

## A digital health solution for parasitological surveillance at Anti-Malaria Campaign, Sri Lanka

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### Abstract

The Anti Malaria Campaign in Sri Lanka is a public health initiative aimed at preventing and controlling the spread of malaria in the country. The outcome of the malaria control program is improved by effective surveillance. The National Malaria Strategic Plan highlights the lack of a web-based surveillance system for malaria as a weakness in the central-level availability of malaria parasitological surveillance data. DHIS2 (District Health Information Software 2) is a global-good, health management information system recommended by WHO. Creating a malaria information system based on DHIS2 and incorporating an interactive dashboard are employed to enhance the prompt accessibility of data at the national level.

### Introduction

The Anti Malaria Campaign (AMC) is the focal point of the Ministry of Health, Sri Lanka for the prevention and control of malaria. The Program oversees the prevention of malaria reintroduction (PoR) and ensures a malaria-free, Sri Lanka. The AMC has a central and regional network that includes regional malaria offices and treatment facilities that are linked to the curative health sector. In 2016, the World Health Organization (WHO) recognized Sri Lanka as a country free of malaria [1]. It was a significant public health achievement in Sri Lanka's history. However, Sri Lanka reports approximately 50 imported malaria cases yearly. At this stage, the AMC's two main strategies are to carry out imported case monitoring and vigilant parasitological and entomological surveillance. The national malaria strategic plan has identified the lack of a web-based surveillance system for malaria as a weakness in the central-level parasitological surveillance data availability [2]. Therefore, proposing a digital health surveillance system as a cost-effective solution for malaria parasitological data flow management benefits AMC's timely decision-making.

### Malaria Surveillance

The third pillar of core intervention, according to the WHO Global Technical Strategy for Malaria 2016–2030, is malaria surveillance. Surveillance plays a major role in settings of any level of transmission. Preventing the reintroduction of malaria is crucial for countries attempting to eliminate it as well as for countries that have already achieved this goal [3]. The effectiveness of the malaria control program is improved by effective surveillance of the disease.

In Sri Lanka, parasitological surveillance activities are being carried out by teams comprised of a Parasitologist, Public Health Laboratory Technicians (PHLT) and Public Health Field Officers (PHFO). Parasitological surveillance is conducted in two ways: passive case detection and active case detection. Active Case Detection is the detection of malaria infections in the community by health workers. The process of screening of people who are visiting medical facilities consists of passive case detection (PCD) and activated passive case detection (APCD). The medical facility that has a PHLT and/ or PHFO performs the testing. In PCD, patients with fever

and an overseas travel history to a malaria-endemic country and patients with symptoms and signs suggestive of malaria are screened for malaria while in APCD, all fever patients attending health institutions are screened for malaria. The most significant approach suggested by AMC is PCD [4]. Rapid Diagnostic Tests (RDTs) are also performed as a supplemental tool, although microscopic screening is the gold standard diagnostic technique. This process encourages early case diagnosis and reduces malaria spread. Before transfusion, all donor blood is being screened for malaria by PHLTs in Sri Lanka.

All suspected malaria cases are reported to the AMC. Malaria control activities in all districts are monitored monthly at the review meeting with Regional Medical Officers in charge of malaria in respective districts. The diagnosis of malaria is confirmed by laboratory tests for malaria (Rapid Diagnostic Test, microscopy, and PCR where necessary). The AMC is also in charge of dispensing all the drugs required for treating malaria. Each confirmed case of malaria is assessed by the case review committee which is a subgroup of the Technical Support Group independently concerning classification and case management. The Anti-Malaria Campaign's operations are guided by the National Malaria Strategic Plan for Elimination and Prevention of Reintroduction.

### **The Problems and Solutions**

Despite the frequent execution of malaria monitoring, there are gaps in the surveillance data that is available in the anti-malaria campaign for timely decision-making. Therefore, it was important to establish a long-term solution for the flow of surveillance data. The solution needed to cater to both national level and regional level requirements with minimum cost. Several malaria-endemic countries have tried different digital health solutions for malaria data flow management. Cambodia introduced Microsoft Access based national malaria information

system in 2009. It was gradually evaluated into SQL based information system with real-time case reporting [5,6]. Thailand's electronic malaria information system (eMIS) is based on both mobile and web-based technology which caters to laboratory results, case registration, case investigation and case follow-up [7].

To help countries to strengthen and monitor their national routine surveillance systems and to facilitate the use of data for decision-making, data standards and tools have been established by WHO. The WHO recommends using the DHIS2 platform as a digital health solution for malaria [8]. Currently, at AMC both malaria case investigation and entomology surveillance are operational using an electronic health information system. Further, all malaria cases and potential vector breeding grounds are also mapped using GIS maps. DHIS2 platform is used in the development of these systems. A single platform helps improved resource utilization and collaborative data analysis. Further, the support for DHIS2 design, development, implementation and capacity building is provided by regional Health Information Systems Programme (HISP) groups. Sri Lanka also has an established HISP node to provide necessary support within the country. Therefore, customization of DHIS2 could be done with minimum cost to incorporate parasitological surveillance data. Further, Sri Lanka has several public health information systems based on the DHIS2 platform [9]. Therefore, DHIS2 was selected as the preferable solution for catering to AMC's new information system needs.

### **DHIS2**

DHIS2 is a global public good, web-based platform that is widely used as a health management information system (HMIS). DHIS2 is now considered, one of the world's largest HMIS platforms. There are 73 low- and middle-income countries using it. The University of Oslo is the global partner leading the development of the DHIS2 software [10]. DHIS2 provides two

types of data collection modules. Those are the aggregated and the tracker modules. For the data collected as a data set which represent aggregated or summarized data, the aggregated module is used. When collecting individual-level data such as case-based which needs individual-level follow-up, it is recommended to use the tracker module.

### Design and Implementation

In any system design, the initial step is requirement gathering. A team involving the Director AMC, consultant community physician, medical officers, parasitologist, a few regional malaria officers and registrar-health informatics led the burden of initial requirement gathering. When creating a digitalized solution for health data management, it is not simply to replicate the paper-based data-collecting formats in the electronic system. Therefore, as the initial step, the data collection form was revised in view of the digital data collection. Recently a shared spreadsheet was created as the first step in digitization. The data fields available in that spreadsheet were also incorporated. Following numerous online and in-person sessions, the data collection form was finalized. In the malaria parasitological surveillance case scenario, regional blood samples from individuals are collected and followed up. Therefore, the tracker module was selected to cater the individual data entry and follow-up.

In the DHIS2 the three main data dimensions are the data element, the organization unit and the time period. The data elements were created by mapping the fields in the finalized data-collecting form. To facilitate the data analysis, most of the data elements were created as drop-down items using option sets. MOH level was selected as the lowest data entering organizational unit as the AMC needed to analyse data at the MOH level. Further, the system was designed in a way that maintains the flexibility for system extension up to institutional levels whenever the facilities become

accessible in the future. When considering the time period, data entry was planned daily. To provide decision-making support at the national level a national-level dashboard was created with DHIS2 (Figure 1).

### Limitations and Challenges

Out of the three data dimensions in DHIS2, the most challenging dimension was deciding on the organizational structure. Anti-malaria Campaign is needed to collect data at the MOH level. However, the lowest level of the paper-based data flow was established from the regional malaria office (RMO) level which represented the district level most of the time. Further, the data collection occurred at RMO offices, field and curative health institutions distributed throughout the RMO region. Due to the complex nature of the organizational structure, it was decided to use a hybrid method of data collection and entry. The data collected at the institutional level using the paper-based format was planned to enter according to the MOH area at the RMO level. Further, in some case scenarios, blood samples were tested in one district while the patient's living area belongs to another district. This created the need for accessing the MOH areas of a different district. However, the architecture of DHIS2 does not allow that. Therefore, it was decided to enter those limited scenarios by AMC headquarters as they have access to all the organizational units in Sri Lanka.

### Conclusion

The use of a free and open source, web-based platform supported an easy design and implementation process. Identification of key stakeholders early and getting them involved in the development has smoothened the development process. The integrated dashboards with timely information are important in providing decision-making support at the national level.

### Author Declaration

**Author Contributions:** All authors contributed to the requirement gathering,

system designing, system testing, manuscript writing, literature review and revision of the manuscript. Institutional decision-making, resource allocation and supervision by KDNPR. Overall Coordination and Final Approval of the Manuscript by NVJT and PUC. System development and concept of the Manuscript by AIKR.

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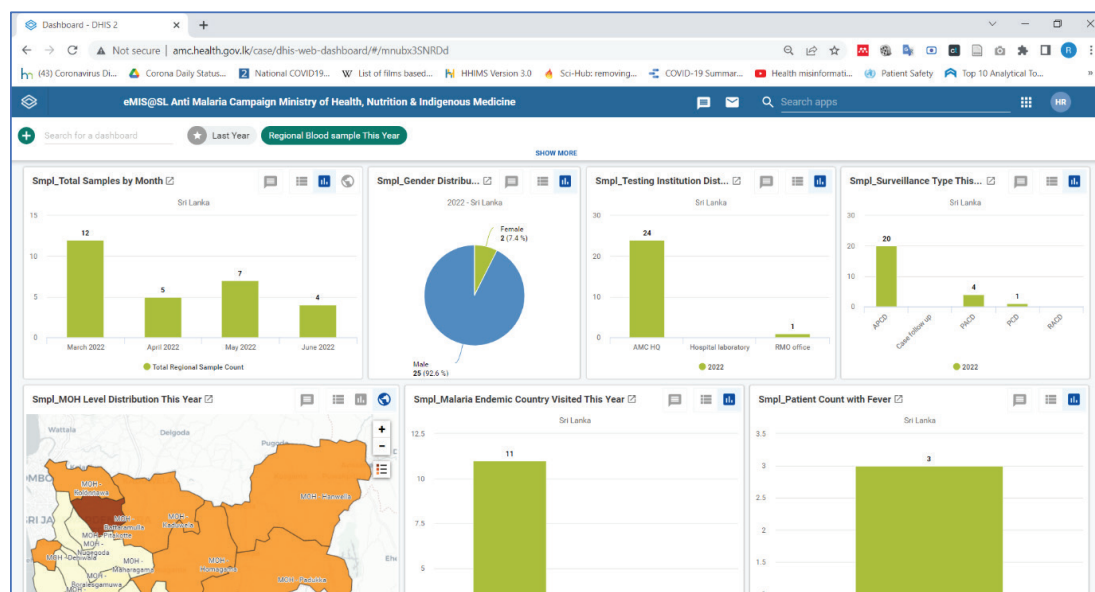


Figure 1: Administrative Dashboard