

Information technology in morbidity management of human lymphatic filariasis—A promising tool in global programme for elimination of lymphatic filariasis

R. Renuka Devi¹⁻² & V. Raju³

¹*School of Information Technology, Vellore Institute of Technology, Vellore;* ²*Software Engineering Department, SRM University, Kattankulathur, Chennai;* ³*Vellore Institute of Technology, Vellore; Tamil Nadu, India*

ABSTRACT

Background & objectives: India is a signatory to the 1997 World Health Assembly resolutions on lymphatic filariasis, and other neglected tropical diseases, and supports global elimination of lymphatic filariasis by 2020. The global programme to eliminate lymphatic filariasis (GPELF) has two main components, *viz.* interrupting transmission of LF through mass drug administration; and managing morbidity and preventing disability. Consorted efforts by the Public Health Department in Tamil Nadu state (India) for elimination of LF was launched in the year 1997 concentrating on both the components of the programme. The data on the prevalence of filarial morbidity and its entire management at present is based on manual reports and registers maintained by the field functionaries. To overcome the constraints in the manual reporting, an attempt was made to develop a web-based reporting system with different modules and user-friendly interface.

Methods: The Vellore and Thiruvannamalai districts were selected as a study area. The study was conducted between 2011 and 2014, which revealed that the entire morbidity management was based on the manual formats. Constraints in the present manual reporting were analysed. PHP and MySQL tools were used to generate user friendly modules. Feedback was collected from field functionaries at different health centre levels, on the adequacy in the modules and effectiveness of the web-based reporting system.

Results: The online reporting modules facilitated data entry at the health subcentre level itself. Analysis and retrieval of data was facilitated at all other levels in the public health system. The modules also covered details of surgical interventions, ex-gratia payments and other benefits extended to the lymphoedema patients by the Government.

Interpretation & conclusion: The usage and feedback of the web-based reporting system appeared very encouraging and reliable, indicating that it can be implemented in health programmes for disease management. This web-based user-friendly online reporting system can contribute largely to achieve the goals of the GPELF; specially after MDA is withdrawn.

Key words Lymphatic filariasis; morbidity management; web-based reporting system

INTRODUCTION

Lymphatic filariasis (LF) is a parasitic disease caused by small, thread like worms affecting the human lymphatic system. Globally, around 1.5 million people are affected by LF related lymphoedema, that includes progressive swelling of the limbs, genitals and breasts. Almost 25 million men are affected by filarial scrotal lymphoedema¹. Although, these clinical manifestations are not fatal, they categorize LF as world's leading cause of permanent and long-term disability². The 50th World Health Assembly (WHA) in 1997, resolved to eliminate LF as public health problem³. The World Health Organization subsequently launched the global programme to eliminate lymphatic filariasis (GPELF)⁴ in the year 2000 with the goal of

eliminating LF by the year 2020 and proposed a comprehensive strategy based on two components, *viz.* (i) interrupting transmission of LF through mass drug administration (MDA); and (ii) managing morbidity and preventing disability.

India is a signatory to the 1997 WHA resolutions on LF, and other neglected tropical diseases, and supports the mandate of global elimination of LF by 2020. The Indian National Health Policy (2002) however, envisages to eliminate LF in the country by the year 2015, which aims at cessation of LF as a public health problem by bringing down the microfilaria carriers in the community to < 1% and ensure that children born after the initiation of the elimination programme are free from circulating antigenaemia, *i.e.* presence of adult filarial worm in the body.

In April 2002, LF was endemic in 73 countries and territories, an estimated 1.39 billion people were at risk of infection and approximately 120 million were already infected⁵. More than 40 million people were incapacitated and disfigured by LF related disease, *i.e.* predominant lymphoedema and its advanced form; elephantiasis and hydrocele. About one third of filarial cases in the world are found in India⁶. In India, mass drug administration (MDA) with tablet diethylcarbamazine (DEC) was launched as a pilot project in 13 districts of seven states in the year 1996; later it was implemented at all endemic states/districts of the country⁷. However, the major programme to eliminate LF was universally launched in the year 2004 covering 220 endemic districts in 20 states/union territories, and subsequently scaled up to cover all the 250 endemic districts targeting a population of about 600 million.

The MDA campaign in 2005 covered a population of 463 million using DEC alone, and 17.34 million with DEC+albendazole combination⁸. The Government of Tamil Nadu state launched the National Filaria Day (NFD) programmes in 10 districts covering 15 Health Unit Districts (HUD) in 1996. MDA with tablets DEC alone was taken up till the year 2000. From the year 2001, MDA was conducted with tablet DEC co-administered with tablet Albendazole⁹. As a part of GPELF, morbidity management of filarial lymphoedema is being carried out through different health care institutions in the public health department.

In order to ensure the control strategy to be more effective and appropriate, the collection and compilation of data (epidemiological and socioeconomic) needs to be of a high standard, followed by proper approach for data analysis and disease management¹⁰⁻¹¹. Over the past several years, advances in public health approaches have satisfactorily assisted in epidemiological data collection and management. The success of an epidemiological study depends on many factors including complexities in management of epidemiological data and database support¹².

The entire data on the beneficiaries, implementation of the drug distribution and compliance is generated manually in the formats communicated to the concerned Primary Health Centres (PHC) and other health care units. The whole line-listing of lymphoedema cases and statistical analysis is manually generated and reported as presented in the flowchart (Fig. 1). Periodically the list is updated by door to door surveys by the field staff. Since, filariasis (manifested with lymphoedema and hydrocele) is a chronic disease with no epidemic potential or mortality, monthly collection of number of cases is likely to be unrealistic¹³. There are several constraints on the present data (on the prevalence of filarial lymphoedema cases)

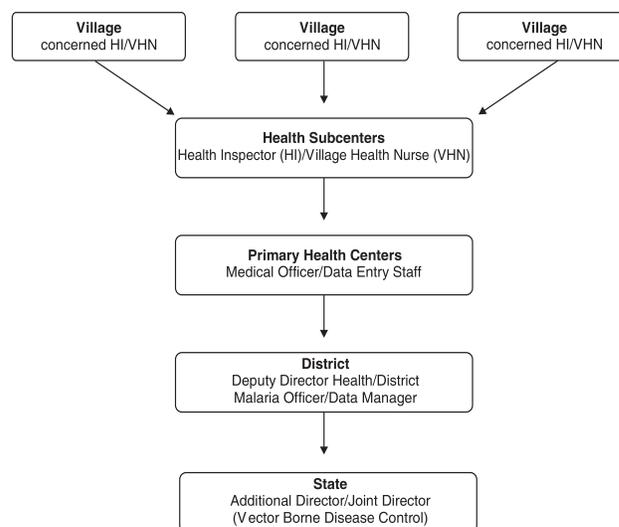


Fig. 1: Flow chart indicating the existing reporting system for lymphoedema cases in public Health Department in Tamil Nadu state, India.

and its accession (since only manual reports under the National Filaria Control Programme of NVBDCP for LF are available) like (i) time constraint; (ii) labour intensive; (iii) untraceable duplication of data and difficulties in periodical updation; (iv) difficulty in retrieval of specific data; (v) inconsistency; (vi) predominantly with user-end utility; (vii) deficient in general reporting requirements; and (viii) deficient for use in rehabilitation and ex-gratia grants.

The outcome of the objectives of the GPELF would be more credible only with a precised web-based online reporting system that is capable of subduing the above constraints in the reporting system. It could also be viewed and monitored by programme officers at different levels, both in the state and country. The web-based reporting system would provide effective management of lymphoedema cases and hence could strengthen the objective of the GPELF as well as national control programmes.

MATERIAL & METHODS

For operational convenience, Vellore and Tiruvannamalai districts in Tamil Nadu state were selected for the study conducted between 2011 and 2014. The Public Health Department in Tamil Nadu operates through the Health Unit Districts (HUD). For operational purposes each district in Tamil Nadu is divided equally into two HUDs. Each HUD comprises of about 40 Primary Health Centres (PHC). Preliminary surveys were conducted in the HUDs and Government Vellore Medical College, Vellore. Details of existing manual reports in these units were collected and documented. Pre-tested questionnaire

was used to draft the response of concerned staff on the existing reporting formats and constraints in morbidity management in filarial lymphoedema patients.

Information based on the responses (from public health department workers) to the questionnaire were compiled for analysis. Appropriate algorithms were developed by using data mining, PHP and MYSQL tools/concepts to design the input and output formats compatible to the use of SPSS software. Relational data base management system (RDBMS), the most popular model among the currently available database management system¹⁴, was employed for the web-based online reporting formats. This facilitates extensive storage of information without redundancy, and ease in retrieving large volumes of data.

Geographical location of lymphoedema cases by sample coding from State to HSC level was stored in the database, that could be retrieved in the “pop-down boxes” in the web-based online reporting formats. A minimum of two characters (numbers) were allocated for geographical location of the patient and hence, about 17 characters were assigned as patient identification number (Patient ID) (Table 1). Database for each character was assigned under the RDBMS, that could appear in the “pop-down boxes”.

Hypertext preprocessor (PHP) and my structured query language (MySQL) were used to generate modules for the online reporting system. MySQL not only acts as an open source relational database management system, but also as a server providing multi-user access to huge volumes of database.

Feedback was collected from government doctors, health inspectors, data entry managers and data entry operators by demonstrating the web-based reporting system.

The database was tested by using the field collected data from the study area. For validation, the input field check at user end was performed by routine JavaScript, using domain and integration pathways.

Table 1. Allocation of characters for geographical location of lymphoedema patients identification number (ID)

| Location | No. of characters |
|----------------------|-------------------|
| State | 2 |
| District | 2 |
| Health Unit District | 2 |
| Taluka | 2 |
| Block | 2 |
| PHC | 2 |
| HSC | 2 |
| S. No. | 3 |

RESULTS

The use and implementation of the modules resulted in creation of a web-based disease management tool that can be managed locally as well as remotely. User login and password provides access to navigate in the Home page as shown in Fig. 2. The Home page includes navigation panels to patient history, portfolio, register and administrator login, *etc.*

Figures 3 and 4 show registration formats for patients (portfolio) with options for filling/indicating their state, district, taluka, block, HUD, PHC, HSC as well as address, period of registration, *etc.* In addition to these, the page has formats for providing details of lymphoedema onset, affected part of the body with template for photograph, surgical interventions through government aids, if any, receipt of ex-gratia payments from government, income status and wellness.

The administrator login in the Home page screen provides search option for desired patient/individual, retrieving the entire line-list of lymphoedema patients with all relevant details along with the photograph of patient



Fig. 2: Screen shot depicting Home page of the web-based reporting system/software meant for lymphatic filariasis.

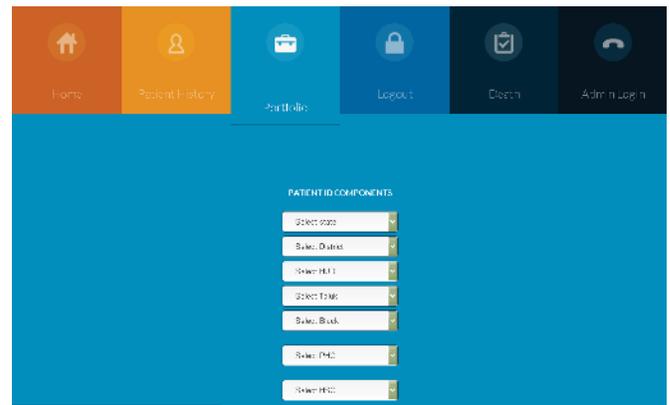


Fig. 3: Screen shot of the software depicting the patient registration format (patient portfolio).

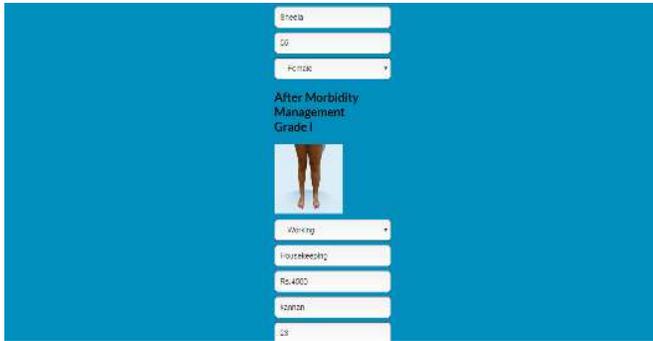


Fig. 4: Screen shot of patient registration format with current health status of the patient.

indicating present position and wellness, as entered in the input pages like shown in the Figs. 5 and 6. Edit and delete options were also provided for prompt updation of data as shown in Fig.6. The feedback collected revealed that the system/software was very user friendly and effective for disease management.

Modules for the entire health care rendered to the lymphoedema cases dealing with their registration, therapy, interventions, ex-gratia and death were developed as follows:

- Module 1: Lymphoedema cases registration.
- Module 2: Particulars of interventions and cure in patients with filarial lymphoedema
- Module 3: Module for incorporating details of ex-gratia for IV grade lymphoedema patients and other government incentives from time to time.
- Module 4: Line list of all grades and types of lymphoedema.
- Module 5: Module for incorporating details of death of lymphoedema patients and registration of new cases (deletions and additions).

Several endemic states in India have granted ex-gratia payment to IV grade lymphoedema patients in order to enable them to exercise foot hygiene and travel to the nearest PHCs for treatment of secondary infections. Likewise, adequate funds have also been allocated for hydrocelectomy.

Module 1, i.e. lymphoedema cases registration form has patient ID components. The patient ID has 17 characters, each component comprises of two characters based on their locations, complete profile and lymphoedema status. Module 2 allows data entry and retrieval for interventions and cure in patients with filarial lymphoedema along with their entire profile. This provides information on the receipt of government assistance with details of interventions and current status. The module is supported with edit facilities for updating data.

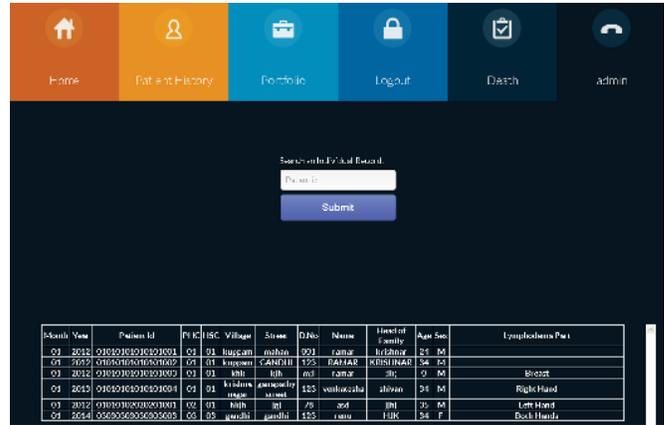


Fig. 5: Screen shot of the admin page depicting search and sample output format.

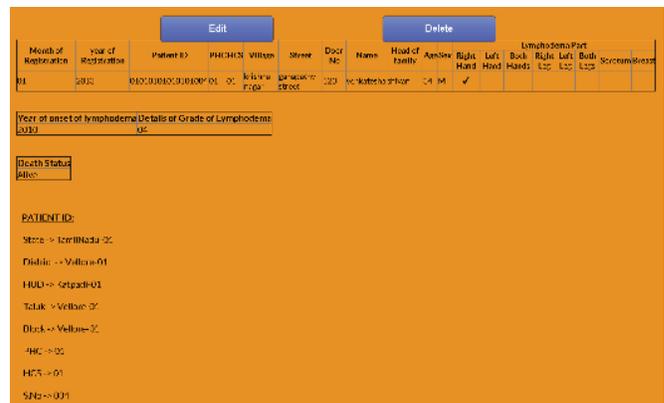


Fig. 6: Screen shot depicting “Edit” and “Delete” options for updating the records.

Sponsoring patients for ex-gratia benefits of the government is generally done by utilizing the existing manual reports at different levels in the public health services. The state headquarters/national headquarters at present, submit proposals for financial sanctions based on manual reports from the districts/states. The Module 3 not only incorporates the details of ex-gratia for lymphoedema patients but also the details of sponsoring agents, the date of receipt of the benefit, the amount paid as ex-gratia etc. These details are accessible at all levels and hence, feasible for concurrent monitoring and further utility.

Additions and deletions to the list of lymphoedema cases is presently done by manual entries. It is most likely that even after the death of lymphoedema cases their names still remain in the list. Apart from this the registration of new cases of lymphoedema is also manually done and thus needs to be altered in the relevant files maintained at village level. All these issues could be addressed in the Module 4 and Module 5. The advantage of the Modules 4 and 5 is that all the corrections in the database could be viewed at all levels.

DISCUSSION

In the earlier studies, efforts have been taken to design database management system collectively for several activities under the National Filaria Control Programme such as entomological activities and microfilaria surveys¹². In contrary, the present study prioritizes on morbidity management and prevention of disability due to LF, thereby attempting to strengthen the objective under the GPELF.

For obvious reasons, huge data on the prevalence of lymphoedema cases needs to be generated and stored for satisfactory morbidity management. The extension of priority to such patients shall depend on the reliability of the data and ease with which it would be periodically managed and updated.

The database so generated in the study is user friendly and readily available for multi-tasking assignments at all levels. Multi-user support system enables monitoring of the disease prevalence and thereby, refine management strategies and fund allocation, credibly.

Responses in the pre-tested questionnaire collected from the Health Inspectors of Health Sub Centres indicated that periodicity of submission of manual reports on LF is done infrequently and during special campaigns. Several registers are required to compile data generated from manual surveillance of lymphoedema cases. The periodicity of analytical reviews from higher officers is mostly weekly and entirely dependent on the manual reports. Deletions and additions are also done manually in the subsequent years based on the records maintained as hard copies.

The details of surgical or non-surgical interventions for the lymphoedema cases is separately maintained. The status after such interventions is manually incorporated in the registers and files pertaining to the patients. Also, selection of patients for benefits of assistance announced by the local governments or sponsors, is manually undertaken and recorded.

Government of Tamil Nadu has supplied Laptops to all the Village Health Nurses (VHN) at the Health Sub Centre (HSC) level with facility for internet connectivity. This is in addition to the mobile phones already supplied to the VHNs. Adequate training has also been imparted to the VHNs for online reporting of data on other schemes. In such instances the web-enabled reporting system for LF would be relatively easy for implementation and could be effective in management of lymphoedema and prevention of disability due to LF.

The National Vector Borne Disease Control Programme (NVBDCP), Delhi has issued guidelines on the

implementation of the transmission assessment surveys (TAS) in the MDA states based on the favourable impact of the MDA¹⁵. TAS has been proposed as one of the technical prerequisites before declaration of elimination status of LF. Consequently, the prime focus hitherto would be morbidity management and prevention of disability due to LF. In such instance, the web-enabled reporting system for the lymphoedema patients would be far more effective in achieving the goal under GPELF. In future with certain modification this system can be used for management of other diseases as well.

Conflict of interest : None.

CONCLUSION

Mass drug administration for elimination of LF in India has gained encouraging results. Evaluative surveys are underway to declare the elimination status. In this juncture the management of existing lymphoedema cases would remain a big challenge for fairly larger period of time. For this the web-based online reporting system supporting the line-listing and management of lymphoedema cases would invariably be a promising tool and assist in the global programme for elimination of lymphatic filariasis.

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Correspondence to: Mrs. R. Renuka Devi, Assistant Professor, Software Engineering Department, SRM University, Kattankulathur, Chennai–603 203, Tamil Nadu, India.
E-mail: renukaraja8@gmail.com

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