

**A Study on Hospital Information System at a Tertiary Teaching Hospital**

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***Abstract:-***

*The Global Hospital Information Systems market is forecast to grow at a Compound Annual Growth Rate of 10% from 2010-2017. Healthcare organizations globally recognize the importance of investing in information technologies. The HIS systems are large computerized data bases intended primarily for communication, store health and administrative information. It is evident that the use of HIS offers tremendous opportunities to reduce clinical errors, support health care professionals decision making, increases the efficiency & quality of patient care. The development, testing, and adoption of HIS remain limited and numerous barriers exist. There is an urgent need to take a fresh look at HIS. The advancement of information system & technologies made various new applications possible. The purpose of this study is to understand infrastructure, system practices, hindering and motivating forces behind HIS at a tertiary teaching hospital which is explorative in nature. The study also focuses on details about hardware, operational procedure and other important facts pertaining to forces resulting in acceptance of HIS.*

***Key words:*** Healthcare, Hospital Information Systems, Computers, Information Technology.

#### **Introduction**

The report published by Fierce Healthcare 2011 highlights the Global Hospital Information Systems Market is forecast to grow at a Compound Annual Growth Rate of 10% from 2010-2017 i.e. It was valued at US\$7.4 billion in 2010, and is forecast to grow at a Compound Annual Growth Rate of 10% to reach about US\$14.7 billion by 2017. The high growth forecast for the period 2010-2017 is significantly influenced by accelerated efforts from the public and private sectors around the world to contain rising healthcare costs and enhance quality of care (Fierce healthcare, 2011). The global data 2010 research report talks about global Hospital Information Systems Company market Shares where GE Healthcare and Siemens Healthcare are the two leading companies in the HIS market and together account for 24% of the total market share. GE Healthcare is the market leader with 12.9% of the market share, followed by Siemens Healthcare and Cerner Corporation with 11.7% and 8.9% respectively (Global data, 2010). Healthcare organizations globally recognize the importance of investing in information technologies (Seyed et al, 2011). HIS is one of the most common computer systems designed to support health care services. These systems have large computerized data bases which are intended primarily for communication, store health and administrative information. HIS has a different components and includes broad scope and level of systems from departmental (a system limited a specific clinical or financial domain) to knowledge based systems that provide diagnostic support and intervention for patient care activities (Al-Nashmi and Maha Eissa, 2003).

It is evident that the use of HIS offers tremendous opportunities to reduce clinical errors (e.g. medication errors, diagnostic errors), to support health care professionals (e.g. availability of timely, up-to-date patient information), to increase the efficiency of care (e.g. less waiting times for patients), even to improve the quality of patient care (D.W. Bates et al, 2001). Despite the substantial opportunities for improvement in patient safety, the development, testing, and adoption of information technology remain limited and numerous barriers exist (David W. Bates

et al, 2003). There is an urgent need to take a fresh look at HIS from the perspective of the organizational structure of hospitals, the funding of such systems, and the role that physicians should play in their operation. Failing this, it is believed that HIS and its medically related components will continue to suffer serious developmental lags (Bruce A. et al, 1987)

The latest information system technologies tools such as Clinical Data Warehouses (CDW), Clinical Decision-Support (CDS) systems, data-mining techniques, Online Analytical Processing (OLAP) and Online Transactional Processing (OLTP)), are used to maintain and utilize patient data intelligently, based on the users' requirements (Ashish Mangalampalli et al, 2007)

### **Methods**

The study was conducted at a 1050 bedded tertiary care teaching hospital which is operational from 1996. Total of 8 departments of the hospital were studied for assessing the Hospital Information System. The present research is an Exploratory and qualitative in nature. The study is undertaken to know the current HIS and to take an overview of enhancements done. Extensive interviews for the sample of 100 fulltime employees which included Clinical, Non-Clinical and Administrative Staff of the hospital have been taken followed by a questionnaire to get a handle on the situation and understand the phenomena. The sampling method followed is convenient sampling.

The data is collected through questionnaire, observation & interviews. The questionnaire was constructed with emphasis on the content, clarity and simple language. The scoring done for was on a five-point scale. The scoring has been given according to the nature of the questions. Forced field analysis technique is used for data analysis to show how to plan and implement a solution or make necessary changes in HIS.

**Discussions**

- The tertiary teaching hospital is using Aristotle Medics Software since 2008 before the implementation the entire hospital operations were paper based and manual.
- The HIS network architecture is centralized with a Mainframe server having a configuration of – HP ML350 XEON Server, 4GB RAM and 750 GB HDD and the workstations are installed in the respective department i.e. Patient Registration, Accounting and Finance, Billing, Laboratory, Radiology, Human Resource Pay Rolls, Stores and Pharmacy with a configuration of Core 2 Duo, 1 GB RAM and 320 GB HDD. **(Refer Figure 1 And Figure 2)**

**Figure – 1 Skeleton Layout**

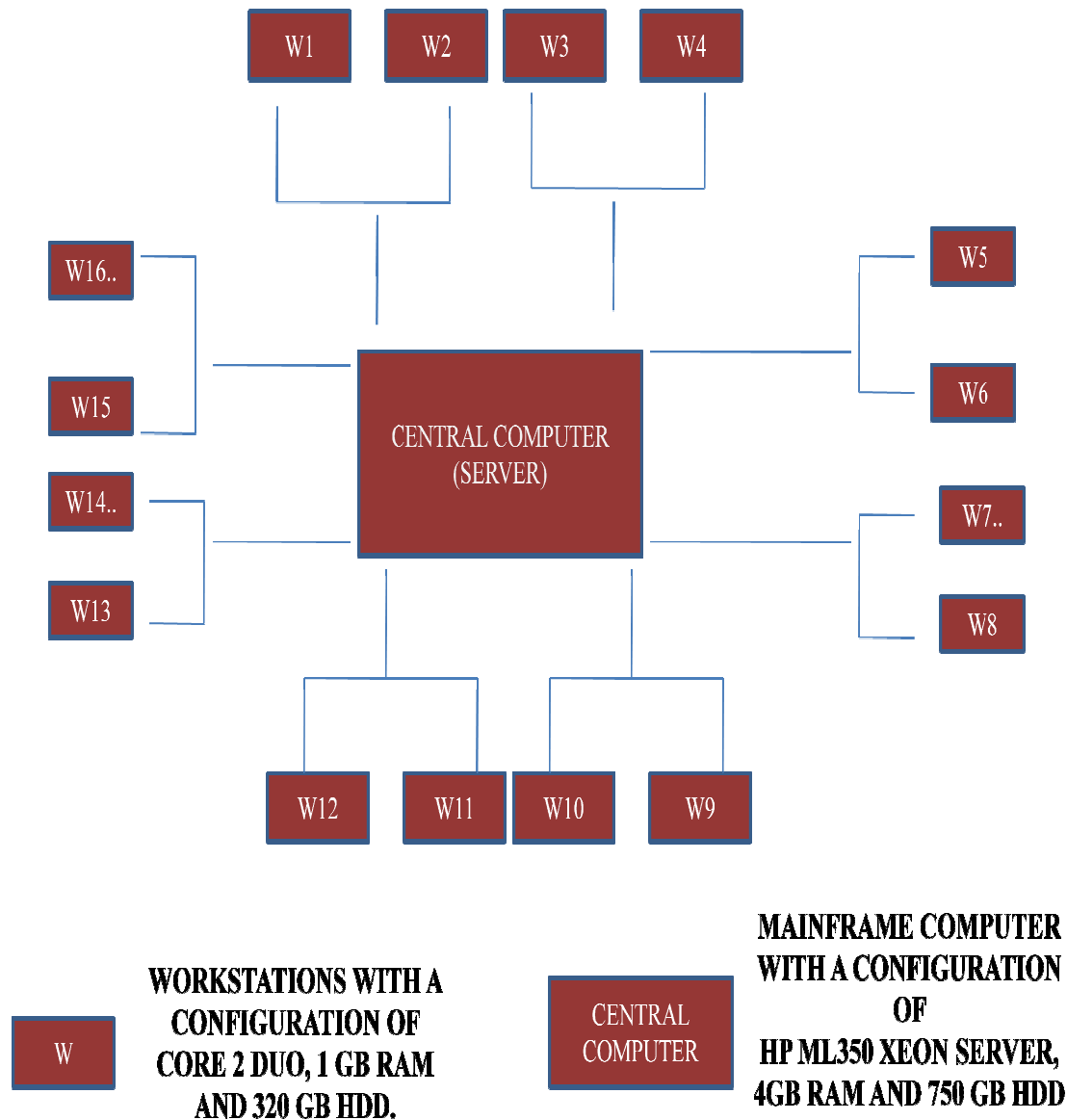
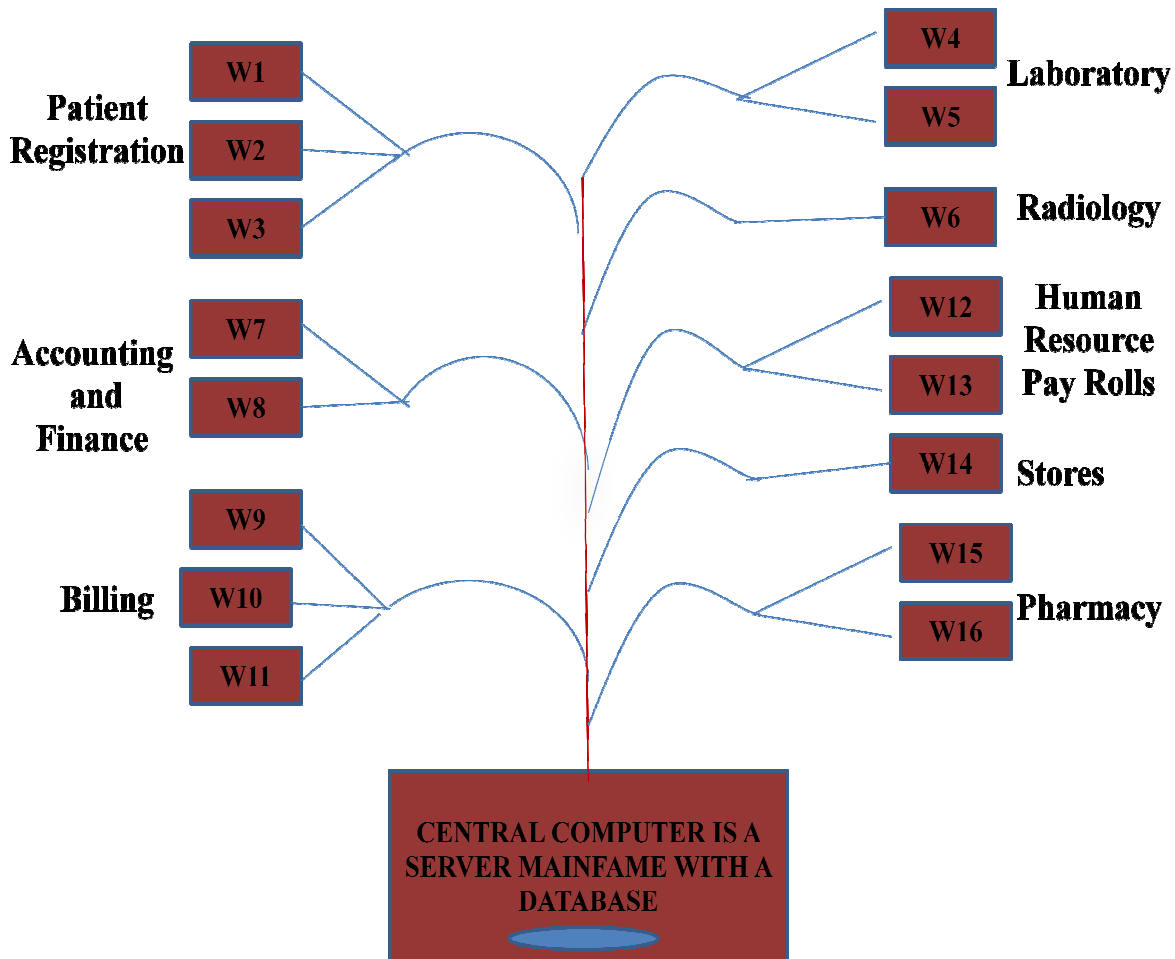


Figure-2 Detailed Layout Department Wise



- The HP ML350 XEON Server runs ERP software (Aristotle Medics) and workstations are connected through standard networking devices (switches and routers).
- The entire hospital server and workstations are wired through fiber optics.

- The database is maintained in the central server and shared with other departments through network sharing.
- ICD10 Coding is a part of ERP software.
- The Unique Patient Identifiers (UHID) is unique for all the patients approaching the hospital for treatment. i.e. (UHID=RI-11), RI means Registration Information & 11 is the year.
- Every year in the month of March the UHID changes example:-from 2011 to 2012. (Suppose the current year UHID is RI-12, and then the next year the UHID will be RI-13).
- All the Patients Records are stored at the database software for a period of 15 years and Medico Legal Cases records are stored for life time.
- Backup of the database is stored in External Hard drive which is done every day.
- The fully operations modules are Patient Registration, Accounting and Finance, Billing, Laboratory, Radiology, Human Resource Pay Rolls, Stores and Pharmacy.
- The hospital has an IT department headed by IT manager with supportive team who are available 24 hrs with a resident server administrator.
- Day-to-day operations such as data entry, report generation, stock maintenance etc. are performed by the staff that are trained by the IT department.

**Table – 1 Opinion about the existing Hospital Information System**

Category (n=100)	Responses			
	Good	Moderate	Poor	Total
Administrative Staff	13	12	5	30
Clinical Staff	8	12	10	30
Non Clinical Staff	9	17	14	40

Total	30	41	29	100
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The key findings from the questionnaire were as follows

From **Table -1** It is found that only 30% of the respondents agreed that present HIS is good and 41% agreed the present HIS is moderate and 29% had indicated the HIS to be poor.

**Table – 2 Opinions About The Characteristics of Present HIS.**

Questions	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
HIS User Friendliness	10	22	14	26	28
HIS In Enhancing Communication	8	22	20	26	24
HIS In Decision Making	4	16	14	38	28
HIS In Work Efficiency	4	18	2	36	40
HIS Helps In Utilization Of Resources	6	14	14	32	34
HIS Helps In Better Process Flow	6	30	24	32	8
HIS Contribution In Planning	8	28	22	22	20
HIS Role In Cost Containment	8	26	24	20	22
HIS Role In Quality Assurance	10	12	21	28	29
Training For Better Use Of	8	4	10	34	44



HIS					
A Fully Integrated System	2	4	2	20	72
Seeking Help from IT Department	4	14	8	56	18
Non-Existence Of Computers At All The Wards Effects HIS Performance	6	4	14	28	48
Need For A New And Better System	4	6	14	38	38

**Table -2** shows that 32% of the sample disagreed that HIS is not User Friendly to that of 53% of sample agreed that the present HIS is User Friendly, it was also found out that 30% of sample said that HIS is not helpful in Inter-departmental communication and 50% agreed that HIS helps in better communication., it was found out that 66% of staff agreed that HIS helps in Decision Making whereas 20% disagreed, it was found out that 76% of sample agreed that HIS helps in better work efficiency and 22% of the sample disagreed, more over 66% of sample agreed that the Utilization of Resources is effective but 20% disagreed that the utilization of resources is not effective, other findings were 40% of sample agreed that the present HIS helps in better process flow but where as 36% of the sample disagreed to it, 42% of sample agreed that HIS contributes in planning and 36% disagreed to this, 42% of sample agreed that HIS plays a vital role in cost containment and 34% of sample disagreed that the present HIS is not effective in cost containment, 57% of the sample agreed that HIS plays a key role in Quality Assurance, whereas 22% disagreed to it, 78% of sample agreed that Training is needed for better use of HIS, but 12% of sample disagreed that training is not essential, 92% of sample agreed that there is a need of fully integrated system whereas, 6% of sample disagreed that a fully integrated system is not

needed, 74% of sample agreed that they seek help from IT department but 18% of sample disagreed that they don't need to seek help from IT department for HIS, 76% of sample says that non-existence of computers as wards effects the performance of HIS and 10% of sample disagreed to it, 76% of the sample agreed that there is a need of a new and better system but 10% of sample disagreed.

**Table 3 – Classification of Forces according to Force Field Analysis**

<b>Motivating Forces</b>	<b>Hindering Forces</b>
User Friendliness	Training
Enhancing Communication	Fully Integrated System
Decision Making	Seeking Help
Work Efficiency	Cost Containment
Resources Utilization	Non-Existence Of Computers
Better Process Flow	
Quality Assurance	

**Table-3 and Table -4** Classifies the forces into 2 broad spectrums, i.e. Motivating Forces and Hindering Forces.

Motivating Forces are those forces affecting a situation that are pushing in a particular direction; they are positive forces. In terms of improving the effectiveness in working of HIS the forces that are categorized based on User Friendliness, Enhanced Communication, Decision Making, Work Efficiency, Resources Utilization, Better Process Flow and Quality Assurance.

Hindering Forces are negative forces that decrease the driving forces which lacks in the effectiveness in the operations of HIS. The restraining forces include Training for Employees, Fully Integrated System, Seeking Help, Cost Containment and Non-Existence of Computers.

Table -4 Force Field Analysis study

Total	Disagree	Agree	+Forces (Motivating Forces )  ⇒	-Forces (Hindering Forces )  ⇐	Agree	Disagree	Total
86	32	54	User Friendliness	Training	78	12	90
80	30	50	Enhancing Communication	Fully Integrated System	92	6	98
86	20	66	Decision Making	Seeking Help	74	18	92
98	22	76	Work Efficiency	Cost Containment	42	34	76
86	20	66	Resources Utilization	Non-Existence Of Computers	76	10	86
76	36	40	Better Process Flow				
79	22	57	Quality Assurance				

## Conclusions

The Global Hospital Information Systems Market is forecast to grow at a Compound Annual Growth Rate of 10% the high growth forecast for the period is significantly influenced by accelerated efforts from the public and private sectors around the world. Hospital Information system is one of the most common computer systems primarily used for communication, store health and administrative information with tremendous growth opportunities towards patient care reducing clinical errors, support health care professionals, increase the efficiency of care improve the quality of patient care. There are Motivating Forces such as. User Friendliness, Enhanced

Communication, Decision Making, Work Efficiency, Resources Utilization, Better Process Flow and Quality Assurance which are making staff rely on HIS while some Hindering Forces like Training for Employees, Fully integrated system; Seeking Help, Cost Containment and Non-Existence of Computers are acting as barriers.

#### **List of Abbreviations**

**CDS-** Clinical Decision-Support

**CDW-** Clinical Data Warehouses

**HIS-** Hospital Information System

**IS-**Information Systems

**IT-**Information Technology

**OLTP-** Online Transactional Processing

**OLAP-** Online Analytical Processing

#### **Competing Interests**

The authors declares no competing interests

#### **Authors' Contributions**

The entire work has been carried as an original research. There has been a serious effort to make the research fit to the purpose and be useful for further reference.

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