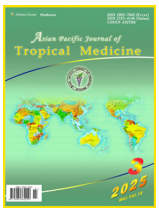

Perspective

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Enhancing dengue control: Addressing current gaps, future challenges, and the need for improved approaches in Sri Lanka

Sampath Indika Kumara[1]✉, Shilanthi Seneviratne[2]

[1]*Medical Administration Research Fellow, James Paget University Hospitals NHS Foundation Trust, United Kingdom*

[2]*Specialist Community Medicine, Ministry of Health, Sri Lanka*

Dengue fever presents a significant and persistent public health challenge in Sri Lanka. The disease, transmitted by *Aedes aegypti* and *Aedes albopictus* mosquitoes, affects individuals across all age groups, with working populations and school-aged children at higher risk due to increased outdoor exposure[1]. Dengue transmission in Sri Lanka is seasonal with two high transmission waves corresponding with the two monsoon rains every year. The estimated average annual incidence is 175/100 000 population, and it was 407.5/100 000 in 2023 with a case fatality rate of 0.07%[2].

Wider national guidelines and protocols are available in hospitals across the country to detect patients early and manage efficiently, with special emphasis on severe dengue patients. The health care workers receive regular training on the management of dengue patients. High Dependency Units (HDU) have been established in major hospitals, and the health workers have been trained to cater more specialised care for severe dengue patients. These critical measures have led the country to report a low case fatality rate of less than 0.1% in 2023. All suspected dengue cases are reported within 24 to 48 hours and response activities on eliminating mosquito breeding sites, mosquito larvae surveys, and health education are implemented to mitigate further transmission and emergence of outbreaks. Any dengue related death must be notified to the national dengue control unit within 24 hours. The death must be investigated at the institutional level and at the field level. A confidential death review is conducted to find out whether the patient has been managed according to the national guidelines for dengue management and to identify areas for improvement. The blood samples of a subset of dengue patients are tested for serotypes. The proportion of circulating serotypes is dynamic and when the predominant serotype changes, there is a high tendency for outbreaks because most people are non-immune to that serotype[3].

In Sri Lanka, dengue vector surveillance is carried out regularly for effective vector control measures. Source reduction, chemical methods including adulticide through fogging, and larvicide measures, biological methods such as application of larvivores fish and *Bacillus thuringiensis* subsp. *israelensis* (Bti) bacteria are implemented as vector control measures[4,5].

Political support and collaboration across government and non-government sectors are in place for effective dengue control efforts, with emphasis on community engagement. The Presidential Task Force was appointed by His Excellency the President of Sri Lanka to strengthen multisectoral collaboration and implementation of strategies at all administrative levels.

Despite several efforts in vector surveillance, clinical management, and community engagement, dengue continues to impose a high health and economic burden on Sri Lankan society. The situation is aggravated by environmental factors, including climate change and rapid urbanization, which create favourable conditions for mosquito breeding[6,7]. Hospitals are overcrowded with dengue patients, especially during outbreaks, compromising the health care for other diseases and straining already limited resources. The cost associated with dengue is substantial, including direct medical costs for treatment and control measures as well as indirect costs due to lost

✉To whom correspondence may be addressed. E-mail: sampath.kumara2024@outlook.com

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productivity stemming from the illness and death. The psychological impact of frequent outbreaks creates a sense of fear, distress, and anxiety.

In Sri Lanka, several strategies have been used to prevent and control dengue. However, areas for further improvement have been noted.

Insecticides have been used for fogging, especially during outbreaks, and larvicides are used to control breeding sites. However, the effectiveness of insecticides tends to reduce due to increasing resistance in mosquitoes. Mosquito breeding source reduction is essential in controlling dengue in Sri Lanka. However, sustainability and community cooperation are challenging to maintain over time.

Innovative vector control strategies, such as the release of *Wolbachia*-infected mosquitoes, to reduce the dengue mosquito's capability to spread the virus have been initiated in Sri Lanka; however, the continuous implementation and expansion of the initiative is slow due to interrupted flowing of funds.

Community awareness campaigns have shown some success but not necessarily translated into action, as evident by continued improper waste disposal and delay in seeking treatment. No proper analysis has been carried out to determine the knowledge gap in the community and the most effective mode of delivery of behaviour change communication[8].

The management of severe dengue cases has improved significantly in recent years in Sri Lanka, mainly due to abiding by the national protocols and regular capacity building programs. However, close monitoring and ensuring the sustainability of skills and motivation among the health staff along with adequate supply of required logistics is sometimes a challenge due to the economic crisis of the country and health care worker migration.

The use of currently available dengue vaccines is limited in Sri Lanka due to its safety concerns in people due to inadequate research evidence on its adaptability to the country and lack of resources to assess the eligibility of the community to receive the vaccine.

A multisectoral approach to dengue control ensures that dengue prevention is not entirely the responsibility of the health sector and the importance of partnership with urban planning, waste management, political commitment, and community mobilization[9]. However, the implementation is often interrupted by limited resources, overwhelming other health priorities. In addition, political and administrative changes result in inconsistencies in the implementation of activities.

Advanced research must be implemented to investigate the adaptability of evidence-based strategies and to execute novel strategies. This needs capacity-building for research and assistance from international agencies in terms of technical and financial support.

Here are some recommendations:

1. Implementation of more targeted and culturally sensitive behaviour change communication programs focusing on emphasising the personal responsibility of individuals in preventing dengue is needed.

2. Sri Lanka should focus on innovative strategies such as the release of *Wolbachia*-infected mosquitoes, which have shown a reduction of dengue transmission. The use of sterile insect techniques, which encompasses releasing sterile male mosquitoes to reduce the population, should also be considered.

3. Strengthening the combining of real-time data from various sources, such as climate data and vector surveillance, along with the usage of predictive models combined with geographic information systems should be used to guide decision-making.

4. Expanding the capacity of the health work force and hospital facilities is essential for reducing the strain on the health system. This includes ensuring the availability of medical logistics, continuous training, and expanding the work force in dengue case management.

5. Expanded and continuous multisectoral collaboration is crucial in dengue control. Strengthening partnerships with national and internal agencies for technical and funding support in vector control efforts is essential to achieve notable progress in reducing dengue transmission by achieving long term strategic targets of the Sustainable Development Goals.

In conclusion, climate changes and environmental, social, and behavioural factors continue to facilitate the transmission of dengue fever. Dengue fever is one of the major public health problems in Sri Lanka. The reporting of dengue is still high during monsoon rain seasons every year despite continuous control measures. However, Sri Lanka has shown excellent performance in lowering dengue death rates. Sri Lanka can significantly lower the burden of dengue and lower the seasonal epidemic curve if more innovative control measures are put into place.

Conflict of interest statement

There is no competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Authors' contributions

SIK and SS contributed to the concept, content, and literature search. SIK and SS wrote the article. The manuscript has been read and approved by all the authors.

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