

HOSPITAL INFORMATION SYSTEM (HIS)

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1 INFORMATION SYSTEMS IN HEALTH CARE

Information systems facilitate the activities of planning, management and delivery of health care services at many levels. The main area discussed in this website is Hospital Information System (HIS) and perhaps a bit regarding Telehealth plus some aspects of links of the HIS to Community health systems.

2 HOSPITAL INFORMATION SYSTEM (HIS)

An information system that facilitates the activities of a hospital takes into consideration:

01. the functions of a health care facility
02. the capability of information technology

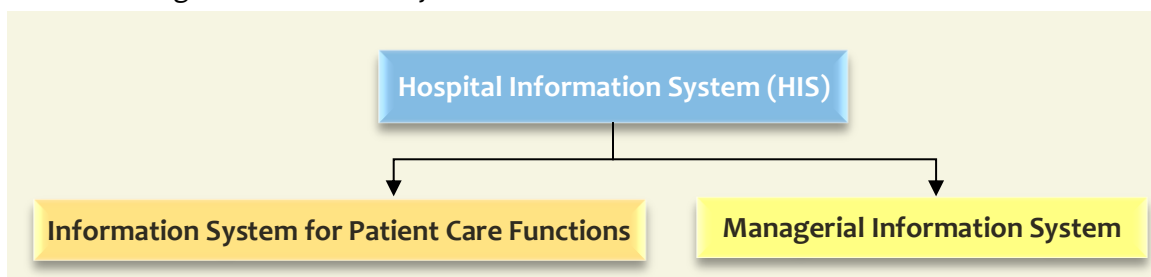
The information management system complements the other components of the very complex organizational structure and operations of a hospital. Its scope, content and structure serve a myriad of functions. It contains a set of sub-systems and applications that utilizes information technology and computerization optimally to facilitate the delivery of services of the hospital.

In general, the various functions and services that can be facilitated by information systems can be divided into two main group of activities:

01. **The core business of care of patients**
02. **Managing the hospital as a business entity, a provider of hospitality services and a physical facility**

The set of fully integrated hospital-wide information systems that support the activities is called the Hospital Information System (HIS). It is focused primarily on the Operations Management of the hospital. However, data available from the system may be collated, analyzed and used for strategic or project management and research. The HIS is envisaged as consisting of two broad systems i.e.

01. Patient Care Information System
02. Managerial Information System



The division into these two broad categories is conceptual. The information system that supports administrative, human resource, facility and hospitality management activities are placed arbitrarily under the Managerial Information System. Articles in this website deals mainly with the Information Systems for Patient Care Function, i.e. the core business activity of a hospital..

2.1 CONTRIBUTIONS TO OTHER HEALTH INFORMATION SYSTEMS

The Hospital Information System should be capable of sharing patient data with other health care institutions so as to enable continuity of care via the Telemedicine approach or other means. It is expected to contribute to the national health database (in Malaysia: the National Health-Management Information System) by supplying information for health promotion, disease prevention and early detection efforts as well as for planning, resource allocation, epidemiology, case-mix calculations etc. at district, state and national level. It should also provide information to systems belonging to third party institutions e.g. external agencies like the Drug Safety Council, Registration Department, Road Safety Council, the Police, Insurance companies and many others.

2.2 HOSPITAL INFORMATION SYSTEM : CHARACTERISTICS

A Hospital Information System can be designed and built in-house from the outset or purchased. Either way, the suite of applications software and databases need to be assessed or appraised to determine suitability for use before being made available to intended users. Systems purchased off the shelf, need to be customized to suit the hospital's services, policies, procedures and equipment. On the other hand, some compromises in the existing processes may be required.

The data structure needs to be elucidated by defining entities, relationships and naming of data elements and possible values attributed to each data element. This is achieved through the activity of Business Process Re-engineering, Customization and Database Design. User Acceptance Testing should be thorough; initially on a TEST version of the system in a simulated Operations environment, and subsequently on the actual Operations Version. After implementation the system has to be appraised continuously and improved upon if necessary.

Where legacy systems are retained they should be aligned with the structure and arrangement of the new HIS. A difficult issue is data migration. Success depends on ensuring technical compatibility as well as semantic consistency between the new database with the old data such that the data can be migrated into the new database and is accessible through the new applications. Data migration is discussed in a separate section.

Some devices and instruments may need to be replaced or new ones added to enable interfacing. There will be definite changes in the way data is collected because this needs to match with the data structure, collection and presentation used by the system.

An important aspect of the design of the system is the use of standard naming conventions of services, locations, care provider categories, visits, encounters and events. These static data elements are made available in reference tables.

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2.3 SYSTEM INTEGRATION

The information systems and applications are usually considered to consist of modules for ease of description. Each module may have its own subsystem or the various modules may be shared in a virtual server. It is expected that the Hospital Information System is fully integrated so as to function seamlessly across modules. Integration refers to the interaction between applications software with each other and with the hardware that supports it, enabling one to work with another for a desired purpose. Poor integration often make it necessary for the user to go through extra steps to complete a task and also slows down the system response time. A substantial part of integration is the interfacing of information system computers with computers of hardware (machines, measuring apparatus and etc.) enabling them to engage in transfer and retrieval of data or instructions. Integration can be achieved at the stage of:

- A. HIS design
- B. Implementation

It would be desirable to design or procure a HIS that have been fully integrated from the start and where the modules and sub-systems are proven to interact smoothly with acceptable response time and ease of use. Trying to integrate disparate applications software with different data structure and using different operation systems at the time of implementation would be an unenviable task. Integration usually involves two or more parties. Sharing out of responsibilities, agreeing on a schedule and assigning costs are issues that can pose a stumbling block to speedy and successful implementation.

Another important consideration is the coordination between services and units within the hospital so that the each module takes into consideration differences in their policies and procedures. It would be desirable for these policies and procedures to be made complementary, uniform and standardized. Minor variations can be allowed.

2.4 ENABLING AND ENHANCING COMMUNICATIONS

Communications between users of the system especially care providers is of paramount importance. Various approaches and means can be used to facilitate and enhance communications. The main method is through the sharing of information. This is achieved if data generated by each user is placed in a common database and then made available to others through tailored views and displays. Instructions, orders and reminders can be placed in the individuals users in-box. Messages can be relayed from the information system to users via both internal and external communications systems and devices such as computers (in-boxes, e-mails via intranet and internet), electronic white boards and mobile phones. Communications with patients can be through the same means, interactive kiosks and through web portals

3 INFORMATION SYSTEM FOR PATIENT CARE

The Hospital information System (HIS) can be broadly divided into two halves:

- 01. The Systems for the Patient Care Function
- 02. The Managerial Information Systems

The clinical and other functions relating to the care of a patient is facilitated by a set of systems which can be given a generic name of Information Systems for the patient care function. The term **Patient Care Information System** is attractive and acceptable but, unfortunately, is used only by small number of [advocates](#). This term will be used in all subsequent discussions here because this extra category level clarifies the nomenclature of systems. The entire system is made up of sub-systems each of which can be discrete and seldom integrated when built. The term Clinical Information System (CIS) should not be used to mean the whole Information Systems for patient care. The name CIS should be confined to the system that facilitates or supports **direct patient care** functions. Another commonly used term is 'EMR/EHR **Systems**'. This should not be used at all because information systems are useful only if they facilitate work rather than "[the creation, storage, and organization of electronic medical records](#)" as understood by some.

3.1 OBJECTIVES & FUNCTIONS OF PATIENT CARE INFORMATION SYSTEM

Being a system for facilitating operations, these set of sub-systems and applications are expected to utilize information technology and computerization optimally to realize the following objectives:

- a. Productivity
- b. Effectiveness
- c. Appropriateness
- d. Efficiency
- e. Quality
- f. Safety

To achieve the above objectives, the computerized information system provides the following functions:

01. Guide and enable the performance of Patient Care Processes
02. Facilitate communication between care providers through sharing of information
03. Enable automation of work processes through links within it, integration with other components of the hospital information system and interfacing with other computers, machines, printers and scanners.
04. Provide clinical decision support at point of care
05. Gather, store and make available vital clinical information (individual and aggregated) for primary and secondary use
06. Maintain a permanent record of events and all activities of patient care (as the Electronic Medical Record and other documents based on medico-legal requirements)

Any system being designed, proposed or implemented must possess characteristics that would fulfil all the above objectives and functions; both in its content and the methods used.

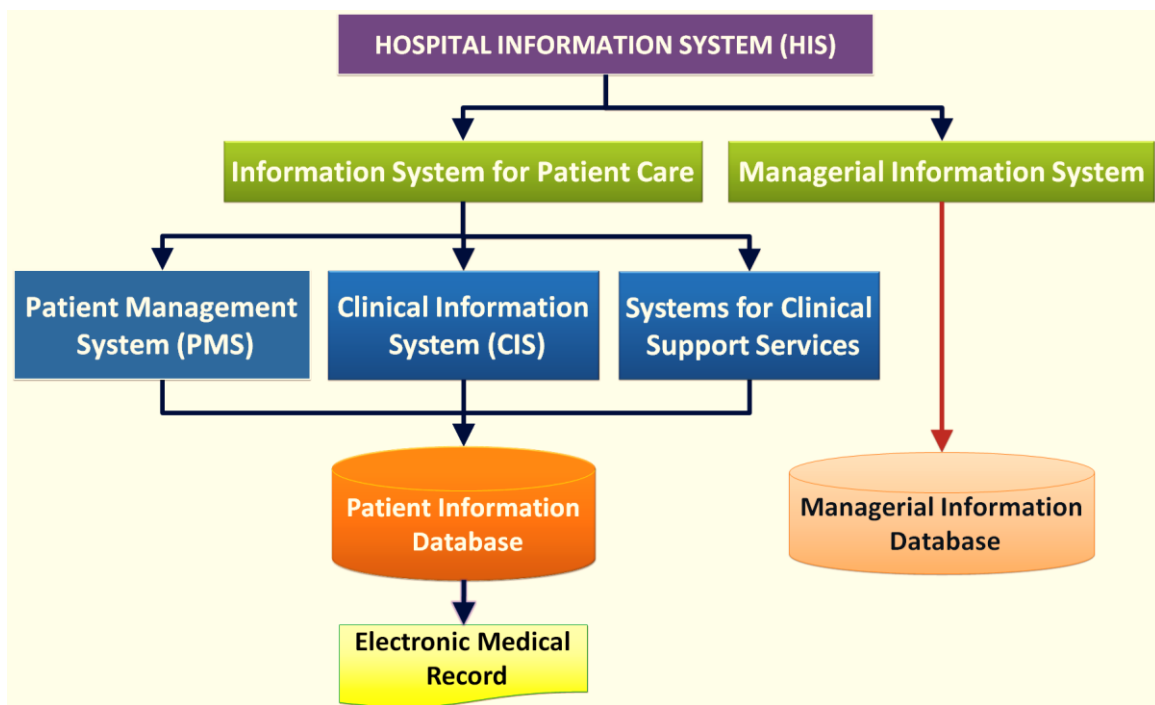
3.2 SCOPE, CONTENT & RELATIONSHIPS OF PATIENT CARE INFORMATION SYSTEM

The **Patient Care Information System** consists of:

1. [Patient/Client Management \(Administration\) Information System](#)
2. Clinical Information System (CIS)
 - CIS for various specialties
 - Clinical Documentation
 - Clinical Decision Support
 - Centralized Continuous Monitoring System
 - Electronic Medical Record
3. Clinical Support Systems
 - [Laboratory Information System](#)
 - Blood Banking Information System
 - Radiology Information System
 - Pharmacy Information System
 - Food and Beverage Supply System
 - Operation Theatre / Suite Information System
 - Sterilization and Sterile Inventory & Supplies System
 - Other support systems
4. Bridging or intermediary systems
 - [Order Entry - Result Reporting System \(CPOE\)](#)
 - Patient Information Database Management System
5. Clinical Governance Systems
 - Clinical Managerial Decision Support Application
 - Quality and Productivity Management Application
 - Infection Prevention and Control Application
 - Clinical Data Extraction and Reporting Application
6. Supply of Data for External Organizations

The relationships of the systems are as depicted the chart below:

Relationships of HIS



For the sake of choosing the best of the breed it may be necessary to procure separate systems or from different vendors e.g. for Systems for Clinical Support functions, the Charging-Billing-Receipt of Payment Application and various clinical support systems. It is imperative that these are demonstrated to be capable of full integration with the rest of HIS.

All the above systems are used by health care personnel to care for patients. Care is here defined as all work activities to deliver services to patients in response to their needs.

3.3 INTEGRATION OF THE PATIENT CARE INFORMATION SYSTEM WITH THE REST OF HIS

It is crucial that the Information System for the Patient Care Function is able to integrate with other systems of HIS. It must support the activities of incident reporting, clinical epidemiology, disease surveillance, quality management, utilization review, risk management and similar functions. Due consideration must be given to areas where Management Information Systems interact with the Information System for the Patient Care Function. Examples of such areas are Charging and Billing, Human Resource deployment, Bed allocation and Food-Beverage services.

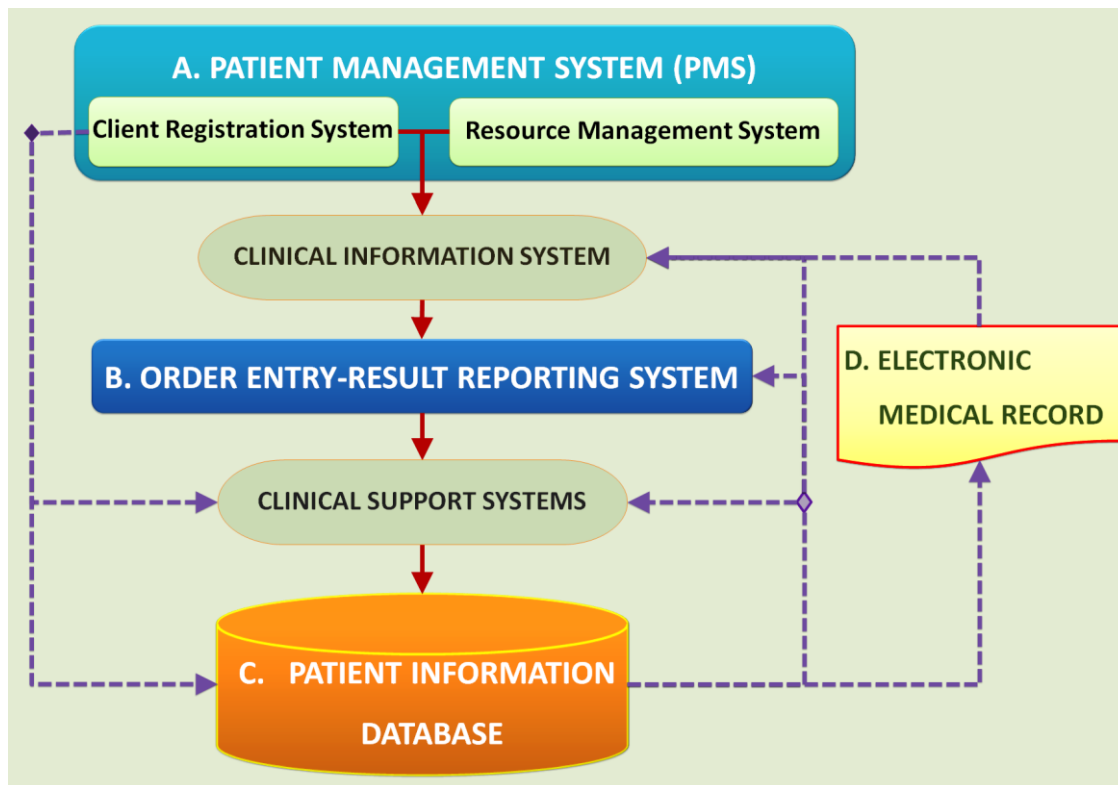
3.4 KEY BRIDGING APPLICATIONS

Integration within the Patient Care Information System is essential. The main patient care applications software i.e. the Clinical Information System and the various Clinical Support Systems are built around key bridging (intermediary) applications i.e.

1. Patient Administration/Management System (Registration, Scheduling, Resource allocation)
2. Order-Entry Result Reporting Application (CPOE)
3. Database Management System (DBMS)
4. Electronic Medical Record

These applications are thought of and designed first and then amended as each clinical and clinical-support application is designed. Any additional applications software is designed to be compatible with these key bridging (intermediary) applications.

Chart Showing Bridging Role of Four Key Applications of the Patient Care Information System



The Patient Administration/Management System (PMS) supplies data to the Patient Information Database from which the Electronic Medical Record (EMR) is derived, thus obviating the necessity for identification and demographic data to be obtained repeatedly.

The Order Entry (CPOE) application acts as a means of communications between care providers and the tool for planning, initiation, execution of processes and enabling charging-billing.

The Patient Information Database enables data generated by each user to be shared with others through displays on the computer screen, printed material (documents & labels) or exported to other communication systems.

The traditional function of the paper-based Medical Record is to make available historical data to future clinical users for continuity of care and to non-clinical users for various valid purposes. In a computerized environment, most of the functions of the paper record (i.e. the capture, storage, distribution and communication of data) is taken over by the Patient Information Database. The content and arrangement of data in the clinical applications and database need to take into account of the legal and professional requirements of the Medical Record. A data extraction application is then designed to generate the Electronic Medical Record.

4 MANAGERIAL INFORMATION SYSTEM

4.1 FUNCTIONS OF MANAGERIAL INFORMATION SYSTEM

The Managerial Information System refer to the set of sub-systems and applications that assist managers in running the hospital as a:

- business entity
- provider of hospitality services
- physical facility

The term 'managerial' is generic and refers to a set of sub-systems useful for managers. It is used here because other terms such as Management / Operations / Business / Enterprise Resource Planning systems have their own usage.

4.2 COMPONENTS OF MANAGERIAL INFORMATION SYSTEM

Systems that support the business operations include:

1. General Administration Information System & Office Automation
2. Charging, Billing and Receipt of Payment (Accounting) System
3. Human Resources Management System
4. Finance and Budgetary Systems
5. Consumables Purchasing and Inventory System

Systems for facilitating the hospitality services of a hospital include:

1. Bed management
2. Food-Beverage Order-Supply System

Systems for management of the hospital as a physical facility include:

1. Facility Engineering Systems
2. Equipment and Machinery Maintenance and Inventory System
3. Environmental Safety, Housekeeping, Cleansing and Waste Management

Managerial Decision Support Systems can be very helpful and include:

1. Business Intelligence Systems
2. Enterprise Resource Planning System

The components making up the Managerial Information System is wide-ranging and complex. They are not within the scope of this discussion (at this point) but mentioned here for completion. However certain components that integrate or interface with the Information System for Patient Care Function will be discussed.

Chart Showing Components of Managerial Information System

