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Hospital Information System (HIS):At a Glance

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ABSTRACT—*Information is the foundation for policy making, planning, programming, and accountability. Health informatics is the intersection of information science, computer science, and health care. It deals with the resources, devices, and methods required to optimize the acquisition, storage, retrieval, and use of information in health and biomedicine. Boddy et. al (2005) describes an information system (IS) as "a set of people, procedures and resources that collects data which it transforms an`d disseminates". Most professionally run hospitals and clinics now rely on Hospital Information Systems (HIS) that help them manage all their medical and administrative information. A health information system (HIS) can be defined as "comprising all computer-based components which are used to enter, store, process, communicate, and present health related or patient related information, and which are used by health care professionals or the patient themselves in the context of inpatient or outpatient patient care" (UMIT, 2005). It is also known as Healthcare Information System. In health organization such as hospitals, implementation of HIS inevitable due to many mediating and dominating factors such as organization, people and technology.*

Data for this paper were collected through bibliographic and internet research. Four key areas will be addressed in this paper:

1. ***An analysis of HIS and its components.***
2. ***Benefits of HIS***
3. ***Phases Of Implementation Of HIS***
4. ***Suggestions for selecting of HIS***

Study showed that End-user training is crucial for the success of an HIS. Without the users being trained properly in their assignments the chance of failure increases substantially. Training is not only important as a mean for teaching the individuals how to perform certain tasks, it's also one of the most pervasive methods of communicating organization goals to the personnel.

Key Words: Hospital Information Systems, Hospital, System, Electronic Medical records

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1. INTRODUCTION

Healthcare is a very important part of our society. On the other word, One of the most important issues is health services. In recent times, Health care concept of the people has undergone a tremendous change which has led to higher expectations and an increased demand for high quality medical care and facilities. Hospitals provide a medical assistance to people. Healthcare organizations of all sizes face a critical need to manage and integrate clinical, financial and operational information. In order to accomplish this task, a Hospital Information System should be developed.

It is commonly defined as a comprehensive information system used to collect, store, process, retrieve, and communicate patient care and administrative information for all hospital-affiliated activities and to satisfy the functional requirements of all authorized users in a hospital (Van Bemmel J.H, Musen M.A. 1999). Therefore, Information Systems are computer systems that collect, store, process, retrieve, display, and communicate timely information needed in practice, edu- cation, administration and research (Malliarou, 2006; Malliarou et al., 2007). The benefits of using Information Systems are many. They not only reduce errors and increase speed of care and accuracy but they also can lower health costs by coordinating services and improving quality of care. The best introduction for hospital information systems has been made in 2011 International Conference on Social Science and Humanity, which is: "Hospital Information Systems can be defined as massive, integrated systems that support the comprehensive information requirements of hospitals, including patient, clinical, ancillary and financial management".

A Hospital Information System is essentially a computer system that can manage all the information to allow health care providers to do their jobs effectively. It is also known as Healthcare Information System. Hospitals are becoming more reliant on the ability of hospital information system to assist in the diagnosis, management and education for better and improved services and practices. In health organization such as hospitals, implementation of HIS inevitable due to many mediating and dominating factors such as organization, people and technology.

The technology changes quickly and if the system is not flexible it will not be able to accommodate hospital growth. A good HIS offers numerous benefits to a hospital including but not limited to the delivery of quality patient care and better financial management. The HIS should also be patient centric, medical staff centric, affordable and scalable. An effective HIS also delivers benefits such as enhances information integrity; reduces transcription errors; reduces duplication of information entries; and optimizes report turnaround times.

2. AIM OF HOSPITAL INFORMATION SYSTEM

The HIS is a comprehensive, integrated information system designed to manage the administrative, financial and clinical aspects of a hospital. the aim of a hospital information system is to achieve the best possible support of patient care and administration by electronic data processing. As an area of medical informatics the aim of an HIS is to achieve the best possible support of patient care and outcome and administration by presenting data where needed and acquiring data when generated with networked electronic data processing. Hospital Information Systems main demands are correct data storage, reliable usage, fast to reach data, secure to keep data on storage and lower cost of usage. Damen(1991) stated that the purpose of the Hospital Information System is to raise "managing" from the level of piecemeal spotty information, intuitive guesswork and isolated problem solving to the level of systems insight, systems information and systems problem solving.

Hospital Information Systems provide a common source of information about a patient's health history. The system have to keep data in secure place and controls who can reach the data in certain circumstances. These systems enhance the ability of health care professionals to coordinate care by providing a patient's health information and visit history at the place and time that it is needed. Patient's laboratory test information also visual results such as X-ray may reachable from professionals. HIS provide internal and external communication among health care providers.

The HIS may control organizations, which is Hospital in these case, official documentations, financial situation reports, personal data, utilities and stock amounts, also keeps in secure place patients information, patients medical history, prescriptions, operations and laboratory test results. The HIS may protect organizations, handwriting error, overstock problems, conflict of scheduling personnel, official documentation errors like tax preparations errors.

3. BENEFITS OF HOSPITAL INFORMATION SYSTEM

The main goals of Information system are: Planned approach towards working; Accuracy; Reliability; No Redundancy; Immediate Retrieval of Information; Immediate Storage of Information; and Easy to Operate. Furthermore, The benefits of using Hospital Information System are:

- Easy access to doctors data to generate varied records, including classification based on demographic, gender, age, and so on. It is especially beneficial at ambulatory (out-patient) point, hence enhancing continuity of care. As well as, Internet-based access improves the ability to remotely access such data.
- Improved quality of patient care.
- It helps as a decision support system for the hospital authorities for developing comprehensive health care policies.
- Efficient and accurate administration of finance, diet of patient, engineering, and distribution of medical aid. It helps to view a broad picture of hospital growth.
- Improved monitoring of drug usage, and study of effectiveness. This leads to the reduction of adverse drug interactions while promoting more appropriate pharmaceutical utilization.
- Improved quality of documentation.
- Enhances information integrity, reduces transcription errors, and reduces duplication of information entries.
- Hospital software is easy to use and eliminates error caused by handwriting. New technology computer systems give perfect performance to pull up information from server or cloud servers.
- Development of a common clinical database.

4. WHO BENEFITS FROM HOSPITAL INFORMATION SYSTEM

The information regarding hospital information system can gathered from the staff members and patients, the computer user and the administration staff. Hospital information systems can be characterized by their benefits; their functions; their types of processed information and their types of services offered. The following groups benefit from Hospital Information System:

A) Physicians

- Introduces Computerized Provider Order Entry (CPOE)
- Improves accuracy & legibility of, and access to, the required patient medications
- Improves clinicians' efficiency & effectiveness through provision of key patient information (e.g., allergies) at time of ordering, plus conflict checking, order checking and online access to best practice information
- Improves care through the logging of all orders
- Reduces medication error rates

B) Nurses

- Will allow immediate access to orders and results
- Will provide immediate access to patient demographics, medication and test results
- Will provide improved access to information on line (i.e.: suggested medications or drug alerts)
- Will decrease the need for paper, decrease errors and increase patient safety

C) Allied Health Professionals

- Will allow immediate access to orders and results
- Will provide immediate access to patient demographics, medication and test results
- Will provide improved access to information on line (i.e.: suggested medications or drug alerts)
- Will decrease the need for paper, decrease errors and increase patient safety

D) Ward and Registration Clerks

- Will provide a single point of contact for patient registration information and reduce duplication of effort

E) Clinical Benefits

- Provide a common source of information about a person's health history
- Enhance the ability of health care professionals to coordinate care by providing a person's health information and visit history at the place and time that it is needed
- Link information from diagnostic information systems such as X-ray and laboratory into the EPR
- Strengthen internal and external communication among health care providers
- Eventually be accessible for use in all of Manitoba's academic and community hospitals, as well as long term care facilities
- Allow care providers access to the patient's health history and results between facilities
- Will provide improved access to information on line (ie: suggested medications or drug alerts)
- Will decrease the need for paper, decrease errors and increase patient safety

F) Administrative Benefits

- Will provide improved access to information on line (i.e. suggested medications or drug alerts)
- Will decrease the need for paper, decrease errors and increase patient safety
- Strengthen internal and external communication among health care providers
- Will decrease the need for re-registrations of patients across multiple sites

5. COMPONENTS OF HOSPITAL INFORMATION SYSTEM

Hospital Information System is a comprehensive, integrated computer system. Within this umbrella system, there are varieties of subsystems in medical specialties, There are five key components or "modules" in the system, include:

1. Registration
   The system captures and records patient demographics and visits at the point-of-care. Registration data will be displayed consistently and automatically on screens in the clinical system.
2. Order Entry and Results Reporting
   All clinical orders will be listed with indications of what has been completed and what is pending. Electronic alerts will appear for orders duplication and errors and provide information to assist clinical decision-making. All test results in the patient's electronic chart will be filed with alerts for abnormal results.
3. Clinical Documentation
   This module provides on-line documentation of clinical encounters such as flowcharts and structured notes. Eventually this information will be shared across health care facilities within Manitoba.
4. Scheduling
   Patient scheduling schedules patients for appointments with clinicians or for tests and procedures.
5. Patient Billing
   All billable health services will be accessible and processed in this system. Examples: private rooms, out-of-country coverage . The vendors selected to provide the software is Eclipsys. The Eclipsys suite of clinical software is known as Sunrise Clinical Manager (SCM), Sunrise Access Manager (SM). MidexPro and MediSoft are the software for the billing system.

6. SUBSYSTEMS OF HIS

As Lippeveld T. (2000) stated Hospital information systems contribute to an "integrated effort to collect, process, report and use health information and knowledge to influence policy-making, programme action and research .

There are different types of HISs including routine- and clinical HISs. Components of a hospital information system consist of two or more of the following:

1. Picture Archiving Communication System (PACS)
2. Radiology Information System (RIS)
3. Clinical Information System (CIS)
4. Physician Information Systems (PIS)
5. Financial Information System (FIS)

6. Laboratory Information System (LIS)
7. Nursing Information Systems (NIS)
8. Pharmacy Information System (PIS)

- **Picture Archiving And Communication System (PACS):** a PACS is a medical imaging technology which provides economical storage of, and convenient access to, images from multiple modalities (source machine types).[1] Electronic images and reports are transmitted digitally via PACS; this eliminates the need to manually file, retrieve, or transport film jackets. The universal format for PACS image storage and transfer is DICOM (Digital Imaging and Communications in Medicine). Non-image data, such as scanned documents, may be incorporated using consumer industry standard formats like PDF (Portable Document Format), once encapsulated in DICOM. A PACS consists of four major components: The imaging modalities such as X-ray plain film (PF), computed tomography (CT) and magnetic resonance imaging (MRI), a secured network for the transmission of patient information, workstations for interpreting and reviewing images, and archives for the storage and retrieval of images and reports.
- **Radiology Information System (RIS)** - These systems are also popular for their ability to provide radiology billing services, appointment scheduling as well as reporting and patient database storage. The radiology practice has become more complex with advances in technology and more hospitals now turn to RIS to manage the business side of their practices.
- **Clinical Information Systems (CIS)**: A Clinical Information System is a computer based system that is designed for collecting, storing, manipulating and making available clinical information important to the healthcare delivery process. Clinical Information System helps healthcare organizations improve the delivery of clinical services. hospital information systems present clinical information and reports that enable clinicians to make more informed decisions at the point of care.
- **Nursing Information Systems (NIS)** – These computer based information systems are designed to help nurses provide better patient care. A good NIS can perform a number of functions and deliver benefits such as improving staff schedules, accurate patient charting and improve clinical data integration. The nursing department can have a better managed work force through schedule applications enabling managers to handle absences and overtime. The solution can also be used to monitor staffing levels and achieve more cost-effective staffing. Patient charting applications allow users to enter details regarding patients' vital signs. Nurses also use it for admission information, care plan and all relevant nursing notes. All important data is securely stored and can be retrieved when required. Clinical data integration is also very useful, allowing nurses to collect, retrieve and analyze the clinical information and then integrate it to design a patients' care plan. All these features in NIS ultimately lead to a reduction in planning time and better assessments and evaluations. The chance of prescribing the wrong medication also decreases since there is always a reference for electronically prescribed drugs.
- **Physician Information Systems (PIS)** - As the name suggests, PIS systems aim to improve the practice of physicians and are also recommended by the government for deployment. Physicians can avail themselves of the Federal Government stimulus package aimed to provide better medical care. Various packages are available to suit different budgets and can be implemented to increase efficiency, cut costs and deliver high quality patient care. Physician information systems are delivered through computers, servers, networks, and use widely deployed and popular applications such as, electronic medical records (EMRs), electronic health records (EHRs), and more. Most of these services have 24/7 remote support that allows hospital staff to troubleshoot problems occurring during system usage.
- **Pharmacy Information Systems (PIS)** - Designed to address the demands of a pharmacy department, PIS helps pharmacists monitor how medication is used in hospitals. PIS helps users supervise drug allergies and other medication-related complications. The system allows users to detect drug interactions and also helps administer the proper drugs based on the patient's physiologic factors.
- **Financial Information System (FIS):** Financial Information Systems are computer systems that manage the business aspect of a hospital. While healthcare organization's primary priority is to save lives and not making profits, they do acquire running costs from day to day operations; including purchase and staff payroll.
- **Laboratory Information System (LIS):** A Laboratory Information Management System (LIMS), sometimes referred to as a Laboratory Information System (LIS) or Laboratory Management System (LMS), is a software-based laboratory and information management system that offers a set of key features that support a modern laboratory's operations.

7. PHASES OF IMPLEMENTATION OF HOSPITAL INFORMATION SYSTEM

Life Cycle Model is one of the methods for the development of Information Systems. This method contains the following seven distinct phases: the definition of the user needs, the analysis of the current system, the design of the new system, the codification of the new system, the acceptance and the evaluation, the implementation, and the maintenance of the new system (Damigou et al., 2006).

Kling et al. (2000) say that a pure technological view on ISs will lead to failures, and gives the following explanation as to why: " It cannot adequately account for the interactions between ICT, the people who design, implement and use them, and the social and organizational contexts in which the technologies and people are embedded".
A lot of implementations of ISs fail, and the reasons for it are usually not pinned down to one cause. Abreu and Conrath (1993) say that one can almost find as many reasons for IS failures as the number of failures themselves, and that a significant proportion of new systems are underutilized, do not meet their potential, or fail to be used at all.
Phases of implementing an HIS are (Allan and Englebright, 2000):
1.Planning phase 2.Analysis phase 3.Design phase 4.Development phase
5. Implementation phase 6.Evaluation phase 7.Upgrade phase

a. Planning Phase
The planning phase involves the following steps:
1. Define problem and /or stated goal
2. Conduct feasibility study
   - State objectives
   - Determine scope
   - Determine information needs
   - Decide whether to proceed
   - Negotiate the project definition agreement
   - Write the project definition document
3. Allocate resources

b. Analysis Phase
In the Analysis Phase data must be collected in the form of written documents, questionnaires, interviews, observations. After analysing data with data flowcharts, grid chart, decision tables, organizational charts a model can be made. Data must be reviewed before proceeding to the design phase.

c. Design Phase
The design phase is divided into two parts:
I) Functional Design
1. Personnel 2. Time Frame 3.Cost and Budget
4.Facilities and Equipment 5. Data Manipulation and Output 6.Operational Considerations

7.Human-Computer Interactions 8. System Validation Plan

II) Implementation Design
1. Design Inputs 2. Design Outputs 3. Design Files and Databases, Design Controls

d. Development Phase
The Development phase includes the following:
1. Select Hardware 2. Develop software 3. Test System
4. Document system
   - User's manual
   - Operator's manual
   - Maintenance manual

e. Implementation Phase
The implementation phase includes a detailed description of the system that specifies not only all hardware and software components but implemen- tation, training, operation, and maintenance procedures as well. Includes the following steps:
1. Train users 2. Install System 3. Manage and Maintain System

f. Evaluation Phase (I)
The evaluation and test approach is to test each entity with successively larger ones, up to system test level. Steps of project testing are: Program testing; String testing; System testing; Project documentation; User acceptance testing.
The following criteria are considered essential in selecting a Hospital information system and can be used as a basis for evaluation:
1. Applications 2. Overall system performance 3. Evaluation features 4.Ease of system use

5.Configuration or programming performance 6. Security 7. Simplification of reports

8. Database access 9. Hardware and software reliability 10. Connectivity 11. System cost

g. Evaluation Phase (II)

Methods and tools for evaluating a system s functional performance include:

1. Record review 2. Time study 3. User satisfaction 4. Cost-benefit analysis

h. Upgrade Phase

Some of the important considerations in upgrading a system include the following new technologies:

1. Bedside /point-of-care terminals 2. Workstations 3. Multimedia presentations
4. Desicion support systems 5. Artificial intelligence 6. Neural networks
7. Integrated systems architecture 8. Interfaced networks 9. Open architecture

Usage of the system is a crucial factor for success for HIS, and the users of the system use it on a voluntary basis. Barki and Huff proposed in 1985 that use is an appropriate measure of implementation success when use is voluntary (Abreu and Conrath, 1993). And also, Kimaro and Titlestad (2005) point out the problems if the communication between developers and users is lacking: It will lead to insufficient capturing of design needs and thus system failures. Intended users and developers need to agree on what is being designed by sharing technological and contextual understandings and available design options.

8. CONCLUSION

End-user training is crucial for the success of an IS. Without the users being trained properly in their assignments the chance of failure increases substantially. Training is not only important as a mean for teaching the individuals how to perform certain tasks, it's also one of the most pervasive methods of communicating organization goals to the personnel (Gupta and Bostrom 2006).

Despite the benefits Hospital Information Systems have to offer, they are not widely used in healthcare and where they have been installed, they have not been readily accepted. Many problems have been reported during the implementation of health information systems in Healthcare environment. This could probably due to lack of adequate training and failure of educate the end-user what the reasons are for their introduction. Problems that have been reported when introducing computers to support health care are the lack of standardized medical terminology, computer anxious users, fear of less individual care and too much control as well as unclear benefits (Goossen et al., 1997; Harris, 1990; CNA, 2006; Reuss, 2007).

System developers, however, have been remiss in providing relevant, useful information to the various healthcare professionals involved in the care of the patient. There is also a need for users to develop a framework of understanding about how the systems function. To implement HIS for users who do not understand it may lead to the failure of the system. Users are drivers of the system if they do not have reasonable knowledge about it, it is difficult for it to be optimally driven to provide objectives. There is a general ignorance of information systems amongst health workers. It is time to analyse the problems that exist in the development and use of ISs and to look for solutions to solve them (Jeffrey, 1998).

The key for effective administration and management of the Service of a Hospital is the availability of reliable, valid, and qualitative information. This fact predicates the existence and appliance of Hospital Information Systems, and makes indisputable their superiority against the manual procedure. Organizations may need to redesign the computer interface, to provide better hardware and to maintain a more reliable network function to meet the Users' needs during the adoption process, as well as to modify or devise appropriate documentation regulations (Damigou, 2007).

The health sector still lacks the discipline of system thinking, shared vision and a team approach. Study of HISs systems that have already been implemented need re-evaluation to determine not just whether they work, but how and in what circumstances they work (Dowling, 1985).

A critical factor governing the sustainability of information systems is the availability of qualified and experienced personnel. Information systems require active management if they are to succeed. Procedures need to be established for data collection, reporting, follow-up of missing reports, data quality control, data summary and providing feedback (Jett , 2007).

Finally, no hospital information system can be regarded as a success unless it has the full participation of its users. Thus human and social factors would have to be considered in its design, more often than not, they can be easily addressed by providing adequate training and education about the system.

9. SUGGESTIONS

Some of the important considerations in selecting a HIS include the following:

1. ***Total cost of package***- Generally, **HIS** providers are happy to visit and discuss the requirements of your hospital with you. Solutions are available for hospitals of all sizes and budgets. It is important to have a hospital information system that has a low cost of ownership. Some vendors reduce costs by having a design that requires less hardware

and fewer servers. This type of design is known to cut upfront acquisition costs and also reduces maintenance in the long run.

2. ***Web based system***- In addition to the user friendly features, a good HIS system must be available on the web. Availability on the web means authorized personnel can access the information whenever they want from anywhere. This does not bind all caregivers to their office desks and also provides them with information when they need it most. A web based system becomes even more important if it is used to share information between two or more hospitals. Healthcare facilities in different geographic locations can share relevant data quickly if they use an internet based HIS.
   For instance, a hospital may decide to shift a patient to another facility for better care or specialty treatment. If the present hospital has updated all the patient information in their **HIS**, the second hospital can instantly access the information needed for treatment. The medical history of the patient will always be stored within these facilities and can be readily retrieved if the patient is not able to provide it himself.
3. ***Implementation and support***- Change is always resisted by humans and deploying or upgrading a hospital information system may also invite employee criticism. It is always better to ask the vendor for support in an implementation and request for staff training. Choose a vendor that offers 24x7 supports via the telephone or web, so your hospital staff can immediately access support. Some hospitals also consult their staff while making a purchasing decision, as the staff may be able to tell you something new or inform you about things others may have overlooked.
4. ***User-Friendly*** : The interface should be user friendly and simple

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