A Study on Health Management Information System (HMIS) with reference to Periyanaickenpalayam Government Hospital, Coimbatore

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ABSTRACT

The Government of Tamil Nadu has overcome the hurdles in patient care at Government Hospitals by implementing Health Management Information System (HMIS). HMIS is a combination of Information Technology (IT) and Health Care Management. To improve health care management in the State, the only solution is to introduce Information and Communication Technology (ICT) in health care management system. The present HMIS is an initiative of Government of Tamil Nadu through Tamil Nadu Health Systems Project (TNHSP). In this paper, Periyanaickenpalayam Government Hospital (GH) is taken for observation and data collection. The primary objective of this study is to understand the working process and modules of Hospital Management System (HMS) and how it is linked with HMIS. The secondary objective of this study is to understand the services rendered by the health workers to the public though HMS & HMIS and to provide recommendations for better monitoring of health system performance. For detail description, real time photos and real time data are captured and used as figures and screenshots. The primary and secondary sources of data are collected by direct observation method and by face to face interview with health workers of GH.

Introduction

World Health Organization (2004) defined "Health Management Information System (HMIS) as an information system specially designed to assist in the management and planning of health programmes, as opposed to delivery of care".

AbouZahr C and Boerma T (2005) quoted in this study that "integrated effort to collect, process, report and use health information and knowledge to influence policy-making, programme action and research".

In practice, most country health information systems lack such cohesion, having developed in a piecemeal way, fashioned by administrative, economic, legal or donor pressures and are invariably highly complex (AbouZahr C and Boerma T, 2005).

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The development and maintenance of health information systems are all the more important in the recent times of resource constraints necessitating good governance, transparency, accountability and evidence-based decision making (Harikumar S, 2012).

The National Health Bill (2009) explained (as cited in Harikumar, 2012) "The evaluation of computer based HMIS provides the opportunity to fine tune the system and should be supplemented by periodic evaluations to sustain the results achieved. This is especially important in countries like India, where there are many policy initiatives and increasing budgetary allocations to strengthen the HMIS".

In this paper, HMIS implemented in Government Hospitals of Tamil Nadu is taken for study. HMIS in Tamil Nadu is called TNHSP by Government of Tamil Nadu.

Tamil Nadu Health Systems Project (TNHSP) is an initiative of the Government of Tamil Nadu, in partnership with the World Bank, NRHM, and ICMR to create a Health System in Tamil Nadu that is highly accessible, equitable and effective. Health Management Information System (HMIS) is a combination of Information Technology and Health management. HMIS is implemented by Tamil Nadu Health Systems Project, Department of Health & Family Welfare with soft loan support of World Bank (http://www.tnhsp.org/project).

The TNHSP has been rolling out HMIS at government health institutions across the State in a phased manner (Serena Josephine M, 2015).

Four components are under HMIS such as HMS, MIS, CMS and UAS

- Hospital Management System (**HMS)**

- Management Information System **(MIS)**

- College Management System **(CMS)**

- University Automation System **(UAS)**

- HMIS is for III tier health care system i.e., Primary, Secondary & Tertiary care. HMIS covers the following Secondary Care Hospitals, Primary Health Centres and Medical University

    (i)   287 Secondary Care Hospitals

    (ii) 20 Govt Medical College Hospitals+ Allied Institutions

    (iii) 1889 Primary Health Centres &

    (iv) One Medical University (Shanmugam M.S, 2014).

Tamil Nadu Health Systems Project (TNHSP) is considering a proposal to upload the in-patient data of Coimbatore Medical College Hospital (CMCH) on to a Health Department portal. This will make CMCH the first Government hospital in the State to implement this as till now, only the data of outpatients was being uploaded (Sairam R, 2014).
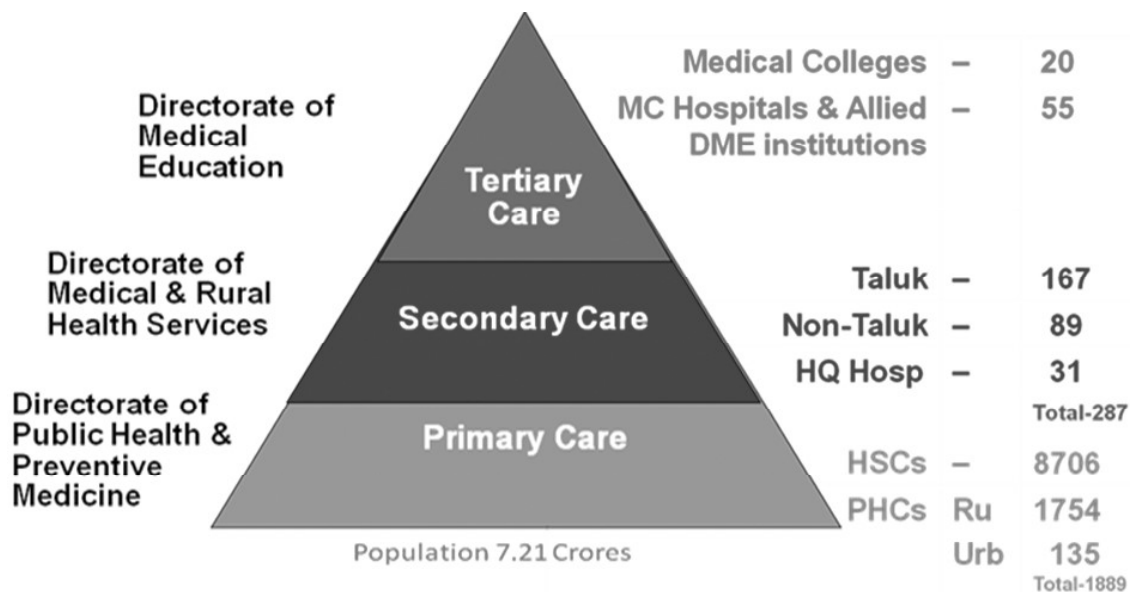
Fig. 1 : No. of Institutions covered underHMIS (Courtesy TNHSP)

The Coimbatore Medical College Hospital (CMCH) began implementing a major information technology project that will allow a patient to access his/her case detail at any Government hospital across the State (Sairam R, 2015).

An initiative of Tamil Nadu Health Systems Project (TNHSP) and Health Department, the Health Management Information System (HMIS) envisages providing real-time data from all 2,000 healthcare centres in the State to help policymakers to quickly analyse disease patterns, spot epidemic outbreaks and take preventive measures (Sairam R, 2015).

Research Objectives

1. The primary objective of this study is to understand the working process and modules of Hospital Management System (HMS) and how it is linked with HMIS.

2. The secondary objective of this study is to understand the services rendered by the health workers to the public though HMS and HMIS.

3. To provide recommendations for better monitoring of health system performance.

Review of Literature

In India, mostly the healthcare delivery systems are based on manual record keeping despite a good telecommunication infrastructure (Suptendra Nath Sarbadhikari, 2005).

Nowadays healthcare organizations globally recognize the importance of investing in information technologies to improve the quality of care delivery and reduce costs (C. Okan Özogul et al., 2009).

Health is an intrinsic human right as well as a central input to poverty reduction and socio-economic development (World Health Organisation, 2006).

Health information is the foundation of public health and a well performing routine health management information system is needed to improve evidence-based decision making and health system performance (AbouZahr C and Boerma T, 2005).

The medical information is the most important resource from the field of medical cares, it is essential to establish the health strategies, the treatments and medical decisions (Kreps, 1988).

The Health Electronic File is a data base with the complete medical files of the patients (medical chart, medical data, examinations, medication, etc), it can be accessed by physicians or other authorized persons, extremely useful in cases of emergency, and by a simple search, the medical staff can have at disposal the antecedents and medical data of a person (IDG Romania, 2004).

Health management information incorporates all the data needed by policy makers, clinicians and health service users to improve and protect population health. Few countries in the world today have effective and comprehensive systems in place to gather this data (Carlson. C, 2011).

Timely and accurate information forms the basis for management to strengthen the information infrastructure with a computer at a Primary Health Centre (A.K. Singh et al, 1992).

A well functioning health information system is identified as one of the six building blocks of a health system by the World Health Organisation's framework of health system strengthening (World Health Organization, 2007).

The core components of the information system has been described as the development of indicators based on management information needs, data collection, transmission, processing and analysis, which all lead to information use (Lippeveld T et al., 2000)

The Health Informational System must be standardized, aligned to the strategy of the European and World Health Informational System, in order to accomplish *data, information and medical knowledge exchange* (Bãlan, 2008a).

The shortcomings of this system starts from the collection of an oversized volume of data which fails to assure the need of information to the modern public health system because only a small part of data is used now in the process of taking any decision (Bãlan, 2008b).

Data stocking and electronic processing is practically non-existent in some medical offices, the software applications are heterogeneous and incompatible, the electronic transmission is minimal, the data producers – hospitals, family physicians confront themselves with a double or triple reporting in incompatible formats and soft (Irma Eva et al, 2004).

The information that are stocked in the data bases are not useful to the organization, only those communicated are also useful, so that "*information must circulate smoothly through the communication channels of the organization*" because the great danger of an organization is the breaking between stocked information and communication (Solcan, 2005).

If nowadays the medical piece of information is not completely available, with the new developed and refined informational technologies the relation between the past and present of the medical data of a patient can be used in order to evaluate the medical risk of a group of patients (Zelman, William N et al, 2003).

Information on health needs, the delivery of services, and the availability and use of resources is important to all health service organizations. Such information can help an organization to increase its efficiency, effectiveness and responsiveness in several ways (R.E. Cibulskis & G. Hiawalyer, 2002).

The information and communication technology gives the possibility to professionals in the system to take the best decisions regarding the way the patients are approached, the way treatments are defined, selected or elaborated. It is the only way to generate, outline, apply and share the medical knowledge (Coiera, 2003).

The Performance of Routine Information System Management (PRISM) framework and associated tools were used for empirical assessment of the technical, organizational and behavioural determinants, the processes and performance related to HMIS in Kerala. The descriptive cross-sectional study involved 115 respondents from 26 sub-centres, 12 primary health centres, six blocks, two districts and the state level office (Harikumar S, 2012).

The study revealed many inadequacies in HMIS processes in the state. Detailed analysis provide insights into the determinants of these processes and probable avenues for improving performance. Low levels of accuracy, completeness and use of information found in this study are consistent with low levels of competence, promotion of culture of information,training, supervision and feedback which needs to be improved (Harikumar S, 2012).

The various factors that influence the adoption of HRIS are technological factors, organizational factors, environmental factors and psychological factors. It has become an essential criterion for the manager to focus on these factors before introducing any new technological system in an organization (Aruna M, 2014). The same way the success of HMIS is influenced by those factors as discussed in PRISM framework as discussed by Harikumar S.

However increasing evidence from developing countries showed that health management information systems were not producing the intended results due to poor data quality, weakness in analysis, limited use of information and poor management practices. An evaluation of the immunisation programme reporting system in Mozambique showed that emphasis on targets and technicalities without proper support mechanisms leads to poor data quality and a situation wherein data is merely transmitted upwards rather than used locally (Mavimbe JC et al., 2005).

Evidence from Kyrgyzstan suggests that strengthening the information system should begin at the grass-root level with training and capacity building. This helped improve the quality of data along with timely detection and reaction to health problems by the health workers. The process of strengthening HMIS should not be driven solely by donor priorities and external consultants (Weeks RM et al., 2000).

The strengths and weaknesses of existing health information systems have to be evaluated through the use of a comprehensive framework. Efforts to develop a comprehensive set of criteria for evaluation of health information systems in developing countries were initiated in the late 1990s. In South Africa focal group discussions involving experts from various fields of medicine, computer science, and nursing, biostatistics and health informatics were held to identify criteria that can be used for evaluating health information systems. Several criteria were identified which were grouped under categories such as philosophy and objectives, policy and procedures, functionality, facilities and equipment, management and staffing, patient interaction, staff development and education and evaluation and quality improvement (Hanmer L, 1999).

However the instrument was too expensive to be used by district health information managers and needed refinement to identify core evaluation criteria. Similar efforts in Kenya led to the development of separate evaluation criteria to be used during the pre-implementation, implementation and post-implementation phases of setting up a health information system. The post-implementation criteria were divided into internal, external and ultimate criteria. The internal criterion relates primarily to data quality, use of information and overall system design. The external criterions were meant to assess resource availability and management issues, while the ultimate criterion assessed the impact of health information system on the health status of the people (George W. Odhiambo-Otieno, 2005).

The National Health Systems Resource Centre, New Delhi has developed a readiness matrix to assess the level of HMIS implementation and capability achieved to use information for action. It is based on the dimensions of technology, information systems processes, data quality, human capacity, institutional collaboration and use of information for action each of which were graded from least ready to most ready (National Health Systems Resource Centre, 2011).

The World Health Organisation has provided practical guidelines for data collection activities for evaluation of HMIS in developing countries. The major areas to be covered include data generation, report compilation, data utilisation, computer infrastructure, training, monitoring and other general resources. The methods of data collection for evaluation purposes should include key informant interviews, focus group discussions and review of records and logbooks (World Health Organization, 2004).

Research Methodology

HMIS connectivity is available in 32 revenue districts of Tamil Nadu. (Figure: 2) The researchers have chosen Coimbatore district for research study using purposive sampling method. Judgmental sampling method is used for collecting data from professional workers.

In this paper, Periyanaickenpalayam Government Hospital (GH) is taken for observation and data collection. Face to face interview with doctors, nurses, lab technician, pharmacist and other hospital workers are carried out for data collection. Sometimes, focused group discussions are made with small group comprising of four doctors and three staff nurses for collecting primary level data.
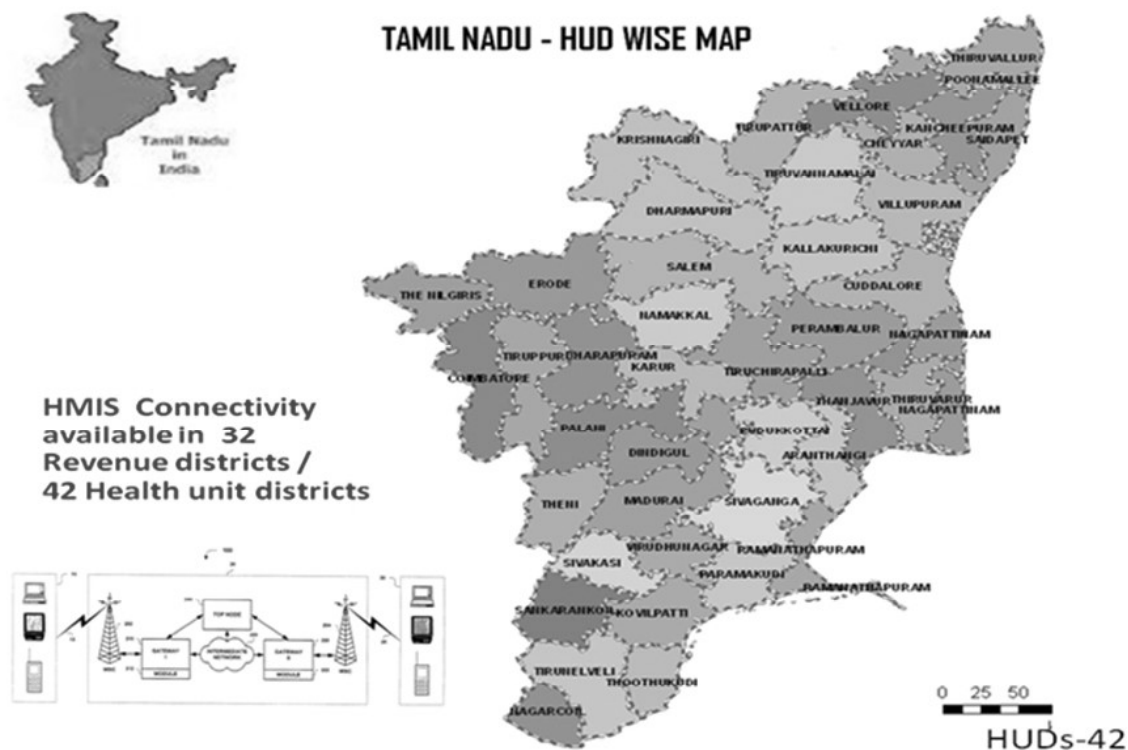
Fig.2 : HMIS Connectivity in 32 Revenue districts of Tamil Nadu (Courtesy TNHSP)

Figures & Screen Shots - Illustrations

"A figure can speak more than a thousand of words do".

Figure 3 illustrates the various modules of Hospital Management System (HMS), Figure 4 illustrates the Online Usage Dashboard HMIS and Figure 5 illustrates Outpatient ticket (OP Registration ticket).

- **Registation**
- **Out Patient Consultation**
- **Inpatient**
- **Lab, X-Ray & Other Investigation**
- **Pharmacy & Main Stores**
- **Biomedical Waste Managemnet**
- **Blood Bank**
- **Diet**
- **Linen**
- **Online Daily Report Generation**
- **Final Diagnosis mapped ICD-10 classification**
- **Medical Records Department**

Fig. 4 : Modules of Hospital Management System (HMS) - Courtesy TNHSP

Different types of modules are used in HMS. But Registration, Outpatient consultation, Lab investigations and Pharmacy modules are taken for study in this paper.

n   Registration module is used by Hospital worker for entering the patient's information and a unique Patient Identification Number is generated.

n   Outpatient Consultation module is used by Doctors and Staff Nurses for entering patients' diagnoses and treatment kit.

n   Lab, X-ray & other investigations module is used by Laboratory technician to enter tests conducted and lab test results of the patients.

n   Pharmacy & Main stores module is used by Pharmacist to enter Outpatient Drug issue and drug stock updates.
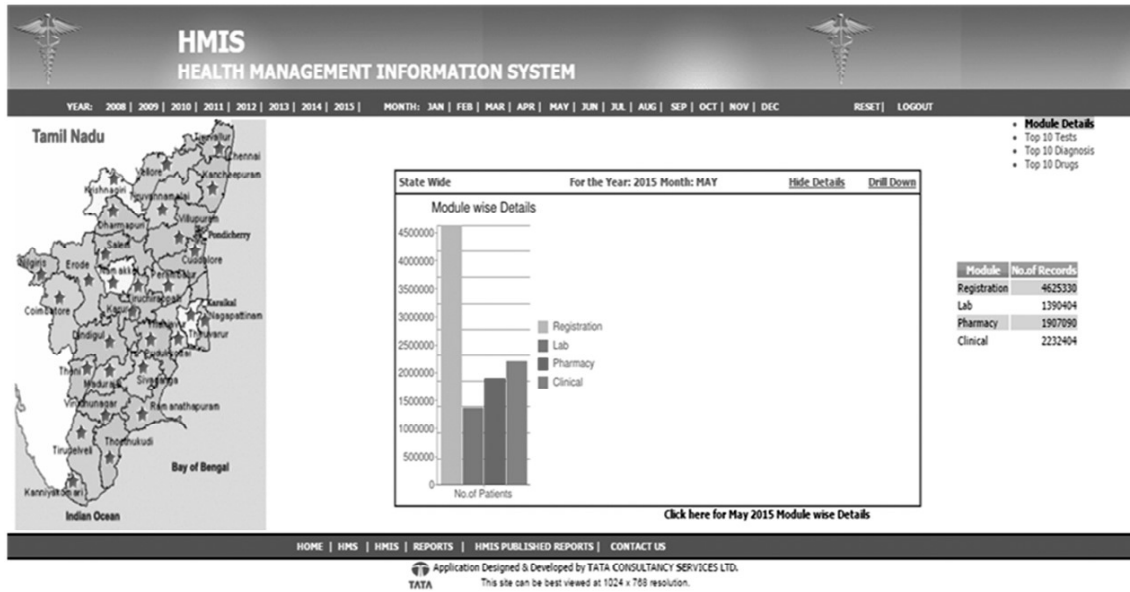
Fig. 4 : Online Usage Dashboard HMIS - Courtesy TNHSP

Online Dashboard will have information on:

n   Module wise details based on data entry in Registration, Outpatient consultation, Lab investigations and Pharmacy.

n   Number of records entered in each module.

n   Number of Outpatient, Inpatients, Investigations report etc.,

n   Year / month wise data entry into HMS.

n   State / District wise usage of HMS.

The figure 5 describes the manual slip and printed slip before and after the implementation of HMS. OP ticket contains hospital name, PIN & Registration details, Diagnosis, Findings, Lab report, Prescription and Medical Officer's (M.O) name.
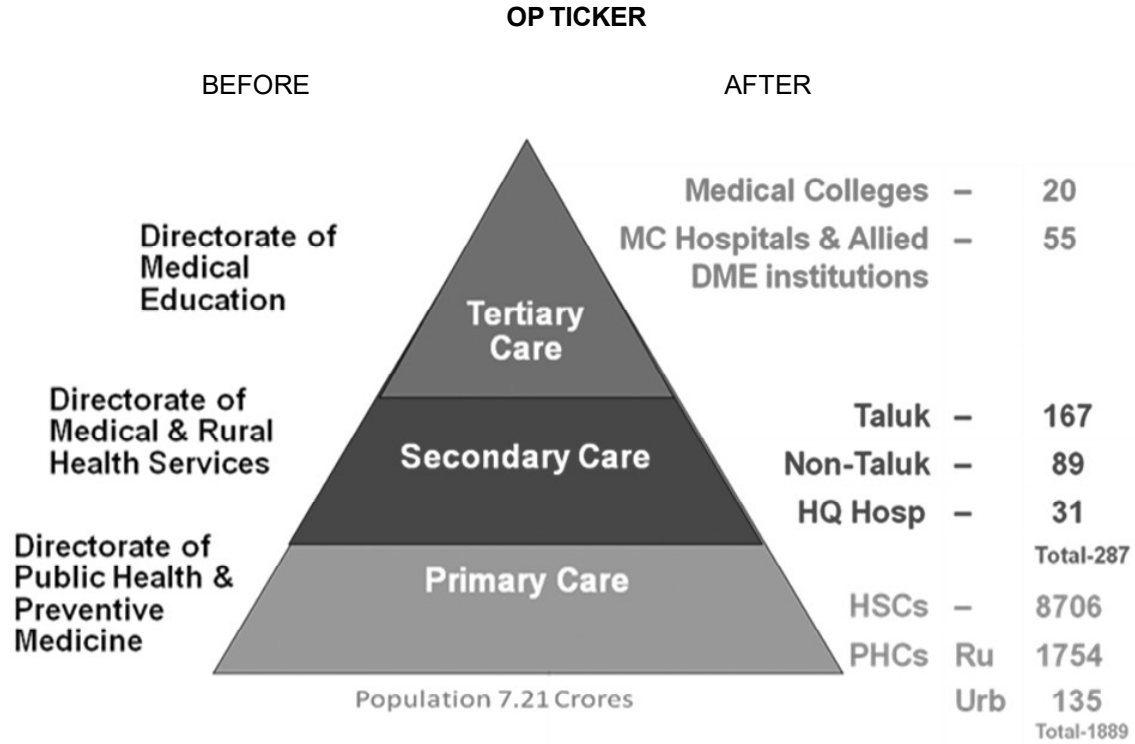
OP TICKER

BEFORE   AFTER

Fig.5 : Outpatient ticket (OP ticket) - Courtesy TNHSP

For detail description, real time photos and real time data are captured and used as figures and screenshots. The primary and secondary sources of data are published with prior permission from hierarchical authorities from TNHSP.

The sequence of **figures 6 to 12** and **screenshots 1 to 5** describe the day to day activities carried out in Periyanaickenpalayam Government Hospital and how the data are entered into HMS. The Hospital Management System has input, process and output layers. Each layer has many HMS modules.

In input layer, the raw data of outpatients are registered into HMS module i.e., Outpatient (OP) Registration using unique Patient Identification Number (PIN number); in process layer, the input data are transferred to doctors' system, in which doctor checks the patients and enter the diagnoses and treatment given on the Out-Patient records, staff nurse checks the entries of doctor for injection, Lab technician do required tests in Patient-wise result entry noted by doctors; and in output layer, the prescribed medicines are issued by pharmacist as OP Drug Issue. After all the data are entered in the respective modules, each GH is connected with Headquarter using Health Management

Information System (HMIS). HMIS is networked connection of all GHs' HMS like client-server connection. Top level authorities are monitoring the performance of health workers and need of the patients using HMIS.

The following figures and screen shots show the working of the Hospital Management System (HMS) and how hospital workers are feeding data into HMS system and simultaneously giving treatment for patients.

Fig. 6 : Periyanaickenpalayam Government Hospital (GH) Old & New Buildings

The figure is about the first page of HMS module, opening with morning OP. After submission, the module goes to OP Registration module.

Screenshot.1: Hospital Management System (HMS) Module – Morning OP (First Page)

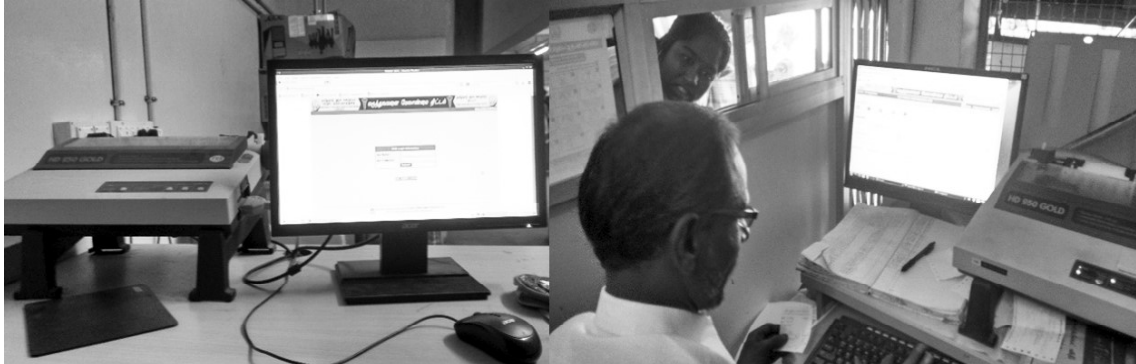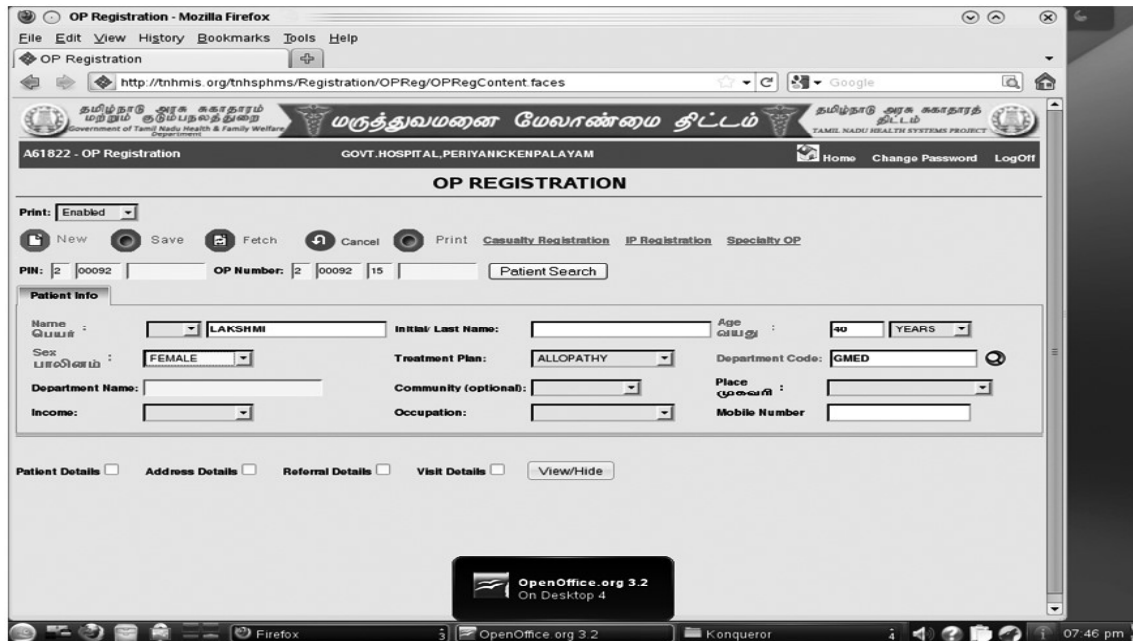Here, details of patient are entered by hospital worker.

Fig.7 : Periyanaickenpalayam GH - Outpatient (OP) Registration Venue (using Computers)

The details include patient's name, age / sex, Occupation, Income, type and department code & name.

Screenshot.2 : Hospital Management System (HMS) Module – OP Registration

HMS generates OP registration slip with date, PIN number and OP number by itself.

OP consultation module showing clinical notes, visit summary of the patient, diagnosis name and treatment kit etc.

Medical officers are treating patients, entering diagnoses and treatment summary in their computers using OP consultation module in HMS.
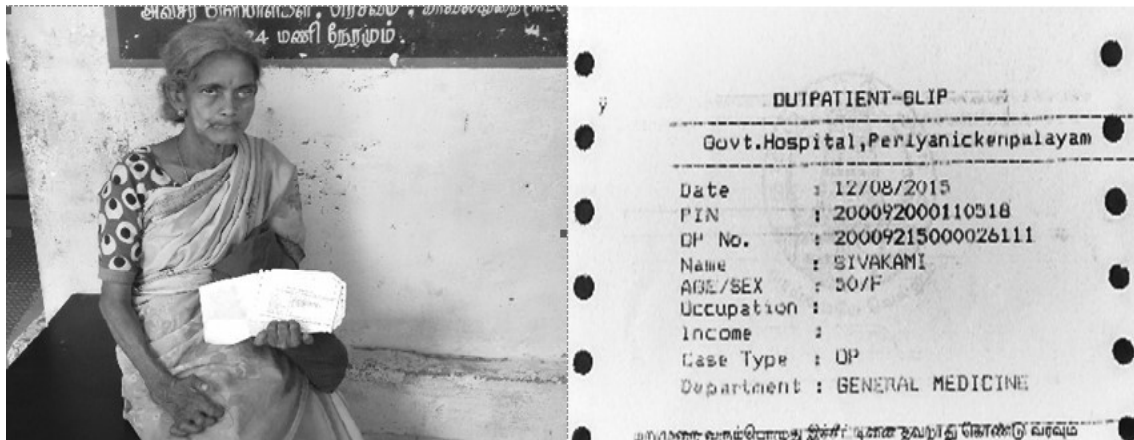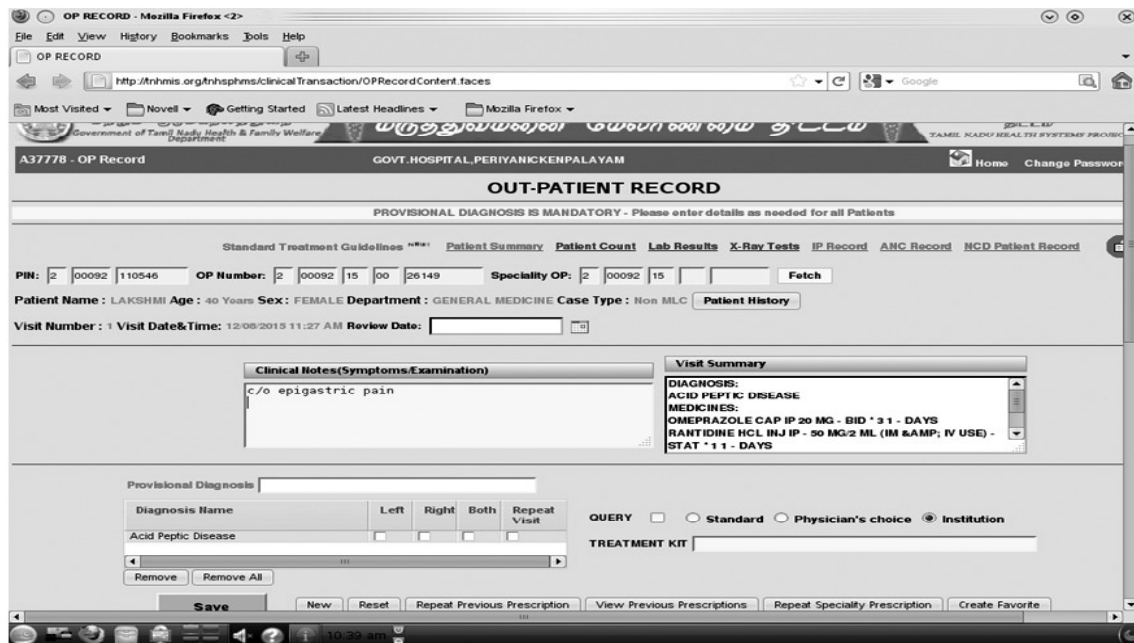
Fig. 8 : Periyanaickenpalayam GH - Outpatient Slip of a patient

Screenshot 3 : Hospital Management System (HMS) Module – OP Patient Record (OP Record)

Medical officers are treating patients, entering diagnoses and treatment summary in their computers using OP consultation module in HMS. Staff nurses are entering injections details.

Lab technician are recording tests conducted and entering lab test result summary in their computers using Lab investigations module in HMS.

Patient wise result entry in Lab investigations module. It contains number of tests conducted for a patient.

**Fig. 9 : Periyanaickenpalayam GH – Doctors treating OP patients (using Computers)**

Fig. 10 : Periyanaickenpalayam GH – Doctors and Staff Nurse recording diagnoses and treatments (using Computers)

Fig. 11 : Periyanaickenpalayam GH – Laboratory technician recording tests (using Computers)

Pharmacist is entering drug issue details in Pharmacy module and taking OP ticket print out.

Pharmacy Module contains OP drug issue details. It also contains medicine description, dosage, duration, quantity and expiry date etc.
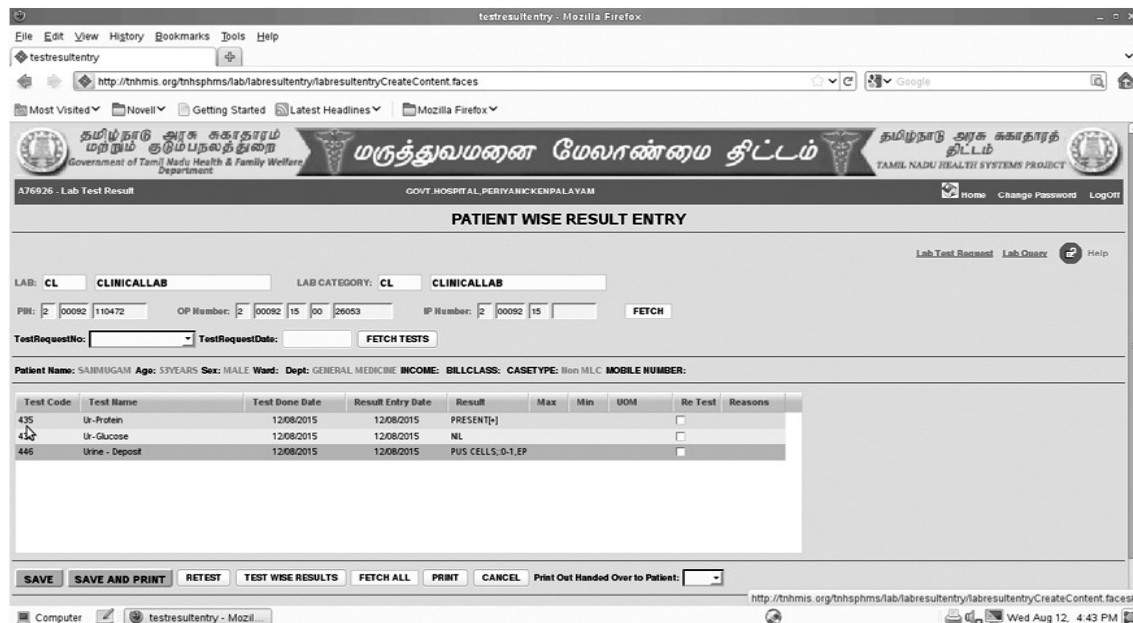
Screenshot 4 : Hospital Management System (HMS)
Module – Patient wise Result Entry (Lab Test Result)


Fig.12 : Periyanaickenpalayam GH – Pharmacist recording drugs issued (using Computers)

Recommendations

The researcher would recommend the following suggestions based on observation and face to face interviews made with health workers. These recommendations are provided to Government Hospitals for further improvement of the system.

n **Training:** Providing monthly module-wise training to corresponding end users of HMS software (i.e., health workers) so as to enrich and enhance their knowledge on HMS/HMIS and to understand the importance of reports generation.
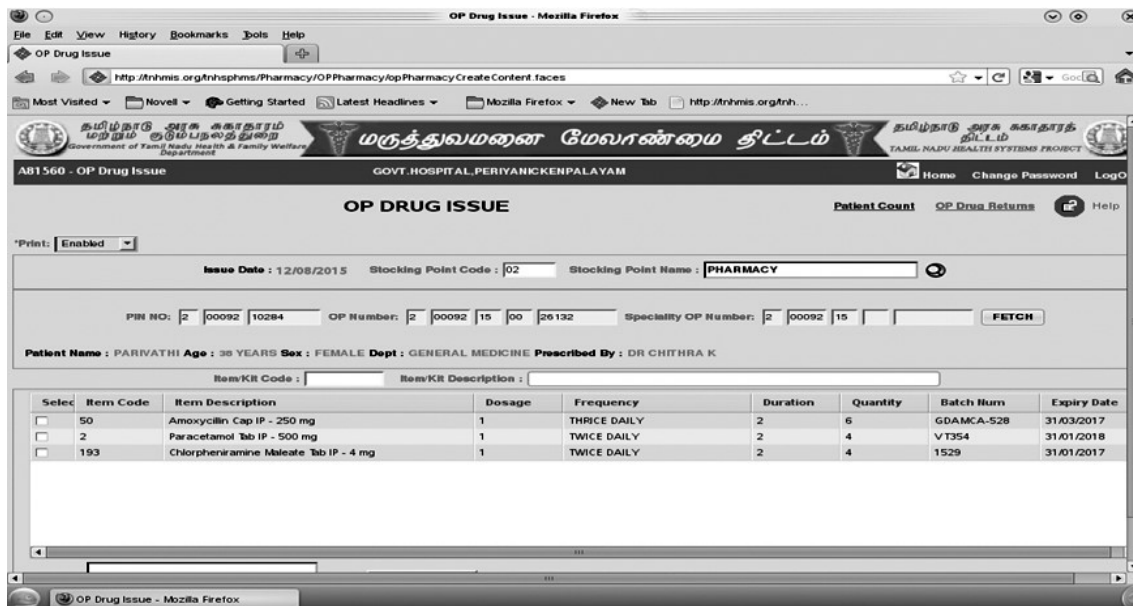
Screenshot 5 : Hospital Management System (HMS) Module – OP Drug Issue

n **Supervision and Feedback:** Higher authorities should supervise the reports generated by end users of HMS/HMIS software (i.e., health workers) and should convene monthly feedback meetings for understanding drawbacks and for further improvements.

n **Infrastructure:** Infrastructures like full-fledged internet or Wi-Fi, latest hardware, latest software, high speed processors for system and some computer professionals/ experts should be provided further more to increase the performance of the system. Patients to health workers ratio are more important for the success of the HMS/HMIS system.

Conclusion

From the above description, every researcher can understand the importance of HMS and HMIS. And also the excellent services rendered by service providers of Government Hospitals. Timely, accurate and reliable information are the backbone for increasing the life expectancy of a nation. All the health policy makers, ministers, health workers, expert advisors, hospital workers and patients are cooperating with this new revolutionary system, to improve our nation's human development index. Like other service sectors, health sector determines the nation's development as a whole. If HMS and HMIS are utilized in each and every hospitals of Tamil Nadu, then it develops more number of new researches for many researchers in multidiscipline mode such as performance of Hospital Management System, Decision Support System using HMIS, data mining, data warehousing, big data analytics, business intelligence, new service delivery system, technology advancements in health sector, health workers' participation, patients - health workers relationship, stress management among health workers, issues in system networking, etc.,

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