Hospital Information Systems: An Observational Study in a Tertiary Hospital

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Abstract: *Background:* **Hospital Information Systems (HIS) are the necessity for medical organizations to prove themselves committed to better healthcare solutions with improved services. The long waiting time in a few government hospitals due to inadequate performance of the HIS prompted me to volunteer as an observer in a large government hospital to study their HIS.** *Aims and Objectives:* **1. To observe and understand the functionalities of a hospital management system in ESIC (Employees' State Insurance Corporation) Model Hospital, Rajajinagar, Bangalore. 2. To identify any technical challenges in the working of the system. 3.To assist staff in making use of the Hospital information system in an efficient manner.** *Methodology and Observations:* **The system follows a client-server architecture with the data center located in the ESIC headquarters in New Delhi. It runs on a WLAN intranet with two SD-WAN connections, one acting as a backup in case the primary SD-WAN fails. HIS of ESIC Model Hospital, Rajajinagar, aptly named Dhanwantri after the Hindu God of Medicine, consists of software that manages all aspects of the hospital right from registration of patients, the OPD, inpatient admissions and bed allotment, Operation theatre module, stores, laboratory and blood bank modules. The challenges faced by the hospital in effective implementation of the HIS are both human and technical. Recommendations to overcome both technical and human challenges are addressed.** *Conclusion:* **ESIC Model Hospital, Bangalore has implemented the Hospital Information System successfully and is making sincere and concerted efforts to strengthen its application. Though facing certain technical and human challenges, in the long run, it should be one of the few government hospitals to become a paperless hospital.**

Keywords: Hospital Information Systems, Challenges, Implementation.

1. Introduction

Hospital Information Systems (HIS) is a computer system that helps manage the information related to health care. In this day and age, they are the necessities for medical organizations to prove themselves committed to better healthcare solutions with improved services. It automates the manual procedure of managing hospital activities eliminating the need for paper records. The system is convenient and flexible as it saves effort, money, and resources. Despite the benefits of HIS, its implementation faces many challenges, both technical and human.

The long waiting time in a few government hospitals due to inadequate performance of the HIS prompted me to volunteer as an observer in a large government hospital to study their HIS, the challenges they faced in its application and suggest remedies for the same.

2. Aims and Objectives

1. To observe and understand the functionalities of a hospital management system in ESIC (Employees' State Insurance Corporation) Model Hospital, Rajajinagar, Bangalore.
2. To identify any technical challenges in the working of the system.
3. To assist staff in making use of the Hospital information system in an efficient manner.

3. Methodology and Observations

A detailed study of the HIS at ESIC Model Hospital, Rajajinagar helped me gain insight into the benefits and the challenges faced by a large government hospital in digitizing its business and strategic operations. I conducted the study under the guidance of Dr. Girish Bengalorkar, Associate Professor, Department of Pharmacology and Nodal Officer, Dhanwantri, ESIC Model Hospital, Rajajinagar. This hospital caters to the working and underprivileged class who earn <20,000 INR per month. They are provided an ESI card which they can use to receive treatment at this hospital and are referred to as "Insured person". Each insured person and their close family members are assigned a Unique health identification number (UHID) that makes them eligible to receive treatment at any ESIC hospital in India.

HIS of ESIC Model Hospital, Rajajinagar, aptly named Dhanwantri after the Hindu God of Medicine, consists of software that manages all aspects of the hospital right from registration of patients, the OPD, inpatient admissions and bed allotment, Operation theatre module, stores, laboratory and blood bank modules. It also stores employee data and is integrated with a finance management software called Pragathi which is responsible for tracking the payroll of employees. It was created by WIPRO and is currently managed by CMS.

A. Architecture

The system follows a client-server architecture with the data

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center located in the ESIC headquarters in New Delhi. It runs on a WLAN intranet with two SD-WAN connections, one acting as a backup in case the primary SD-WAN fails. The systems within the premises are connected through the intranet using a Local Area Network (LAN). The intranet is provided by the L2 switch whereas a modem is responsible for ensuring internet connectivity. The L2 Switch uses hardware-based switching techniques to connect and transmit data in a LAN. In order to provide connectivity to departments located in distant buildings, CAT-6 Optic fibers have been utilized

In addition, the hospital utilizes software for the laboratory information system that is accessed through the internet called AyusLabs. Values read from analyzers in the lab are directly uploaded to the AyusLab website. Each patient's lab records are stored in association with the UHID which allows doctors to keep track of all the patient's previous records.

Another software used is called Radspa which is responsible for storing CT and MRI image results of patients for ease of access and archiving by doctors. The hospital is planning to extend this feature to ultrasounds and X-Rays. Radspa works on a Java environment.

The Dhanwantri website is created mainly using HTML, Javascript and CSS. Any complaints and issues with these portals are immediately reported to the help desk at the headquarters where they are addressed and resolved.

This paper discusses the working of one of the modules, i.e.; the store module, shown in the given figure. [1]
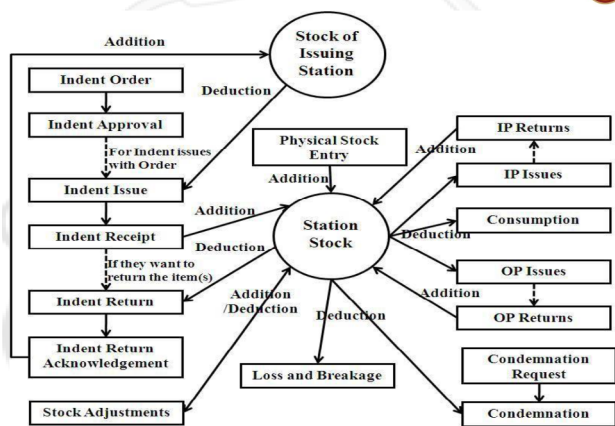

Fig. 1. Architecture

The store module is responsible for keeping track of and distributing the supplies i.e., medicines and equipment obtained from the Government E-Marketplace (GEM). Once the required goods are procured, purchase requisition and purchase order values are generated through Materials and Management 2 (MM2), an enterprise resource planning software (ERP). The companies supplying the necessities receive the order for the goods and a goods receipt note is generated, updating the store module with the available supplies.

Each of the medicines recorded in the store is divided into sets for ease of access and organization. Set A includes tablets, Set B includes injections and Set C includes ointments. Each doctor, while writing a prescription must select the particular

set that the prescribed medicine belongs. When an indent is raised by a facility i.e., A ward, the OPD or the pharmacy, a request is sent to the store, where it needs to be approved by the store manager, depending on the requirements and the availability of the drugs. Once approved by the store manager, it can be collected by the person in charge and an online indent acknowledgment is generated.

The Dhanwantri HIS includes many other modules like Administration, Registration, OT Resource Scheduling, Blood Bank and many more. These modules successfully and efficiently perform their functionalities.

4. Discussion

The HIS at ESIC Model Hospital is a well-implemented system managed by a dedicated administration and a willing-to-learn staff. Registration, Store, Laboratory and Blood Bank Modules are streamlined and have smooth functioning. It is to be appreciated that in-house orientation and training programs are held regularly to train and update the staff. The areas which need robust implementation are employing its application for booking appointments, and simplifying data entry right from registration at the hospital to discharge from the hospital. The Covid pandemic has contributed to slowing down the efficient implementation of the HIS.

The challenges faced by the hospital in effective implementation of the HIS are both human and technical. The human factors include impressions and beliefs regarding HIS and making use of them efficiently. The fact that using HIS has not reduced manual data entry is a major concern, but at the same time, there is awareness among the staff that this will happen gradually and in a phased manner.[2] The lack of healthcare professionals experienced in computer applications is another setback in the efficient implementation of HIS. Few health care professionals found it difficult in the initial stages as they were not well versed with the computer applications, but it improved after repetitive Dhanwantari training, which happens every 6 months for the doctors from the headquarters in New Delhi through virtual platforms and online meetings. Additionally, the user manuals, documentation, troubleshooting and guidelines for using HIS is available online in form of pdf and user assistance is provided by technical support 24*7 through helpdesk, New Delhi. Regular intern orientation training in Dhanwantari is conducted every year to address the issues so medical students are trained in HIS when they come for internship.

Multi-specialty hospitals, in comparison to single specialty hospitals, tend to have more varied workflows, requiring very flexible software. ESIC Model hospital being a multi-specialty hospital hence faces its own technical challenges. With the increase in usage of HIS by all departments, certain processes may become slower, especially one where more data has to be entered than in the manual process. The equipment has to be constantly maintained and upgraded but with the implementation of optic fiber connections internet speed is increased to 1GB and issues are resolved for HIS works.[3]

Few recommendations to overcome Human Challenges:

- It's a good idea to develop both postgraduate and undergraduate specialized programs in Health Information Management, Health Informatics and Health Information Technology, which increases the number of health informatics specialists and technicians. [4]
- Healthcare professionals can be made to participate and involve themselves right from the stages of system implementation, development, and deployment which would motivate them to use the system effectively. [5]
- Incentives, rewards, bonuses and more for the departments and sections that implement HIS successfully can be considered.

Few recommendations to overcome the Technical Challenges:

- Ensuring computers and networks have fewer maintenance problems. Technical support and hardware maintenance are also significant.
- Implementing newer innovations in both hardware and software is required to overcome data entry difficulties. [6]
- Making sure the system interface design is understandable and user-friendly.
- Data standards usage is one of the crucial steps for source accuracy, quality, and reliability as well as to validate system data.
- Increasing the computer terminal numbers at the point of care.
- HIS implementation is a collective responsibility of the entire hospital staff, and not the administration alone.

5. Conclusion

ESIC Model Hospital is a large government hospital catering to the working class of patients. It has implemented the Hospital Information System successfully and is making sincere and concerted efforts to strengthen its application. Though facing certain technical and human challenges, in the long run it is one of the few government hospitals to become a paperless hospital.

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