

# Total hospital information system hospital selayng

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1. 0 Hospital Information System (HIS) - Overview 1. 1 Definition Hospital Information System (HIS) is an integrated information system which passes through the organization crafted to manage clinical, administrative, financial and operational functions of a hospital. HIS strives to achieve the most effective support for patient care and administration through various different electronic data processing and analyzing tools (Ismail, et al. , 2010).

HIS serves as a platform to provide the required information to each level of the management at the correct time, in the correct form, and in the correct place, contributing towards improved decision making. HIS plays a pivotal role in planning, initiating, organizing and controlling the operations of the subsystems of the hospital and thus equips an organization with synergy and integrity required for it to function. More importantly, HIS also enhances patient care and comfort by offering personalized suggestions for care and enables a hospital to move from retrospective to a concurrent review quality (Ismail, et al. 2010).

1. 2 Global Trend in Hospital Information System (HIS) In early 2009, the market value of Hospital Information Systems (HIS) market was \$7. 8 billion worldwide and this figure has been predicted to leap to an alarming \$18 billion by 2016. The boom is primarily driven by governments' dynamic motives and hospitals continually trying to increase workflow efficiency Hence, hospitals are confident that embracing HIS will result in increased efficiency and reduced medical errors, which later translates into uplifting the quality of care provided to patients (Global Data, 2010).

Growing evidence has demonstrated that the current systems fail to deliver adequately safe, high standard, efficient and economical healthcare. This can be curbed through computerization, with electronic medical record

(EMR) as the fundamental component. This has resulted in clinicians and healthcare organizations around the globe scrutinizing into adopting more EMR technologies in their respective hospitals.

France, UK, US, Canada, Finland, Denmark, Australia, New Zealand and several other countries have proposed plans to construct a fully intergrated computer-based hospital infrastructures with the electronic medical record systems laying the cement work. In the Asia-Pacific region alone, umpteen successful HIS implementations have taken place in various hospitals such as in Japan, South Korea, Singapore and Malaysia (Global Data, 2010). 1. 3 The Malaysian Outlook The federal government had adopted a national-level strategy to create a paradigm shift in the nation's healthcare system.

The Federal Government aims to revamp the healthcare system so as to produce a county of healthy individuals and communities through the adoption of informationtechnology(IT). Major projects which has been undertaken include Multimedia Super Corridor Telehealth Project and MSC Telehealth Blueprint (1997) (Malaysianmedicine, 2004). Dr. H. M. Goh, secretary of both MalaysianHealthInformatics Association and Asia-Pacific Association for Medical Informatics mentioned that it is impossible to provide good, safe and efficient healthcare ignoring IT, thus the the cost of healthcare would rise.

He also stated that without computerisation, we won't be able to retrieve timely information. ( Malaysianmedicine, 2004). Following this, Malaysia has witnessed several significant developments in the health care sector. One such eminent development is the establishment of total hospital information

systems in Selayang Hospital (Malaysianmedicine, 2004). 2. Overview of organization - Selayang Hospital 2. 1 Brief History Located along the Kepong Selayang road of Gombak District, Selayang Hospital is a 960-bedded hospital which has been in operation since 1996.

Selayang Hospital (SH) is the pioneer in being the paperless and filmless hospital in Malaysia. Though classified as a government hospital, it has sophistication of a luxury private medical center with a leading-edge on technology. The need for this ultra-modern hospital came about as Hospital Kuala Lumpur (KLH) was already bursting to its limits with its overworked staffs. Organized and accurate documentation and archiving was impossible with mislaid or missing patients' records. This had resulted on KLH being entangled in legal matters. Increasing number of patients expressed their displeasure and quality of patient care was deteriorating.

These circumstances surged MOH to come up with SH project with proper incorporation of HIS (Yook, 1999) 2. 2 Clinical services at Selayang Hospital Among the services offered at Selayang Hospital are Gastroenterology, Hepatobiliary, Cardiology, Nephrology, Urology, Hand and Micro and Surgery. All the rest are categorised under secondary services, outpatient services and supportive services. The core business of Selayang hospital is providing a exclusive tertiary referral services to patients across Malaysia and a broader range of clinical services to customers who rely on Selayang Hospital as their regional or local hospitals.

High quality specialist services in a large number of other fields is also a highlighted aspect of this hospital (Yook, 1999). 2. 3 Vision The Selayang

Hospital project was designed by the Ministry of Health (MOH) in accordance with the Malaysia's Vision of 2020, where the country would become a developed the country's Vision for Health was formulated proposed a national health policy. Besides, it was particularly mentioned in the Seventh Malaysian that there will thirty three paperless public hospitals launched in Malaysia. More specifically, eight of these hospitals will be using Total Hospital Information System (T.

H. I. S), Selayang Hospital being one of them (Yook, 1999). 2. 4 Mission The mission of Selayang Hospital is to be a role model for Malaysian hospital, in using innovative, dynamic and cost effective technology and delivering a friendly, caring, compassionate and humanistic service. This will be achieved through teamwork in partnership with the community to provide quality care to the satisfaction of our customers (Yook, 1999). 2. 5 Organizational Structure Patients at Selayang Hospital are of top priority so the structure is designed to maximize patients/customers' satisfaction with emphasis on staff efficiency.

The Board of Directors (BOD) with the assistance of Total Hospital Information System and a Medical Advisory Board committee oversees the hospital overall operation. There are five distinct divisions in the hospital administration. The total medical and non-medical staffs amounts to 1090 people. The BOD is accountable to the State Health Directors (Image could not be retrieved) (Yook, 1999). 3. 0 Total Hospital Information System (THIS) in Selayang Hospital Selayang Hospital, the pioneer paperless and filmless

hospital in Malaysia, uses Total Hospital Information System (THIS) for its fundamental operation.

THIS combines aspects of clinical, administrative and financial management, enabling continual data flow between separate areas (Ismail, et al. , 2010).

THIS would aid in meeting the objective of enhancing productivity, effectiveness, efficiency, quality and safety. THIS

facilitates communication between care providers through sharing of

information, enables automation of work processes, integration and

interfacing with other components of HIS in addition to providing clinical

decision support and maintaining a permanent record as a medico-legal

requirement (Abdollah, 2011).

For the incorporation and functionality of THIS, Selayang Hospital had opted

to vendor solutions like Cerner for electronic medical record, Seimens for

radiology department, Spacelabs for critical care unit, Oracle for materials

management, finance and administration and Microsoft Office for internet

and intranet usage (Li, 2010). Figure 1 depicts the system architecture as

well as the technology partners that associate to Selayang Hospital

(Abdollah, 2011). Figure 1 : Information Technology System Support and

Technology Partners in Selayang Hospital (Abdollah, 2011).

Figure 2 illustrates the structure of THIS in Hospital Selayang. Selayang

Hospital incorporates clinical, administrative as well as financial processes as

their total hospital information system within their hospital operations. There

are various information system being deployed to cater specific needs and

wants of patients and care providers as described in the following sections

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(Abdollah, 2011). Figure 2: Structure of Total Hospital Information System in Hospital Selayang (Abdollah, 2011) 3. 1 Types of Hospital Information System 3. 1. 1 Electronic Medical Record (EMR)

Clinical Information System (CIS) is thought of as the system that mediates direct patient care. Within it, also lies the mechanical framework for capturing, storing and displaying the data generated by all clinical care activities. A defined portion of patient-specific collected from disparate sources by care-providers working in the various clinical services is put together as the Electronic Medical Record (EMR). EMR essentially provides for the recording of the following groups of data: a. profile of the patient b. information gathered regarding the patient's illness, allergies and health status c. ctivities performed on the patient d. events that occurred (planned and unplanned) e. results or findings emanating from these activities and events (numeric, text or images) f. communications between care providers i. e. instructions, opinions, referrals and advice g. decisions and plans both immediate and long term (diagnosis, treatment plan) This consolidation is essential for the availabililty of future data for tracking puposes which in turn governs clinical management and patient data mining, in addition to report generating (Abdollah, 2011). EMR largely benefits government and health care providers.

The need and requirement to document is both professional and legal as documentation enables care providers to communicate with each other thus facilitating continuity of patient care. Thus, in the form of the EMR, documentation satisfies the legal requirement of maintaining a record of

events. It is accessible from multiple access points and units within the hospital and selective access outside the hospital. This largely reduces the time taken to retrieve medical records. Hence, the time taken to retrieve patient records are reduced. This would pave the way for increased productivity and quality of care.

In the mean time, it would contribute towards better knowledge in clinical practices. Besides that, administrative benefits include easier report generation, better organization of clinical information, enhanced claiming and ordering processes, reduced billing timings which translates into providing better service to patients. Futhermore, THIS improved clinical decision making and disease management, patienteducationin addition to better documentation, increased time allocated per patient, and rejuvenated perception of care and quality of a healthcare institute.

The incorporation of DSS into drug management, result generation and disease management are essential in good clinical practise. On the other hand, for researchers and policy makers can utilize EMR to device long term strategies for towards development country's health care and proper allocation of resources (Haslina and Sharifah 2005). The workflow process such as the improvement of data inputting by avoiding duplications of data's, reduction is transcriptions costs as well as improved communication is also benefited by Selayang Hospital due to the successful implementation of EMR (Erstad, 2003).

Hence, in a nutshell, implementation of EMR such as improved decision making, disease management enhanced records and has made it possible to



eliminate the use of papers for medical records. As a result, medical records become more trustworthy and easily comprehensible. Figure 3 : Electronic Medical record system . Source : <http://level8systems.com/page.php?33>.

1. 2 Patient Management System (PMS) This system encompasses Patient Registration, Client-Resource Management and Charging, Billing and Payment system. For example, during patient registration, a identification number unique to that particular person is issued.

This would act as the Medical Record (index) Number (MRN). It allows data regarding a single patient to be kept in a single record, shared between systems and used for subsequent visits and encounters without the need for repeated data acquisition and entry of static data. Staff job assignment is be part of the Client Resource Management System. It should enable all categories of staff to be allocated to work areas, rooms, wards, cubicles, beds, machines etc. according to dates and work shifts. Care providers need to sign in to confirm that they are available.

The system should allow for constant updating of staff assignment. The Patient Tracking facility through PMS would also provide real-time status display and reports on attendances, location of patients, status of service provision and discharges Next, The Charging-Billing System would be able to calculate charges based on factors according to policies set by the hospital. It would be able to charge differently based on the service delivery such such outpatient service, emergency service and Inpatient service in addition to scrutinization by financial class.

Figure 4 illustrates a typical Patient Management System software which stores and updates patient records. Hence, PMS enables patient's records to be compiled and accessed in an organised manner. Besides that, subsequent processes like patient administration, clinical support tools and generating reports also is made easy. In addition, it also enables quicker diagnosis with proper relevant treatments available (Netripples, n. d. ). Figure 4: Typical Patient Management System. Source <http://hpathy.com/software/homopath-classic8.asp> 3. 1. Picture Archiving and Communication System (PACS)

Picture Archiving & Communication System (PACS) is majorly used in medical imaging unit. X-ray, echocardiogram, ultrasound machines capture digital images of a patient's clinical condition. These images are sent to appropriate destinations using this system. It can be imagined as a pipeline network which carries water, which in this case are the images. Every laboratory at Selayang Hospital is equipped with a high-end resolution computer screen to view these images captured from the machines.

This service is provided by Siemens in Selayang Hospital. With the help of PACS, images are viewed on screens rather than the conventional x-ray images which are as bulky as a spreadout newspaper. More importantly, PACS reduces the radiation exposure in both patients and care providers. This leads to a healthier working environment; better image distribution; timeless retrieving of data and images; image quality improvement as well as easier handling of images Dr. Zaharah (n. d. ).

Thus it can be understood that PACS is not a stand alone system but a subsidiary support system of Radiology Information System (RIS) described

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in next section. 3. 1. 4 Radiology Information System (RIS) The Radiology Information System (RIS) is a system, which enables care providers who to capture, store and distribute images by interacting with the machines that produce these images and also the clinicians who request for the images. The Radiology Information System (RIS) is a system, consists of the following major functional areas: 01.

Ordering of examination 02. Scheduling of appointments for examination 03. Creation of work lists 04. Tracking of examination and reporting status of cases 05. Image Tracking and Management 06. Clinical Result Reporting, 07. Storage and retrieval of reports To summarise, RIS which belongs to the radiology department, is a huge database which can be used to perform x-ray imaging, echocardiograms, computerized axial tomography (CAT) scans, positive emission tomography scans (PET) and magnetic resonance imaging (MRI) tests when necessary ( Dr Zaharah , n. . ). The RIS creates and schedules the patient order for an image study. The RIS allocates a unique accession number to the order, sends a message to the PACS and the imaging modality to maintain accuracy in patient demographic details (Figure 5). Figure 5: Integration of RIS and PACS in acquiring and processing of images Source: <http://www.pukkaj.info/NewsArchive2007/SendingradiotherapyimagestoPACS/tabid/1111/language/en-GB/Default.aspx>) In a fully functional THIS system, RIS must be a high degree of integration between with EMR, PACS and PACS.

In this sense PACS is a sub-set of RIS. Radiology images are considered as part of each patient`s EMR. Images need to be treated just like other patient

data. Images as data are managed by Picture Archiving and Communications System (PACS). RIS is also linked with scheduling system to schedule appointments for patients. Figure 6 shows the schematic representation of functions and relationship between RIS, PACS and EMR (Abdollah, 2011).

Figure 6: Schematic representation of functions and relationships between RIS, PACS and EMR (Abdollah, 2011).

3. 1. Pharmacy Information System (PhIS) Pharmacy Information System (PhIS) operates in the pharmacy department for numerous activities which includes clinical screening, inventory management, prescription tracking etc. PhIS are elaborate computer systems that were structured to meet the needs and wants of a pharmacy division to function effectively and efficiently. Pharmacists will be able to overlook how medications are used in a hospital using insights from this system (Biohealthmatics, 2010). Clinical screening is one of the most important usage of PhIS.

Drug interactions, allergies and all plausible drug-related disorders can be monitored using the assistance of PhIS. When a prescription is issued, the system checks for all possible interactions between all the drugs prescribed together to a patient at one time or with any particular food, reported allergies to the drug, and even if the sufficient and appropriate dosage has been given based on the individual's body mass index (BMI), age, and other physiological factors. Instant alerts and warning messages are displayed if adverse drug interaction is detected (Biohealthmatics, 2010).

Inventory Management is another major component of the PhIS.

Pharmacists need to know the drugs available, usage pattern and balance of

stock. This inventory can be separate from or be a part of the Procurement and Storage Information System of the hospital's integrated Management Information System. Continuous inventory monitoring is an essential requirement of a pharmacy in order to ensure that drugs never goes out of stock. Besides, multiple dispensing locations and manual inventory keeping is not only tedious but can also lead to inaccuracy in inventory management (Biohealthmatics, 2010).

In addition, prescription management for both in patients and outpatients is also a vital segment of PIS. For instance, when the issued prescription arrives to the pharmacy, the orders are checked and matched against available drugs in the pharmacy and then dispensed accordingly to respective patients. More interestingly, prescriptions that passes through the system that can track the physician prescribing the drug, date of prescription, to whom was it prescribed and when was it was dispensed.

Automated label printing which bears directions on how medication should be followed is also possible (Biohealthmatics, 2010). Besides, patient drug profiling can also be achieved through PIS. These are patient profiles and holds particulars of their present and previous medications history, known allergies, familyhistory and other parameters. These profiles are also during clinical screening. A physican who prescribes a particular drug to a patient would be able to instantly see the patient's profile and decide on whether or not this drug is appropriate (Biohealthmatics, 2010).

Figure 7 shows a typical pharmacy information system modal provided by Siemens. This includes relevant information such as patient name, name of

the drug, route of administration, dosage and frequency of administration. PIS works hand-in-hand with EMR to detect contraindications due to drug allergy, streamlines workflow in addition to assisting billing and charging in administrative and financial system. Figure 7: Pharmacy information system modal by Siemens Source: [http://www.medical.siemens.com/siemens/en\\_US/rg\\_marcom\\_FBAs/files/presskits/SiemensMAC](http://www.medical.siemens.com/siemens/en_US/rg_marcom_FBAs/files/presskits/SiemensMAC). pg 3. 1. 6

Laboratory Information System (LIS) Laboratory Information System (LIS) manages all the laboratory faculties which includes clinical chemistry, parasitology, hematology, immunology and microbiology in terms of receiving orders, performing tests and producing results. It also provides modules for sending laboratory trials order to the appliances through its multiple instrument interfaces so that the results can then be analysed instantly and a reports can be generated. Patient management is an important aspect of LIS.

Patient particulars such as the date of admission, consulting doctor, and respective reference number would be maintained by this system. Data pertaining to the patient's samples including the consulting doctor, corresponding department, specimen type, method of collection and the technician-in-charge of the collection can also be monitored (Nationmaster Encyclopedia, n. d. ). In summary, LIS is used for processing and storage of information generated by medical laboratories. EMR, PMS as well as order management system are customized in order to allow interferences between LIS which supports in-patient as well as out-patient services.

Moreover, the system produces barcode sample labels which are therefore used for acknowledgment of test samples. In Selayang Hospital, there are around 150 barcodes readers that are being widely used daily (Abdollah, 2011). 4. 0 Impact of Total Information System (THIS) 4. 1 Benefits of Total Hospital Information System (THIS) Total Hospital Information System (THIS) is an enterprise-wide system which ps the organisaton, designed to enhance clinical outcomes, operational efficiency and to improve financial management for healthcare industry.

THIS serves as a secured and dependable meticulously integrated system that allows hospital officials to record, store and selectively disseminate clinical and other patient related information to appropriate entities (Netripples, n. d. ). T. H. I. S. provides effective solutions to hospitals which plan on reducing the administrative burden and clinical transactions, in addition to providing compassionate services to their patients. On a typical day in Hospital Selayang, the inpatient admissions reach 150/day whereas outpatient visits would reach upto 1000/day amounting to 250GB of patient records.

T. H. I. S has enabled effective management of such high flow of patients, data storage, processing and retrieval. Figure 8 illustrates the daily usage of T. H. I. S shows the heavy reliance and interdependance between Selayang Hospital and the information systems. Figure 8: Daily Utilization of T. H. I. S (Abdollah, 2011). With the presence of THIS, most of the patient care demands can be met because it computerizes the process of collecting, arranging, filing and retrieving patient information.

Furthermore, world class patient care can be provided by the hospital when equipped with good decision support system from THIS. Additionally, T. H. I. S. benefits in various other methods such as comprehensive patient record keeping, much lesser paperwork, quicker information sharing means between various departments, more flexible organization, reliable and timely information and adequate inventory management. A user satisfaction survey conducted in 2003 among staffs of Selayang Hospital revealed that T. H. I. S was appreciated and well received among nurses and doctors followed by allied staffs and clerks as depicted in Figure 9. (Abdollah, 2011) Figure 9: User satisfaction survey 2003 (Abdollah, 2011). Productivity wise, Selayang Hospital has evidently shown higher productivity after the successful implementation of Total Hospital Information System (T. H. I. S. ). As Selayang Hospital had incorporated T. H. I. S. from the start of its operation, studies analysing the effectiveness of T. H. I. S. before and after implementation is not possible. However, a comparative study comparing T. H. I. S. n Selayang Hospital with a traditional government hospital, Hospital Klang is currently being carried out. Few early findings from this study shows implementation of T. H. I. S. has managed to reduced time taken for admission by 40%, patient stay by 10% and discharge processes by a remarkable 70%. Qualitative benefits of this system highlighted in this study include easy availability of data, better patient record management and improved workflow (Abdollah, 2011). The ability of Pharmacy Information System (PIS) to keep track of the entire drugs inventory within the hospital is commendable.



The PIS head manager is also able to make orders when an alert is raised on a particular drug. This therefore ensures proper inventory management and that all drugs are always in stock. In addition to the privileges that pharmacies' will get through the implementation of T. H. I. S, doctors of the hospitals are also able to reap off its benefits as well. For the clinicians, EMR and PMS aid in clinical management of patients. A medical officer no longer requires the doctor-in-charge to be physically present but still can receive consults from him/her utilizing EMR and PMS.

All these systems has indeed helped Selayang Hospital to manage the hospital effectively with efficient decision making. Moreover, T. H. I. S. aids hospital administrators whereby it significantly improves operational control. Lastly, in addition to enhancing patient care, T. H. I. S also increases the profitability of the respective organization. In summary, there are a number of direct benefits of THIS in hospitals. The most important advantage of this system is the ability to meet patients' demands in a timely manner owing to the automation involved in data collection.

Other uses include great reduction in paperwork and more efficient patient particular collection and management. Considering the unwavering benefits from implementation of Total Hospital Information System, it will soon become a necessity in terms of hospital management.

#### 4. 2 Ethical Concerns

The number and the magnitude of challenges faced by healthcare organizations are unprecedented. Selayang hospital is no different. Increasing financial bruden, rising public an payer expectations and

increasing number of consolidations have placed these hospitals under immense stress.

Heavy usage of information systems have provided record-keeping which is otherwise impossible. However, this leads to rapid and easy access to medical records raising issues of privacy against expediency (Boyle, 2001). In Selayang Hospital, these issues are handled with utmost priority. Patients' privacy and confidentiality is protected through several measures. Only authorised users are allowed to access these information. Authorised users who are found to be misusing their access would be tracked in audit trails and stringent disciplinary actions would be taken against them.

Therefore, patients are assured of their personal data protection (Abdollah, 2011). 4. 3 Drawbacks and challenges of Total Hospital Information System (THIS) Like any other information system implementation, in T. H. I. S. , users' resistance to change is one of the major concerns. This is largely related to individual acceptance of IT application particularly by doctors and nurses. Though this is now not an issue in Selayang Hospital, failures in HIS has been repeated reported over the years.

Unrealistic goals, complex user-interface, lack of clarity on the functionality required and lack of sensitivity to the local systems were some of the key reasons contributing towards failure of THIS in many fledgling hospitals (Cassels, 1995). The developing countries face even deeper problems such as inadequate electricity supply, lack of proper infrastructure, unsustainable funding, and the inadequate educational levels of the hospital staffs who are

likely to be the primary users of the system rather than doctors in these countries.

Other concerns include slow response time, absence of easy login-procedures, and tedious data entry (Chandrasekhar and Ghosh, 2001).

Selayang Hospital though comparatively better in IT receptiveness, initial reluctance was present. Even today, reluctance to change and accept an IT application especially the EMR system in a conventional society still persists. Appropriate strategies like IT training and incentives need to be devised to make both patients and hospital officials more receptive towards these systems (Haslina and Sharifah 2005).

### 5. 0 Future Plans

Following the successful execution of T. H. I. S, Selayang Hospital is currently looking a step ahead into developing an entirely automated Pharmacy Information System (PIS) with Decision Support System (DSS). Besides, management is also emphasizing on improving reporting and data analysis, enhance clinical documentation module with decision support and introduce mobile computing function to facilitate better hospital management (Abdollah, 2011).

### 6. 0 Conclusion

It is beyond doubt that T. H. I. S has been the backbone in assisting hospital administration to ensure Selayang Hospital runs smoothly.

However, without the staunch commitment from top management, physicians and other users and adequate number of IT professionals, this success would have remained as a dream. Thus, information systems only when coupled with good reception would prove beneficial.

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