, which continues until April.





Graph: Monthly distribution of dengue cases across Bangladesh in 2022–2024

Spatiotemporal suitability maps for dengue transmission in Bangladesh based on temperature. The map represents suitability in the following manner: **green** (lowly suitable), yellow (moderately suitable), and red (highly suitable).



Methods of Biological Prevention and Control:

To combat the prevalence and spread of dengue disease, biological methods are the most environmentally favorable and sustainable options. Various natural and environmental components, including components of flora and fauna, function biologically to protect against 8 the virus. It is extremely widespread in many nations across the globe, especially those that are considered less developed. Despite being an extremely primordial method, its success rate is exceptionally high.

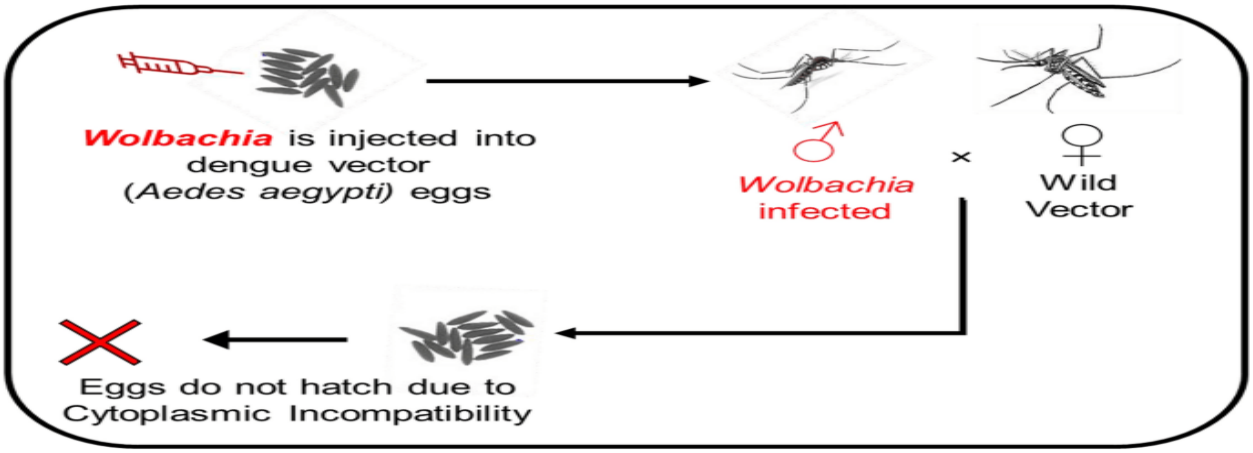


Figure: Biological dengue prevention

Methods of Chemical Prevention and Control:

Fogging, a chemical prevention system, is implemented in numerous countries across Asia and South America. In this chemical dengue prevention system, damp, dark areas are sprayed with chemical vapors to eliminate the disease's presence. This is prevalent in South Asian nations such as Bangladesh, Pakistan, and India. Usually, chemicals like pyrethroids, IGRs (Insect Growth Regulators), and pyriproxyfen are used in the fogging system.

Figure: Chemical spray dengue prevention

Methods of Community-Based Prevention:

The community-based prevention method is the most effective and efficient for a wide range of a number of reasons. Those are given here below:

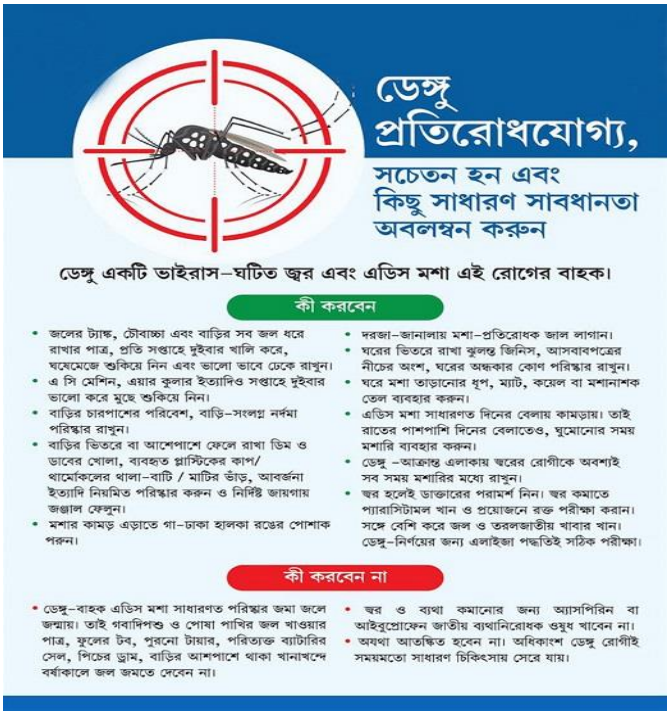


Figure: Community dengue prevention.

1. Due to the enormous number of participants, the outcome is considerably more favorable for use in a large area.
2. It unifies the inhabitants of a specific community or society.
3. It allows adolescents and students to cultivate their leadership capabilities.
4. It is possible to acquire knowledge of novel dengue prevention methods through dialogue with others.
5. When it comes to community-based prevention methods, a wide range of technological tools and social media platforms are readily available
6. In contrast to chemical prevention methods, community-based prevention approaches do not involve using any form of chemical.
7. The method prioritizes environmental sustainability and mosquito control.
8. Volunteers perform every activity, eliminating any financial burden associated with implementing this method.
9. A locality or society becomes more harmonious than ever thanks to community-based prevention methods.
10. Numerous distinct kinds of animal abuse occur when using biological methods. This form of animal cruelty is not committed by community-based
11. Onerousness regarding the prevention of dengue and other diseases is heightened through the use of this method.
12. Community-based practices facilitate immediate dengue prevention during extreme dengue outbreaks.
13. Community-based interventions impede the transmission of dengue to foreign regions and nations.

Sustainable Dengue Prevention and Management:

The collaborative approach should inherently be reciprocal, involving comprehensive feedback from all stakeholders. This is especially crucial when adapting strategies to diverse geographic contexts and specific sub-groups. Some barriers to achieving strong, multi-stakeholder collaboration include a potential lack of alignment with the national priority for dengue prevention and a lack of clear leadership. If these barriers are not overcome, differences in stakeholder priorities can ultimately jeopardize the program's success. As a multi-pronged dengue prevention and management program comprises various initiatives implemented simultaneously by different stakeholders, a lack of coordination can lead to misalignment in the different prongs and cause delays in program implementation. For example, it is critical to drive the message that the introduction of new dengue vaccines does not diminish the need for continued vector control activities. When building a new narrative for new dengue vaccines, it is also important to emphasize its differences in comparison to previous dengue vaccines. While leveraging different stakeholders to communicate to the population can help to tailor messages to local contexts, the key narratives should remain consistent.

Conclusion

The mosquito–borne disease dengue is emerging in Bangladesh gradually at an alarming rate. In spite of having moderate knowledge of dengue transmission vectors and symptoms, the preventive practices are not well executed. However, it was found that the paucity of basic knowledge on dengue epidemiology and vector bionomics among the population could be a major cause for the increasing trend of dengue in this highly populated country. So, an emphasis should be provided on health education programme especially on dengue disease to increase community knowledge and awareness towards Aedes mosquitoes and DF prevention countrywide.

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