

A comprehensive integrated review of malaria, leishmaniasis, filariasis and dengue control programmes in Sri Lanka

Report of a WHO mission, 13-20 May 2024



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சுகாதார அமைச்சு
Ministry of Health



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Acronyms and abbreviations

ACD	Active Case Detection	PHC	Primary Health Care
ACT	Artemisinin-based Combination Therapies	PHFO	Public Health Field Officer
AFC	Anti-Filariasis Campaign	PHI	Public Health Inspector
AMC	Anti-Malaria Campaign	PHM	Public Health Midwife
CCP	Consultant Community Physician	PHLT	Public Health Laboratory Technician
DDT	Dichloro-Diphenyl-Trichloroethane	PHNS	Public Health Nursing Sister
DENV	Dengue Virus	PMoH	Provincial Ministry of Health
DGHS	Director-General of Health Services	RDHS	Regional Director of Health Services
EA	Entomological Assistant	RDT	Rapid Diagnostic Test
FHB	Family Health Bureau	RE	Regional Epidemiologist
FTS	Filaria Test Strip	RFCU	Regional Filaria Control Unit
HEO	Health Entomology Officer	RMO	Regional Malaria Officer
IVM	Integrated Vector Management	SMO	Spray Machine Operator
KAP	Knowledge, Attitudes and Practices	SOP	Standard Operating Procedure
LLIN	Long-Lasting Insecticidal Nets	SPHM	Supervising Public Health Midwife
MDA	Mass Drug Administration	TAS	Transmission Assessment Survey
Mf	Microfilaria	TDR	The Special Programme for Research and Training in Tropical Diseases
MMDP	Morbidity Management and Disability Prevention	TSG	Technical Support Group
MO	Medical Officer	VBDs	Vector-Borne Diseases
MOH	Medical Officer of Health	WHO	World Health Organization
MRI	Medical Research Institute	WHO-SEARO	WHO Regional Office for South-East Asia
NaDSys	National Dengue Surveillance System		
NDCU	National Dengue Control Unit		
NSP	National Strategic Plan		
PCD	Passive Case Detection		
PCR	Polymerase Chain Reaction		
PDHS	Provincial Director of Health Services		



Executive summary

Providing free health care, the health system of Sri Lanka has achieved significant successes; this has led to high immunization coverage and impressive public health outcomes. Maternal mortality stands at 25.7 per 100 000 live births and infant mortality at 8.5 per 1000 live births. The country has eliminated diseases such as polio, malaria, rubella, measles, lymphatic filariasis and leprosy as public health concerns, with no reported cases of mother-to-child HIV/syphilis transmission since 2019. In 2024, Sri Lanka attained certification for hepatitis B control as well.

However, vector-borne diseases (VBDs), notably dengue fever, endemic across all districts with recurring outbreaks, remain a challenge. Although malaria was declared eliminated in 2016, imported cases pose a re-introduction risk. Although not a public health issue since 2016, lymphatic filariasis persists in localized areas due to importations and insufficient disease prevention efforts. Cutaneous leishmaniasis has emerged as a concern, requiring a strategic plan for prevention and treatment.

The Ministry of Health (MoH) oversees disease control through disease-specific national programmes (campaigns), supported by provincial and regional health directorates. A comprehensive programme review was convened to enhance effectiveness and efficiency in disease control efforts, leveraging expert input for integrated strategies.

The overall objective of the mission was to conduct a comprehensive integrated review of the prevention and control programmes of dengue, malaria, lymphatic filariasis and leishmaniasis in Sri Lanka. An expert team, comprising international specialists in the fields of public health, medical professionals and entomologists, was constituted by the World Health Organization Regional Office for South-East Asia (WHO-SEARO), in consultation with the WHO Country Office for Sri Lanka and the Ministry of Health, Sri Lanka, to carry out an Integrated External Review Programme for dengue, malaria, filariasis and leishmaniasis in Sri Lanka.

Anti-Malaria Campaign (AMC)



Established in 1911 and decentralized in 1989, AMC operates under the Deputy Director General of Public Health Service -1, overseeing units for surveillance, case management, and vector control, supported by a network of regional offices.



Despite achieving malaria-free status in 2016, the AMC continues to face the challenges of high malariogenic potential due to frequent imported cases (e.g. mainly from India and African countries) amidst high receptivity and presence of *Anopheles stephensi*, the urban malaria vector introduced to the country in 2017.

The structure of the AMC includes a Technical Support Group and a Case Review Committee to ensure robust surveillance and response mechanisms. Surveillance efforts utilize both passive and active case detection. Case management emphasizes rapid diagnosis and treatment adherence, supported by a network of microscopy centres and trained personnel. Entomological surveillance targets key vectors such as *An. culicifacies* and *An. stephensi*, with control measures including elimination of breeding sites, larvicides, fish control and insecticide-treated nets.

However, frequent importation of malaria cases, high receptivity, waning attention and awareness among clinicians, and maintaining health-care provider competencies are significant concerns. Political and financial support must be sustained amid competing public health priorities and economic constraints. Collaboration with sectors such as defence, labour, tourism and education is crucial to prevent re-introduction of malaria, particularly in areas receptive to the disease.

To address these challenges, the AMC should prioritize several recommended actions. Firstly, it needs to enhance surveillance and response capabilities, focusing resources on high-risk areas and strengthening entomological surveillance. Training and retaining skilled personnel, particularly in malaria diagnosis and treatment, are essential to maintain readiness despite declining case numbers. Additionally, community engagement in previously endemic areas must be intensified to heighten awareness and vigilance against malaria re-introduction.

Strategic collaboration with international and local partners should be leveraged to secure funding and technical support for sustained malaria prevention efforts. The AMC should also advocate for continued investment in malaria prevention within the broader context of national health priorities. These actions are critical not only to preserve Sri Lanka's malaria-free status but also to serve as a global model for malaria eradication efforts, offering expertise and support to other countries facing similar challenges.

Anti-Filariasis Campaign (AFC)

Since its inception in 1947, the Anti-Filariasis Campaign (AFC) in Sri Lanka has successfully tackled LF, achieving WHO validation of elimination as a public health problem in 2016.

However, lymphatic filariasis remains endemic in eight districts, primarily transmitted by *Culex quinquefasciatus* and *Mansonioides* species, with recent reports indicating a resurgence of zoonotic Brugian filaria species.

Post-validation surveillance (PVS) efforts from 2016 to 2024 have focused on rigorous parasitological and entomological surveys, though limited by cost constraints affecting serological surveys. Operational inefficiencies have been noted, particularly in the extensive yet low-yield microfilaria (Mf) surveys, prompting a call for a more targeted approach to scale down these efforts effectively. Entomological surveys, while extensive, lack clear objectives and fail to sufficiently complement Mf surveys. Accessibility to Morbidity Management and Disability Prevention (MMDP) clinics for lymphoedema patients also requires scaling up.

To maintain and advance towards total interruption of lymphatic filariasis transmission, the AFC proposes several strategic initiatives. Firstly, enhancing surveillance quality through digitalization of data across parasitological, entomological and clinical domains is prioritized. Implementing comprehensive digital systems promises to streamline data collection, storage and analysis, improving operational efficiency and facilitating evidence-based decision-making.

Microstratification and risk mapping will be pivotal, utilizing collected data to develop precise risk maps for each Medical Officer of Health (MOH) area. These maps will identify residual infection hotspots, enabling targeted interventions and resource allocation. Geostatistical modeling techniques will further optimize surveillance efforts, enhancing the precision of lymphatic filariasis transmission dynamics monitoring and resource deployment.

Regular training sessions are deemed crucial to maintaining high surveillance standards. These sessions will enhance staff proficiency in microscopy, entomological techniques and data analytics, ensuring robust and effective surveillance practices. Introduction of sensitive diagnostic tools such as filaria test strip (FTS) to enhance infection detection capabilities and addressing the resurgence of *B. malayi* are a priority, with the AFC planning comprehensive strategies in collaboration with WHO, potentially integrating ivermectin to improve treatment efficacy.

Managing immigrant populations from endemic countries is also essential. The AFC aims to develop cost-effective treatment plans tailored to these populations, leveraging existing migrants registers and implementing preventive chemotherapy programmes to reduce lymphatic filariasis transmission and overall disease burden.

Integrating MMDP services into primary health care (PHC) facilities is a key initiative to enhance accessibility for lymphoedema patients, particularly in remote areas. Lastly, intensifying community and household vector control measures, such as promoting insecticide-treated bednets and environmental sanitation, will be critical in sustaining lymphatic filariasis elimination efforts.

In summary, the AFC is committed to refining its surveillance strategies and implementing targeted interventions to consolidate lymphatic filariasis elimination achievements and move closer to interrupting transmission in Sri Lanka. These efforts, bolstered by international collaboration and a community health focus, aim to achieve a sustainable impact on public health in the Region.

National Dengue Control Unit

The National Dengue Control Unit (NDCU) in Sri Lanka is tasked with managing dengue fever, a significant public health issue affecting all districts. Established formally in 2005 and upgraded in 2012, the NDCU is headed by the Director under the overall supervision and guidance of the Deputy Director-General of Public Health Services 1, overseeing a range of technical units including disease surveillance, vector surveillance and control, intersectoral coordination and social mobilization, risk communication and outbreak preparedness and response, and coordination with the curative sector for evidence-based clinical care. Despite efforts, dengue remains endemic across the country, with cyclical outbreaks occurring frequently in recent years, exacerbated by factors such as urbanization, climate variability and human behaviour.

Dengue virus (DENV) serotypes 1–4 circulate in Sri Lanka, with periodic shifts in dominant serotypes influencing outbreak dynamics. Recent years have seen an increase in adult cases, shifting the demographic burden from children to adults, likely due to immunological shifts and virus serotype changes.

A number of challenges were identified for prevention and control of dengue in Sri Lanka.



Surveillance and reporting: While an established National Dengue Surveillance System (NaDSys) exists, reporting from outpatient departments of all types of hospitals, including private health-care providers, remains inconsistent, impacting early detection and response efforts. Comprehensive seroprevalence surveys are infrequent, hindering accurate disease burden assessment and long-term planning.



Diagnosis and case management: Diagnostic capabilities vary across health-care facilities, with reliance on clinical diagnosis in some instances due to limited availability and affordability of NS1 antigen testing kits. Case-management guidelines are in place, yet decentralization to primary care facilities for non-severe cases can optimize hospital resource allocation during outbreaks.



Vector surveillance and control: *Aedes aegypti* and *Ae. albopictus* are the primary vectors, with high resistance to pyrethroids and organophosphates reported in certain districts. Current vector control strategies include source reduction, larvicides and fogging, but coverage gaps during interepidemic periods remain, exacerbating risk during outbreak seasons.



Advocacy and social mobilization: Communication efforts lack centralized oversight, leading to inconsistencies in messaging and outreach effectiveness. While community mobilization exists through local health initiatives and partnerships, sustained engagement across all demographic groups and high-risk areas is lacking.

Addressing the challenges faced by the NDCU requires a holistic approach encompassing enhanced surveillance, effective vector control, coordinated advocacy efforts, and sustained community engagement. By implementing the following recommended strategies, Sri Lanka can strengthen its response to dengue outbreaks, mitigate transmission risks, and improve overall public health outcomes in the long term.

- **Firstly**, develop a comprehensive National Strategic Plan for Dengue Prevention and Control 2024-2030, incorporating enhanced surveillance, integrated vector management, and sustained community engagement strategies.
- **Secondly**, improve case-detection and notification systems by integrating reporting from general practitioners and outpatient departments of all hospitals, including the private-sector ones, into NaDSys, enhancing diagnostic capacity with combined NS1/IgM testing, and conducting regular seroprevalence surveys to better understand disease burden and trends.
- **Thirdly**, prioritize effective vector surveillance methods, optimize larviciding and fogging strategies, monitor insecticide resistance, and explore innovative techniques, such as Wolbachia and sterile insect technique, under a unified national framework.
- **Fourthly**, establish a cohesive national communication strategy with standardized messaging, leverage digital platforms for targeted outreach, and strengthen community partnerships to foster sustained behavioral change and public engagement.
- **Finally**, invest in research aligned with public health priorities, enhance data analytics for evidence based decision-making, and build managerial capacity within the NDCU to support integrated vector management and cross-disease collaboration.

Leishmaniasis Control Programme

Leishmaniasis, particularly cutaneous leishmaniasis, has emerged as a pressing public health issue in Sri Lanka, particularly affecting regions in the north-central and southern parts of the country. With approximately 300 cases reported annually, the disease has seen sporadic instances of visceral leishmaniasis over the past decade. Notified as a disease of concern since 2008, the management of leishmaniasis falls under the purview of the AMC, headed by its Director. The AMC oversees a decentralized structure, with provincial health directors supervising entomological activities through regional malaria officers and public health inspectors.

Historically, leishmaniasis was first documented in Sri Lanka in 1904, with indigenous cases reported until 1953. Following extensive dichloro-diphenyl-trichloroethane (DDT) spraying for malaria control, there was a prolonged absence of reported cases until a resurgence in 1992. In recent years, there have been alarming spikes in cutaneous leishmaniasis cases, with a fifteen-fold increase reported in 2010 and a subsequent ten-fold rise by 2019, culminating in annual incidences reaching up to 3000 cases. High case-loads have been found to be concentrated in districts such as Anuradhapura, Polonnaruwa, Kurunegala, Hambantota and Matara.

The causative agent for cutaneous leishmaniasis has been identified as *Leishmania donovani* MON-37, although the specific vector species responsible for transmission remains uncertain. This uncertainty, coupled with limited understanding of vector bionomics and low public awareness, has contributed to the propagation of the disease. Concerns persist regarding underreporting of both cutaneous and visceral forms of leishmaniasis, highlighting gaps in surveillance and diagnostic capabilities.

Surveillance efforts rely primarily on passive case detection, mandated since 2008, with suspected cases required to be reported to local medical officers of health. Diagnostic confirmation typically involves microscopic examination via slit skin smear, conducted by public health laboratory technicians. However, polymerase chain reaction (PCR) and culture-based methods are not widely accessible, limiting diagnostic accuracy. Treatment protocols are similarly constrained, with shortages of antimonial drugs affecting clinical management, necessitating alternative therapies such as hypertonic saline and cryotherapy.

Vector surveillance and control efforts are fragmented, with entomological investigations sporadically conducted by health entomology officers and researchers from national universities. The absence of a cohesive entomological surveillance strategy and guidelines further complicates control efforts, exacerbated by technical and financial constraints.

Despite these challenges, the Leishmaniasis Control Programme benefits from collaboration with local academic institutions and research organizations, providing essential support for entomological research. However, strategic planning for disease control is in its infancy, with efforts underway to develop a comprehensive national action plan. Recommendations include enhancing case management guidelines, ensuring sustained drug availability, improving surveillance quality and bolstering vector control capacities through integrated vector management (IVM) approaches.

In conclusion, Sri Lanka faces a critical juncture in addressing the resurgence of leishmaniasis, necessitating coordinated efforts to strengthen surveillance, diagnostics, treatment protocols, and vector control strategies. Public health responses must be robust, adaptive, and informed by comprehensive epidemiological data to effectively mitigate the spread and impact of this neglected tropical disease.

Overarching and cross-cutting areas

Sri Lanka holds a commendable track record of elimination of diseases, including malaria and lymphatic filariasis, among others. All vector-borne disease programmes are adequately resourced in terms of disease-specific, highly committed and dedicated human resources at all levels and equipment in entomology, vector control and parasitology, implementing extensive and rigorous surveillance (except for leishmaniasis at present).

Each VBD programme/campaign has a strong vertical structure at all levels of the health system, with the national programme/campaign at the central level leading strategic guidance, policy development, resource mobilization and capacity-building for relevant public health workers throughout the health system. Sri Lanka also has a wealth of globally renowned experts on VBDs in its academic community, which must continue to play an important role in generating much-needed scientific evidence for policies and operations.

It was observed that cost-effectiveness and efficiency of programmes can be significantly improved by leveraging opportunities for cross-learning and cross-strengthening among VBD programmes.

To identify and operationalize integration and coordination of common functions (including repurposing of staff) across multiple VBDs to optimize the use of technical expertise and financial resources in an integrated approach without losing the accountability and gains:

- 1 Designate a new position to specifically oversee VBDs to streamline the efforts across various VBD control programmes and to ensure cohesive leadership and accountability, focusing on identifying synergies and preventing duplication of efforts across the malaria, leishmaniasis, filariasis and dengue programmes. Develop terms of reference (ToR) for the new VBD leadership position outlining responsibilities such as:
 - Coordinating integration among different VBD-specific programmes.
 - Leveraging existing human resources and technical expertise to optimize efficiency.
 - Ensuring that VBDs operate under a unified strategy while preserving disease-specific accountability and monitoring.
- 2 Develop an action plan to operationalize integration of common functions (including repurposing of staff) across multiple VBDs.
- 3 Improve data analytics of VBDs for robust data analysis, development of high-resolution risk maps and guiding strategic, targeted and timely response measures, including digitization of data, through designation of VBDs data analytics team and building their capacity.
- 4 Improve quality of surveillance by prioritizing resources for high-risk areas with significant transmission risk while avoiding dilution of surveillance efforts in areas with minimal or no risk. Conduct a risk-based review and stratification of all areas to streamline activities, ensuring that resources and expertise are concentrated where they will have the greatest impact.
- 5 Enhance field staff capacity by improving their skills in critical areas such as vector collection, dissection, and microscopy, while incorporating advanced diagnostic tools and techniques. Specialized training sessions, supported by international and local stakeholders/experts, should be conducted to ensure early detection, timely intervention, and effective outbreak response.
- 6 Strengthen synergistic collaboration between programmes/campaigns and academicians to leverage implementation research to improve programme efficiency, jointly fill knowledge gaps and adapt more innovations.
- 7 Establish a mechanism for intersectoral coordination for all VBDs to address environmental and social determinants of diseases, particularly joint planning, actions and monitoring at national, provincial, district and municipality level.

Annexure 3 summarizes the list of all disease-specific and cross-cutting recommendations.

1

Introduction



Sri Lanka has invested in a health system that has ensured access to free health care for the population and this has resulted in remarkable public health gains. The immunization coverage is over 98%; the maternal mortality ratio was 25.7 per 100 000 live births (2014 data) and the infant mortality rate was 8.5 per 1000 live births (2014 data) (Ministry of Health, 2019). Further, the country has successfully eliminated polio, malaria, rubella and measles; it has also successfully eliminated filariasis and leprosy as public health problems. No mother-to-child transmission of HIV/syphilis has been reported since 2019. In 2024, it has obtained the certificate for control of hepatitis.

VBDs remain a significant health burden though, particularly in comparison to other infectious diseases. Dengue fever is the most common VBD in Sri Lanka, with an incidence rate of 407.5 cases per 100 000 people in 2023. Although the disease has a low annual case-fatality rate of less than 0.1%, it has become endemic in all districts of the country, with large outbreaks occurring every 3–4 years.

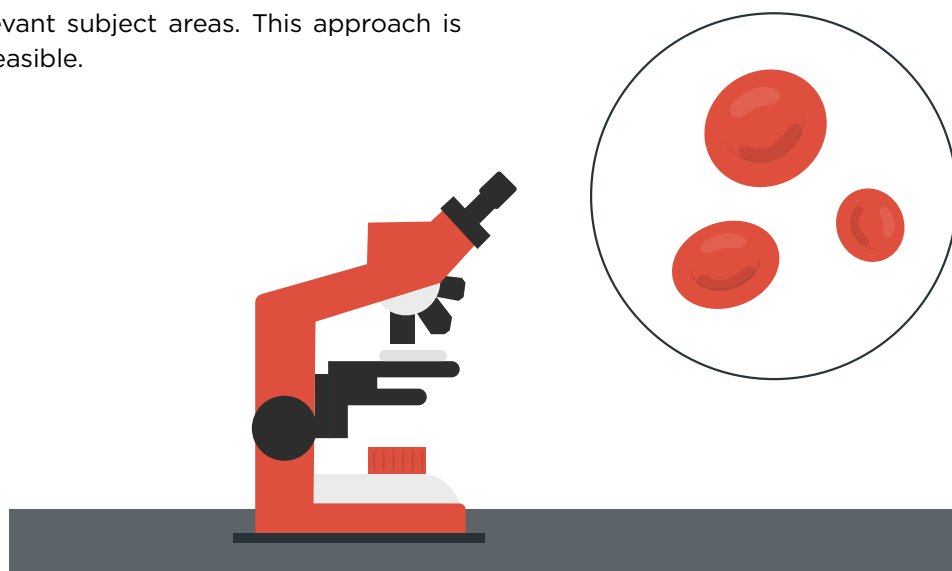
Sri Lanka was declared malaria-free in 2016, but, on average, 40–50 imported malaria cases are detected each year, posing a risk of re-introduction of the disease. Therefore, prevention of such occurrences requires immediate attention.

Though lymphatic filariasis has no longer been a public health issue in Sri Lanka since 2016, a small number of areas still show significant rates of microfilaria. Importations by migrant workers and a lack of stakeholder engagement in preventing the disease are major concerns.

Cutaneous leishmaniasis has become a significant public health issue in Sri Lanka. The disease is spread by sandflies, and a lack of knowledge about vectors and their habits is contributing to the spread of the disease, particularly in some areas of the country. Additionally, there is concern about the possibility of visceral leishmaniasis. To combat this disease, it is necessary to develop a comprehensive strategic plan that includes early identification and treatment of all forms of leishmaniasis as well as measures to prevent its spread. The Ministry of Health (MoH) has recently entrusted the AMC with the responsibility of controlling and preventing leishmaniasis, and with WHO assistance, the first National Strategic Plan has been developed.

Control of all VBDs is supported by vertical programmes at the headquarters, under the Deputy Director -General of Public Health Services 1. The National Dengue Control Unit (NDCU), the AMC and the AFC are the national-level institutions providing overall guidance in the prevention and control of respective diseases. Implementation is carried out at the levels of the Provincial Directorate of Health Services and the Regional Directorate of Health Services, under the administration of the Provincial Director of Health Services and the Regional Director of Health Services respectively. Consultant community physicians/regional epidemiologists, regional malaria officers, regional filaria officers and entomologists provide technical guidance. At the local level, medical officers of health are responsible for implementing control activities.

The Ministry of Health has recognized the need for a comprehensive review of these programmes to identify cost-effective ways of controlling all four diseases. Therefore, a joint integrated comprehensive programme review is conducted with the technical contribution of experts in relevant subject areas. This approach is economical, time-saving and feasible.



2

Objectives of the integrated external review

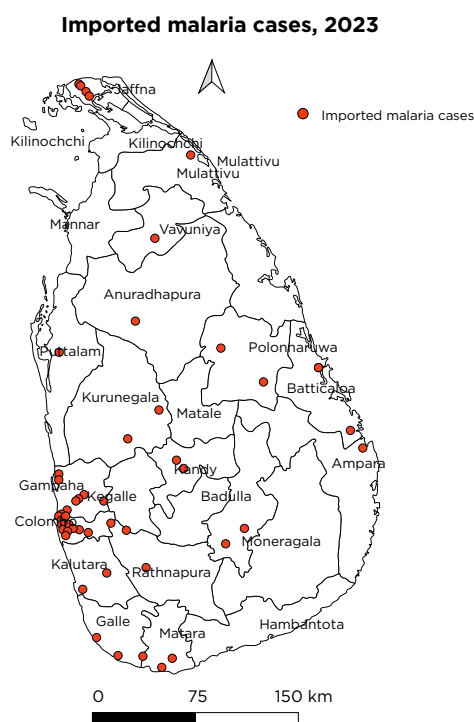


The overall objective of the mission was to conduct a comprehensive integrated review of the prevention and control programmes of dengue, malaria, lymphatic filariasis and leishmaniasis in Sri Lanka. The team aimed to review existing strategies, identify gaps and challenges, and provide recommendations for improvement of the programmes.

The specific aims of the review were to:

- review progress towards achieving the goal and objectives of the current National Strategic Plan (NSP), including analysis of overall programme impact on burden (incidence, prevalence and mortality) and overall programme coverage and outcomes;
- review the data management capacity to monitor disease trends progress of the programmes and stockout of major commodities;
- review communication and collaboration between implementing partners;
- analyse how partners contributed to the observed coverage, outcomes and impact;
- make recommendation for improving dengue control, keeping the prevention of re-establishment state for malaria, elimination of lymphatic filariasis, accelerate the Leishmaniasis Control Programme and make recommendations on how to revise the current NSP;
- review existing strategies, identify gaps and challenges, and suggest recommendations to improve the programmes, including the areas of potential integration and coordination among VBD programmes and beyond.

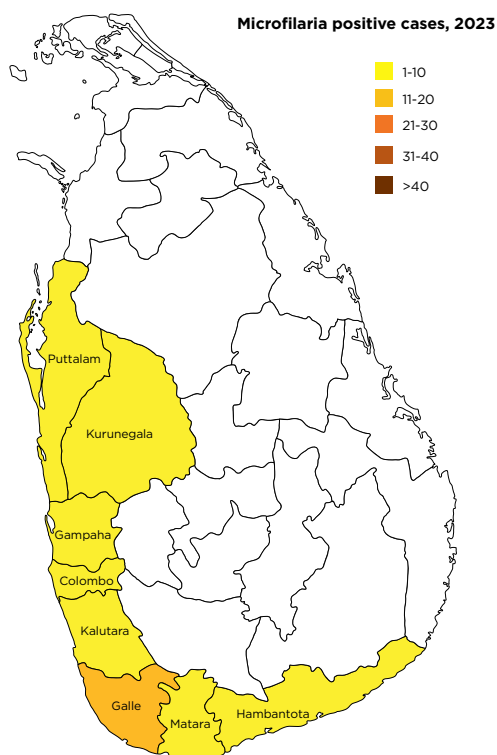
The following areas and items were reviewed for each of the diseases.



Sri Lanka reported no indigenous cases since 2013.

Malaria

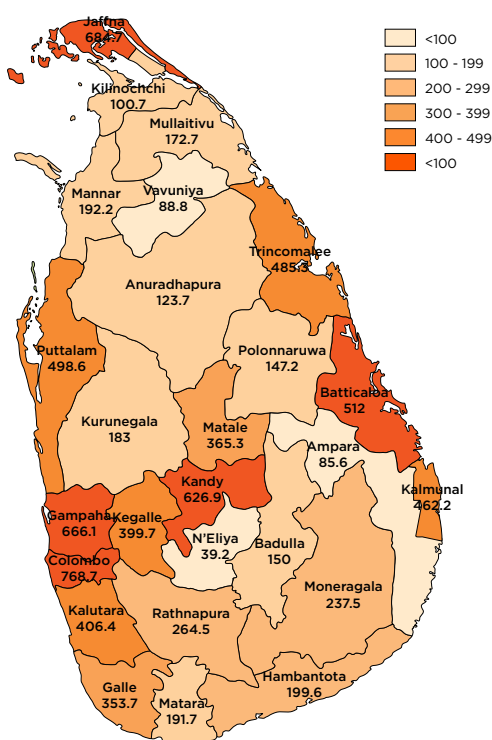
- existing disease, entomological and parasitological surveillance systems to assess their suitability for preventing the re-establishment of malaria in Sri Lanka
- implementation status of the key prevention of re-establishment activities in Sri Lanka and assessment of the programme's preparedness for outbreak prevention and response;
- existing strategies, identifying strengths, gaps, weaknesses, threats and opportunities, and making recommendations to strengthen the programme for preventing re-establishment of malaria, including in the areas of potential integration and collaboration among VBD programmes and beyond.



Lymphatic Filariasis

- existing disease, entomological and parasitological surveillance system;
- implementation status of key control activities;
- strengths, weaknesses, challenges and opportunities in the implementation of lymphatic filariasis activities (preventive, control, diagnostic and management);
- discussions/interviews with national- and subnational-level programme implementers to identify challenges to implementing programmatic activities;
- discussions with the country stakeholders and technical partners at central and regional levels to generate opinion on control strategies/programme implementation;
- entomological and parasitological techniques in order to formulate cost-effective integrated techniques to improve surveillance;
- gaps in national lymphatic filariasis research evidence and development of a nationally important and timely needed operational research plan and training needs for VBDs, including lymphatic filariasis;
- standard operating procedures (SOPs) and other relevant documents and providing recommendations for further improvement;
- other parallel health system development initiatives/plans (i.e. primary health care strengthening, human resource and development planning, etc.), which will have an impact on present and future control programmes in the country;
- key strategies in the NSP considering global strategies and providing recommendations for improvement, including the areas of potential integration and coordination among VBD programmes and beyond.

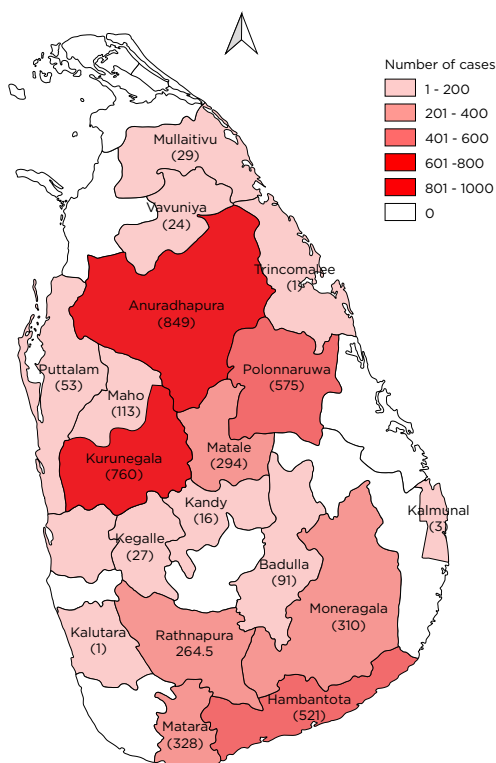
Dengue incidence in Sri Lanka, 2023



Dengue

- existing dengue disease and entomological surveillance systems;
- current practices and health system capacity for case diagnosis, clinical management and their outcomes;
- existing approach on vector surveillance and vector control;
- key strategies in the current NAP 2019-2023 in reference to global strategies to provide recommendations for improvement and development of the new NSP (2024-2030), including the areas of potential integration and coordination among VBD programmes and beyond;
- gaps in national dengue research and identifying key operational research areas;
- training needs for dengue.

Leishmaniasis cases in Sri Lanka, 2023

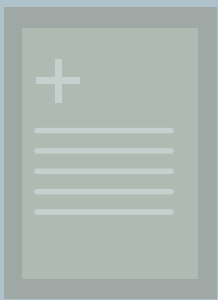


Leishmaniasis

- epidemiology of cutaneous and visceral leishmaniasis
- existing disease surveillance system on leishmaniasis
- vector surveillance including reporting, data management/analysis and vector biology and control activities, availability of guidelines, SOPs and resources;
- current situation/practice on supply chain and stock management activities (drugs, chemicals and necessary commodities);
- community awareness, patients' perspectives, the need of advocacy, communication and social mobilization for leishmaniasis control; and
- recommendations on special working groups and committees, including the areas of potential integration and coordination among VBD programmes and beyond.

3

Review methodology



The World Health Organization Regional Office for South-East Asia (WHO-SEARO), in consultation with the WHO Country Office for Sri Lanka and the Ministry of Health, Sri Lanka, constituted an expert team, consisting of international specialists in the fields of public health, medical professionals and entomologists, to carry out an integrated external review programme for dengue, malaria, filariasis and leishmaniasis in Sri Lanka. Annexure 1 shows the list of expert team members.

The work included desk reviews, interviews, discussions, field visits, onsite observation and stakeholder consultation. All relevant vector-borne disease programmes provided to the country mission detailed information on the country's epidemiology, entomology and public health for the desk review by the experts in advance. The country mission was organized on 13–20 May 2024. The brief agenda of the country mission is described below.

Day 1: There was a briefing on the current status, situation and challenges faced by each vector-borne disease programme in the presence of experts, WHO Representative in Sri Lanka and all relevant officials from vector-borne disease programmes in the Ministry of Health.

Day 2-4: Field visit – the experts, relevant vector-borne disease programme personnel and local experts were divided into four groups. They visited different parts of the country, as mentioned below, with each group having different disease focuses. They also visited several regional directorates of health services, primary health care services or clinics and communities to observe the current structure of relevant vector-borne disease programmes, and field operations of relevant programme activities and service delivery models at different levels of the health system to identify gaps and opportunities to strengthen the service delivery strategies. The experts also interacted with community members and patients regarding the current status, awareness and challenges to relevant disease control.

Group 1 (Dengue) - Colombo, Gampaha, and Kandy	Group 2 (Malaria, dengue and leishmaniasis) - Anuradhapura and Jaffna	Group 3 (Leishmaniasis and dengue) - Kurunegala, Polonnaruwa and Mathale	Group 4 (LF, leishmaniasis and dengue) - Hambantota, Galle, Kalutara
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Day 5: A mid-mission briefing with the Secretary of Health was held to discuss his concern and expectation. This was followed by further consultation with local experts and other stakeholders on ongoing research relevant to the target diseases and collaboration between the programmes and local stakeholders.

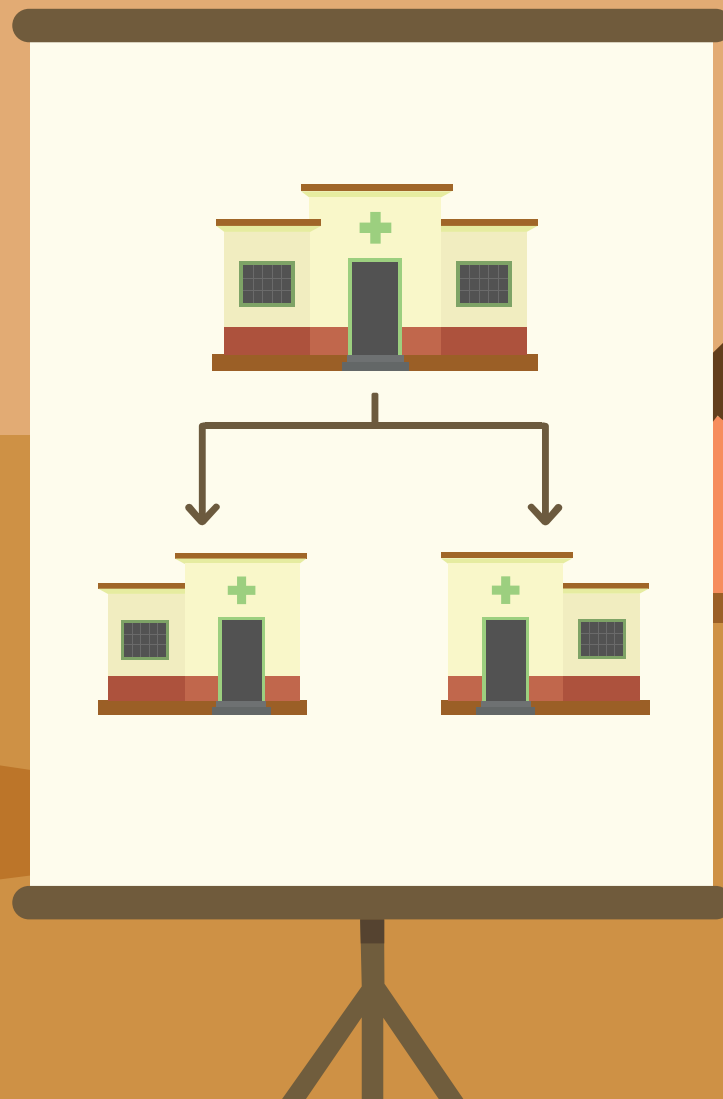
Day 6-7: The experts worked on a situational review report with key recommendations and debriefing presentation.

Day 8: Debriefing with the Minister of Health, the State Minister of Health, the Secretary of Health, the Director-General of Health Services and the WHO Representative in Sri Lanka was held; this was followed by debriefing with local stakeholders.

This report provides the outcome of the expert review, prepared in collaboration with relevant vector-borne disease programmes.

4

Overview of the health system in relation to vectorborne diseases in Sri Lanka



The Sri Lankan health system blends Western allopathy and traditional medicine, with the former being predominant. Public hospitals handle nearly all inpatient care and half of outpatient services. Internationally lauded for its efficiency and low-cost model (Perera et al., 2019), the system notably has improved maternal and child health, although progress has plateaued in recent years. Sri Lanka has successfully eliminated diseases such as polio, neonatal tetanus, malaria, filariasis and leprosy, and has achieved near elimination of other diseases covered by the expanded programme on immunization (Lalini Rajapaksa et al., 2021).

Organization

The Ministry of Health, led by the Minister of Health, oversees government health services, providing policies, leadership, guidance and monitoring. The administrative head is the Secretary, while technical direction is provided by the Director General of Health Services (DGHS), supported by Deputy Directors-General. National programmes have separate units headed by directors, serving as focal points for both curative and public health services. Additionally, various agencies such as the National Authority on Tobacco and Alcohol, the National Medicinal Regulatory Authority and the Human Resources for Health Coordination Division play vital roles in supporting health initiatives.

Provincial health services fall under the jurisdiction of the provincial ministries of health, led by provincial ministers of health. With devolved powers, provincial councils can establish statutes within their scope, making health a devolved subject. Provincial ministries of health operate within national health policies. The Provincial Director of Health Services (PDHS) leads the Provincial Health Department, accountable to the Secretary and the DGHS at the national level and to the Chief Secretary and the Provincial Health Secretary at the provincial level. Each health district is led by the Regional Director of Health Services (RDHS), accountable to both the PDHS and Ministry of Health (MoH) administrative officials (Fig. 1).

Vertical programmes, focused on promotion and prevention, are overseen by specialized campaigns and directorates within the MoH. Technical units and campaigns, such as the Family Health Bureau, the Epidemiology Unit, the Noncommunicable Disease Unit, the AFC, the Anti-Leprosy Campaign, the NDCU and the AMC, provide guidance to RDHSs for programme implementation at the district level.

Service delivery

The primary level comprises primary medical care units (PMCUs) and divisional hospitals (DHs), collectively known as primary medical care institutions (PMCI); there are 996 such institutions nationwide, six of which are under the MoH. Secondary care involves district general hospitals and base hospitals, totalling 98 institutions, 18 of which are under the Central ministry. Tertiary care is provided by national, teaching and provincial general hospitals, all 24 of which are directly under the MoH. Notably, patients have the option of bypassing primary care and seeking treatment directly at secondary or tertiary hospitals. This is a notable feature of Sri Lanka's health system and often attributed to perceived deficiencies in primary care services.

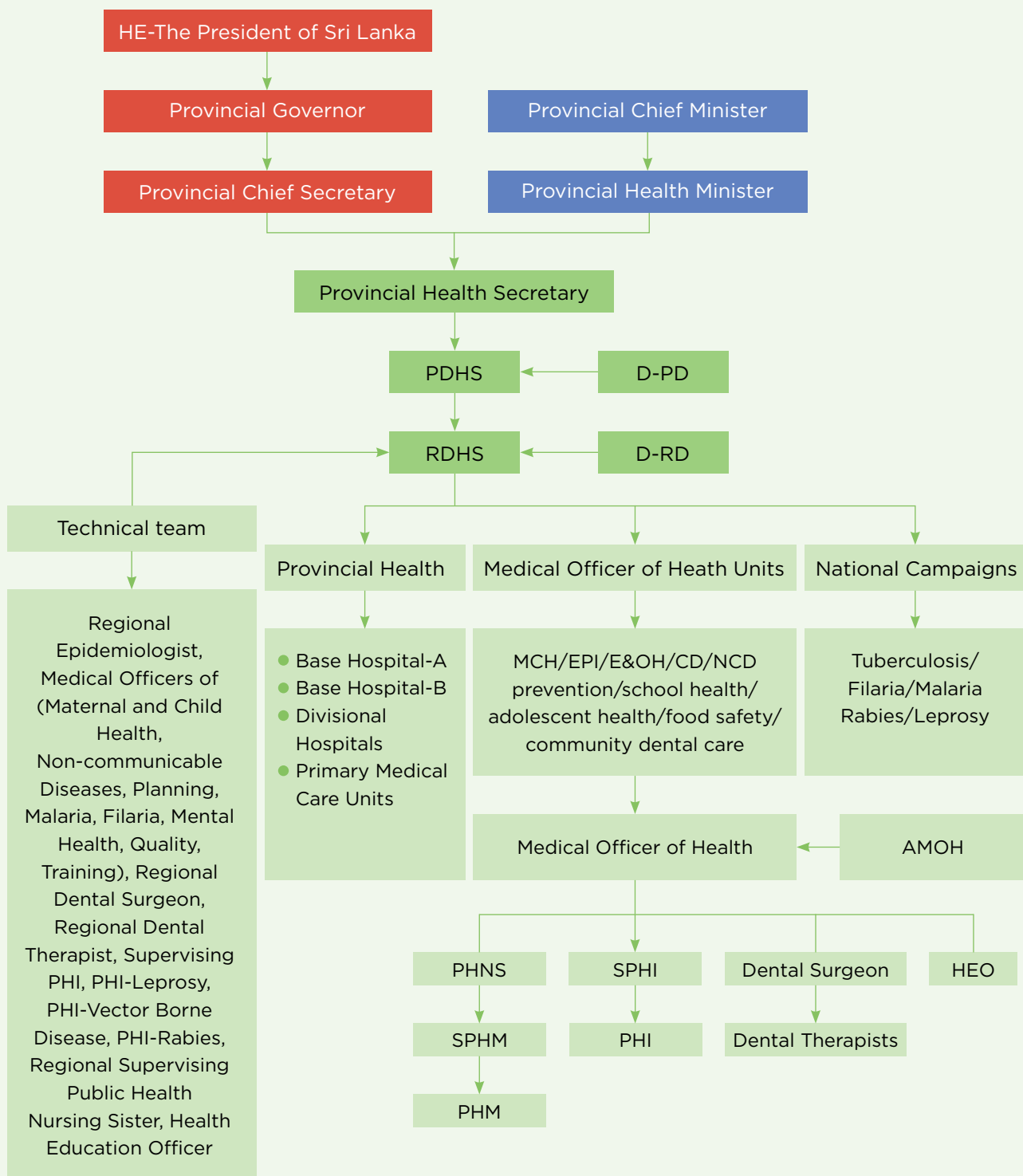
Preventive health services are overseen by 354 Medical Officer of Health (MOH) units: nine of them come under four municipal councils and the rest under provincial health authorities. Each unit is managed by a team of professionals including the Medical Officer of Health (leading the team), additional medical officers of health (AMOHs), public health nursing sisters (PHNSs), supervising public health midwives (SPHMs), supervising public health inspectors (SPHIs), public health inspectors (PHIs) and public health midwives (PHMs). These units cater for a defined geographical area, typically with a population of 50 000–100 000.

National programmes, such as the Family Health Bureau (FHB), the Epidemiology Unit and the Health Promotion Bureau, along with disease-specific vertical programmes, are implemented at the community level through MOH units and their staff. MOHs receive technical support from relevant officials at provincial and national levels. At the community level, the public health midwife (PHM) plays a central role in the National Family Health Programme and Immunization Services, supported by the supervising public health midwife (SPHM) and public health nursing sister (PHNS) through regular supervision.

Communicable disease prevention, environmental and occupational health, and food sanitation fall under the responsibility of public health inspectors (PHIs). School health services are provided by the MOH with support from the PHI and the PHM in the area.

Preventive health services are overseen by district-level supervisory staff. The Medical Officer of Maternal and Child Health (MOMCH) supervises maternal and child health activities while the Regional Epidemiologist (RE) oversees disease surveillance and control. Regional medical officers of vertical programmes monitor campaign-related activities. These officers are supervised by the Regional Director of Health Services (RDHS) at the district level and provincial consultant community physicians (CCPs) and the Provincial Director of Health Services (PDHS) at the provincial level, and technically supervised by national focal agencies such as the Family Health Bureau (FHB), the Epidemiology Unit and vertical campaigns.

Figure 1. Organizational structure of the Provincial Ministry of Health



PDHS: Provincial Director of Health Services; RDHS: Regional Director of Health Services; D-PD: Deputy Provincial Director; D-RD: Deputy Regional Director; AMOH: Additional Medical Officer of Health; PHNS: Public Health Nursing Sister; SPHM: Supervising Public Health Midwife; PHM: Public Health Midwife; SPHI: Supervising Public Health Inspector; PHI: Public Health Inspector; HEO: Health Educational Officer; E&OH: Environmental and Occupational Health

Sources: Lalini Rajapaksa et al. (2021). *Health Systems in Transition*. Vol. 10, No. 1. 2021; Sri Lanka Health System Review, WHO, 2021

5

Review of Anti-Malaria Campaign (AMC)



5.1. Programme management

The mission of the AMC is to implement a comprehensive programme to sustain intensive surveillance and outbreak preparedness, prevention and rapid response to prevent re-establishment of malaria in Sri Lanka, as per the National Health Sector Masterplan 2016–2025. In recent years, the AMC was also entrusted with the additional responsibility of controlling leishmaniasis.

Established in 1911, the AMC used to be a vertical programme until 1989 when it was decentralized. The Deputy Director-General of Public Health Services 1 provides direct supervision and administration to AMC HQ, which has three units (Surveillance, Case Management and Vector Control) and two specialized teams (Parasitology for Laboratory Diagnosis and Entomology for Vector Surveillance). Currently, the AMC HQ has 108 positions, including 18 professionals, under the leadership of Director (Medical Administrator) and Deputy Director. Staff categories include consultant community physicians (CCP), medical officers (MOs), parasitologists, entomologists, public health laboratory technicians (PHLTs), health entomology officers (HEOs), PHIs, public health field officers (PHFOs), spray machine operators (SMOs), and administrative and supportive staff.

The staff in 27 regions comprise the Regional Malaria Officer (RMO), the PHI, the PHFO, the HEO and the SMO. They are responsible for prevention of re-establishment of malaria in the provinces and districts. They report administratively to the provincial and regional directors of health services and receive technical guidance from the AMC HQ.

The AMC has maintained its structure and human resource positions even after the country was certified malaria-free by WHO in 2016. It has even expanded to other regions that were not endemic in the past due to high importation of malaria and detection of *Anopheles stephensi* in some regions. A “VBD Medical Officer” has been appointed to previously non-endemic regions in the Western province.

A Technical Support Group (TSG), which comprises independent external experts and is chaired by the Director-General of Health Services, provides continuing technical guidance to the AMC. A Case Review Committee, a subgroup of the TSG, reviews in detail every case of malaria reported each month, decides on the final classification of the case and provides guidance to respond to the case.

The government provides financial support that sustains prevention of re-establishment since the Global Fund grant ended in 2021, after almost 20 years of support. WHO provides continuing technical assistance and some financial support.

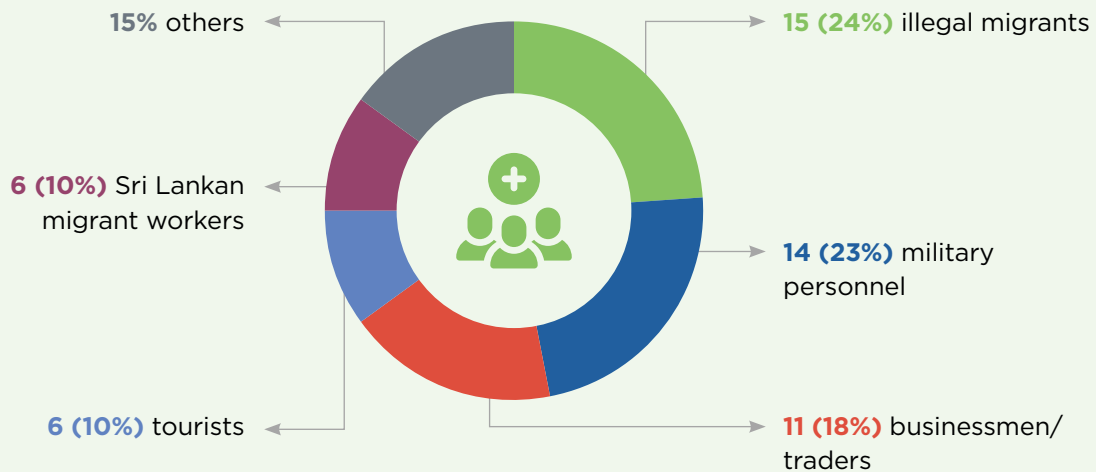
The AMC conducts monthly review meetings on prevention of re-establishment of transmission of malaria, including control of *An. stephensi* and collaboration with defence services. Supportive supervision, monitoring and evaluation are being conducted regularly.

The AMC staff remains dedicated to performing their tasks. The key challenges are sustaining adequate financial support and maintaining competencies. Rotation of key staff every four years may negatively impact the programme unless mitigating measures are in place to sustain motivation and managerial and technical competencies on malaria.

5.2. Situation analysis

An intensified, evidence-driven, national AMC, in collaboration with different sectors and supported by the Global Fund, WHO and other international and local partners, has led to elimination of indigenous malaria in Sri Lanka since October 2012. WHO certified Sri Lanka malaria-free in September 2016. No indigenous malaria case has occurred for almost 12 years now. The AMC remains vigilant since the country used to be highly endemic, with catastrophic epidemics taking place in 1934–1935, 1967–1969, 1986–1987 and 1990–1992; large parts of previously endemic areas remain receptive, importation of malaria is frequent and *An. stephensi*, a vector of malaria in urban areas in India, has invaded some regions.

During 2013–2023, the annual number of malaria cases detected ranged from 25 to 95. In 2024 (up to 12 May), 11 cases were reported. The cases were all imported, except for one introduced in 2018 and one blood transfusion induced in 2021.



Distribution of malaria cases by occupation, 2023 (n=62)

Only one case was detected among foreign workers. The rest included other occupational groups (5), students (3) and an asylum seeker (1). The illegal migrants were those who tried to move to developed countries through transit points in Africa; 90% (56/62) of imported cases were acquired from 16 countries in Africa, mainly from South Sudan (23%) and Sierra Leone (15%). Few cases were acquired from India (3), Pakistan (2) and Papua New Guinea (1). The 11 cases detected in 2024 (as of 12 May) were imported from nine countries in Africa. All human malaria parasite species were detected and in the past three years, most of the cases were due to *P. falciparum* (73% in 2023).

In 2021, one malaria case was due to transfusion of blood from a donor with imported malaria. This incident led to a change in policy that prohibits blood donation from those with history of travel to malaria-endemic countries in the past three years. It also highlights the importance of ensuring the competencies of medical malaria technologists (MLTs) and public health laboratory technicians to detect malaria among blood donors and in blood prior to transfusion.

One malaria death was recorded in 2023. The patient who sought consultation in the private sector was initially not suspected as a case of malaria and was treated for other diseases. By the time malaria diagnosis was confirmed, the patient was already suffering from severe and complicated disease. High levels of awareness and competencies of health-care providers regarding case detection and treatment of malaria, particularly among febrile patients with history of travel to malaria-endemic countries, should be maintained.

Given the high burden of malaria in many countries in Africa and some parts of India and the high proportion of imported cases from those countries, it is necessary to further strengthen the AMC's collaboration with agencies responsible for people travelling to and/or returning from Africa and India.

In October–November 2020, a Malaria Programme Review was carried out with support from WHO. There were 13 recommendations and most of it were acted upon positively. One of the recommendations was to shift the focus of the Malaria National Strategic Plan from prevention of re-introduction to prevention of re-establishment of transmission.



AMC is now implementing the NSP on Prevention of Re-establishment of Malaria in Sri Lanka 2023–2027.

● **The NSP has two strategic objectives:**

- ✓ prevent the re-establishment of malaria,
- ✓ maintain zero mortality due to malaria.

● **It has three strategic approaches:**

- ✓ Intensified surveillance,
- ✓ Case management,
- ✓ Strengthening outbreak preparedness, prevention and response.

● **Furthermore, the NSP has seven cross-cutting approaches:**

- ✓ Quality assurance,
- ✓ Health systems strengthening,
- ✓ Intersectoral collaboration and coordination,
- ✓ Communication and advocacy strategy,
- ✓ Monitoring and evaluation framework,
- ✓ Improving programme management and response,
- ✓ Operations and implementation research.

5.3. Surveillance

The AMC maintains surveillance as a core intervention for prevention of re-establishment. Parasitological surveillance is being carried out through passive case detection (PCD) and active case detection (ACD). The AMC also maintains mobile malaria clinics for active case detection in high-risk areas and among high-risk groups such as foreign workers and military personnel arriving from deployment in malaria-endemic countries.

The AMC has a hotline for immediate reporting. Cases detected are reported within one day and investigated within two days, and appropriate response is mounted within five days. Severe malaria cases and deaths are also thoroughly investigated. A Case Review Committee, a subgroup of malaria TSG, reviews and makes the final classification of every case.

The collaboration between the AMC and the Ministry of Defence on malaria surveillance and case management remains strong.

Surveillance of malaria among potential blood donors is also being conducted. Screening of blood for malaria before transfusion is mandatory. These activities are part of the workload of PHLT. It can/should be conducted by the medical laboratory technologist (MLT) assigned to blood banks and hospitals.

5.4. Case management



Malaria case management includes diagnosis, appropriate treatment, counselling and follow-up. The AMC ensures universal access to quality-assured diagnostic services through an intensive network of health facilities in the public sector, including 200 malaria microscopy centres, and by engaging hospital laboratories, general practitioners and private-sector hospitals and clinics.



Quality assurance (QA) of malaria microscopy is in place. There are around 19 WHO-certified Level 1 microscopists. Slide banks are being maintained. Maintaining competencies on malaria microscopy is becoming a challenge since malaria cases are now rare. Training and refresher training of MLTs and PHLTs, both in the public and private sectors, are periodically being carried out. Training malaria PHLTs and empowering them to support case detection of other VBDs are a way to optimize their services. For rapid diagnostic tests (RDTs), only quality-assured products are being procured.



Treatment policy is based on local evidence and aligned with WHO recommendations. Malaria medicines are pre-positioned in strategic areas so that these can be delivered to a health facility within two hours, when needed. A patient is confined to a health facility for treatment to ensure adherence; patients are also being followed up on to detect treatment failures and relapse.

Some of the challenges are: delays in seeking care; health provider not considering malaria initially in a febrile patient; maintaining knowledge and skills regarding case management due to rarity of cases; and procurement of small quantities of malaria commodities, especially antimalarial drugs, RDT kits, long-lasting insecticidal nets (LLINs) and point-of-care G6PD RDTs.

5.5. Entomological surveillance and vector control

The ecology and climatic conditions in the country remains favourable for malaria vectors. *Anopheles culicifacies* is the primary vector and is present in many parts of the country. Secondary vectors are *An. subpictus*, *An. annularis*, *An. vagus*, *An. tessellatus*, and *An. varuna*.

An. stephensi, a known malaria vector in urban areas in India and resistant to different classes of insecticide, was detected in Mannar in December 2016. Since then, it has been reported in all five regions in the Northern province (Mannar, Vavuniya, Mullaitivu, Kilinochchi, Jaffna) and Kalmunai region in Eastern Province. Intensive control using larvicide and larvivorous fishes (mainly *Gambusia* species) was carried out, and as of April 2024, it has only been reported in Jaffna and Kalmunai regions. Some regional offices maintain biological ponds for fish stocks.

Entomological surveillance, including surveillance of *An. stephensi* in urban settings, is still being carried out extensively based on the guidelines updated recently. The activity focuses in areas with high risk of importation of malaria, and those around hotels / tourist spots and development project sites.

There is a need to scale down this resource intensive but essential activity to focus on strategic areas. Also, integrated entomological surveillance to support other VBD programmes should be carried out wherever feasible.

The AMC promotes the use of insecticide-treated nets (ITNs). It provides LLINs to hotels in previously endemic areas. Stocks of LLINs and insecticides for IRS are available. A rapid response team is in place to conduct vector control, as needed.

5.6. Key challenges

Re-establishment of malaria transmission is a continuing risk due to frequent importation of malaria and favourable ecology. Malaria should not be a forgotten disease and neglected by the government, health-care providers and people in general.

The following key challenges should be addressed to maintain malaria free-status and ensure zero deaths due to malaria:

1. sustaining political will and financial support from the national and provincial governments in view of economic situation and the needs of other important public health services.
2. maintaining competencies on malaria and prevention of re-establishment of health-care providers both in public and private sectors;
3. eliminating *Anopheles stephensi*;
4. sustaining the collaboration with other sectors on prevention of re-establishment, particularly defence services, labour, tourism, education and key agencies responsible for development projects that bring in foreign workers;
5. continuing the engagement with the communities and their local leaders in previously endemic areas that remain highly receptive and where importation of malaria is high;
6. optimizing the utilization of existing staff of the AMC at the headquarter and regional level to support other vector-borne disease programmes while maintaining technical leadership, accountability, dedication, and high level of vigilance and response against malaria.

5.7. Recommendations

Sri Lanka has remained free of indigenous malaria for almost 12 years now, despite high receptivity, frequent importation of malaria and invasion of *An. stephensi*, a vector of malaria in urban areas. This is a reflection of the commitment of the government to maintaining the malaria-free status following the WHO certification in September 2016. It is also a reflection of the capacity of the health systems to deal with malaria, the competencies and dedication of all cadres at national and regional levels, and the technical soundness of the national strategic plans on prevention of re-establishment (2017-2022 and 2023-2027) that are being implemented. The country is an excellent global role model. It has the experience and technical expertise in malaria control, elimination and prevention of re-establishment that should be leveraged to generate resources from donors, host international trainings, conduct research on prevention of re-establishment and provide consultancy services for malaria programmes in other countries.

The government needs to continue investing in prevention of re-establishment and actively take part in the global advocacy on malaria until eradication is achieved. The AMC should evolve in the context of the planned re-engineering of health services and socioeconomic realities of the country while maintaining its strong technical leadership, accountability and dedication to preventing re-establishment of transmission and malaria deaths.

Given the challenges identified, the following are recommended (refer the table below).

Recommendations	Time frame	Responsible agency
1. Develop and implement a comprehensive plan and materials needed for advocacy, social mobilization and behaviour change communication on POR. Meanwhile, leverage the support of TSG and multi-media groups in the county to continue advocacy for prevention of re-establishment.	Development and approval of the plan – before the end of 2024 Implementation – as soon as the plan is approved	AMC headquarter and Malaria TSG, with technical and financial support by the WHO Country Office and WHO-SEARO
2. Revamp entomological surveillance to focus on the areas listed below. Collaborate with other VBD programmes to ensure complementarity and optimize the use of resources: a. urban and peri-urban areas with high potential for invasion by <i>An. stephensi</i> ; b. previously endemic areas with high risk of importation of malaria, particularly development project sites; c. areas where people detected with imported malaria resides; d. limiting monitoring of bionomics and insect resistance to previously endemic areas, where agricultural insecticides are used on a massive scale; e. previously endemic areas where other VBDs are still prevalent and entomological information is non-existent or outdated.	Within six months or as soon as there is consensus and SOPs are updated	AMC, in collaboration with other VBD programmes and support from malaria TSG
3. Collaborate with other VBD programmes to jointly develop and implement SOPs in areas where collaboration and integration will be cost-efficient. It may include entomological surveillance, training, supportive supervision and monitoring, outbreak preparedness, and response and logistics management.	Within six months or as soon as there is consensus among VBD programme officers and the SOPs are developed	AMC and other VBD programmes
4. Conduct innovative approaches to upgrade and sustain competencies on malaria among health care providers in public and private sectors, in addition to ensuring that malaria remains part of the curriculums in medical and allied health courses. Some suggestions for consideration: a. online course on malaria, with specific components to address the competencies required for each category of health staff. Make it a mandatory requirement once every 3 years for those in public sector and as a requirement for renewal of license for those in private sector. Incentivize those who successfully completed it. b. hybrid online and face to face training; c. follow-up after training and mentoring;	Within 12 months and continue thereafter	AMC headquarter and Malaria TSG, with technical and financial support from the WHO Country Office and WHO-SEARO

Recommendations	Time frame	Responsible agency
d. mentoring of young/junior staff based on a framework to be developed with support from pedagogists and malaria subject matter experts; e. combined tabletop and field simulation exercises on malaria outbreak investigation and response; f. collaboration with other VBD and public health programmes to find ways to include key information on malaria and prevention of re-establishment during training, whenever appropriate.		
5. Invest in developing and sustaining a core group of highly skilled new generation of malariologists, epidemiologists, parasitologists, entomologists and vector control specialists. Explore support from the national government, WHO, including the Special Programme for Research and Training in Tropical Diseases (TDR), academia and international donors.	Development of costed plan – within 12 months Implementation – to start as soon as the plan is approved and resources are mobilized	AMC, with support from malaria TSG and WHO AMC and universities
6. Organize an international training in malaria elimination and prevention of re-establishment to promote best practices and lessons learnt in Sri Lanka to support WHO's efforts to build capacities on malaria elimination and prevention of re-establishment globally, regionally and in Sri Lanka.	Within 12 months	AMC with support from malaria TSG and from three levels of WHO
7. Establish a Centre of Excellence on Malaria Elimination and prevention of re-establishment, as recommended in the 2020 Malaria Programme Review.	Develop a plan with estimated cost – within 12 months.	Malaria TSG, in collaboration with AMC, WHO Country Office and WHO-SEARO
8. Strengthen collaboration with the Ministry of Education to ensure that information on malaria is part of school curriculums at primary and secondary levels, so that the current and future generations remain aware of malaria and its prevention.	Within six months and continue thereafter.	The Minister of Health and the Health Secretary, with inputs and for follow-up by the DG, the DDG and the AMC HQ
9. Continue to invest in research, and documentation and dissemination of best practices and lessons learnt.	Continuing activity	AMC, Malaria TSG, Academia, with support from WHO
10. Establish an independent multidisciplinary national task force to examine the feasibility, benefits, risks and budget implications of structural and functional integration of disease-specific VBD programmes into one VBD programme as part of medium- and long-term plan in the context of re-engineering of health services and ensuring cost-efficiency of health programmes. An integrated VBD programme should consider, among other things, the number of staff and the competencies needed to implement the National Strategic Plan of each VBD programme, retooling required, and ensuring leadership and accountability for each disease programme.	Creation of task force – within three months Completion of the work of the task force – within 12 months from its establishment	Health Secretary National Task Force WHO Country Office to provide technical and financial support

6

Review of Anti-Filariasis Campaign (AFC)



6.1. Programme management

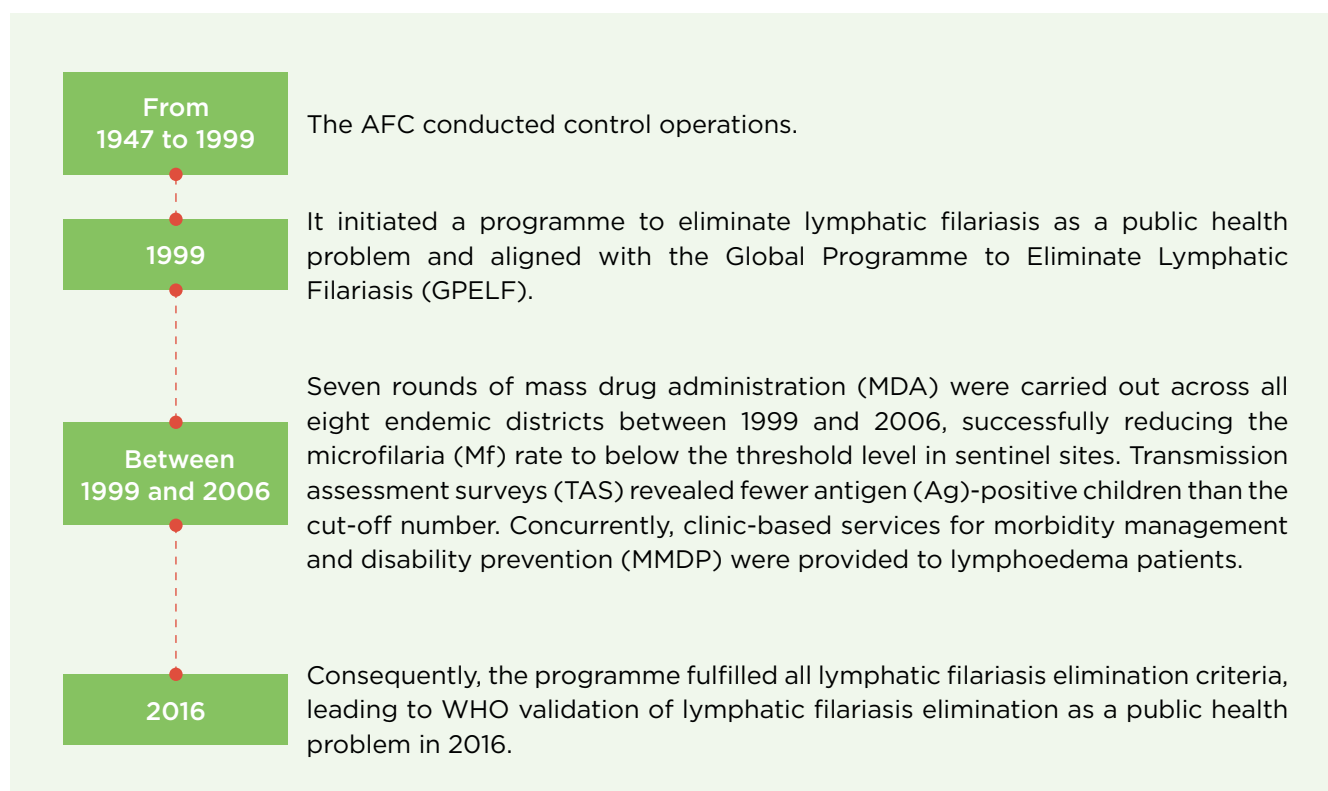
Lymphatic filariasis used to be a major vector-borne disease in Sri Lanka. The national AFC began in 1947 to combat the disease. The AFC consisted of a headquarter with a laboratory and eight regional filaria control units (RFCUs) active in eight endemic districts, overseen by the regional medical officers. The staff of RFCUs are based in RFCUs or offices of Medical Officer of Health areas. The AFC not only provides technical guidance to RFCUs but also monitors, supervises and evaluates their activities.

From 1947 to 1999, the AFC focused on routine parasitological surveillance and treatment, entomological surveillance, vector control, lymphoedema patient care, health-care worker training, community education, and surveys in special and non-endemic populations.

The AFC, led by the Director, is supported by a diverse team. The central AFC staff includes the Director, CCPs, MOs, entomologists, nursing sisters, PHIs, PHLTs, HEOs, PHFOs as well as clerical and support staff. The RFCU staff mainly comprises RMO-filariasis, PHLTs, EAs, PHFOs, clerical and support staff. Both AFC and RFCU staff work tirelessly to achieve targets across their activities.

6.2. Situation analysis

Lymphatic filariasis is endemic in eight districts of Sri Lanka, with both bancroftian and brugian forms prevalent. Bancroftian lymphatic filariasis is transmitted by *Culex quinquefasciatus* while brugian lymphatic filariasis is transmitted by *Mansonioides* species. Additionally, prevalence of *B. malayi*, *B. pahangi*, *B. ceylonensis* and *Dirofilaria repens* is reported in cats and dogs (Sasa, 1976; Rathnayake et al., 2022; Mallawarachchi et al., 2018a). Re-emergence of *B. malayi* and presence of a diurnally subperiodic strain of *B. malayi* of animal origin are recently reported (Mallawarachchi et al., 2018b). The programme data also suggest considerable incidence of *B. malayi* infection in children in some districts.



As recommended by WHO, AFC has been implementing a post-validation surveillance (PVS).

The current mission provided the chance to assess the current post-validation lymphatic filariasis situation, observe diverse field, laboratory and clinic activities conducted by RFCUs under the PVS, and engage with staff across Hambantota, Galle and Kalutara districts. Field activities observed encompassed Mf surveys for case detection and entomological surveys, alongside lymphoedema services provided at filaria clinics.

6.3. Ongoing PVS surveys

Between 2016 and 2024, PVS activities comprised parasitological (Mf) and entomological (vector) surveys, along with lymphoedema care services, with fewer serological surveys due to cost constraints. The primary goal of these activities was to survey high-risk public health midwife (PHM)/ Public Health Field Officer (PHFO) areas within MOH regions, and detect and treat as many Mf carriers as possible to diminish the parasite reservoir, thereby reducing transmission risk and preventing recrudescence.

A standout aspect of PVS involves its elaborate vector surveys aimed at identifying infected vector mosquitoes within communities, localities or households, serving as an indicator of Mf carrier presence. Regions with suspected high vector density received priority for these surveys. Subsequently, areas or communities where infected mosquitoes were found were prioritized for Mf surveys.

Parasitological surveys

Mf surveys were conducted in various modes. The primary surveys, led by PHFOs and supervised by RMOs, are termed “routine surveys”. Additionally, the AFC and RFCUs in the districts conducted weekly surveys throughout a year, along with surveys at some institutions. Special surveys were conducted in high-priority areas across districts to enhance interventions and in non-endemic districts to assess their current endemicity status.

PHFOs conducted routine surveys in clusters of households within selected communities. These surveys were carried out three days a week, covering villages. Each day, one village was surveyed by an individual PHFO or as a team supported by a local volunteer or an assigned supportive staff member. Ahead of the survey, the team informed the community to ensure active participation. Surveys took place from 20:00 pm/20:30 pm to 22:30 pm/23:30 pm, employing a convenience sampling approach. Approximately 15–20 households were visited and all consenting members, spanning all age groups, underwent Mf blood tests. Each PHFO or team tested 40–80 individuals per day. Encouraging the reluctant households to participate in blood tests posed a challenge for field workers.

Approximately three drops of finger-prick blood were collected from each tested person, expected to be about 60 µl, which were then used to create two thick smears on a single glass slide. Blood drops were carefully placed and smeared onto the slide using the same finger. Basic information, such as name, sex, age and address, was recorded for each individual on a standard proforma. The blood smears were left to dry, bundled together and, usually, transported to the laboratory for staining within few days, though occasionally this occurred only once a week.



Giemsa stain was prepared at the laboratory using the stock solution provided by the AFC Central Laboratory, as needed; it was used to stain the blood smears. Trained PHLTs examined the stained blood smears under a compound microscope, counting and recording Mf for each positive individual. The Mf rate and density for each survey were calculated and reported to the AFC. To ensure quality control, all positive Mf slides, 15 negative slides from each PHLT, and five unstained thick blood smears from each PHFO in each district were sent every month to the AFC headquarters for cross-examination. The completion of blood smear examination and communication of results to positive individuals typically took up to one month or longer after the collection of blood samples.

Observations



While the AFC's dedication to PVS and its extensive activities are commendable, there is a notable absence of strategic direction, planning, timing of the surveys and downscaling strategy. Given the current low lymphatic filariasis prevalence in the districts, the Mf surveys are overly extensive and lack a rational approach. For instance, in Kalutara district, out of the 68 269, 100 894 and 28 580 people tested during 2022–2024, only 1, 5 and 1 individuals were found Mf-positive respectively (Annexure 2). This underscores the potential for significantly scaling down Mf surveys in the districts, employing a scientific approach and considering the very low endemicity situation.

While the laboratories are well-equipped and maintain paper-based records effectively, the quality of blood smears and their handling were subpar in some districts. Given the very low Mf prevalence levels, enhancing survey quality in terms of glass slide cleanliness, timing of blood sample collection, blood volume collected, handling of blood smears, staining and microscopy should be a top priority for the AFC.

Serological surveys

Serological surveys were conducted rarely and only if surplus kits were available. Ag surveys using FTS were carried out in Galle, involving few hundreds of people. The scale of serological surveys to detect infected persons was negligible, compared with Mf surveys.

Entomological surveys

Entomological surveys comprised various mosquito collection methods, including indoor resting mosquito collection, indoor and outdoor all-night landing mosquito collection and gravid trap collection of *Cx. quinquefasciatus* as well as indoor and outdoor resting collection and baited trap collection of *Mansonia* mosquitoes.

Mosquito collection and dissection

Each district's entomological surveys were conducted by HEOs and health assistants (saukya kaarya sahayaka). As *Cx. quinquefasciatus*, the vector of bancroftian filariasis, is predominantly endophilic and endophagous, indoor resting collections are implemented. Mosquitoes are collected using either oral aspirators or mechanical aspirators from selected households.

Each team collects mosquitoes from a cluster of 15–25 adjoining houses, between 07.30 am and 08.30 am during each visit. Teams return to the office by noon. All night landing collections on human bait are also ensured, indoors and outdoors, to collect the mosquitoes. Generally, mosquitoes are collected from one community per day.

In *B. malayi*-endemic areas, outdoor collections of *Mansonia* vector mosquitoes are primarily performed using cattle-baited traps as a proportion of these vectors displays zoophilic behaviour. Traps are set at dusk and mosquitoes are collected the following morning.

Collected mosquitoes are processed over the next few days. Prior to dissection, they are stored in refrigerators. Before dissection, mosquitoes are identified and separated according to species. Only blood-fed female *Cx. quinquefasciatus* or *Mansonia* vector mosquitoes are dissected following a standard procedure to detect and quantify infection.

The dissection process involves placing each mosquito on a clean glass slide, dividing it into head, thorax and abdomen parts, teasing the tissue finely with needles and examining it under a compound microscope for filarial larvae. The number of different stages of filarial larvae (Mf, L1, L2 and L3) present in different body parts is noted in a standard data form for each infected mosquito. The human bait landing mosquitoes, collected all over the night, are dissected at night in the field itself, which is unusual and cumbersome.

Gravid trap collections are conducted in select communities to capture *Cx. quinquefasciatus* mosquitoes. In each community/locality, eight traps are deployed during dusk, strategically placed near households situated close to suspected vector breeding habitats. The following morning, teams revisit the villages to retrieve traps with mosquitoes from all targeted households and return to the office. Typically, one PHM area (approximately three village) is covered per day.

Mosquitoes collected in gravid traps undergo either PCR to detect filarial DNA or dissection to identify filarial larvae, as previously described. However, the infrastructure and facilities required for PCR are exclusively available at the Central Laboratory at the AFC, Colombo. Consequently, mosquitoes from other districts must be sent to Colombo for PCR assays. Two surveys are to be performed by each district per month covering two PHM areas; they play a relatively limited role in surveillance efforts.

Observations



The dedication of staff and labour involved in entomological surveys is commendable, but the surveys themselves are routine and excessively extensive, and utilize numerous methods without clear objectives. The purpose behind deploying multiple labour-intensive mosquito collection methods remains unclear. Despite claims that entomological collections inform targeted human screening with Mf surveys, this objective appears largely unrealized.

For instance, in Kalutara in 2023, although 88 infected mosquitoes were found (infection rate 0.98%), only one Mf carrier was detected (Mf rate 0.005%) (Annexure 2). Gravid trap collections and sensitive PCR tests indicated a 0% infection rate in Hambantota and Galle, despite the presence of some Mf carriers (Annexure 2). Data details are incomplete or unavailable for other methods such as human landing collection and cattle-baited trap collection (Annexure 2), suggesting inadequate conclusion of surveys. Another concern is the dissection of mosquitoes after storing them for up to one week, which can render them dry and compromise the sensitivity of the technique. It would have been more effective if entomological surveys and Mf surveys complemented each other instead of being repeated in the same areas. Additionally, a thorough analysis of survey results should have been conducted to understand their outcomes and utility more comprehensively.

Clinical surveys



The lymphatic filariasis MMDP clinics provide excellent services to lymphoedema patients, with necessary medicines and supplies readily available. Currently, there are 24 MMDP clinics providing MMDP services. Patient records are meticulously maintained in hard copies. It is likely that the same group of patients visits the clinics regularly and these clinics serve individuals from surrounding catchment areas.

However, there is a notable accessibility issue for patients residing in remote villages, which warrants examination and remedial action, such as offering lymphoedema care at local health centres, e.g. primary health care units. Additionally, the AFC should compile data on the burden of hydrocele and the number of surgeries performed across various health facilities to estimate the resource needs and ensure comprehensive morbidity management and disability prevention services.

6.4. Opportunity

With tremendous human resources, capacity and experience, the AFC is well placed to refine the current PVS system and strategy in collaboration with WHO and other stakeholders, aim for transmission elimination or total interruption of transmission and be a global model.

6.5. Recommendations

1 Quality of surveillance:

The prevalence of lymphatic filariasis infection is scattered, with scanty Mf rates observed across districts, highlighting the need for high-quality surveillance to detect and eliminate residual infection and progress towards transmission elimination.

To enhance the precision and efficacy of PVS, the following measures are recommended:



Digitalization of data:

Implement digital systems to collect, store and analyse parasitological, entomological and clinical data. Undertake thorough analysis for evidence-based decision-making.



Microstratification and risk mapping:

Utilize collected data for microstratification of each MOH area and develop high-resolution risk maps, pinpointing high-risk areas and residual infection hotspots.



Geostatistical modelling:

Employ geostatistical modelling techniques to identify, target and eliminate residual infection with precision.



Methodological evaluation:

Conduct critical analysis to determine the relative value of different surveillance methods. Optimize deployment of cost-effective techniques to ensure sustainability of post-validation surveillance efforts.



Regular training:

Provide regular refresher training sessions focusing on microscopy, entomological techniques and data analytics to ensure proficiency among staff.



Sensitive diagnostic techniques:

Introduce sensitive diagnostic tools, such as FTS, to enhance infection detection capabilities, particularly in areas with low Mf rates.



LF transmission elimination plan:

Develop a comprehensive five-year strategic surveillance and response plan (2025-2030) for the total interruption of lymphatic filariasis transmission in collaboration with WHO, local experts and other stakeholders.

2 *B. malayi* resurgence:

Develop a comprehensive strategy to combat the resurgence of *B. malayi* in collaboration with WHO, adopting good practices followed in other countries.

This strategy should include the introduction of ivermectin as part of triple drug therapy to enhance treatment efficacy.

3 Immigrant population:

Create a cost-effective and feasible treatment plan for immigrants from endemic countries by leveraging existing resources such as the migrants registers of the AMC. Implement preventive chemotherapy programmes tailored to the needs of immigrant populations, ensuring they receive timely and appropriate treatment to prevent the spread of lymphatic filariasis.

4 Integration of lymphoedema management:

Integrate lymphoedema management into primary health care (PHC) services and enhance the capacity of health-care providers to deliver quality care. This integration will facilitate expanded access to lymphoedema treatment for affected individuals and promote hydrocele surgery among eligible patients.

Conduct training programmes and provide necessary resources to PHC facilities to support effective MMDP implementation.

5 Community and household vector control:

Promote community- and household-level vector control measures as integral components of efforts to achieve total interruption of transmission. Educate people on targeted interventions, such as insecticide-treated bednets and environmental sanitation campaigns, to reduce vector breeding sites and minimize human-vector contact.



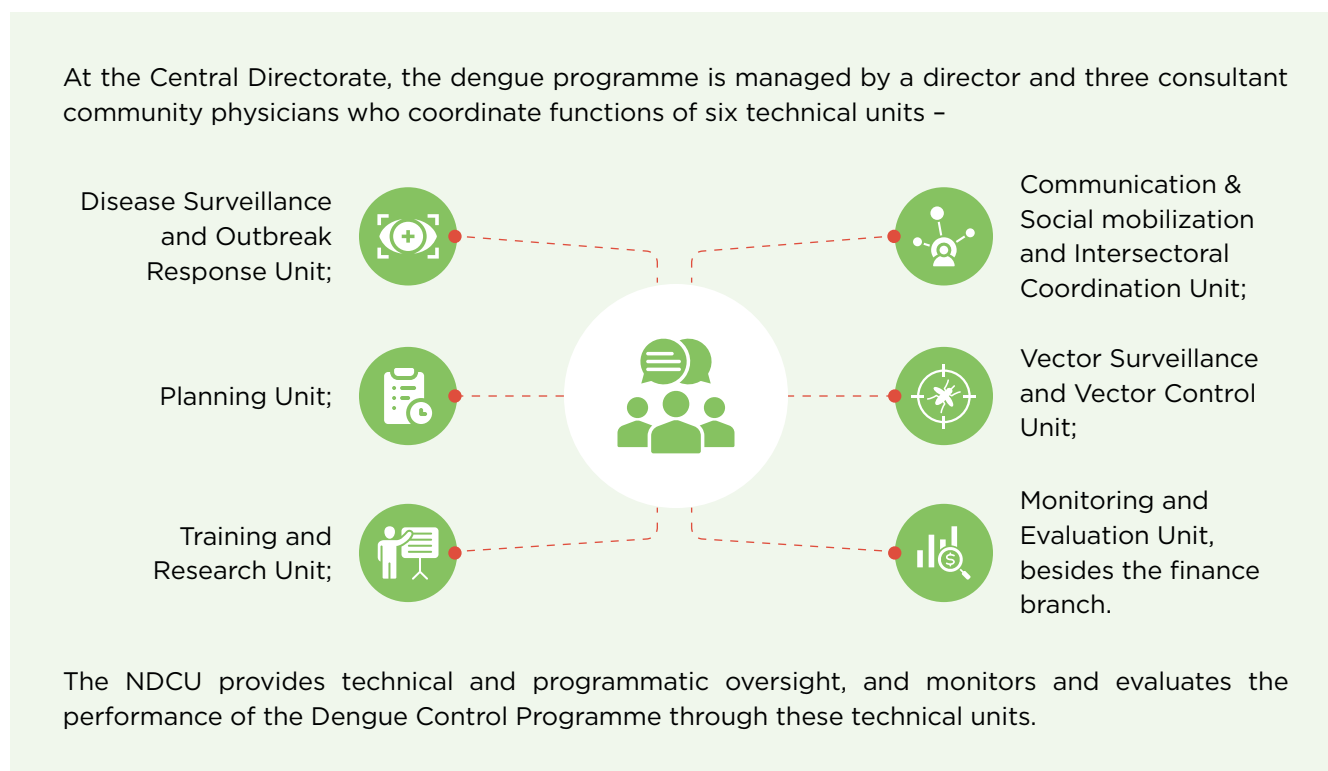
7

National Dengue Control Unit (NDCU)



7.1. Programme management

In Sri Lanka, dengue is a major vector-borne disease in all districts. A National Dengue Coordinating Unit was first established in 2005 and later upgraded to a national programme as the National Dengue Control Unit (NDCU) in 2012. A Presidential Task Force, established in 2010, guides and monitors dengue control in the country. Like other vector-borne disease control programmes in Sri Lanka, it has a vertical organization under the Deputy Director-General of Public Health Services 1.



The Director, NDCU, coordinates with 26 regional directors of health services, Colombo Municipal Council and National Institute of Health Sciences at the district level; they in turn supervise the regional area health officials such as epidemiologists, consultant community physicians, medical officers, entomologists, health entomology officers and public health inspectors for the implementation of case surveillance and management, vector surveillance and control, and other technical activities. The NDCU has about 1500 positions for field mosquito control assistants deployed in high-risk areas to inspect premises and engage community, 180 entomological officers who conduct surveillance and 26 entomologists who plan and supervise. These staff members undertake vector surveillance only while vector control is the responsibility of the medical officers of health and SPHI/PHIs. Hospitalized dengue patients are treated at the base, with higher-level hospitals and provincial health facilities currently totalling 1126 in number.

At local health-care facilities, patients diagnosed with or suspected of suffering from dengue are notified by treating medical doctors and their details are uploaded on the web-based National Dengue Surveillance System (NaDSys) by the Infection Control Nursing Officer of the hospital concerned. In response to notified cases, public health inspectors engage in vector control interventions, including inspection of premises, breeding source reduction and legislative enforcement at the household and community levels, under the supervision of medical officers of health and the SPHI. The job responsibilities of the entomology personnel under the NDCU are *Aedes* spp. surveillance, insecticide resistance monitoring, managing insecticide and spray equipment stores, and assisting collaborators with entomological research in the country.

The Registrar of Pesticides is the national authority for implementing the laws and regulations on insecticides under the Control of Pesticides Act, 1980.

7.2. Situation analysis

Dengue was first reported in Sri Lanka in the 1960s (Munasinghe et al., 1966) and the first major outbreak occurred in 1989 in Colombo, as reported by Malavige et al. (2021). In 1996, it was made a notifiable disease. It is now a leading communicable disease-related public health problem in all districts in the country, with hyper-endemicity in many areas. Although a low annual case-fatality rate of <0.1% has been achieved with good case management capability, dengue has become endemic in all districts of the country, with large outbreaks occurring every 3–4 years with high intensity, which resulted in higher levels of disease endemicity in the country. There were 72 and 62 dengue-associated deaths in 2022 and 2023 respectively, with no age bias. In 2023, the case incidence per 100 000 ranged from <100 in three districts to 101–400 in 14 districts to 401–769 in nine districts, with districts of Colombo, Jaffna, Gampaha, Kandy and Batticaloa leading incidence rates. In the past three years, the incidence rose from 162 cases in 2021 to 408 cases in 2023. While increasing in intensity in areas already endemic, dengue is expanding to new territories in the country, raising major concerns.

In Sri Lanka, all four dengue virus serotypes (DENV-1, 2, 3, 4) have been circulating (Sirisena and Noordeen, 2014). The major outbreak of dengue in 2017 was attributed to DENV2 (Withanage et al., 2020; Tissera et al., 2020; Nwe et al., 2023). Subsequently, the rise in dengue cases in late 2021 coincided with an increased proportion of DENV3 (Ariyaratne et al., 2022). Like the recent South Asian trend, the rising incidence continued in 2022–2024 (48% to 74%) (data source: Medical Research Institute, Centre for Dengue Research of the Faculty of Medical Sciences, University of Sri Jayawardenapura, and NH Kandy). Co-infection of these viruses, particularly with DENV2, can result in unusual clinical outcomes and can be a key factor for surge in dengue cases during outbreaks. Over the past three decades, the age distribution of dengue cases has shifted from children under 15 (Sirisena and Noordeen, 2014) to adults (20–64 years), who constitute a higher proportion of cases now (~64%; NDCU data). The age shift epidemiology is consistent with the observed trend of dengue moving into new territories with immunologically naïve populations. Men show a slightly higher incidence than women, which may be associated with occupational exposures or bias in health-seeking behaviour.

The key determinants and drivers of dengue transmission are:

- Immense anthropophagic opportunities in crowded populations;
- Expanded mosquito breeding opportunities due to urbanization, housing expansion, low water security leading to water storage in open containers, and solid waste accumulation;
- Vector biology such as long survival of dry eggs;
- Human behaviour;
- Climate-related factors such as optimum temperature, high humidity, and rainfall often influenced by El Niño–Southern Oscillation, and sub-optimal case surveillance and treatment
- many of these factors are relevant to different eco-epidemiological settings in Sri Lanka.

The National Action Plan for Dengue Prevention and Control 2019–2023 is now due for revision. The control of VBDs falls within the larger Sri Lanka National Health Policy 2016–2025.

7.3. Case surveillance

Dengue cases are diagnosed and notified by public health care facilities and main private hospitals. The Integrated Disease Surveillance System has been in operation in Sri Lanka and the National Dengue Control Unit had established a dedicated electronic dengue surveillance system, NaDSys, in 2024. It was reported that notified cases involved inpatients from hospitals only and currently, there is no notification of data on outpatients from any hospital and general practitioner, including both from public and private sectors, despite the requirement by law.

Of the two main hospitals visited, one relies on clinical diagnosis while another emphasised the importance of laboratory diagnosis with NS1 kits. Though it is impossible to detect every case of dengue, the failure to report cases represents a missed opportunity for early detection of and response to transmission in the community – an important aspect of dengue control. While some districts (MOH and NDCU) demonstrated capability to perform spatial analysis to identify hotspots and high-risk areas for prompt response, it is unclear how consistent the practice is across the country.

Likewise, for seroprevalence surveys (using IgG tests), efforts are ad hoc with limited sample size and regional representation (Tissera et al., 2010; Jeewandara et al., 2024) – as a result, the true burden of the disease remains unknown.

Some ad hoc studies have shown local transmission of chikungunya and Zika viruses, which are transmitted by the same *Aedes* vectors as dengue. However, the intensity and burden of the two diseases are not known.

7.4. Diagnosis and case management

The diagnosis of dengue is largely clinical-based, with confirmation of some cases by NS1 antigen test at some health facilities. The Infectious Disease Hospital in Colombo uses platelet counts and haematocrit values for clinical diagnosis. Use of NS1 is limited due to preference by clinicians. A combined test of NS1 and IgM provides higher sensitivity, and is recommended for use, instead of NS1 only.

Case management guidelines of WHO-SEARO and national guidelines of the Ministry of Health, 2023, are used for case diagnosis and management. The major hospitals in Sri Lanka, such as the Infectious Disease Hospital and the District General Hospital Negombo, have a high capability of managing dengue cases, and they also train other medical and health-care personnel in case management. In 2013, the Ministry of Health had also introduced case monitoring forms for mandatory use by all health-care facilities. A standardized outpatient triage for screening fever cases suspected of dengue was introduced in 2019. Placing care for non-severe dengue cases at the primary health care level can release hospital capacity for severe cases, especially during an outbreak. Equipping all hospital wards with ultrasound to facilitate early detection of plasma leakage is commendable. To assist self-care at home, the Ministry of Health has also released advice for dengue patients.

7.5. Vector surveillance and control

Vector surveillance

The key vector of dengue in Sri Lanka is *Aedes aegypti*, with significant implication of *Ae. albopictus* in virus transmission (Jayasooriya et al., 2010). A study in Sri Lanka showed unused and unprotected outdoor containers in shaded areas to be the most productive for pupae (Arunachalam et al., 2010). The seasonality of *Aedes* species showed a bimodal pattern of larval breeding, with two population density peaks – June–July and the latter part of November–January. The monthly premise index data pooled for both species did indicate a correlation with case incidence after a one-month (4–6 weeks) lag period.

The dengue vector surveillance consists of many methods integrated into three approaches:



sentinel surveillance at fixed locations by monthly larval/pupal surveys, adult collections from resting places, ovitraps; quarterly human baited trap collections; annual insecticide susceptibility testing; and certain bio-efficacy tests annually;



routine vector surveillance in randomly selected sites in high-dengue-transmission/transmission-risk areas; monthly larval/pupal surveys; adult mosquito resting collections and ovitraps – based on the situation;



spot checks for larvae, pupae and adults in certain localities based on environmental situations, and at and around households where new dengue cases are reported.

Data show that the two species breed in a variety of indoor and outdoor habitats. Though at least one facility showed data on the estimated density of larvae in various containers, there is no consistent collection of data that can determine the most productive larval habitats and resting habitats of these species. Based on data seen by the expert group, the *Aedes* population density level remains high, and the data demonstrating the impact of vector control and community engagement were not adequate and sustainable.

Intensive surveillance offers much opportunity for deeper data analysis in order to gain insights into the risk and situation in Sri Lanka, especially when integrated with epidemiological data and other environmental data. Such efforts can be coordinated and harmonized at the central level.

Multiple surveillance methods are currently used – this is resource-intensive. Data analysis can also shed light on the value of each method and possibly reduce the number of methods used. Resources can be channelled to expand the coverage of surveillance, in time and space. Adult oviposition traps with sticky lining can be considered in place of ovitraps, adult collections and human baited trapping, resulting in several added benefits, such as trapping-out effect that can reduce dengue risk.

In the past 10 years, the NDCU Central Entomology Laboratory has reported pyrethroid and organophosphate resistance of both *Aedes* vectors in certain districts. While the entomology teams routinely use the WHO test procedures and standard operating procedures for insecticide resistance monitoring (WHO, 2022a; WHO, 2022b), the limited procurement of insecticide impregnated papers from the WHO-coordinated facility in Penang, Malaysia, has adversely affected resistance monitoring in Sri Lanka.

The entomological data from surveillance are shared by entomological field officers in the districts through epidemiologists and entomologists with the National Dengue Control Unit.

Sustained vector control

The vector control policy is aligned with the WHO policy on integrated vector management (WHO, 2012), which by design encompasses control of other vectors of disease, such as *Anopheles stephensi*, *An. culicifacies* and sandfly vectors, in their specific geographical ecologies. The Government of Sri Lanka has a long-standing commitment to the national integrated pest management policy. A WHO-coordinated vector control needs assessment in Sri Lanka identified the critical needs of vector control (van den Berg, 2024). Dengue control in Sri Lanka accords high priority to environmental management, which benefits from the National Environment Act 47 of 1980. The observed clean streets with effective waste management in public areas in the country establish a commendable foundation for *Aedes* control.

For mosquito breeding control, public health inspectors and field assistants in mosquito control visit various premises where new dengue cases have been notified on the preceding one or two days, issue notices to the premise owners to eliminate the breeding, supply larvicides and apply fogging under the supervision of the Medical Officer of Health. Where required, they take enforcement actions according to the Prevention of Mosquito Breeding Act, No. 11 of 2007. The amendment to the Act is now under preparation by the National Dengue Control Unit in coordination with the Legal Unit of the Ministry of Health.



Among the vector control tools used are:

- larvicides (temephos 1% SG, Bti, insect growth-regulating products – pyriproxyfen, S-methoprene, novaluron)
- Indoor fogging with Pesguard (**Cyphenothrin 13.2% d-Tetramethrin 4.4%**),
- Gokilaht-S (d-d, trans-cyphenothrin),
- Malathion outdoor fogging,
- Some indoor residual spraying (deltamethrin; lambda-cyhalothrin) in Colombo municipality targeting each new dengue case notified.

Vector control, including community-based source reduction, appears to be performed or promoted only in response to cases or transmission and because surveillance and follow-up household engagement are only conducted in selected areas; most households, including in high-risk areas, may not be reached during the interepidemic period. As the *Aedes* population and the number of dengue cases during pre-outbreak periods set the stage for outbreaks, a sustained programme to reduce the *Aedes* population during the interepidemic period is critical to moderate any impending outbreaks, particularly with outreach to all households in high-risk areas.

A field trial to introgress the intracellular bacterium *Wolbachia pipientis* (wMel strain) into *Ae. aegypti* populations was interrupted by the COVID-19 pandemic, thus it was met with inconclusive outcome. No data were available to support the claim of a positive impact or otherwise on dengue transmission. Once the monitoring phase is over, the impact can be assessed and scaling-up can be decided on.

In technical collaboration with the International Atomic Energy Agency, Vienna, the University of Kelaniya conducted a field trial on sterile insect technique to suppress *Ae. albopictus* mosquito population, but it was discontinued, despite some success, due to the end of funding. The team has started to prepare a trial on sterile insect technique to suppress the *Ae. aegypti* mosquito population. A spatial repellent product is also undergoing a trial.



Insecticide resistance management inter alia requires introduction of new products with unrelated modes of action. Therefore, coordinate with the Pesticide Registrar Office in Kandy to evaluate, if required, and register new products to maintain effectiveness of vector control interventions.

7.6. Advocacy, social mobilization and risk communication

Health education, health promotion and dissemination of health information are undertaken by the Health Promotion Bureau for the Ministry of Health. As its priorities may differ annually, the NDCU and its provincial units often manage the health education and promotion activities themselves to raise awareness and inculcate positive habits to prevent the spread of dengue. This has resulted in inconsistencies in brand identity, messaging and delivery approaches due to limited coordination and central oversight.

With the appropriate communication expertise and supervisory oversight, dengue prevention communication should be strategically planned to increase communication effectiveness with the following features:



common brand identity through design elements such as logo, tagline, colour palette, tone of voice;



clear and consistent key messages used nationwide, though messages can be customized locally;



central repository of key creative assets (e.g. flyers, posters, videos, digital assets and templates for information dissemination) to serve as resources that can be cascaded down and adapted for use at the district level to support engagement and social mobilization, as part of a larger objective to prevent and prepare for outbreaks;



annual dengue prevention publicity campaign with launches timed to precede the forecasted dengue peak each year to signal the start of concerted dengue prevention efforts nationwide as well as complement district publicity efforts in high-risk areas;



ability to optimize media spend and reach;



enhanced risk communication, such as by having a common community alert system;



capacity for sustained social media content (e.g. Facebook, Instagram);



coordinated stakeholder efforts nationwide in support of dengue prevention to amplify the messages;



regular assessment of communication effectiveness.

The NDCU has a Facebook page but posts are sporadic and can be more audience-centric to increase levels of engagement (likes, follows). Due to changing demographics and the profile of dengue cases being among school-aged children and working adults, there is an opportunity to strengthen communication to the youth and working adult segments through sustained social media content.

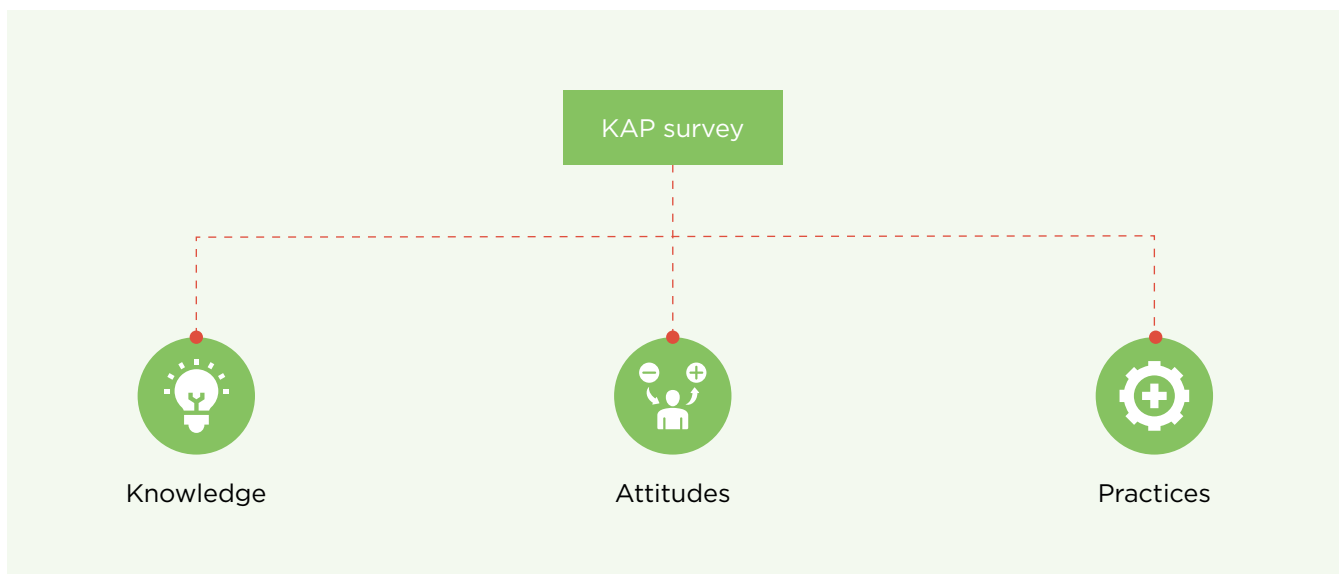
This will serve to expand the reach of key messages to complement traditional forms of media as well as allow rapid sharing and dissemination of disease risk information to disparate audiences, particularly in high-risk areas with fast-evolving disease situations. Digital platforms also allow for tracking of user engagement, enabling fine-tuning of messages to suit targeted audiences for greater message effectiveness.

Education on dengue prevention is already incorporated into school curriculum. There are opportunities to enhance educational efforts through the development of educational materials at the central level (e.g. worksheets, games) to ensure that consistent branded content and key messages are relayed to students. Ultimately, efforts should aim to cultivate students as dengue advocates to their families at home, as part of a broader community mobilization strategy.

Community mobilization strategies are able to target a specific population profile and encourage ground-up, concerted and proactive approach to protect more individuals against dengue, and to complement and enhance general nationwide messaging. There is currently good utilization of community channels such as school health clubs and mother's support groups, facilitated by health education officers at the district level.

As financial resources are often a challenge, it is important to build and sustain relationships with NGOs and other stakeholders (e.g. corporates, grass-roots organizations) to mobilize their resources, stimulate investment and catalyse action. Examples will be leveraging partner assets during non-outbreak periods to help with preventive efforts, securing sponsorships through corporate social responsibility programmes or tapping into partners' media channels (Facebook, WhatsApp, websites, community touchpoints) to educate and amplify disease messages to their follower base. To ensure a pipeline of stakeholders, it is important to continue to build new engagements, encourage ownership and cultivate champions within the community.

Beyond actions, there is also a need to review efforts regularly to fine-tune strategies. **The Health Promotion Bureau administers knowledge, attitudes and practices (KAP) surveys to measure behavioural changes**, but this may not have been extended to the dengue (or other VBD) campaigns. Hence, the effectiveness of communication interventions has not been assessed for ongoing programmes and channels. At the district level, key indicators are often based on the number of health promotion settings and other measures such as frequency of school cleaning. However, regular reporting is a challenge, evidenced by the fact that schools are consistently identified as one of the top mosquito-breeding premises, indicating that there is still a gap between the reported actions and behaviours.



7.7. Recommendations

National strategic plan

1. Considering the recommendations of this WHO mission, develop a National Strategic Plan for the Prevention and Control of Dengue 2024–2030.

Enhance case surveillance and risk stratification for preparedness and effective response to dengue outbreaks

2. The presence of multiple arboviruses warrants an integrated surveillance for all major arboviral diseases in the country (see the Section 9).
3. Maximize surveillance for real-time case detection and notification.

- Improve laboratory diagnostic capacity and ensure sustained availability and affordability of RDTs (NS1/IgM). A combined test of NS1 and IgM provides higher sensitivity, and is recommended for use, instead of NS1 or IgM only. Sri Lanka can consider waiver of taxes for essential medical products such as those needed for surveillance and treatment of dengue.
- Monitor circulating dengue serotype, e.g. fortnightly or monthly, to first determine if outbreak signals can be glimpsed from the serotype distribution (Lee et al., 2010). Leverage academia and hospitals with RT-PCR facility for this effort by consolidating data from research projects to supplement the data obtained by the NDCU.

4. Intensify data collection by extending NaDSys to outpatients and the private sector to improve case notification and reporting of fatalities, including those involving dengue, Zika and chikungunya, by public and private health providers to enhance downstream control and disease management efforts.
5. Consider placing care for non-severe dengue cases at the primary health care level to release hospital capacity for severe cases, especially during an outbreak. Training in primary health care is thus critical.

Understand disease burden and monitor and evaluate control programme

6. Regular countrywide seroprevalence surveys (IgG tests) can help understand the true burden of the disease and evaluate the long-term impact of the Dengue Control Programme. Considering the resource constraints, conduct a district-level pilot on dengue seroprevalence to assess the burden of dengue, economic impact and effectiveness of the control programme. Based on the outcome of the pilot survey and contingent upon resource availability, consider nationally representative seroprevalence surveys every five years.

Sustained risk-based interventions for disease prevention and control

7. Put in place a programme and campaign that ensure sustained effort from the community and all stakeholders, including during the interepidemic period. This can include:

- Ensure sustained coordination with stakeholders, especially those involved in high-risk sites, e.g. construction sites and schools.
- Broaden the excellent environmental and waste management practices to all districts.
- Increase coverage of surveillance areas, potentially with resources diverted from prioritization of surveillance tools (see Recommendation 10 below).
- Extend MOH's inspection and enforcement beyond areas and period with case notification. Together with the NDCU, consider a systematic risk-based plan for inspection and enforcement.
- Ensure low-intensity public engagement during the lull dengue season to nudge behaviour and habits change.

8. Develop a risk-based system (in time and space) for social mobilization, stakeholder engagement and vector control.

- Spatial and temporal risk stratification should be performed across all districts, with oversight and harmonization from the central unit. These risk stratification systems should use case, entomological and other environmental data to generate early outbreak warning and geospatial mapping of dengue risk to facilitate preparedness, resource allocation and prompt risk-based vector interventions, case management and social mobilization.
- Develop an early warning system, taking virus serotype into consideration, for forecasting dengue outbreaks and necessary capacity of the public health staff for early response.
- Leverage academia, hospitals and international projects for virus serotype and genotype surveillance, and consolidate data into a national database

9. Improve capacity for data analytics to gain epidemiological insights and perform risk stratification (Recommendation 7). This involves interdisciplinary efforts among epidemiologists, entomologists, virologists and data analysts.

- Develop a dedicated group that consolidates data, performs data cleaning, analysis and interpretation, and documents and reporting.
- Collaboration with countries that have such a system in place and leveraging academia are strongly encouraged.

Vector surveillance and control

10. Digitize and integrate vector surveillance data with epidemiological and virus data to create comprehensive dashboards and maps. This integration will enable robust analysis and facilitate sustained risk-based vector control strategies to facilitate rapid response to transmission dynamics (Recommendations 7 and 8 above).
11. A critical assessment of various entomological surveillance techniques (e.g., ovitrap, larval surveys, adult collection) with robust data analytics is essential for prioritizing and focusing on the most effective tools. There should be clarity on the objective and intended outcome of each tool used. Optimizing surveillance methods will allocate resources more effectively, potentially expanding coverage and improving data quality, community awareness and involvement, thereby enhancing overall outcomes. Data from public health inspectors' and field assistants' (mosquito control) inspections can be used to complement surveillance data.
12. Continue current classical vector control methods.
 - a Ensure judicious use of insecticides, especially for fogging for outbreak containment, manage pesticide use in a life-cycle approach to minimize human and environmental risks, and maximize efficacy.
 - b Monitor insecticide resistance in *Aedes* vectors as part of a coordinated national effort in representative eco-epidemiological risk/transmission settings of all VBDs.
13. Evaluate emerging vector control methods such as *Wolbachia* and sterile insect technique using existing global and local data to prioritize one or two approaches for longer-term funding.
 - a Given the high costs associated with field trials and implementation of novel tools, committing to a selected approach enables long-term planning and enhances the likelihood of translating studies and trials into meaningful public health impacts.
 - b Collaborate closely with the academic entomology community and funding bodies to synergize efforts, and concentrate on the most promising tool.
14. Enhance managerial capacity in vector control policy formulation, planning, evidence-based decision-making and assessment of integrated vector management (IVM) interventions by establishing senior-level entomology positions at the central level. Consider appointment of a Chief Entomologist at the national level. These positions not only provide a career pathway for entomology personnel akin to public health or medical cadres, but also foster expertise development and retention within the system.
15. Implement integrated vector surveillance and management and cross-disease collaboration at the central level according to rationale criteria.
16. Consider strengthening environmental guidelines or building codes to prevent mosquito breeding, and orient architects and civil engineers to mosquito-free designs and environmental management.

Advocacy, social mobilization and risk communication

17. Ensure having a dedicated communication expert with the appropriate technical skills at the central level. This resource may also play a role as part of an intersectoral communications team that seeks to integrate the vector-borne disease efforts.

18. Develop a national communication strategy, including risk communication through national and international collaboration.
19. Strengthen alignment with the Health Promotion Bureau to ensure consistent and timely communication support annually.
20. Conduct formative research to ensure effective behavioural change. Consider more outcome-based indicators (e.g. regularly measure shifts in awareness, knowledge, attitudes, practices) to identify gaps in communication and knowledge as well as to further improve use of communication channels for optimized message delivery. This data can be subsequently used to fine-tune the communication strategy and customize messages to optimize effectiveness.
21. Recommendations for the longer term:



Research

22. Leverage national research resources by working with research funding bodies to identify priority areas for academic research, align public health needs with grant calls and be part of the review panel of projects, to ensure that research is translated into public health or clinical management measures.

8

Leishmaniasis control programme



8.1. Programme management

Cutaneous leishmaniasis is emerging as a public health problem in north central and southern parts of Sri Lanka, with 300 reported cases per year. A few isolated cases of visceral leishmaniasis have also been reported in the last decade. Visceral leishmaniasis is notifiable since 2008. There is no separate organogram for the leishmaniasis that is being managed by the AMC, headed by its Director. The Deputy Director of the AMC looks after eight units at the national level, including a Vector Control Unit. A consultant community physician, together with one of the four entomologists, looks after entomological work on malaria and leishmaniasis and a central entomological laboratory. The provincial directors of health services control the activities in their respective provinces and oversee the entomological activities through the regional malaria officers of different districts who in turn supervise public health field officers and public health inspectors for vector surveillance, along with other activities. Sandflies are collected by health entomology officers and spray machine operators, with *saukya karya sahayaka* as health assistants. Some universities and medical colleges in Kurunegala, Kandy and Gampaha regions support entomological investigations on prevalence of sandfly species and their bionomics. Other researchers also conduct entomological research in Kegalle, Kurunegala, Hambanthota, Anuradhapura and Matata districts.

8.2. Situation analysis

Leishmaniasis was first reported in Sri Lanka in 1904. Indigenous cases of cutaneous leishmaniasis and visceral leishmaniasis were reported until 1953, and then no more reported cases thereafter until 1992 (Athukorale, et al., 1992) probably due to the effect of extensive DDT indoor residual spraying carried out for malaria control in the country. The disease transmission appears to have remained at a low level till 2001–2009 in Polonnaruwa. A 15-fold increase in cutaneous leishmaniasis cases in 2010 and then a further 10-fold increase were reported in 2019 when the annual incidence of cases reached up to 3000 (Karunaweera, et al., 2021). The districts reporting the highest number of cases include Anuradapura, Polonnaruwa, Kurunegala, Hambanthota and Matara. Seven confirmed visceral leishmaniasis cases, including two HIV co-infections and two mucocutaneous leishmaniasis patients, were also reported during this period. *Leishmania donovani* MON-37 (Ranasinghe et al., 2012) was confirmed as the causative agent for cutaneous leishmaniasis. The vector species is/are yet to be confirmed, and the presence of *L. tropica* and suspected vector *Phlebotomus salehi* in the endemic area is also yet to be confirmed.

The five species of *Leishmania* parasites known to cause CL in humans in the Old World are *L. tropica*, *L. major*, *L. infantum*, *L. aethiopica* and *L. donovani* (WHO, 2010).

Limited understanding of vector bionomics and low public awareness contributed to the spread of the disease in the country. Furthermore, the possibility of underreported cutaneous leishmaniasis and visceral leishmaniasis is a matter of concern.

8.3. Case surveillance, diagnosis and management

Leishmaniasis was made a notifiable disease in 2008 and is part of the Communicable Disease Surveillance Programme of Sri Lanka, a national network covering the whole country. The passive case surveillance had been the mainstay till 2023. It is mandatory for cases of suspected leishmaniasis to be notified to the Medical Officer of Health of the area in which the patient is residing through the Communicable Disease Surveillance, using the H544 form. Once the Medical Officer of Health receives the notification form, the details are entered in the Communicable Disease Notification Register maintained at the Medical Officer of Health office. The PHI of the area should investigate the case within seven days of notification. All household contacts of the index patient are screened for cutaneous leishmaniasis through dermatology clinics. During the investigation of the notification of a suspected or confirmed case, the PHI of the area is required to visit around 50 houses in the immediate vicinity of the residence of the patient to check if there are persons with suspected cutaneous leishmaniasis lesions; if any are found, they should be referred to a dermatology clinic.

There is no organized active case-detection system. During the visit of the mission team in Kurunegala, Polonnaruwa and Dumbulla hospitals, 2, 3 and 10 new cases were seen per day respectively, without seasonality. Irregular passive surveillance of the disease is in practice. The reports on cases using a paper-based reporting system are up-to-date and available (Fig. 2). The patient may be treated on clinical suspicion at the dermatology clinic and not notified. There is no disease surveillance system with regard to migrants.

Figure 2. Cutaneous leishmaniasis cases reported at Polonnaruwa District General Hospital (left) and Kurunegala Teaching Hospital (right)



Cutaneous leishmaniasis cases are diagnosed microscopically with slit skin smear for all suspected cases. Slit skin smear is performed by public health laboratory technicians; it is available at all institutions having such personnel at national and district levels. PCR and culture are not readily available. The rk39 RDTs for diagnosing visceral cases are not available in the country.

There is no standard clinical case management system. No standard treatment of CL cases is available. There has been a shortage of antimonial drugs for more than six months and the WHO Country Office has committed to importing the drug (sodium antimony gluconate). Presently, patients are treated with intralesional hypertonic saline, intralesional metronidazole and cryotherapy. There are difficulties in treatment of complex cutaneous leishmaniasis cases – a case of *Leishmania recidivans* at a hospital was treated for one year by intralesional hypertonic saline.

There is no system of management of scars inflicted by cutaneous leishmaniasis. Most of the patients (19) were found to be adults, with a predominance of men, and 1–2 small-size (1–3 cm) lesions on each patient. Fourteen patients had plaques (>4 cm in size) and one woman had the *Leishmania recidivans* type on the face. Seven patients were healing with remaining dyspigmented and atrophic scar (disabilities) (Fig. 3). There is a lack of a case follow-up system and there is no involvement of the private sector in case detection and notification.

Figure 3. Clinical presentation of cutaneous leishmaniasis patients



The presence of dermatologists and medical officers, who manage cases in addition to discharging other responsibilities, is a favourable point. Lack of a standard drug as well as specific training for the medical health staff is a key weakness.

8.4. Vector surveillance and control

In China and India, the causative agent for anthroponotic cutaneous leishmaniasis was found to be *L. donovani*, transmitted by *Phlebotomus longiductus*. In Cyprus, *L. donovani* was found to be the causative agent for both visceral leishmaniasis and cutaneous leishmaniasis; the vector is still unknown. In Israel, cutaneous leishmaniasis is caused by zoonotic cutaneous leishmaniasis parasites such as *L. major*; it is transmitted by *P. papatasi* in Iran, Israel and Tunisia and by *P. salehi* in India. *L. tropica* causes anthroponotic cutaneous leishmaniasis in Saudi Arabia, Morocco and the Russian Federation; it is transmitted by *P. sergenti*. *Leishmania donovani* causes visceral leishmaniasis in India, Nepal and Bangladesh, and is transmitted by *P. argentipes*. Mucocutaneous leishmaniasis has also been reported from Sri Lanka, but the causative parasite is yet to be confirmed.

In the Indian state of Himachal Pradesh, *P. (alderius) longiductus* and *P. (larrousisus) major* have been found; *P. longiductus* was identified as the vector for transmitting *L. donovani* and causing anthroponotic cutaneous leishmaniasis (Lata et al., 2022). However, in Sri Lanka, a study has come up with evidence in favour of zoonotic transmission of the local species (Siriwardana et al., 2008). With such indications, the initial view of anthroponotic *L. donovani* transmission is being questioned (Amarsinghe and Wikramasinghe, 2020).

The epidemiology of cutaneous leishmaniasis in Sri Lanka is not fully understood yet. There are plans to achieve the goal of reduction in incidence of cutaneous leishmaniasis (<5 cases/10 000 population) at the district level and reach zero mortality due to visceral leishmaniasis by 2028 in Sri Lanka.

During the WHO mission, sandflies of genus *Phlebotomus* and *Sergentomyia* were identified. The species of *Phlebotomus* comprises *P. argentipes*, *P. stantoni* and *P. salehi*; these were identified previously in Sri Lanka (Gajapathy and Surendran, 2012). In other regions, the established vectors for visceral leishmaniasis are *P. argentipes* and those for cutaneous leishmaniasis are *P. salehi*.

Entomology teams at offices of regional malaria officers in areas such as Kurunegala, Moneragala and Polonnaruwa and the AMC HQ team have started sandfly surveys from May 2024. The staff of RDHS offices in some districts are also doing sandfly surveys but without coordination with the AMC HQ. The WHO mission team visited an endemic village in Kurunegala, the Kotapatiya village in Polonnaruwa and Kumbuk-Kandanwala in Dambulla district, and found sandflygenic conditions inside houses and in outdoor situations, such as in dense vegetation of wild shrubs, stacks of straw and heaps of coconut shells stored for fuel. Installation of CDC light trap and sticky traps inside houses and outdoor was demonstrated to the accompanying staff in the villages visited. Resting sandflies were also collected from three houses; these were identified as *Phlebotomus argentipes* and *Sergentomyia* spp.

The circular dated 14 November 2019 issued by the Director-General of Health Services states, “Based on the entomological investigation findings, both regional malaria officers and district entomologist need to take appropriate vector control measures in collaboration with regional epidemiologists and the relevant MOH to be maintained till finalization of the national programme.”

8.5. Strengths



The Leishmaniasis Control Programme has just been initiated and is being managed by the AMC.



Scientific and academic collaborators from the local universities and research organizations are available to support entomological research work in leishmaniasis-endemic districts.

8.6. Weaknesses

- There has been no strategic plan for control of leishmaniasis; a new strategic plan was recently developed.
- There are no integrated activities for leishmaniasis control with other programmes.
- There is no formal entomological surveillance programme for sandflies.
- There has been no guidelines on entomological surveillance and data reporting; the guidelines are being finalized.
- There is no vector control guidance specific to the needs regarding sandflies.
- No formal training in taxonomic identification, preservation, suitable collection methods, laboratory rearing, sandfly surveillance, insecticide resistance testing, bioassay and sandfly control has been provided to entomologists, including health entomology officers. There are technical and financial limitations for conducting entomological surveillance.
- There is limited community awareness about the disease and health-seeking behaviour.
- The number of CDC light traps available is insufficient for effective sandfly surveillance.

8.7. Recommendations

1

Leishmaniasis control plan:

Develop and disseminate the national action plan for leishmaniasis control.

2

Case management:

Develop national standard case management guidelines for leishmaniasis and provide regular training to health professionals, both for cutaneous leishmaniasis and visceral leishmaniasis.

3 Essential medical commodities:

Ensure sustained availability of drugs (for cutaneous leishmaniasis and visceral leishmaniasis) and rk39 RDT (for visceral leishmaniasis).

4 Awareness raising:

Improve awareness of leishmaniasis among health-care professionals and people in risk areas; also raise awareness of visceral leishmaniasis among migrant workers.

5 Quality of surveillance:

Strengthen surveillance both for cutaneous leishmaniasis and visceral leishmaniasis, and develop high-resolution geospatial risk map to implement targeted interventions.

- Develop standard guidelines on disease and vector surveillance and data management.
- Provide training in use of suitable surveillance methods, taxonomic identification and characterization of sandflies up to species level, using morphological and molecular tools.
- The sandfly species, *Leishmania* parasite (promastigote form), animal reservoir specimens and other relevant specimens should be cross-checked by the reference centre/recognized laboratories

6 Transmission dynamics study:

Study bionomics and spatiotemporal seasonality, host preferences, biting preferences of sandflies in well-defined eco-epidemiological settings of sandflies (in both endemic and non-endemic areas).

- Establish any zoonotic reservoir, based on characterization of sandfly vector and parasites, including blood meal analysis of wild-caught sandflies. The parasitology division of a medical college/veterinary college may be involved to collaborate for *leishmania* parasite culture for isolation of promastigotes from sandflies and amastigote from skin smear and lesions of cutaneous leishmaniasis patients, and splenic aspirates/bone marrow inoculation.
- Detect natural infection of *Leishmania* parasites with microscopic and molecular tools.

7 Vector control capacity:

Strengthen capacity of entomological staff for planning and implementing vector control based on the IVM approach at different levels.

8 Insecticide resistance:

Assess and monitor insecticide susceptibility against different insecticide classes against local sandfly species.

9

Overarching and cross-cutting areas

Sri Lanka holds a solid track record of elimination of diseases, including malaria and lymphatic filariasis. All vector-borne disease programmes are well-resourced in terms of disease-specific human resources and equipment in entomology, vector control and parasitology, and highly committed and dedicated staff is available at all levels, implementing extensive and rigorous surveillance (except for leishmaniasis at present), with leishmaniasis control as an exception because it is an emergent disease.

Each vector-borne disease programme/campaign has a strong vertical structure at all levels of the health system, with the national programme/campaign at the central level leading strategic guidance, policy development, resource mobilization and capacity-building for relevant public health workers throughout the health system. Sri Lanka also has a wealth of globally renowned experts on VBDs in its academic community, which must continue to play an important role in generating much-needed scientific evidence on policies and operations.

It was observed that cost-effectiveness and efficiency of programmes could be significantly improved by leveraging opportunities for cross-learning and cross-strengthening among VBD programmes (Table 1).

Table 1. Areas with opportunities for functional integration and coordination to improve programme efficiency, cost-effectiveness and visibility

Functions	Dengue	Malaria	Filariasis	Leishmaniasis
Disease surveillance, epidemiology, M&E, data analytics	Integration among VBDs			
Vector surveillance & control, data analytics, new tools, pesticide management	Integration among VBDs			
Laboratory services and diagnostics	Integration with PHC	Integration among VBDs		
Case management	Integration with PHC			
Advocacy, social mobilization and risk communication	Integration among VBDs where feasible			

9.1. Disease and vector surveillance, epidemiology, M&E and data analytics

Common to all vector-borne disease programmes reviewed, multiple surveillance methods are currently used in parallel for each disease, marking inadequate rationalization of the value of each method. In addition, the same entomological surveillance activities are implemented independently for different diseases. These resource-intensive activities should be reviewed holistically and coordinated across programmes to reap synergy and improve cost efficiency. This can be facilitated by a small dedicated central coordination office or appointment of an existing programme to coordinate each cross-cutting function.

An enormous amount of data is being collected routinely by each programme through both disease and entomological surveillance. However, data are often collected and stored in hard copies and not being analysed at a granular level to rationalize each surveillance approach and focus actions in high-risk areas in a timely manner. Data analysis can also shed light on the value of each method and possibly reduce the number of methods used. Resources can then be channelled to expand the coverage of surveillance in time and space.

The potential cross-programmatic integration opportunities to strengthen overall surveillance and strategic use of data for actions are proposed as follows:

- entomological activities that target similar areas and landscape.
- data reporting system from the periphery to the central level to enable cross-analysis.
- data analytics capability to enable granular analysis of the data across diseases e.g. identifying risk factors, risk mapping, timely responses, disease forecast, cost benefit analysis.
- cross-learning on case investigation approach (e.g. dengue vs malaria).
- regular monitoring and supervision of surveillance quality and interventions on the ground.
- use of a migrants register in the AMC for provision of preventive chemotherapy for lymphatic filariasis and raising awareness of leishmaniasis for migrants from endemic countries.
- seroprevalence survey for multiple VBDs and beyond, for example, by utilizing serum samples collected through COVID-19-related study or seroprevalence survey of vaccine-preventable diseases.
- integrated vector surveillance through integration of vector collection, cross-sharing of entomological facility, sharing of data/information, and joint analysis and risk mapping, according to the eco-epidemiological settings, covering all disease-endemic/at-risk areas, including any further invasion of *An. stephensi*.

9.2. Vector control, new tools and pesticide management

For vector control, the common factors of the cross-programme are the overarching national policies, such as those on IVM, environment, pesticides control, mosquito breeding control and the WHO Global Vector Control Policy 2017–2030. Within the Ministry of Health (MoH), the vector control units in different central VBD programmes are responsible for vector surveillance and control of their respective diseases with no cross-disease mandate. They coordinate with other teams for other functions such as community mobilization and intersectoral collaboration for identification of risk areas, breeding prevention, source reduction, compliance with insecticidal applications and use of personal protective measures. These programmes provide necessary feedback and instructions to vector control teams at the district level.

Vector control is decentralized to districts and municipal councils, but different programmes have their own entomological personnel, whose roles and responsibilities at each organizational level are clearly identified. The duty lists of entomological staff and PHIs are unified at the district level and below though, and there is some degree of coordination on vector surveillance and control between programmes at the peripheral level.

These staff members are transferable across vector-borne disease and other public health programmes. The PHIs also supervise insecticide applications but need sound training in vector control. Outside of the MoH jurisdiction, municipal council areas have no entomology staff, except in the Colombo Municipal Council. Many private pest control operators also use insecticides, but there is ample scope for their involvement in the construction industry and housing sector for mosquito control.

Overall, within the context of an integrated approach, vector surveillance and control and research on vector bionomics and innovative tools should encompass vectors of dengue, malaria (*An. culicifacies* and the invasive *An. stephensi*) and leishmaniasis (phlebotomine sandflies).

The potential cross-programmatic integration opportunities and relevant recommendations are proposed as follows:

- 1 Insecticide resistance monitoring for all vectors of diseases including procurement of test kits, data management and geospatial threat mapping for informing effective interventions.
- 2 Selection and use of vector control interventions (indoor residual sprays, LLINs, larvicides) according to the IVM decision-making criteria.
- 3 Training and re-training of all entomologists in identification, bionomics, surveillance and control of all vectors (*An. stephensi*; *An. culicifacies*; *Aedes aegypti*; *Aedes albopictus*; sandflies) to monitor any intensification of vectorial potential and/or invasion in other districts.
- 4 Quality control and procurement of vector control tools, efficacious WHO-prequalified and/or nationally registered pesticides, and WHO-certified pesticide application equipment:
 - Maintain a stock of pesticide application equipment quality certified by WHO.
 - If required, import and use only WHO-prequalified insecticides.
- 5 Procurement of vector surveillance devices.
- 6 Monitoring of insecticide resistance against the insecticide modes of action groups used in the country and potentially new classes of alternative products:
 - The three programmes should undertake this activity once annually in a coordinated manner and in representative eco-epidemiological risk/transmission settings of dengue, malaria and leishmaniasis, and not in all districts/cities as is currently carried out.
 - Create a national digital database and prepare digital threat maps, and share data with WHO for global threat mapping.
 - Regularly procure insecticide resistance test kits/impregnated papers.
 - Coordinate with the Registrar of Pesticides to register new/alternative insecticide products already prequalified by WHO for using them in areas of high insecticide resistance intensity and outbreak risk mitigation.
 - Strengthen the capacity of the pesticide quality control laboratory to assess the quality of public health pesticides, according to the United Nations Food and Agriculture Organization (FAO)/WHO specifications guidelines.
- 7 Evaluation of innovative vector control products for registration and use.
- 8 Coordination for development of innovative vector control tools.

9.3. Laboratory services and diagnosis

The public health laboratory service plays a critical role in monitoring, diagnosing and controlling VBDs, such as dengue, malaria, lymphatic filariasis and leishmaniasis. The Medical Research Institute (MRI) in Colombo generally serves as the National Reference Laboratory, providing advanced diagnostic services, conducting research and offering training to health-care professionals. However, routine laboratory services for dengue, malaria, lymphatic filariasis and leishmaniasis are currently managed by each disease control programme and delivered at the district level separately, with a minimum role of the MRI.

For malaria and lymphatic filariasis, microscopic diagnosis of blood smear is conducted by public health laboratory technicians of the AMC and the AFC at the district level respectively; all positive smears and 10% of negative smears are cross-checked by public health laboratory technicians of the AMC and the AFC at the national level. However, suboptimal capacity of microscopy was observed in some district offices. WHO-recommended RDTs for lymphatic filariasis are rarely used in Sri Lanka due to funding constraints for procurement. For dengue, diagnosis is mainly conducted clinically and NS1/IgM RDTs are seldom used in the public sector again due to funding constraints for procurement (but used in the private sector frequently). Cutaneous leishmaniasis cases are also diagnosed microscopically with slit skin smear for all suspected cases by public health laboratory technicians and medical laboratory technicians at national and district levels. PCR and culture are not readily available. The rk39 RDTs for diagnosis of visceral cases are also not available.

Overall, within the context of an integrated approach, the potential cross-programmatic integration opportunities are proposed as follows:



optimization of laboratory infrastructure and equipment, for example, through shared facility across diseases and mobilization of adequate resources to procure sufficient quality-assured RDTs to improve early case detection and timely response.



microscopy training and QA/QC mechanism for malaria and lymphatic filariasis.

9.4. Case management

The health-care system in Sri Lanka is equipped with a network of hospitals and primary health care centres that provide diagnostic, treatment and preventive services. However, the existing capacity for case management of VBDs varies by disease.

Case management of dengue is well integrated into the existing health system, with the major hospitals in Sri Lanka having a high capability of managing dengue cases and also providing regular training to other medical and health-care personnel on a regular basis in collaboration with the NDCU.

Case management for cutaneous leishmaniasis too is operated by and hence integrated into the existing dermatology clinics with appropriate care. However, there is an urgent need to develop national case management guidelines to standardize case management practices according to global standards.

Sri Lanka remains free of indigenous malaria since the last indigenous case in September 2012. Post-elimination, the country is highly receptive and vulnerable to malaria with previous malaria vectors still being prevalent in large parts of the country, along with the risk of receptivity expanding to urban settings due to the newly introduced urban vector of malaria, *An. stephensi*. Imported malaria continue to occur every year, thus maintaining the malariogenic potential, necessitating the country to have an effective programme to prevent the re-establishment of the disease. Malaria has rapidly become a forgotten disease, with clinicians and healthcare staff no longer suspecting malaria among febrile patients as it used to be, the case; this poses a major challenge to early detection and case management.

Sri Lanka was also validated for having eliminated lymphatic filariasis as a public health problem in 2016, yet over 500 new cases of lymphoedema likely due to lymphatic filariasis continued to be identified each year to date. The AFC is in the process of expanding the MMDP clinics in the former endemic areas where trained health-care workers provide appropriate essential package of care for lymphoedema patients. However, given the substantial number of new lymphoedema cases reported annually, there is a need to further expand the access to MMDP services across the endemic areas and integrate such services into the existing primary health care (PHC) units, instead of MMDP clinics established independently, so that lymphoedema due to different causes can be equally attended to and regularly followed up on in a sustained manner.

Further, asymptomatic carrier patients detected through community screening are treated with a full course of Diethylcarbamazine citrate (DEC) and albendazole (ALB), according to the National Treatment Guidelines, and the community living within a certain radius of a positive patient is treated with mass drug administration with DEC and ALB stat dose. Positive patients are followed up on in one month to see the parasitaemic clearance.

As the disease burden decreases, knowledge, awareness and capacity of health-care providers for diagnosis and case management of VBDs also decline over time. In order to sustain their knowledge, capacity and awareness, integration of case management into the existing PHC-based health system is proposed as follows:

integration of case management of malaria and leishmaniasis into primary health care;

integration of lymphatic filariasis MMDP care into the primary health care services for lymphoedema patients due to other causes;

integration of epidemiology, diagnosis and case management of VBDs into in-service training of health-care professionals to ensure their basic knowledge.

9.5. Overarching recommendations

To identify and operationalize integration and coordination of common functions (including repurposing of staff) across multiple VBDs to optimize the use of technical expertise and financial resources in an integrated approach without losing the accountability and gains:

1. Designate a new position to specifically oversee VBDs to streamline the efforts across various VBD control programmes and to ensure cohesive leadership and accountability, focusing on identifying synergies and preventing duplication of efforts across the malaria, leishmaniasis, filariasis and dengue programmes. Develop terms of reference (ToR) for the new VBD leadership position, outlining responsibilities such as:
 - Coordinating integration among different VBD-specific programmes;
 - Leveraging existing human resources and technical expertise to optimize efficiency;
 - Ensuring that VBDs operate under a unified strategy while preserving disease-specific accountability and monitoring.
2. Develop an action plan to operationalize integration of common functions (including repurposing of staff) across multiple VBDs.
3. Improve data analytics of VBDs for robust data analysis, development of high-resolution risk maps and guiding strategic, targeted and timely response measures, including digitization of data, through the designation of a VBD data analytics team and building their capacity.
4. Improve quality of surveillance by prioritizing resources for high-risk areas with significant transmission risk while avoiding dilution of surveillance efforts in areas with minimal or no risk. Conduct a risk-based review and stratification of all areas to streamline activities, ensuring that resources and expertise are concentrated where they will have the greatest impact.
5. Enhance field staff capacity by improving their skills in critical areas, such as vector collection, dissection and microscopy, while incorporating advanced diagnostic tools and techniques. Specialized training sessions, supported by international and local stakeholders/experts, should be conducted to ensure early detection, timely intervention and effective outbreak response.
6. Strengthen synergistic collaboration between programmes/campaigns and academicians to leverage implementation research to improve programme efficiency, jointly fill knowledge gaps and adapt more innovations.
7. Establish a mechanism for intersectoral coordination for all VBDs to address environmental and social determinants of diseases, particularly with regard to joint planning, actions and monitoring at national, provincial, district and municipality levels.

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Chapter 4

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Annexure 1

List of expert team members

1. **Dr Rajpal S. Yadav** - former scientist (Public Health Entomologist) in charge of WHOPES at WHO HQ; the current Chairman, Scientific Advisory Committee, ICMR-Vector Control Research Centre, Puducherry, India
2. **Dr Leonardo Ortega** - former Unit Head at the Global Malaria Programme, WHO HQ
3. **Dr Ng Lee Ching** - Director, Environmental Health Institute, National Environment Agency, Singapore
4. **Dr Ramaiah Kapa** - Independent expert on Lymphatic Filariasis (Entomologist and Epidemiologist), Former Scientist at ICMR-Vector Control Research Centre, Puducherry, India
5. **Dr Mourad Mokni** - Head of WHO Collaborating Centre on Cutaneous Leishmaniasis, Professor of Dermatology, Faculty of Medicine, University al Manar 2, Tunis, Tunisia
6. **Dr Diwakar Singh Dinesh** - Consultant (Entomology), Division of Medical Entomology and Vector Management, National Centre for Disease Control, Directorate General of Health Services, New Delhi, India
7. **Mrs Lynelle Seow** - Deputy Director, Department of Marketing Communications, National Environment Agency, Singapore
8. **Mr Jason Tan** - Senior Assistant Director, National Environment Agency, Central Regional Office, 4545, Jalan Bukit Merah, Singapore

WHO personnel as part of the expert mission

1. **Dr Aya Yajima** - Regional Adviser (Neglected Tropical Diseases), WHO-SEARO
2. **Dr Risintha Premaratne** - Regional Adviser (Malaria), WHO-SEARO

Annexure 2

Details of entomological and parasitological surveys conducted in 2023 in Hambantota, Galle and Kalutara districts (for filariasis control)

		Hambantota	Galle	Kalutara
Entomological surveys				
Indoor resting mosquito collection	#mosquitoes collected	NA	NA	10,338
	#mosquitoes dissected	3,606	6,953	8,948
	#infected (%)	0	22 (0.31)	88 (0.98)
	#infective (with L3) (%)	0	8 (0.11)	0
Gravid trap collection	#mosquitoes collected			18,718
	#mosquitoes subjected to PCR/dissection	4,435+2,210+442*	309 pools	256 pools***
	#infected	0	0	15 pools positive***
	#infective (with L3)	0	-	-
Cattle baited trap collection	#mosquitoes collected	NA	1,475	NA
	#mosquitoes subjected to PCR/dissection	903+438	4,123**	NA
	#infected	NA	15	NA
	#infective (with L3)	NA	15	NA
Man landing collection	#mosquitoes collected	Method not included	NA	NA
	#mosquitoes subjected to PCR/dissection	-	NA	NA
	#infected	-	-	-
	#infective (with L3)	-	-	-
Parasitological surveys	#people tested	20,525	92,853	1,00,894
	#people positive for Mf	3	13	5
	Mf rate (%)	0.02	0.01	0.005

- NA: Data not available
- *#PCR+Dissection by HEO+Dissection by PHLT, data show all negative
- **The source of mosquitoes, other than 1,475, is not clear
- ***Assumed that it is 2023 data

Annexure 3

AMC

- 1 Develop and implement a comprehensive plan and materials needed for advocacy, social mobilization and behaviour change communication on prevention of re-establishment. Meanwhile, leverage the support of TSG and multimedia groups in the county to continue advocacy for prevention of re-establishment.
- 2 Revamp entomological surveillance to focus on areas listed below. Collaborate with other VBD programmes to ensure complementarity and optimize the use of resources:
 - a. urban and peri-urban areas with high potentials for invasion by *An. stephensi*;
 - b. previously endemic areas with high risk of importation of malaria, particularly development project sites;
 - c. areas where people detected with imported malaria reside;
 - d. limiting monitoring of bionomics and insect resistance to previously endemic areas where there is massive use of agricultural insecticides;
 - e. previously endemic areas where other VBDs are still prevalent and entomological information is non-existent or outdated.
- 3 Collaborate with other VBD programmes to jointly develop and implement SOPs in areas where collaboration and integration will be cost-efficient. It may include entomological surveillance, training, supportive supervision and monitoring, outbreak preparedness and response, and logistics management.
- 4 Conduct innovative approaches to upgrade and sustain competencies on malaria among health-care providers in public and private sectors, in addition to ensuring that malaria remains part of the curriculums in medical and allied health courses. Some suggestions for consideration:
 - a. online course on malaria, with specific components to address the competencies required for each category of health staff; make it a mandatory requirement once every three years for those in the public sector and as a requirement for renewal of licence for those in the private sector; incentivize those who successfully completed it.
 - b. hybrid online and face-to-face training.
 - c. follow-up after training and mentoring.
 - d. mentoring of young / junior staff based on a framework to be developed with support from pedagogists and malaria subject matter experts
 - e. combined tabletop and field simulation exercises on malaria outbreak investigation and response.
 - f. collaborate with other VBD and public health programmes to find ways to include key information on malaria and prevention of re-establishment during training, whenever appropriate.
- 5 Invest in developing and sustaining a core group of highly skilled new generation of malariologists, epidemiologists, parasitologists, entomologists, vector control specialists. Explore support from national government, WHO, including TDR, academia and international donors.
- 6 Organize an international training on malaria elimination and prevention of re-establishment to promote best practices and lessons learnt in Sri Lanka to support WHO's efforts to build capacities on malaria elimination and prevention of re-establishment globally, regionally and in Sri Lanka.

- 7 Establish a Centre of Excellence on Malaria Elimination and prevention of re-establishment as recommended in the 2020 Malaria Programme Review.
- 8 Strengthen collaboration with the Ministry of Education to ensure information on malaria is part of school curriculums at primary and secondary levels so that the current and future generations remain aware of malaria and its prevention.
- 9 Continue to invest in research, and documentation and dissemination of best practices and lessons learnt.
- 10 Establish an independent multidisciplinary national task force to examine the feasibility, benefits, risks and budget implications of structural and functional integration of disease-specific VBD programmes into one VBD programme as part of medium- and long-term plan in the context of re-engineering of health services and ensuring cost-efficiency of health programmes. An integrated VBD programme should consider, among other things, the number of staff and the competencies needed to implement the National Strategic Plan of each VBD programme, the retooling required, and ensuring leadership and accountability for each disease programme.

AFC

1 Quality of surveillance:

The prevalence of lymphatic filariasis infection is scattered, with scanty Mf rates observed across districts, highlighting the need for high-quality surveillance to detect and eliminate residual infection and progress towards transmission elimination. To enhance the precision and efficacy of PVS, the following measures are recommended:

- **Digitalization of data:** Implement digital systems to collect, store and analyse parasitological, entomological and clinical data. Undertake thorough analysis for evidence-based decision-making.
- **Microstratification and risk mapping:** Utilize collected data for microstratification of each Medical Officer of Health area and develop high-resolution risk maps, pinpointing high-risk areas and residual infection hotspots.
- **Geostatistical modelling:** Employ geostatistical modelling techniques to identify, target and eliminate residual infection with precision.
- **Methodological evaluation:** Conduct critical analysis to determine the relative value of different surveillance methods. Optimize deployment of cost-effective techniques to ensure sustainability of post-validation surveillance efforts.
- **Regular training:** Provide regular refresher training sessions focusing on microscopy, entomological techniques and data analytics to ensure proficiency among staff.
- **Sensitive diagnostic techniques:** Introduce sensitive diagnostic tools such as FTS to enhance infection detection capabilities, particularly in areas with low Mf rates.
- **LF transmission elimination plan:** Develop a comprehensive five-year strategic surveillance and response plan (2025–2030) for the total interruption of lymphatic filariasis transmission in collaboration with WHO, local experts and other stakeholders.

2 *B. malayi* resurgence:

Develop a comprehensive strategy to combat the resurgence of *B. malayi* in collaboration with WHO, adopting good practices followed in other countries. This strategy should include the introduction of ivermectin as part of triple drug therapy to enhance treatment efficacy.

3 Immigrant population:

Create a cost-effective and feasible treatment plan for immigrants from endemic countries by leveraging existing resources such as the migrants registers of the AMC. Implement preventive chemotherapy programmes tailored to the needs of immigrant populations, ensuring they receive timely and appropriate treatment to prevent the spread of lymphatic filariasis.

4 Integration of lymphoedema management:

Integrate lymphoedema management into primary health care (PHC) services and enhance the capacity of health-care providers to deliver quality care. This integration will facilitate expanded access to lymphoedema treatment for affected individuals and promote hydrocele surgery among eligible patients. Conduct training programmes and provide necessary resources to PHC facilities to support effective MMDP implementation.

5 Community and household vector control:

Promote community- and household-level vector control measures as integral components of efforts to achieve total interruption of transmission. Educate on targeted interventions such as insecticide-treated bednets, and environmental sanitation campaigns to reduce vector breeding sites and minimize human-vector contact.

National Dengue Control Unit (NDCU)

National strategic plan

- 1** Considering the recommendations of this WHO mission, develop National Strategic Plan for the Prevention and Control of Dengue 2024–2030.

Enhance case surveillance and risk stratification for preparedness and effective response to dengue outbreaks

- 2** The presence of multiple arboviruses warrants an integrated surveillance for all major arboviral diseases in the country (see the cross-cutting section).
- 3** Maximize surveillance for real-time case detection and notification:
- Improve laboratory diagnostic capacity and ensure sustained availability and affordability of RDTs (NS1/IgM). A combined test of NS1 and IgM provides higher sensitivity and is recommended for use, instead of NS1 or IgM only. Sri Lanka can consider waiver of taxes for essential medical products such as those needed for surveillance and treatment of dengue.
 - Monitor circulating dengue serotype, e.g. fortnightly or monthly, to first determine if outbreak signals can be glimpsed from the serotype distribution (Lee et al., 2010). Leverage academia and hospitals with RT-PCR facility for this effort by consolidating data from research projects to supplement data obtained by the NDCU.
- 4** Intensify data collection by extending NaDSys to outpatients and the private sector to improve case notification and reporting of fatalities, including dengue, Zika virus and chikungunya, by public and private health providers to enhance downstream control and disease management efforts.
- 5** Consider placing care for non-severe dengue cases at the primary health care level to release hospital capacity for severe cases, especially during an outbreak. Training in primary health care is thus critical.

Understand disease burden and monitor and evaluate control programme

- 6 Regular countrywide seroprevalence surveys (IgG tests) can help understand the true burden of the disease and evaluate the long-term impact of the Dengue Control Programme. Considering the resource constraints, conduct a district-level pilot on dengue seroprevalence to assess the burden of dengue, economic impact and effectiveness of the control programme. Based on the outcome of the pilot survey and contingent upon resource availability, consider nationally representative seroprevalence surveys every five years.

Sustained risk-based interventions for disease prevention and control

- 7 Put in place a programme and campaign that ensure sustained effort from the community and all stakeholders, including during interepidemic period. This can include:
 - Ensure sustained coordination with stakeholders, especially those involved in high-risk sites, e.g. construction sites and schools.
 - Broaden the excellent environmental and waste management practices to all districts.
 - Increase coverage of the surveillance areas, potentially with resources diverted from prioritization of surveillance tools (see Recommendation 10 below).
 - Extend MOH's inspection and enforcement beyond areas and period with case notification. Together with the NDCU, consider a systematic risk-based plan for inspection and enforcement.
 - Ensure low-intensity public engagement during the lull dengue season to nudge behaviour and habits change.
- 8 Develop a risk-based system (in time and space) for social mobilization, stakeholder engagement and vector control.
 - Spatial and temporal risk stratification should be performed across all districts, with oversight and harmonization from the Central unit. These risk stratification systems should use case, entomological and other environmental data to generate early outbreak warning and geospatial mapping of dengue risk to facilitate preparedness, resource allocation and prompt risk-based vector interventions, case management and social mobilization.
 - Develop an early warning system, taking virus serotype into consideration, for forecasting dengue outbreaks and necessary capacity of the public health staff for early response.
 - Leverage academia, hospitals and international projects for virus serotype and genotype surveillance, and consolidate data into a national database.
- 9 Improve capacity for data analytics to gain epidemiological insights and perform risk stratification (Recommendation 7). This involves interdisciplinary efforts among epidemiologists, entomologists, virologists and data analysts.
 - Develop a dedicated group that consolidates, performs data cleaning, analysis and interpretation, and oversees documents and reporting.
 - Collaboration with countries that have such a system in place and leveraging academia are strongly encouraged.

Vector surveillance and control

- 10 Digitize and integrate vector surveillance data with epidemiological and virus data to create comprehensive dashboards and maps. This integration will enable robust analysis and facilitate sustained risk-based vector control strategies, to facilitate rapid response to transmission dynamics (Recommendations 7 and 8 above).

- 11 A critical assessment of various entomological surveillance techniques (e.g. ovitrap, larval surveys, adult collection) with robust data analytics is essential for prioritizing and focusing on the most effective tools. There should be clarity on the objective and intended outcome of each tool used. Optimizing surveillance methods will allocate resources more effectively, potentially expanding coverage and improving data quality, community awareness and involvement, thereby enhancing overall outcomes. Data from public health inspectors' and field assistants' (mosquito control) inspections can be used to complement surveillance data.
- 12 Continue current classical vector control methods:
 - a. Ensure judicious use of insecticides, especially for fogging for outbreak containment, and manage pesticide use in a life-cycle approach to minimize human and environmental risks and maximize efficacy.
 - b. Monitor insecticide resistance in *Aedes* vectors as part of a coordinated national effort in representative eco-epidemiological risk/transmission settings of all VBDs.
- 13 Evaluate emerging vector control methods, such as *Wolbachia* and sterile insect technique, using existing global and local data to prioritize one or two approaches for longer-term funding.
 - a. Given the high costs associated with field trials and implementation of novel tools, committing to a selected approach enables long-term planning and enhances the likelihood of translating studies and trials into meaningful public health impacts.
 - b. Collaborate closely with the academic entomology community and funding bodies to synergize efforts, and concentrate on the most promising tool.
- 14 Enhance managerial capacity in vector control policy formulation, planning, evidence-based decision-making and the assessment of integrated vector management (IVM) interventions by establishing senior-level entomology positions at the central level. Consider appointment of a Chief Entomologist at the national level. These positions not only provide a career pathway for entomology personnel akin to public health or medical cadres, but also foster expertise development and retention within the system.
- 15 Implement integrated vector surveillance and management and cross-disease collaboration at the central level, according to rationale criteria.
- 16 Consider strengthening environmental guidelines or building codes to prevent mosquito breeding, and orient architects and civil engineers to mosquito-free designs and environmental management.

Advocacy, social mobilization and risk communication

- 17 Ensure having a dedicated communication expert with the appropriate technical skills at the central level. This resource may also play a role as part of an intersectoral communications team that seeks to integrate the vector-borne disease efforts.
- 18 Develop a national communication strategy, including risk communication through national and international collaboration.
- 19 Strengthen alignment with the Health Promotion Bureau to ensure consistent and timely communication support annually.
- 20 Conduct formative research to ensure effective behavioural change. Consider more outcome-based indicators (e.g. regularly measure shifts in awareness, knowledge, attitudes, practices) to identify gaps in communication and knowledge as well as to further improve use of communication channels for optimized message delivery. This data can subsequently be used to fine-tune the communication strategy and customize messages to optimize effectiveness.

- 21 Recommendations for the longer-term:
- Ensure regular awareness publicity campaigns along with actions to keep the environment clean.
 - Build a suite of publicity materials for effective communication.
 - Ensure regular engagement of community and other stakeholders.
 - Conduct annual surveys to measure effectiveness, e.g. awareness, action, knowledge.

Research

- 22 Leverage national research resources by working with research funding bodies to identify priority areas for academic research, align public health needs with grant calls and be part of the review panel of projects, to ensure that research is translated into public health or clinical management measures.

Leishmaniasis control programme

- 1 Leishmaniasis control plan:**
Develop and disseminate the National Action Plan for leishmaniasis control.
- 2 Case management:**
Develop national standard case management guidelines of leishmaniasis and provide regular training for the health professionals both for cutaneous leishmaniasis and visceral leishmaniasis.
- 3 Essential medical commodities:**
Ensure sustained availability of drugs (for cutaneous leishmaniasis and visceral leishmaniasis) and rk39 RDT (for visceral leishmaniasis).
- 4 Raising awareness:**
Improve awareness of leishmaniasis among health-care professionals and the public in risk areas, and also raise awareness on visceral leishmaniasis among migrant workers.
- 5 Quality of surveillance:**
Strengthen surveillance both for cutaneous leishmaniasis and visceral leishmaniasis, and develop high-resolution geospatial risk map to implement targeted interventions.
 - Develop standard guidelines on disease and vector surveillance and data management.
 - Impart training in use of suitable surveillance methods, taxonomic identification and characterization of sandflies up to species level, deploying morphological and molecular tools.
 - The sandfly species, *Leishmania* parasite (promastigote form), animal reservoir specimens and other relevant specimens should be cross-checked by the reference centre/recognized laboratories
- 6 Transmission dynamics study:**
Study bionomics and spatiotemporal seasonality, host preferences, and biting preferences of sandflies in well-defined eco-epidemiological settings of sandflies (both endemic and non-endemic areas).
 - Establish any zoonotic reservoir, based on characterization of sandfly vector and parasites, including blood meal analysis of the wild-caught sandfly. The parasitology division of a medical college/ veterinary college may be involved to collaborate for *leishmania* parasite culture for isolation of promastigotes from sandflies and amastigotes from skin smear and lesions of cutaneous leishmaniasis patients, and splenic aspirates/bone marrow inoculation.
 - Detect natural infection of *Leishmania* parasites by microscopic and molecular tools.

7 Vector control capacity:

Strengthen capacity of entomological staff for planning and implementing vector control based on IVM approach at different levels.

8 Insecticide resistance:

Assess and monitor insecticide susceptibility against different insecticide classes against local sandfly species.

Overarching and cross-cutting areas

1 Designate a new position to specifically oversee VBDs to streamline the efforts across various VBD control programmes and to ensure cohesive leadership and accountability, focusing on identifying synergies and preventing duplication of efforts across the malaria, leishmaniasis, filariasis and dengue programmes. Develop Terms of Reference (ToR) for the new VBD leadership position outlining responsibilities such as:

- coordinating integration among different VBD-specific programmes.
- leveraging existing human resources and technical expertise to optimize efficiency.
- ensuring that VBDs operate under a unified strategy while preserving disease-specific accountability and monitoring.

2 Develop an action plan to operationalize integration of common functions (including repurposing of staff) across multiple VBDs.

3 Improve data analytics of VBDs for robust data analysis, development of high-resolution risk maps and guiding strategic, targeted and timely response measures, including digitization of data, through designation of VBDs data analytics team and building their capacity.

4 Improve quality of surveillance by prioritizing resources for high-risk areas with significant transmission risk while avoiding the dilution of surveillance efforts in areas with minimal or no risk. Conduct a risk-based review and stratification of all areas to streamline activities, ensuring that resources and expertise are concentrated where they will have the greatest impact.

5 Enhance field staff capacity by improving their skills in critical areas such as vector collection, dissection and microscopy while incorporating advanced diagnostic tools and techniques. Specialized training sessions, supported by international and local stakeholders/experts, should be conducted to ensure early detection, timely intervention and effective outbreak response.

6 Strengthen synergistic collaboration between programmes/campaigns and academicians to leverage implementation research to improve programme efficiency, jointly fill knowledge gaps and adapt more innovations.

7 Establish a mechanism for intersectoral coordination for all VBDs to address environmental and social determinants of diseases, particularly joint planning, actions and monitoring at national, provincial, district and municipality levels.



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