

Original Article: **Dengue Outbreak Control and Prevention: A Case Study of Gampaha District, Sri Lanka**

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Keywords: Dengue, Gampaha District, Sri Lanka, public health, data-driven decision-making

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Abstract

Dengue fever remains a persistent public health challenge in Gampaha District, Sri Lanka. Despite ongoing efforts by the Ministry of Healthcare, Nutrition & Indigenous Medicine, the district reported 10,212 cases in 2022, with significant hospital admissions and deaths in high-risk areas like MC Negombo, Gampaha, and Minuwangoda. The study examines Dengue control and prevention strategies implemented from November 2022 to March 2023. Data was collected from existing records, interviews with key informants, and field observations. Major challenges were identified and prioritised using evidence-based methodologies, including the "Five Whys" root cause analysis. The analysis revealed significant challenges categorised into program-related and non-program-related issues. Key issues include inadequate use of existing data, insufficient evidence-based control measures, and operational inefficiencies. The root cause analysis identified

core problems such as lack of funding, poor planning, and limited community engagement. The study highlights the critical need for data-driven decision-making and enhanced collaborative efforts. Establishing a technical body, develop context-specific programs, and improve community involvement. Resource mobilisation for research and forecasting epidemics was also emphasised. This case study provides valuable insights into the challenges and strategic interventions necessary for effective Dengue control in the Gampaha District. Emphasising evidence-based decision-making and a comprehensive action plan underscores the importance of collaborative efforts to combat Dengue in the region.

Keywords: Dengue, Gampaha District, Sri Lanka, public health, data-driven decision-making

Introduction

Dengue is a viral infection transmitted to humans through the bite of infected mosquitoes, primarily *Aedes aegypti* and, to a lesser extent, *Aedes albopictus* [1]. There is no specific treatment for Dengue or severe Dengue, but early detection and proper medical care can reduce fatality rates to below 1%. Dengue is prevalent in tropical and subtropical regions, especially in urban and semi-urban areas, and its global incidence has grown dramatically, with about half of the world's population now at risk [2]. An estimated 100-400 million infections occur annually, although over 80% of these cases are generally mild and asymptomatic. Effective prevention and control of Dengue rely heavily on vector control measures, and sustained community involvement can significantly enhance these efforts [3].

Dengue fever and the more severe Dengue Haemorrhagic Fever (DHF) became nationally notifiable diseases in Sri Lanka in 1996. The highest number of dengue cases was reported during the 29th week of 2017 [4]. The disease has a seasonal transmission pattern in Sri Lanka, with peaks occurring during the monsoon rains in June-July and October-December. Currently, nearly all districts in the country report dengue cases, with the Western Province's Colombo, Gampaha, and Kalutara districts recording the highest case rates, particularly during epidemic years. Approximately 41.8% of dengue cases in Sri Lanka are reported from the Western Province [5].

Gampaha District is one of the most affected areas by the dengue menace. It has a history of high infection rates and deaths due to Dengue. Medical Officer of Health (MOH) areas such as Kelaniya, Gampaha,

Ja-Ela, Mahara, Wattala, MC Negombo, Ragama, and Attanagalle have been identified as high-risk areas. Gampaha District is ranked as the second most affected area, and it also has the highest socio-economic status in the Western Province, indicating a high potential for rapid dengue spread if control measures are not effectively implemented [6].

The Ministry of Health (MoH), along with other agencies, has intensified dengue prevention and control activities. At the national level, a National Task Force on Dengue Prevention and Control, chaired by the Secretary of Health, and an Advisory Committee on Communicable Diseases, chaired by the Director General of Health Services (DGHS), meet regularly to review the situation and make policy decisions to enhance activities. The Epidemiology Unit monitors disease trends and alerts all health authorities at the district and divisional levels. Vector surveillance and integrated vector control activities are conducted in all high-risk areas, with the Anti-Malaria Campaign leading vector surveillance and control, supported by the Entomology Division of the Medical Research Institute and the Anti-Filariasis Campaign.

Epidemiological Trend in Gampaha District

In 2022, Gampaha District reported 10,212 dengue cases. During the 49th week, 402 suspected cases were reported, marking a 4.4% increase compared to the previous week. Despite ongoing efforts, the incidence of Dengue Fever (DF) and Dengue Hemorrhagic Fever (DHF) has increased exponentially [7].

High-risk MOH areas within the district, including MC Negombo, Gampaha, Minuwangoda, Ragama, Katana, Seeduwa, and Meerigama, have shown increasing

trends in dengue cases. These areas were identified as priorities based on suspected case distributions [8].

In 2022, there were seven dengue-related deaths in the district, including two in Biyagama, three in Ja-Ela, one in Negombo, and one in Ragama. Entomological surveillance is crucial for dengue prevention and control, as emphasised by the World Health Organisation (WHO). Reducing dengue vector populations involves eliminating breeding sources, such as small containers around human dwellings. Dengue control is achievable through advocacy, social mobilisation, legislation, inter-sector collaboration, and an integrated approach to disease control and prevention [9].

National Strategies for Dengue Control in Gampaha District

The following strategies are carried out to control DF/DHF in Gampaha District:

1. Surveillance:

- Disease Surveillance: Continuous monitoring and reporting of dengue cases to track the disease's spread and identify emerging hotspots [7].
- Vector Surveillance involves regular assessments of mosquito populations, breeding sites, and distribution patterns. This helps identify high-risk areas and effectively time interventions [5].
- Laboratory Surveillance (Serological): Testing blood samples from suspected dengue patients to confirm infections. This includes both rapid diagnostic tests and more comprehensive laboratory analyses to determine the prevalence of dengue virus serotypes.

2. Management of DF/DHF Cases:

- Ensuring that healthcare facilities are equipped to manage dengue cases effectively, including having protocols for the early detection and treatment of severe cases [10].

3. Vector Control:

- Source Reduction: Eliminating mosquito breeding sites by managing stagnant water in containers, tyres, and other potential habitats around homes and public spaces.
- Chemical Control: Using insecticides to reduce adult mosquito populations and larvicides to target larvae. This includes fogging operations in high-risk areas and applying larvicides in water bodies that cannot be eliminated [11].
- Biological Control: Introducing natural predators or competitors to reduce mosquito populations, such as fish that eat mosquito larvae.

4. Social Mobilisation:

- Engaging communities in dengue prevention efforts through awareness campaigns, educational programs, and community clean-up drives. This includes schools, workplaces, and residential areas [12].

5. Emergency Response:

- Establishing rapid response teams to address outbreaks swiftly, including deploying additional healthcare workers and resources to affected areas.

Objective

To assess the implementation of dengue control and prevention measures in

Gampaha District and propose solutions to strengthen these measures.

Design

This case study employed a mixed-method approach to evaluate the implementation of dengue control and prevention measures in the Gampaha District. The research design incorporated both qualitative and quantitative methodologies to gather comprehensive data.

Methods

The primary data collection methods included direct observations, key informant interviews, and discussions with relevant public health officials and staff. Additionally, a thorough evaluation of records related to dengue control activities and their outcomes was conducted. The nominal group technique was used to identify and prioritise the key problems hindering effective dengue control in the district.

Data Collection

The methodology for gathering information on the implementation of dengue control and prevention measures in the Gampaha District involved several key steps:

1. **Direct Observations:** Field visits and direct observations were conducted to assess the on-ground implementation of dengue control measures. These observations provided real-time insights into the challenges and effectiveness of ongoing activities.
2. **Key Informant Interviews:** In-depth interviews were held with key public health officials, including the Regional Director of Health Services (RDHS), Regional Epidemiologist (RE), and Public Health Inspectors

(PHIs). Discussions were also conducted with selected staff from the RDHS office in Gampaha to gather detailed information on the operational challenges and success factors in dengue control.

3. **Discussions and Evaluations:** Focused group discussions were held with the RDHS, RE, Senior Public Health Inspectors (SPHI), and other relevant stakeholders to understand the perspectives and experiences of various actors involved in dengue control efforts. Additionally, records related to dengue control performance and outcomes were thoroughly evaluated to identify gaps and areas for improvement.

Problem Identification

Based on the information gathered through direct observations, interviews, and discussions, problems were identified and categorised into two main areas:

- Program-Related Problems
- Non-Program-Related Problems

Problem Prioritisation

The nominal group technique was used to prioritise problems. This technique involved gathering opinions from key stakeholders, including the RDHS, RE, SPHI, and other relevant personnel. Problems were prioritised based on their feasibility, cost-effectiveness, urgency, and impact on outcomes. The problem that received the highest score, "Use of existing data and evidence-based control and prevention measures," was selected for further in-depth analysis.

Root Cause Analysis

The root cause analysis of the prioritised problem was conducted using the "Five

Whys" technique. This method involved asking "Why?" multiple times to drill down into the underlying causes of the problem.

Results

The investigation into the implementation of dengue control and prevention measures in Gampaha District revealed several critical findings.

Identified Problems

The problems were divided into two major categories: program-related and non-program-related issues.

Program-Related Problems:

1. Program planning
2. Allocation of resources
3. Use of existing data and evidence-based control and prevention measures
4. Monitoring and evaluation of implemented measures
5. Staff training and supervision

Non-Program-Related Problems:

- Managerial issues: Lack of coordination and cooperation among public health authorities and local government institutions
- Environmental issues: Increasing use of non-biodegradable plastics and poor disposal systems, rapid urbanisation with inadequate health infrastructure
- Community/Social issues: Poor community participation in mosquito breeding site management, lack of awareness
- Demographic issue: High population density in Gampaha district
- Geographical issue: Climatic conditions conducive to mosquito

breeding, including high rainfall and warm temperatures

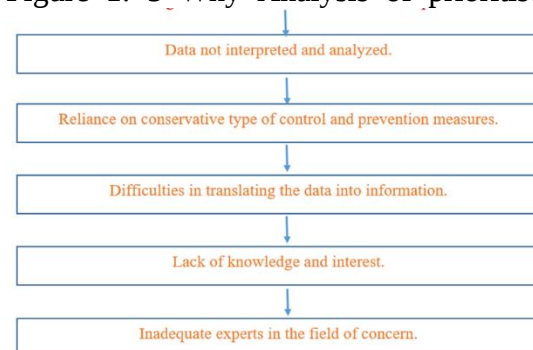
Prioritisation of Problems

Using the nominal group technique, stakeholders prioritised the identified problems based on feasibility, cost-effectiveness, urgency, and impact on outcomes. The problem with the highest priority was the "Use of existing data and evidence-based control and prevention measures."

Root Cause Analysis

The root cause analysis of the prioritised problem using the "Five Whys" technique identified the following underlying issues:

Figure 1: 5 Why Analysis of prioritised



problem "Use of existing data and evidence-based control and prevention measures"

Discussion

The results of this case study highlight significant challenges in the implementation of dengue control and prevention measures in the Gampaha District. The identification of both program-related and non-program-related problems provides a comprehensive understanding of the multifaceted issues impacting dengue control efforts.

One of the most critical findings is the insufficient use of existing data and

evidence-based control and prevention measures. The root cause analysis revealed that data is not being effectively interpreted and utilised to inform decision-making. This gap is compounded by a reliance on traditional, less effective control measures and a general lack of knowledge and expertise among staff. Addressing these root causes is crucial for enhancing the efficacy of dengue control programs.

The prioritisation of problems using the nominal group technique highlighted the urgency and impact of improving data utilisation and evidence-based practices. By focusing on this priority, there is potential to make significant strides in reducing dengue incidence and improving public health outcomes in Gampaha District.

Environmental and community-related issues also play a substantial role in dengue transmission. The improper disposal of non-biodegradable waste and rapid urbanisation without adequate health infrastructure create breeding grounds for mosquitoes. Additionally, low community participation in mosquito control efforts further exacerbates the problem. These findings suggest that a more integrated and community-focused approach is necessary to address the environmental and social determinants of dengue transmission.

Managerial and demographic factors, such as lack of coordination among health authorities and high population density, add another layer of complexity to the dengue control efforts. Strengthening managerial coordination and engaging local government institutions more effectively could enhance the overall response to dengue outbreaks.

Conclusion

Dengue control is a complex yet achievable goal that hinges on several key strategies: advocacy, social mobilisation, legislation, collaboration within and beyond the health sector, and an integrated approach to disease control. The Gampaha District case study emphasises the necessity of evidence-based decision-making and capacity building to address this persistent public health challenge effectively. Entomological surveillance has proven crucial in controlling outbreaks by providing early warnings, which enhance the district's response to Dengue during critical periods. These early warnings significantly reduce the impact of outbreaks, disease transmission, healthcare burdens, and potential mortalities.

Effective dengue control and prevention in Gampaha District require a strong system for utilising data and information scientifically. This entails thorough data interpretation and analysis to inform evidence-based decisions at the field level. The study highlights the need for sustained efforts in these areas to achieve significant improvements in managing Dengue.

Recommendations

To effectively tackle dengue outbreaks in Gampaha District, the following recommendations and plan of action are proposed:

1. **Data-Driven Evidence-Based Decision Making:**
 - Establish a comprehensive system to ensure that decisions at the operational level are based on robust data and evidence.
 - Implement mechanisms for systematic data collection, storage, interpretation, and analysis.

- Equip the system with experts in public health, clinical medicine, information technology, and other relevant fields.
2. Forming a Technical Body:
 - Create a technical body comprising necessary experts and stakeholders to ensure timely data analysis and interpretation.
 - This body should include representatives from various sectors, including health, academia, and technology.
 3. Effective Dengue Prevention and Control Programme:
 - Develop and sustain a dengue prevention and control programme tailored to the specific regional context of Gampaha District.
 - Ensure that the programme is adaptable and responsive to changing disease patterns and trends.
 4. Forecasting and Preventing Epidemics:
 - Utilise past disease trends to forecast and prevent future dengue epidemics.
 - Implement predictive models and early warning systems to stay ahead of potential outbreaks.
 5. Strengthening Liaison and Social Mobilisation:
 - Enhance collaboration with civil society groups, non-governmental organisations, the media, and other stakeholders.
 - Foster community engagement and participation in dengue control efforts to improve effectiveness.
 6. Resource Mobilisation for Research:
 - Identify and mobilise resources to conduct ongoing research on Dengue.
 7. Reducing Morbidity and Mortality:
 - Focus on innovative solutions and strategies to combat Dengue more effectively.
 - Implement targeted interventions to reduce the morbidity and mortality associated with Dengue Fever (DF) and Dengue Haemorrhagic Fever (DHF).
 - Ensure that healthcare facilities are well-equipped and healthcare workers are adequately trained to manage dengue cases efficiently.

By focusing on these areas, the Gampaha District can significantly enhance its dengue control and prevention efforts, leading to better public health outcomes and a reduction in the disease's overall impact.

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