A Conceptual Framework for Real-Time Public Health Dengue Surveillance in Sri Lanka

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Introduction

Dengue pose an outbreak threat in Sri Lanka (Epidemiology-Unit 2015). Due to slow, inefficient, and repetitive collection of data, in present paper based communicable disease notification system, and unorganized resources (Wickramasinghe et al. 2009), public health care professionals face difficulties to manage day-to-day public health responsibilities to effectively detect and manage dengue outbreak cases (Rukshan & Miroshan 2014). Inspired by timely data, knowledge, and organized human resources, the main objective of this research is to outline a conceptual framework for real-time public health dengue surveillance in Sri Lanka. To provide timely data for public health care professionals and others, web-based dengue surveillance system, eDCS: eDengue Control System that was developed by Rukshan and Miroshan (2014), has been suggested. To optimally balance human and automated inputs into ongoing, systematic public health dengue surveillance activities, the existing human resources and man power structure, in local, regional, and national level, has been studied and organized. This work may help to minimize dengue outbreak cases in Sri Lanka. The conceptual framework validation will be made for future work.

Literature Review

The communicable disease notification system is one of the most significant pillars for the early detection of the dengue outbreak cases (Weerasinghe et al. 2011, Rukshan &Miroshan 2014). However, in Sri Lanka, the current notification system is a passive surveillance system, in which it takes approximately 12 days to complete the whole cycle to process a dengue outbreak case: this slow in time is outlined in Figure 1, as annex.

Timely data, knowledge, and organized resources are important to monitor trends and patterns for identifying outbreaks, developing and evaluating interventions, setting research priorities,

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and planning health services (Hall et al. 2012). In some instances, data to address health concerns can be collected in a single system, particularly if a mandate for reporting is included (Hall et al. 2012). The Centers for Disease Control and Prevention's (CDC) National Electronic Surveillance System (CDC 2015) is an example. However this is expensive, in which the implementation and recurrent costs are high. For developing countries, like Sri Lanka, requires a cost effective solution that should facilitate a timely reporting system to report dengue cases. To meaningfully use the electronic health records for identify disease outbreaks rapidly, and increase the ability to control such outbreaks, the existing human resources and man power structure should be organized.

Methodology

A conceptual framework is proposed. That suggests a web-based system as a mandate reporting system. To use the web-based system effectively, with optimally balance of human and automated inputs, the existing human resources and man power structure is organized.

Web-based system

eDCS: eDengue Control System is a web-based real-time surveillance system for controlling dengue in Sri Lanka. This system's architecture together with its implementation environment was presented by Rukshan and Miroshan (2014). Through a centralized database this system provides a timely data.

Organising Health Human Resources and Manpower Structure to Use the System Effectively

To give optimal balance of human and automated inputs into ongoing, systematic public health dengue surveillance activities, this section organises the existing human resources and manpower structure to use the eDCS effectively.

Secondary data available in Epidemiology Unit (2015) were carefully studied to conduct a purposeful sampling technique for interviewing health care professionals (human resources) from the public heath grid. Since Medical Health Officer and Area Pubic Health Inspector, attached to MOH, are playing a major role to prevent and control dengue, they were selected to interview. Eighteen health care professionals were interviewed, who were selected from nine MOH offices - one from a province. Interview was conducted from November, 2012 to November, 2013. Thus, to use the proposed system, the existing human resources and manpower structure from local to regional and national level have been carefully aligned, which is in Figure 2, as annex.

To conduct effective public health dengue surveillance activities, between eDCS and human resources and manpower structure, sequential activities are allocated, as sequential diagram, in Figure 3, as annex. To prevent and control dengue, using the eDCS, with timely fashion, the following activities should be carried out by respected health care professionals in local, regional and national level.

A dengue suspect patient may go to public or private health hospital for a laboratory test. Since surveillance for dengue in humans is primarily by notification of infections by medical practitioners and laboratories (NAMAC 2015), the laboratory test result of the patient is entered into the proposed system by the Laboratory Test Data Operator (LTDO). By recognizing dengue symptoms, from the laboratory test results, the Medical Consultant (MC) conform dengue cases. Then the Infection Control Nurse (ICN) enters patient's current residential address into the system. Then the system will compute patent information and create a work order which is to be attended by MOH officers, in the respective MOH office, where the patient is currently residing. At the same time the system will update 'Live Dengue Map' and alert registered Sri Lankan citizens via SMS and email, regarding the identified local dengue outbreak.

At the meantime, the system automatically creates a work order and sends it via SMS to the respective PHI where the patient resides. After viewing the work order, the PHI should reach the patient current resident, then track and store dengue affected patient last 10 days or possibly last 14 days travel history. Then the system automatically computes the local outbreaks and risk places, and sends it to relevant PHIs, who are responsible for identified risk places. Thus the system notifies to vector control staff (typically PHI) for timely deployment of vector control from the local level. All executed vector control actions performed by PHI should be entered into the system. The Medical Health Officer (MHO) will monitor activities of PHI, and send reports to respected officers.

Since the system generates SMS and emails to send it to the registered citizens, via the citizen alert system, the citizens may act as responsible citizens. They may also actively take part of dengue prevention and control activities.

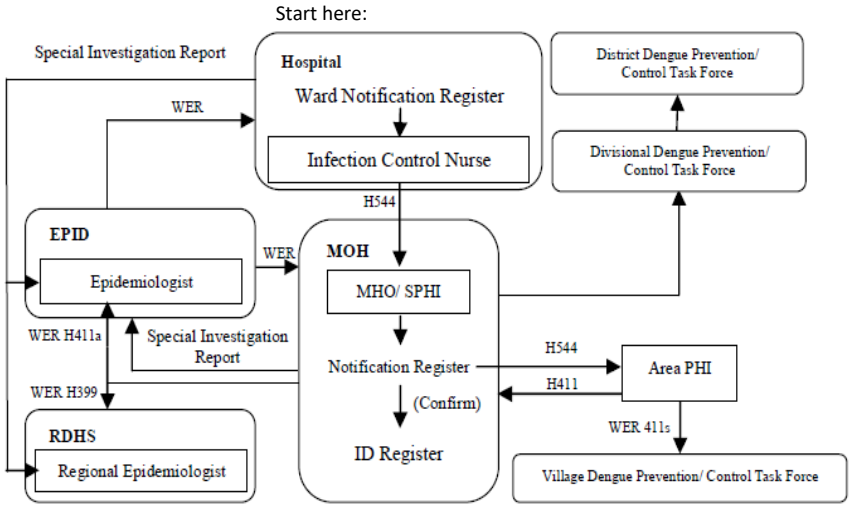
By observing and analyzing the available data and information about the current status of the dengue, the Regional Epidemiologist, from the regional level, and the Epidemiologist, from the national level, may provide early decisions, from their knowledge and experience. Researchers may also use data and information to innovate and suggest ideas through new research for eliminating the dengue from the country.

Results and Discussions

The early paper based 'notification forms' and/or phone calls are suggested to replace with a web-based dengue surveillance system such as eDCS. In addition, the organized human resources and man power structure provides the focal point to address shared concerns in informatics for the meaningful use of electronic health records that can be used to help dengue surveillance practice. For example, the web-based system, eDCS, is used to report early cases from local level. As soon as the data is entered into the system, it is accessible at the local, regional and national level. Such timely data is the basis for early 'Public Health Care' action and 'Early Warning' applications (Reintjes et al. 2006). Therefore, with the optimal balance of human and automated inputs, the early response data can be used to convert information for early action in dengue surveillance. This practice facilitates both the eDCS and health care professionals to regular monitoring of actions to prevent and control dengue in Sri Lanka. Thus this study outlines a well-functioning conceptual framework for real-time public health dengue surveillance in Sri Lanka.

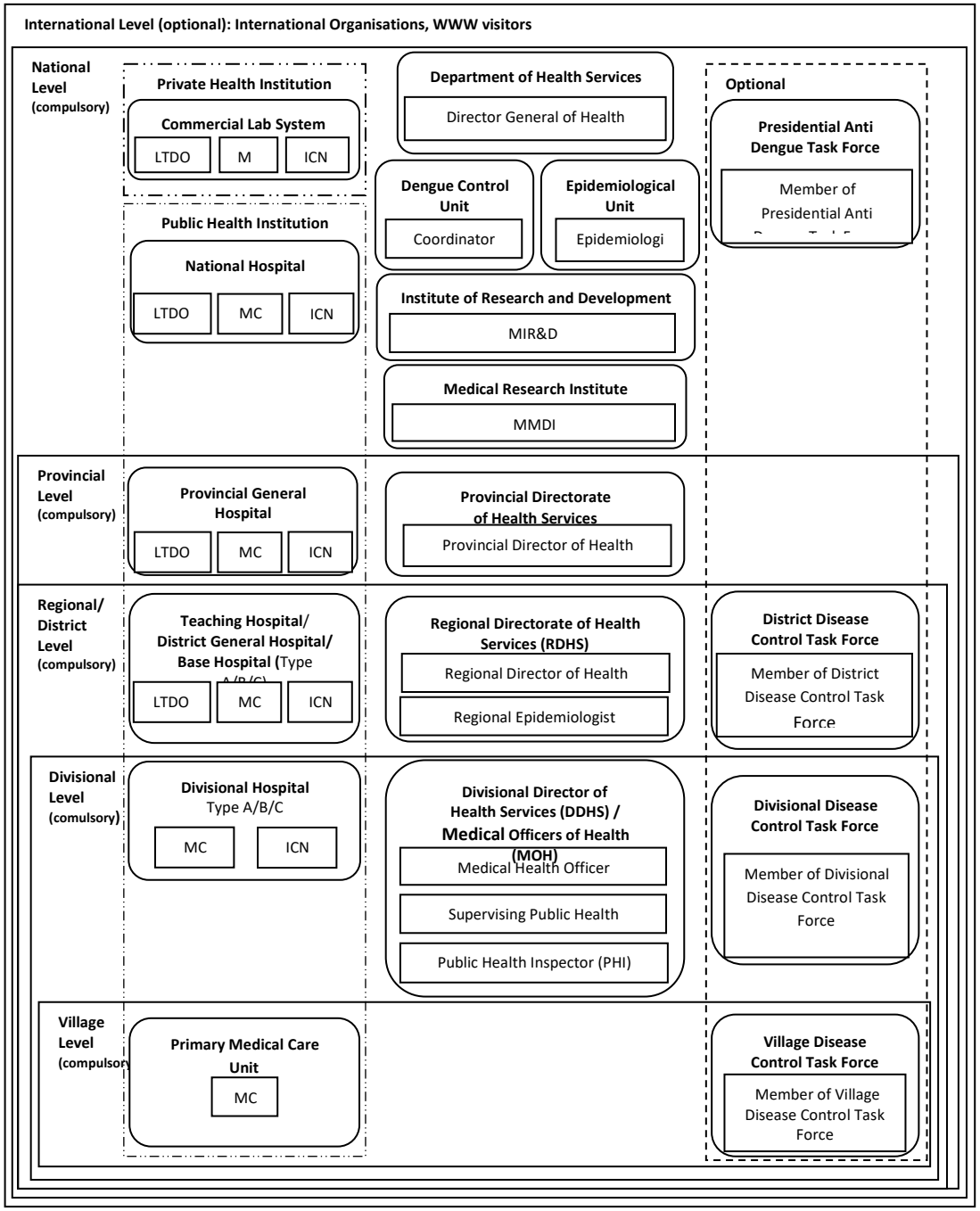
Conclusion and Recommendations

Early outbreak detection and intervention are important to prevent and control Dengue as well as Chikungunya in regional and national level (Weerasinghe et al. 2011). Therefore, to advance public health dengue surveillance in the 21st century, with the advances in Information Communication Technology, changes in data collection mechanism, data availability and data synthesis, and expanded health information needs, a conceptual framework was outlined for real-time public health dengue surveillance. This may timely and useful evidence to minimize dengue outbreaks, and suitable for low-income countries like Sri Lanka. This conceptual framework validation will be made for future work in fortifying the needs for dengue surveillance to prevent and control dengue in Sri Lanka.



where:
MHO: Medical Health Officer; SPHI: Supervising Public Health Inspector; PHI: Public Health Inspector;
MOH: Medical Officers of Health; RDHS: Regional Directorate of Health Services; EPID: Epidemiology Unit of Sri Lanka;
ID: Infection Disease; WER: Weekly Reporting
H399: Weekly Return of Communicable Diseases, Form designed by Ministry of Health, Sri Lanka
H411: Communicable Disease Report - Part I, Forms designed by Ministry of Health, Sri Lanka
H411a: Communicable Disease Report - Part II, Forms designed by Ministry of Health, Sri Lanka
H411s: Weekly Reporting Forms designed by Ministry of Health, Sri Lanka
H544: Notification of Communicable Disease, Forms designed by Ministry of Health, Sri Lanka

Figure 1: The present dengue notification system (Rukshan and Miroshan, 2014)



Where: [ ] : Entities [ ] : Manpower; MC: Medical Consultant; ICN: Infection Control Nurse; LTDO: Laboratory Test Data Operator

Figure 2: Organising human resources and man power structure to use the eDCS

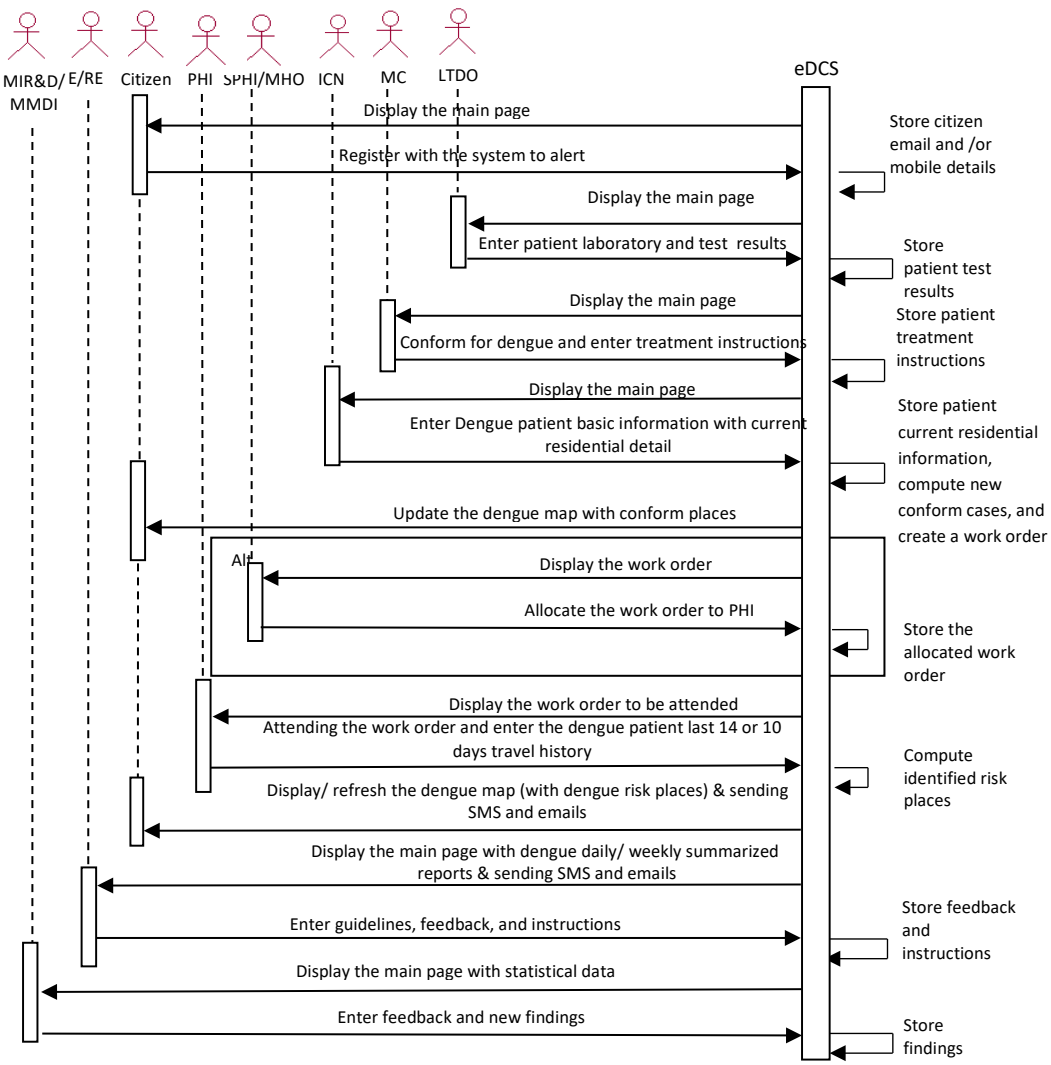


Figure 3: Sequential diagram for the eDCS

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