Dissertation in

Attune Technologies Pvt. Ltd.

On

To streamline the workflows, increase efficiency and reduce turnaround time in a Hospital by implementation of Hospital Information System

A Dissertation Submitted in partial fulfilment of the requirements for the award of

Post Graduate Diploma in Health and Hospital Management

By

Dr. Garima Malik

(PG/11/026)

International Institute of Health Management Research

New Delhi – 110075

May, 2013

Certificate of Internship Completion

Date: 4th May '13

TO WHOM IT MAY CONCERN

This is to certify that Dr. GARIMA MALIK has successfully completed his 3 months internship in our organization from January 3rd, 2013 to April 30th, 2013. During this intern she has worked on **" To streamline the workflows, increase efficiency and reduce turnaround time in a hospital by implementation of hospital information system"** under the guidance of me and my team at Attune Technologies Pvt Ltd.

We wish him/her good luck for his/her future assignments

Signature

Mr. Ragothaman Anandarao

Delivery Manager

Certificate of Approval

The following dissertation titled **"To streamline the workflows, increase efficiency and reduce turnaround time in a hospital by implementation of hospital information system"** is hereby approved as a certified study in management carried out and presented in a manner satisfactory to warrant its acceptance as a prerequisite for the award of **Post- Graduate Diploma in Health and Hospital Management** for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve the dissertation only for the purpose it is submitted.

Dissertation Examination Committee for evaluation of dissertation

Name	Signature
Mr. Ragothaman Anandarao	
Prof. Indrajit Bhattacharya	
AVANISH KR. SINGH.	

Certificate from Dissertation Advisory Committee

This is to certify that **Dr. Garima Malik** , a graduate student of the **Post-Graduate Diploma in Health and Hospital Management**, has worked under our guidance and supervision. She is submitting this dissertation titled **"To streamline the workflows, increase efficiency and reduce turnaround time in a hospital by implementation of hospital information system"** in partial fulfillment of the requirements for the award of the **Post- Graduate Diploma in Health and Hospital Management**.

This dissertation has the requisite standard and to the best of our knowledge no part of it has been reproduced from any other dissertation, monograph, report or book.

Prof. Indrajit Bhattarcharya
Prof. Health – IT
IIHMR
New Delhi
6th May'13

Indrajit Bhattacharya
Professor Healthcare IT
International Institute of Health Management Research
Plot No. - 3, HAF Pocket, Phase-II,
Sector-18A, Dwarka, New Delhi-110075

Mr.Ragothaman Anadarao
Delivery Manager
Attune Technologies Pvt. Ltd
Chennai
4th May'13

FEEDBACK FORM

Name of the Student: Dr. Garima Malik.

Dissertation Organisation: Attune Technologies Pvt. Ltd.

Area of Dissertation: Implementation of HIS

Attendance: Regular

Objectives achieved: Timely submission of report & assignment
Timely completion of task assigned.

Deliverables: To streamline the workflows, increase efficiency and reduce the turn around time in a hospital by implementation of HIS.

Strengths: Good Analytical Skills
Good Decision Maker
Enthusiastic to learn & explore.

Suggestions for Improvement:

Raghuraman A.

Signature of the Officer-in-Charge/ Organisation Mentor (Dissertation)

Date: 4th May'13
Place: New Delhi

Mr. Raghothaman Anandrao
Delivery Manager
Attune Technologies Pvt Ltd
Chennai, Tamil Nadu.

To streamline the workflows, increase efficiency and reduce turnaround time in a Hospital by implementation of Hospital Information System

International Institute of Health Management Research, New Delhi

Dr. Garima Malik

Jan-Apr 2013

Project Report submitted in partial fulfillment of the requirements for the award of Post-Graduate Diploma in Health and Hospital Management By Dr. Garima Malik, Roll No. PG/11/026

NULIFE HOSPITAL

Professional Environment
Perfect Healthcare

ACKNOWLEDGEMENT

I hereby take this opportunity to thank, Mr. Ragothaman Ananadrao, Delivery Manager, Attune Technologies Pvt. Ltd for the valuable guidance and advice. He inspired me greatly to work on this project. His willingness to motivate contributed tremendously.

I would like to specially thank Dr.Ashish Arora, GM – Operations, Irene Healthcare Pvt.Ltd. for his guidance, support, interest, involvement and encouragement. He has left no stone unturned in updating me regarding the subject.

I wish to express deep sense of gratitude to Dr. Shakuntala Kumar and Dr.Harish Kumar, Owner, Nulife Hospital and Maternity Centre, for giving me the opportunity to do my Summer Training at Nulife Hospital and Maternity Centre, GTB Nagar, New Delhi.

Besides, I would also like to thank the entire Healthcare IT team for their encouragement and cooperation in carrying out the project work.

My sincere acknowledgement goes to Professor Indrajit Bhattacharya for his kind assistance and support throughout my dissertation. Finally, an honourable mention goes to my family and friends for their understanding and support on me in completing this project.

Thank You

Dr. Garima Malik

PGDHHM,

IIHMR, New Delhi.

TABLE OF CONTENTS

Acronyms / Abbreviations / Keywords

- CPRS COMPUTERIZED PATIENT RECORD SYSTEM
- EHR ELECTRONIC HEALTH RECORDS
- EMR ELECTRONIC MEDICAL RECORDS
- HIS HOSPITAL INFORMATION SYSTEM
- PACS PICTURE ARCHIVAL AND COMMUNICATION SYSTEM
- CPOE COMPUTERISED PATIENT ORDER ENTRY
- MAR MEDICATION ADMINISTRATION RECORDS
- BCMA BAR CODE MEDICATION ADMINISTRATION
- DBMS DATA BASE MANAGEMENT SYSTEM
- TAT TURN AROUND TIME

B. LIST OF FIGURES

C. LIST OF TABLES

NULIFE HOSPITAL
Professional Environment
Perfect Healthcare

Nulife Hospital and Maternity Centre a vision of Dr. Harish Kumar and Dr. Shakuntla Kumar -a symbol of compassion, quality and dedicated patient care established in November 1990 is a 50-bedded hospital and is located in the heart of North Delhi.

Its aim is to develop an affordable & efficient healthcare system and establishing an enduring doctor-patient relationship.

Its priorities at Nulife are personalised patient care in a safe & secure environment with total integrity and honesty. Over 21 years of continued efforts towards achieving 100% patient satisfaction has made it the most trusted hospital in the locality.

SERVICES AND FACILITIES:

• The Hospital is equipped with state of the art diagnostic and imaging centre, 24 Hour emergency, intensive care and trauma centre, chemist and ambulance services
• Infertility clinic, immunizations and vaccinations.
• 24 Hours Resident Doctor, Home Visit and Nursing facility
• Well furnished accommodation ranging from General ward and Economy to A/C rooms.
• State of the art Laboratory functioning round the clock.

SPECIALITIES:

Gynaecology and Obstetrics, Ophthalmology, Cardiology, Radiology, Neurology, Dental Care, Nephrology, Ortho Surgery, E.N.T, Dietician, General Surgery, Vascular Surgery, Plastic Surgery, Urology, Psychiatry, Pulmonology, Hysteroscopy

We are a visionary healthcare information technology company that delivers next generation healthcare IT products to the market. While most of the other vendors attempt just implementing the software, we focus primarily on delivering business benefits to our customers.

Attune Clinic Kernel is a complete state of the art, secure & web-based solution for clinics and Clinic chains that integrates all its departments and branches that are geographically separated. All the clinics/branches needs are low-end PC's and Internet connectivity with rest of the IT infrastructure and software taken care by us.

- **Improve Business Benefits**

- True & Total Integration across all internal departments and external branches and referring clinics. Doctors' consultation suite, Labs, Radiology, Casualty, Catheterization & Intervention labs, Operation theatre & Post-operative care, In-patient management, Insurance – All on One Platform
- Comprehensive billing system encompassing Out-patient, In-patient, Emergency, Day Care, Insurance, Corporate & Foreign National sections with Single point Control for revenue inflows and out-flows
- Close-knit Stock Inflow & Outflow across all retail pharmacy and consumption units
- Unique Medical Record for every patient, In-built clinical intelligence, Intuitive Medical search for Hospital Medical Research & Learning
- Anytime, anywhere secure access to authorized clinical and non-clinical information.

- Complete management of data back-up, security, license, upgrades and server maintenance – borne by Attune with near-zero work on IT infrastructure laying & maintenance issues for hospitals.

➢ Realize More Value For Your Money

- Pay as you use
- Affordable Periodic Rental Model and Super Flexible Pricing Options
- Software upgrades at NO extra cost.
- No hidden cost.

➢ Service your customers better

- Helps improve overall TAT (Turn Around Time) for medical reports
- Helps share reports for second-opinion, referring doctors' intimation, patients, medical agencies, insurance companies and other authorized divisions
- Track Samples and Stock Movement Real-time avoiding discrepancies and preparing for delayed processes.
- Give online access to patients and customers from appointment scheduling, review and medication alerts to diagnostic and treatment reports.
- Send reminders to your patients, clients and doctors, as need be.

The company provides product for: Hospitals, Diagnostic and Imaging Labs and for Clinics and clinical chains.

The company is based out in Chennai with its headquarters in Singapore.

INTRODUCTION

HEALTH AND HEALTHCARE

The basic necessities of any human being on earth are food, clothing, shelter, water and air. Besides this health is also an essential requirement. The quality of an individual is largely determined by the physical integrity and it also enables the mankind to reproduce and to stay successfully over a period of time.

According to World Health Organization, ―Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

Besides this, the United Nations Universal Declaration of Human Rights emphasizes on adequate standard of living for maintaining an individual's health and well-being. Thus, it's the prime responsibility of every nation in the world to provide a national health infrastructure support, which should fulfil all the needs that are incorporated in the definition of health, which consists of not only the physical freedom from the diseases but also caters to both the psychological and social aspects of an individual's health.

Healthcare means support of individual health and collective health. According to World Health Organization, healthcare embraces all the goods and services designed to promote health, including "preventive, curative and palliative interventions, whether directed to individuals or to populations".

FROM HEALTHCARE TO E-HEALTHCARE

"E-health is an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a state of mind, a way of thinking, an attitude and a commitment for networked, global thinking, to improve healthcare locally, regionally and worldwide by using information and communication technology".

The main objective of E-health is to help the patients, physicians and community hospitals to make suitable use of Information and Communication Technologies in order to get an improved access and enhanced quality of healthcare deliverance and to reduce the cost of its management. Thus this connects medicine, business and information technology in a new innovative way.

TECHNOLOGIES IN E-HEALTHCARE

- Medical Information Technology
- Telemedicine
- Telehealth
- E-health tools
    - Electronic Health Records
    - Patients Information Systems
    - Hospital Information Systems
    - Decision Support Systems
    - National Electronic Registries
    - National Drug Registries

LIMITATIONS IN IMPARTING E-HEALTHCARE

Though it is the most advanced technology for accessing healthcare in almost all unreachable areas but still this technology is having some limitations or challenges as mentioned below

- Using Information and Communication Technologies
- To spare time for this activity by doctors initially
- Society
- Infrastructure f data, storage space and speed.
- Integrity of the data and its security.
- Lack of intimacy associated with traditional environment.
- Limited interaction with doctor.

INDIAN HEALTHCARE INDUSTRY

The Indian healthcare industry growing at a rapid pace and is expected to reach over US$ 70 billion by the end of this year. Indian healthcare sector has experienced growth of 12 % per annum in the last four years. Change in lifestyles, rising income level, increase in elderly population are the factors which drives this growth. But the healthcare infrastructure in India is very poor and has only few centre of excellence in healthcare delivery system. These facilities are inadequate in meeting the current healthcare demands. With a world average of 3.96 hospital beds per 1000 population India stands just a little over 0.7 hospital beds per 1000 population. Privatization has been crucial in the development of Indian health services which led for easy availability of the funds. As funds became readily available infrastructure and technology drastically improved. Medical and Dental tourism has succeeded by offering high quality services at third world prices. Considering the increasing number of medical tourists to India, Electronic Health Records seem to be a necessity for the Indian healthcare industry. The country needs to adopt an efficient electronic information system to stay connected to the patients post-treatment. If this Electronic Health Records are deployed, the foreign healthcare providers can easily have an access to patient records.

HEALTHCARE AND IT

When it comes to the use of IT in Healthcare, the Indian government positioned itself as one of the early adopters of healthcare IT among developing countries when it launched its “Development of Telemedicine Technology” project in 1997. In 2002, the Department of Information Technology established the committee for the Standardization of Digital information in order to facilitate the implementation of telemedicine systems. In 2003, the Department published a framework for “Information Technology Infrastructure for Health in India”. This framework is centred on the philosophy that “information is determined of health” and that “healthcare is one of the keys that can benefit from the use of IT.” The framework encompasses:

In spite of being an early adopter, India is not completely utilizing the benefits of IT in healthcare. The key IT application that are being implemented in the private healthcare sector include hospital IS, PACS and telemedicine programs. So far there are no instances

of EHRs that completely integrate clinical information. The use of EHR for reporting, modelling and improving clinical decision-making is not yet a priority.

IT in healthcare industry is necessary to deliver all information needs to its stakeholders of this industry like government, public sector hospitals, patients, vendors, suppliers, insurance companies and organizations of healthcare delivery.

There are various obstacles in the implementation of IT in the healthcare industry. The providers had a laid back attitude when it came to implementation of IT for maintaining information. Providers should be given proper training to make best use of the technology and avoid resistance.

HIT ADOPTION

Despite India's recent development as the hub of the IT and IT-enabled services industry powered by a vast pool of skilled manpower, it has lagged tremendously behind other countries in HIT adoption. Large corporate hospitals in India spend under 1% of their operating budget on IT, while spending is closer to 3% in the West. Barring a few preliminary attempts to computerize basic hospital administrative and some clinical functions, there has been little appreciation or impetus given to HIT adoption.

CHALLENGES

- Absence of clear & coordinated government policy to promote HIT adoption.
- Non-existent government funding for HIT has resulted in lack of HIT adoption in government health facilities and a lack of trained medical informatics professionals.
- Low computer literacy among the government staff, and to a large extent in the private provider community.
- Lack of supporting infrastructure and coordination between public and private sector. Except for a very few privately owned large hospitals, most patient records are paper based and very difficult to convert to electronic format.
- Local HIT systems that do not adhere to standards for information representation and exchange. This could be further complicated because of the use of multiple local languages by patients and some health workers.

- Patient confidentiality is an open area. The Supreme Court of India has not addressed the specific right of privacy issue with respect to health information.

CRITICAL SUCCESS FACTORS FOR HIS

- Change Management.
- Completion of a readiness assessment.
- Buy- in and contribution from stakeholders, including physicians.
- Ability to report on evaluation metrics established for each phase of the project.
- Training before, during and after HIS implementation.
- How leadership deals with technology malfunctions.

Operationally, the critical success factors leadership in hospital needs to consider are

1. A governance plan that ensures uniform adoption and assimilation of the system.
2. Reliable information technology infrastructure.
3. A well designed system that supports practice workflow and workload.
4. An implementation plan that capitalizes on strength of the hospital and minimizes its weakness.
5. Standardized workflow and processes, which can be designed through a collaborative effort among administration, providers and staff.
6. Ongoing management and development that ensures optimal use of HIS.

Success of any Hospital Information System (HIS) implementation requires strong organizational goals which can be fulfilled by the use, selecting the right vendor and planning for the implementation, ongoing management and development of the HIS system. Critical success factors are the elements which are necessary to accomplish any goals.

BARRIERS TO HIS IMPLEMENTATION IN MEDICINE

The barriers to EMR/ EHR implementation include physicians' limited IT knowledge, cultural barriers, and the need to secure patient privacy (Frodesen, 2001, p.124). Unlike other professions, where IT training is an integral part of studies, medical training in the United States is not multidisciplinary (Frodesen, 2001, p. 125). Even in India IT training is not a part of MBBS/ BDS course curriculum. As such it does not incorporate technology training into its curriculum. Upon completion of graduation from medical school/ college, physicians typically find themselves burdened with loans taken for their education and finally start their own practice. While practicing medicine, physicians incorporate much of what they learned in medical school/ college. Older generations of physicians were being trained to use paper records. Even now at present in India neither undergraduate students nor residents are trained to use electronic format of records. They are still using paper records. At the dawn of this new technology, many of these doctors found themselves not prepared and perhaps overwhelmed. But in US, younger generations and current medical students, already likely possess the required tools to incorporate IT into their practices. It stands to reason that the acquisition of IT skills will serve as a catalyst for early HIS technology adoption and satisfaction (Henning-Thurau, Honebein, & Aubert, 2005, p.136).

The limited computer knowledge of physicians is speculated to inhibit HIS implementation; limited medical knowledge on behalf of IT professionals is also speculated to affect HIS adoption. With the ultimate goal for increased quality of patient care, HIS software designs should incorporate medical terminology, secure data integrity issues, mirror practice work flow and provide the flexibility necessary to thoroughly capture all relevant patient information (Frodeson, 2001, p. 126). Common physician complaint about HIS overly simplified user interface that limits the input of critical information. Consequently, physicians may not view HIS technology as useful or easy to use.

Another barrier is the nature of the medical profession itself. A profession geared toward patient care, it does not generally prepare physicians for their roles as business owners and entrepreneurs. As such, their focus is not on operational efficiency but rather on affective tasks such as service to their patients and fostering respect within their medical

community. Physicians tend to remain dependent on methods they believe will ensure constant assessment and reassessment of their medical practices (Fodersen, 2001, p. 127). Paper records, for example, provide physicians with a limitless method of documentation. In addition, HIS technology typically requires large financial investments. Physicians, who are not trained to evaluate the return of such an investment, may shy away from it.

Another barrier is that the physicians are worried that adoption of HIS in their clinical practice will decrease the rapport between the patients. The doctor patient relationship will be lost as they use much of the time in entering data into computer.

Finally, the need to protect the security and privacy of patient records has also slowed the adoption of HIS technology. In fact, Fodersen (2001) cites maintaining privacy the most significant and immediate barrier to HIS adoption. The Health Insurance Portability and Accountability Act of 1996 (HIPAA) provides regulations for securing healthcare coverage for workers in between jobs (COBRA), preventing healthcare fraud and abuse, and enforces the privacy and security of all patient information. Failure to comply with HIPAA regulation results in severe civil, criminal, and financial penalties. Noncompliance, in some cases, may even lead to imprisonment. With that in mind, while technology may better assimilate, store, and share patient information; physicians are still not sure how well it will protect patient information. Recent headlines of breach of patient-record confidentiality only serve to fuel physician concerns. Patient record privacy must then be guaranteed secure before physicians will feel comfortable using HIS.

HOSPITAL INFORMATION SYSTEM

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. Hospitals are extremely complex institutions with large departments and units coordinate care for patients. Hospitals are becoming more reliant on the ability of hospital information system (HIS) 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.

Modern HIS includes many applications addressing the needs of various departments in a hospital. They manage the data related to the clinic, finance department, laboratory, nursing, pharmacy and also the radiology and pathology departments. The hospitals that have switched to HIS have access to quick and reliable information including patients' records illustrating details about their demographics, gender, age etc. By a simple click of the mouse they receive important data pertaining to hospital finance systems, diet of patients, and even the distribution of medications. With this information they can monitor drug usage in the facility and improve its effectiveness. Many hospitals have as many as 200 disparate systems combined into their HIS.

Hospital information systems have become very advanced and new innovations are continuously being introduced. But a HIS is useless if it confuses the hospital employees. The system must be user friendly and should include training by the vendors. 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. The technology changes quickly and if the system is not flexible it will not be able to accommodate hospital growth. An effective HIS also delivers benefits such as:

- Enhances information integrity
- Reduces transcription errors
- Reduces duplication of information entries
- Optimizes report turnaround times

Modern hospital information systems typically use fast computers connected to one another through an optimized network. These computers are programmed to collect, process, and retrieve patient care and administrative information ensuring better ROI and delivery of service. If the hospital authorities have more relevant information they can make better decisions.

HIS leverage a highly optimized core library that ensures the delivery of operational and administrative information required by users. A centralized information system can be customized according to the specific requirements of a hospital. A hospital can tell the

solution provider its needs and the applications can then be molded to deliver exactly what was demanded. For instance, you can demand a solution that is based on RDBMS for easy retrieval of information. You can also ask the vendor for a HIS that has user friendly features and a multilingual interface that can be used by a diverse workforce.

HIS for Different Departments

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. Mose of these services have 24/7

remote support that allows hospital staff to troubleshoot problems occurring during system usage.

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.

Pharmacy Information Systems- 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.

Selecting a Hospital Information System

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.

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.

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 support 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.

A Hospital Information System encompasses every aspect from administration to its financial department. It also includes everything from patient entry and discharge to laboratory tests. Its purpose is to coordinate and/or regulate information throughout the entire hospital. It helps to keep doctors, nurses, and other hospital personnel informed and up-to-date. Hospital information systems are implemented through various IT companies that specialize in health informatics. These systems are implemented in order to do away with paper base systems. These HIS systems help with keeping patient information in a computer so it is easily accessible by all of the personnel of the hospital. Also, by implementing a computer system the hospital is able to recognize trends that the human eye might not be able to see through paper systems. Databases are filled up so data can be organized. Also there are less hospital errors because everybody can understand and read a computer. Before when doctors wrote on paper their hand writing couldn't be understood because it wasn't written properly. These systems also help with the collaboration between different hospitals in order to reduce duplicate testing. Time is also saved by looking at previous data instead of having to re-write it every time the patient goes to a different hospital.

Applications:

A hospital information system has many different aspects incorporated within itself. Technology allows for the information within these systems to flow more easily and more accurately. Some of these systems include:

Clinical Information System (CIS)
Financial Information System (FIS)
Laboratory Informatin System (LIS)
Nursing Information System (NIS)
Pharamacy Information System (PIS)
Picture Archiving Commuication System (PACS)
Radiology Information System (RIS)

These systems help with the preservation of data so it may be evaluated at a later time. These systems help with the ease of transfer and reading of the data.

ADVANTAGES OF HOSPITAL INFORMATION SYSTEM

- Easy access to doctor's 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.
- 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.
- 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.

OBSTACLES

- Start-up cost of implementing such a system is high.
- The user needs to have some technical knowledge to use the system effectively and efficiently.
- Confidentiality and security issues associated with the use of HIS.
- Portability of the equipment is an issue associated with the use of HIS.
- Lack of standardized terminology, system architecture and indexing.

OBJECTIVES OF AN HIS

1. To Improve Patient Care

In light of the referral system that has patients moving from district to regional and central hospitals in the province, it became imperative that information belonging to patients previously treated at hospitals in the province be available at any other hospital where the patient might be admitted. The improvement in the health care professionals' access to patient related information18 during the treatment process meant improved medical records handling and shorter turnaround time for the release of diagnostic information such as laboratory and special investigation results. The improvement of patient administration procedures resulting in shorter waiting times and a general better level of service to patients.

2. To improve the delivery of services across the department

This included the re-engineering and standardisation of patient administration and relatedprocedures throughout hospitals in the province. The improvement of the information necessary for performance evaluations and health care audits.

3. To improve the efficiency of hospital management

The HIS should facilitate decentralised financial management at hospital level, improve revenue collection and improve management decision-making through the availability of integrated management information. Envisioned was also the cost savings mechanism of identifying primary cost-drivers at hospital level and the scientific monitoring of the mechanisms introduced to lower costs.

PURPOSE OF HIS

The purpose of a hospital information system (HIS) is to manage the information that health professionals need to perform their jobs effectively and efficiently.

- Operational Requirements
  - up-to-date factual information
  - necessary for day to day tasks
- Planning requirements
  - short- and long-term decisions about patient care
  - decisions about hospital management
- Documentation Requirements
  - the maintenance of records
  - accreditation
  - legal record

The Friedman and Martin functional model for an HIS:

- Core Systems
  - patient scheduling
  - admission
  - discharge
  - admission-discharge-transfer (ADT)
- Business and Financial Systems
  - Payroll
  - accounts receivable
- Communications and Networking Systems
  - integration of all parts of the HIS
  - order entry & results reporting
- Departmental-Management Systems
  - the needs of individual departments can be met
  - those subsystems can be useful in a macro-system

- Medical-Documentation Systems
    - collecting, organizing, storing, and presenting
    - Quality Assurance (QA)
- Medical Support Systems
    - assistance in interpreting data
    - issue alerts, provide advice

It can be useful to integrate the clinical and the administrative information into the same information system. This can create a "rich database for decision making."

Alternative Architectures for Hospital Information Systems:

- Central Systems
    - total or holistic system
    - one main computer handling all the information
    - many terminals and printers for information exchange
- Modular Systems
    - distinct software modules carry out specific tasks
    - "plugging in" new task performance

  Problems:
    - "plugging in" never works very well
- Distributed Systems
    - LAN structure
    - independent computers tailored for specific uses
    - autonomous
    - computers with shared data
    - can connect multiple LANs

TRENDS IN HIS DEVELOPMENT:

- Local-area communication networks
    - LANs are cheaper and more effective

- Workstations and personal computers

- On a LAN you need some computers

- Bedside terminals
  - Have not caught on yet due to cost
- Linkages between hospitals and physicians
  - as automation occurs natural links occur

CPRS (COMPUTERIZED PATIENT RECORD SYSTEM)

The purpose of a patient record is "to recall observations, to inform others, to instruct students, to acquire knowledge, to monitor performance, and to justify interventions" [Reiser, 1991]. The many uses described in this statement, although diverse, have an end goal: the implementation of the Health Sciences in order to improve the welfare of patients. Yet, during the observational studies of physicians, use of the paper-based record suggest that the logistical, organizational, and other practical limitations reduce the effectiveness of traditional records for storing and organizing an ever increasing diverse data. A patient record is designed to overcome many of these limitations, as well as provide additional benefits that cannot be achieved by a static view event.

A computer-based patient record (CPR) is a repository of information maintained electronically on the status of a living individual health and health care, stored such that it can serve users Multiple legitimate registration. Traditionally, the patient's record was a record of care when a patient is sick. Managed care encourages health care providers to focus on the continuum of health care and health wellness to illness and recovery. Therefore, the record must include evidence relating to the health of a patient's disease and acquired by multiple vendors across different contexts and in addition, the data must be stored so that different views of this data can be made to serve many purposes.

A computer-based patient record system adds information management tools to provide clinical reminders and alerts, links to sources of knowledge for decision support health care and analysis of aggregate data for results, research and better management of the delivery system of health care. To use a paper patient record, the player must manipulate

data either mentally or on paper to glean important clinical information. However, an RPC system provides tools to help readers organize interpret and react to data.

WAYS IN WHICH A CPRS DIFFERS FROM A PAPER-BASED RECORD

Unlike a traditional patient record, whose functionality is attached by the static nature of paper - a single copy of data stored in a standard format for data entry and retrieval of computer-based patient record is flexible and adaptable. Data can be entered into a form that simplifies the entry process (which includes electronic interfaces to other computers that stores patient data) and displayed in different formats suitable for their interpretation. The data can be used to guide care for one patient or in aggregate form to help administrators develop policies for a population. Therefore, considering the functions of a CPRS, we do not limit discussion to use a single, serial recording of patient provider encounters. A railway network extends the usefulness of patient data by applying the tools of information data management.

Inaccessibility is a common drawback of paper. In large organizations, traditional folder may not be available to others for the day when the clinician ends the documentation of an encounter. For example, paper documents are often sequestered in a medical records department until the discharge summary is completed and each document is signed. Meanwhile, special permission and additional efforts are required to locate and retrieve the record. Individual doctors often borrow records for their convenience, with the same effect. With computer stored records, all authorized personnel can also access patient data immediately when needed. Remote access to common resources is also possible. When data is stored on a secure network, authorized clinicians who need to know can be accessed from the office, home or emergency room, to make timely decisions.

Documentation in a CPRS is generally more readable because it is stored as text rather than printed handwriting, and is better organized, because the structure is imposed on the entry. The computer can even improve the completeness and quality by automatically checking the validity of the data as they are entered. For example, numerical results can be checked against reference intervals. Typographical errors can be detected when data

fails a test reference range. In addition, an interactive system can prompt the user for more information. In this case, the data repository not only stores data but also improves their completeness. Data entered into a computer can be reused. For example, a doctor may reuse their clinic visit notes in the letter to the attending physician and the admission note. Reuse of data is a way that CPRS increases the efficiency of workflow provider.

Reuse of data also increases data quality. The more users and uses that depend on a data item, the more likely it will be reviewed and always be current.

The extent to which a particular CPRS demonstrates these benefits depends on several factors:

- **The completeness of the information:** The CPRS contain information about health and disease? Does it include information from all clinicians who participated in the care of a patient? Does it cover all the parameters in which the care was delivered? Does it include the full range of clinical data, including clinicians, notes, laboratory test results, details of medications, and so on?

- **Duration of use and data retention:** Who has accumulated a record of patient data over 5 years will be worth more than what is the one that contains only records visits for 1 month.

- **Degree of structure of data:** Medical data that are stored simply as narrative text entries will be clearer and more accessible than are similar entries in a medical paper file. Uncoded information, however, is not standardized, and the inconsistent use of medical terminology limits the ability to retrieve data. Using a control, the predefined vocabulary facilitates automated aggregation and summary of data from different doctors or by the same physician at different times. The encoded information is also needed for computer-assisted decision making and clinical research.

- **Ubiquity of access:** A system that is accessible from some sites will have less value than the one accessible from any computer by an authorized user.

HISTORICAL PERSPECTIVE

The historical development of the medical record parallels the development of science in clinical care. The development of automated systems for dealing with health-care data parallels the need for data to comply with reimbursement requirements. Early health-care systems focused on inpatient-charge capture to meet billing requirements in a fee-for-service environment. Contemporary systems need to capture clinical information in a managed care with emphasis on clinical outcomes in ambulatory care.

The Flexner report on medical education was the first official statement on the function and content of medical records [Flexner, 1910]. In advocating a scientific approach to medical education, he also encouraged doctors to keep patient-centred medical records. The content of medical records in hospitals has become subject to review in the 1940s, when hospital accreditation agencies began to emphasize the availability of accurate and well-organized medical records as a condition for accreditation. Since then, these organizations have also demanded that hospitals extract some information from medical records and communicate this information to national data centres. These discharge summaries contain:

(1) Demographics information,
(2) Diagnosis, Admission, discharge
(3) Duration of stay, and
(4) Major procedures performed.

National centres to produce statistical summaries of these case summaries; an individual hospital can then compare its own statistical profile with that of similar institutions.

In the 1960s, the hospital information systems (HISS) began to emerge. These systems were designed primarily for communication. They collected orders from nursing stations; orders routed to different parts of the hospital, and identified all the paid services. They also gave clinicians electronic access to results of laboratory tests and other diagnostic

procedures. Although they contained clinical information (e.g., test results, medication orders), their main goal was to capture the costs rather than helping to clinical care. Many of the early HISS stored and presented much of their information as text, which is difficult to analyze. In addition, these early systems rarely preserved the contents of more than a few days after the release of a patient.

The introduction of case-based medical problems (POMR) by Lawrence against weeds [against weeds, 1969] has influenced medical thinking on both manual and automated medical records. Weed was among the first people to recognize the importance of an internal structure of medical records, whether stored on paper or a computer. He suggested that the main organization of the medical record must be by the medical problem; all diagnostic and therapeutic plans should be linked to a specific problem.

Morris Collen was a pioneer in the use of hospital-based systems to store and present the results of laboratory tests as part of preventive care [Collen, 1983]. Using the computer screen of early warning signs of the disease was a fundamental principle of health maintenance organizations (HMOs). Other first-year university hospital systems have provided feedback to physicians who received clinical decisions and outcomes ultimately patients. The help system [Pryor, 1988] at LDS Hospital and the CTC at Beth Israel Deaconess Medical Center [Bleich et al., 1985] continue to add more data and clinical decision support functionality.

Until recently, the case of outpatient care has received less attention than the commercial suppliers of the hospital register because of differences in financing and regulatory requirements. The status of ambulatory care records was examined in a 1982 report [Kuhn et al., 1984]. Under the influence of managed care, the reimbursement model has moved from a model of **fee-for service** (fee paying vendors for all services provider deemed necessary) to a payment scheme where suppliers are paid a **fixed price** for a specific service (payers pay a flat fee for services approved by the principal). In some parts of the country, health care financing models are moving towards a **capitation system** where providers receive a fixed amount to care for all health care needs of a patient population. In these environments managed care providers are motivated to reduce the cost of care in keeping their client population healthy and out of hospitals. Information management tools that facilitate the effective management of patients outside

of hospitals and providers help implement to achieve these goals. The emphasis on outpatient care has drawn attention to the new ambulatory recording.

Thirty years ago, a single family physician provided almost all medical care of an individual. Today, however, responsibility for patient care moves to teams of health professionals in outpatient clinics and HMOs. Ambulatory recordings may contain notes written by many healthcare providers, many testing laboratories and results, a diverse set of data elements from other, such as X-ray examination and pathology reports and hospital-discharge summaries.

Consequently, the need for information tools in the ambulatory practice has increased. Among the first systems based ambulatory care, COSTAR [Barnett, 1984], the Regenstrief Medical Record System (RMRS) [McDonald et al., 1992], STOR [Whiting-O'Keefe et al., 1985], and TMR [Stead & Hammond, 1988] are still available today.

RATIONALE OF THE STUDY

Healthcare is a very important part of our society and it is imperative for healthcare providers to do their jobs in an efficient and effective manner. Each day hundreds of thousands of patients enter healthcare facilities challenging the administration to run the show smoothly. The employees have to manage and integrate clinical, financial and operational information that grows with the practice. Previously, this data was organized manually, which was time consuming and failed to deliver the desired level of efficiency. Most professionally run hospitals and clinics now rely on hospital information systems (HIS) that help them manage all their medical and administrative information.

A hospital information system (HIS) is essentially a computer system that can manage all the information to allow health care providers to do their jobs effectively. These systems have been around since they were first introduced in the 1960s and have evolved with time and the modernization of healthcare facilities. The computers were not as fast in those days and they were not able to provide information in real time as they do today. The staff used them primarily for managing billing and hospital inventory. All this has

changed now, and today hospital information systems include the integration of all clinical, financial and administrative applications.

Modern HIS includes many applications addressing the needs of various departments in a hospital. They manage the data related to the clinic, finance department, laboratory, nursing, pharmacy and also the radiology and pathology departments. The hospitals that have switched to HIS have access to quick and reliable information including patients' records illustrating details about their demographics, gender, age etc. By a simple click of the mouse they receive important data pertaining to hospital finance systems, diet of patients, and even the distribution of medications. With this information they can monitor drug usage in the facility and improve its effectiveness. Many hospitals have as many as 200 disparate systems combined into their HIS. Hospital Information System (HIS) is vital to decision making and plays a crucial role in the success of the organization. Computerization of the medical records and documentation has resulted in efficient data management and information dissemination for the users. Managers, Clinicians and other healthcare workers can now access the information without delay or errors.

So, the need of the hour is to have efficiency, resource optimisation and utilization and provide quality healthcare to the patients and the effective way to do is by implementing a Hospital Information System and integrate all the departments.

.

LITERATURE REVIEW

The use of computers in medicine dates back to the 1950s with studies that attempted to expand the mental capacity of physicians (Stumpf and Freitas, 1997) or dealt with research on electrophysiology (Collen, 1986). With the evolution of this equipment, especially with the capacity to simultaneously execute various tasks beginning in the 1960s, computers began to be used in the processing of information in large hospitals, in both administrative and financial functions for the collection of statistics and the development of research projects (Stead, 2007; Stumpf and Freitas, 1997). The use of microcomputers, beginning in the 1970s, introduced the concept of distributed processing, increasing the number of systems in use in large hospitals (Stumpf and Freitas, 1997).

Because this diffusion did not always occur in an organized or homogeneous manner, the initial diffusion of computers in hospitals led to the emergence of islands of computerization, with isolated systems that lacked any form of interconnection and were developed by different teams. The redundancy and the lack of data integrity deterred health professionals, who saw these systems as developed by systems professionals for systems professionals (Stumpf and Freitas, 1997). This situation was also investigated by McDonald (1997), who analyzed the lack of interconnection of the different systems used by the hospitals, laboratories, and service providers in the healthcare field.

Collen (1986) described the development of approaches in the 1970s that sought to approximate the habitual processes of decision-making with the use of artificial intelligence in differential diagnoses. In the same decade, studies were undertaken in search of a better organization of the healthcare system (Kaihara, 1978). With the help of computer-processed simulations, the author established an ideal relationship between medical centers and population demands.

The distributed processing was expanded during the 1980s with the development and greater availability of microcomputers, and the possibility of network communication of such equipment increased in the 1990s (Stumpf and Freitas, 1997). This allowed for the emergence of hospital information systems (HIS), covering medical, administrative, and

hospitality areas, although hospitality may be considered as integrated into the administrative area (Cortes, 2008). These three areas are interlinked by horizontal data and information flows, providing support to the developed activities. The information on the electronic records, which contain the procedures, prescriptions, laboratory examinations, professionals involved, and hospitalizations (when applicable), is fundamental for an HIS (Wakamiya and Yamauchib, 2009; Pinochet and Albertin, 2008).

Assessment of HIS on Northern province in South Africa by Nolwazi Mbananga, Rhulani Madale and Piet Becker - A study was conducted to evaluate the Hospital Information System in the Northern province in South Africa, 1998. Both the qualitative and quantitative results suggested that implementing a HIS is an enormous challenge for the health service. However, there was some evidence that HIS can improve some activities. The clerks considered HIS more efficient in the registration and admission of patients in the OPD. Furthermore, an important qualitative association emerged between the system and the easy retrieval of patients' record during second and third visits to the hospitals. These findings indicated that HIS changed the work of OPD clerks positively.

Assessment of implementation of HIS in public hospitals by Zikos D, Mitsios A and Mantas J. of National and Kapodistrian University of Athens, Greece - The use of integrated Hospital Information Systems is related with many benefits for the healthcare system, increasing the effectiveness of the provided services and assuring quality of care. Aim of this study is to investigate the types of Information Systems, the level of integration and the problems identified during the implementation phase, in three public hospitals. The above are expected to contribute to the understanding of the organizational, human resource and technical factors related with the successful implementation of a hospital IS. In order to investigate those elements, an assessment questionnaire was developed and completed by nine hospitals IT employees of the three hospitals. In addition, open interviews were organized with the same employees to further formulate an overall aspect, while in one hospital case, observation and discussion with four different categories of involved staff was undertaken. It was found that the implementation problems are mainly related with the underfunding, inadequate use of standards, lack of skilled IT experts, insufficiently trained personnel and users' reserve. The problems may be tackled with a supportive hospital administration committed to the successful implementation. The external contracting company working on its own,

without any participation of the hospital IT department seems to be a failure recipe. It is evident that an active management support and skilful hospital IT employees, are expected to result to success stories during the implementation of integrated hospital information systems.

Hospital Information System Usability Evaluation in Iran: A Users′ Viewpoint Study by Hossein Dargahi, Reza Safdari, Leila Shahmoradi and Ahmadreza Farzaneh Nejad - The wide application of Hospital Information System (HIS) in healthcare organizations requires the professional evaluation of software's in an operational way. Therefore, it is necessary to evaluate the performance of such systems based on their users' view. Consideration of systematic error tolerance index on HIS users, including not losing of data and possibility of returning to the previous state in case of errors, deceivability of error messages, possibility of error correction, and the like are all factors that if not understood can make the design and deployment of a software rather unsuccessful. The results revealed that the evaluated Iranian hospital information systems did not have an approach to error correction as well as appropriate data presentation and clear error messages. Therefore, if we seek an optimal interaction between users and information systems, we should consider all systematic error tolerance indexes because the inconsideration of such indexes will result in an increase in errors and have a negative effect on the efficiency of the system and users' interaction with it.

Evaluation of a Greek National Hospital Information System: A Prospective Study by Nikomacheia Chiotaki and Panagiotis Kafas - Hospital Information Systems (HIS) focus on developing effective patient`s care through the high-qualified medical, nursing and administrative services. However, user`s opinion and satisfaction is fundamental for the successful information system adoption and acceptance. Evaluation of a Greek national hospital information system and assessment of the user satisfaction using the System Usability Scale (SUS) is the purpose of the study. The study sample consisted of 64 volunteers subdivided into two main groups (Health professionals = 21, administrative employees = 43). The evaluation of the individual satisfaction performed using SPSS 12 and more precisely by descriptive statistics and correlations. The findings confirm the ability and willingness of the national health care personnel to use information systems but the low percentage of users should be emphasized. At the beginning of the 21st century a new strategic plan is essential for the essential training of the personnel. In the

light of the existing evidence, the use of information systems is cost effective and time saving procedure with many advantages. Ideally, this application could be a part of the regular personnel training under the supervision of the Greek Medical Council or other Governmental health authorities.

A multi-method study of factors associated with hospital information system success in South Africa by Hanmer LA, Isaacs S, Roode JD. - A combination of interpretivist and positivist techniques was used to develop and refine a conceptual model of factors associated with computerised hospital information system (CHIS) success in South Africa. Data from three case studies of CHIS use in level 2 public sector hospitals were combined to develop a conceptual model containing seven factors associated with CHIS success at hospital level. This conceptual model formed the basis of a fourth case study which aimed to confirm and refine the initial conceptual model. In the third phase of the study, a survey of CHIS use was conducted in 30 hospitals across two South African provinces, each using one of three different CHISs. Relationships between hospital-level factors of the conceptual model and user assessment of CHIS success were examined. A revised conceptual model of CHIS use was developed on the basis of the survey results. The use of a multi-method approach made it possible to generalise results from the case studies to multiple CHIS implementations in two provinces.

Assessing User Satisfaction of using Hospital Information System (HIS) in Malaysia by Indah Mohd Amin ,Shah Alam, Surya Sumarni Hussein ,Wan Abdul Rahim Wan - Mohd Isa Hospital Information System (HIS) has been successfully being implemented in Malaysia since 1998. However, there is little research being conducted to evaluate the level of satisfaction among the system's user. There is a
need for more investigation and researches being conducted to investigate the quality of the system. The main objective of this empirical study is to investigate the level of user satisfaction of using HIS in Malaysia. The data was analyzed by using
kruskal-wallis. Survey data of 248 respondents from two different hospital in Malaysia that uses similar HIS were used. The users include physicians, nurses, laboratory technologies, pharmacists and others. The results show that there are

significant differences between different types of users for HIS in Malaysia in terms of the (i) quality of HIS interface, (ii) quality of HIS Function, (iii) quality of HIS Performance and (iv) quality of HIS (combination of HIS interface, HIS Function and HIS Performance). Thus, provide indication for customization and better understanding for different type of HIS users to improve the quality of HIS from end-user's perspectives.

Effective Factors on Hospital Information System Acceptance: A Confirmatory Study in Iranian Hospitals by Seyed Jamaledin Tabibi, Amir Ashkan Nasiripour, Reza Baradaran Kazemzadeh, Ali Akbar Farhangi and Parvin Ebrahimi - Information technology acceptance by users is one of the subjects that if not being considered, it will cause organizations to lose their resources and healthcare field is not excluded in this rule. Therefore, investigating and recognizing the factors influencing information technology acceptance in organizations is a necessity. The purpose of this study was to determine the effective factors on Hospital Information Technology (HIS) by its users in non-teaching hospitals of Iran University of Medical Sciences located in Tehran. Methods: After the related models and theories were studied and compared and the literature was reviewed, the primary model included 7 variables was proposed. The questionnaire included 84 questions based on the variables was developed and its validity and reliability were tested and confirmed by expert panel and calculating Chronbach Alfa. Then the questionnaires were delivered among 278 users of HIS in the considered hospitals that were selected according to Morgan table and by using stratified random sampling method. To confirm the model and determine the relationship between variables with each other, Structural Equation Modeling (SEM) method was used by applying LISREL Software. Results: There was no significant Relationship between each of the 2 variables (system Use and Mandatoriness) and other variables of the proposed model. The result of Chi square test showed that by elimination of 2 variables mentioned above, the model has fitness with the gathered data. The figures of the indices are: GFI=0.98, CFI=0.98, RMSEA=0.017, RMR=0.038. Conclusion: According to the results, the factors Perceived Ease of Use (PEU), Perceived Usefulness (PU), Subjective Norms (SN) and Satisfaction (SAT) influence user Behavioral Intention (BI) to use Hospital Information System in the considered hospitals.

GENERAL OBJECTIVE

To study and streamline the workflow at Nulife Hospital by implementation of Attune Health Kernnel – Hospital Information System

SPECIFIC OBJECTIVES

The specific objectives are:

- To study the workflow of the hospital.
- To compare the turnaround time for registration, billing, admission and lab services pre and post implementation of HIS.
- To assess the impact of HIS implementation on patient safety by reducing medication error through e-prescription.
- To study the privacy, security and confidentiality of patient records by HIS.
- To assess the impact of HIS implementation on patient satisfaction.
- To assess the benefit of HIS for appointment scheduling.

SCOPE

- This study can be used as a basis for evaluating the benefits of HIS by recording the episode/time taken for various workflows pre and post implementation.

RESEARCH METHODOLOGY

- **Study Design**

This study was conducted in ABC specialty hospital at XYZ location. This hospital was a 50 bedded hospital with 40 physicians which provides state of art of medical care and services. The owners was keen to implement cloud based HIS in their hospitals. The study was designed as longitudinal study and was carried out over a period of three months. The study was conducted as follows:

Wave 1 – Jan 2013 Before Go Live of HIS (after scheduled training sessions)

Wave 2 – March 2013 1 month after Go Live

The purpose of this study is to analyze whether there is any change in the turnaround time and overall functioning of the hospital post the implementation of HIS. Several statistical approaches have been applied to study and identify the relationship among the technology acceptance, various demographic characteristics, dependent & independent variables. The study depends mainly on the secondary data collection.

The methodology used is as follows:

- Collection of secondary data before the implementation of HIS (pre defned format)
- Collection of secondary data after the implementation of HIS (pre defined format)
- Collection of primary data for patient satisfaction survey on HIS (structured questionnaire)

- **Sampling Method**

A sampling method is a definite plan for obtaining a sample from a given population. Here in this research samples were selected by simple random sampling method. In a simple random sample ('SRS') of a given size, all such subsets of the frame are given an equal probability. Each element of the frame thus has an equal probability of selection: the frame is not subdivided or partitioned. This method also helps in making generalizations from the results back to the population.

Simple random sampling is always an EPS design (equal probability of selection), but not all EPS designs are simple random sampling. Random sampling is the purest form of probability sampling. Each episode has an equal and known chance of being selected. When there are very large episodes, it is often difficult or impossible to identify every episode, so the pool of available subjects becomes biased.

- **Study setting**

The study was focused around an ABC Specialty hospital in which HIS has been implemented few months back. It is a 50 bedded hospital & consists of 15-20 departments. It comprises of approximately 40 physicians, 50 nurses, and other administrative staff as well.

- **Nature of Respondents**

The sample consists of the episodes from registration, billing, admission and laboratory services. The laboratory services episodes start with patient registration to the time patient receives the report. A standardized lab investigation was taken and analyzed to get uniform reports. However other episodes were taken randomly.

- **Sample size**

A minimum of 30 episodes have been targeted to do the analysis and produce results. In this study, the relevant data was collected using self- administered format. 30 episodes of each category pre and post implementation were recorded except for lab investigation and IP admission where 20 episodes each pre and post implementation of HIS were recorded.
So the final size used for analysis is 140.

- **Data Collection Techniques**

Primary data collection method and Secondary data collection method has been used for data collection of this study. Primary data are those which are collected freshly and for the first time and also original in character. Usually there are several methods of collecting primary data in surveys and researches. Here in this study primary data were collected with the help of a structured questionnaire.
Secondary data is data collected by someone other than the user. Common sources of secondary data for social science include censuses, organisational records and data collected through qualitative methodologies or qualitative research. Secondary data analysis saves time that would otherwise be spent collecting data and, particularly in the case of quantitative data, provides larger and higher-quality databases that would be unfeasible for any individual researcher to collect on their own. In addition, analysts of social and economic change consider secondary data essential, since it is impossible to conduct a new survey that can adequately capture past change and/or developments.Here

in this study secondary data were collected with the help of a pre designed format. Secondary data was taken from the hospital and entered into the pre designed format.

- **Quantitative Analysis Techniques**

This describes the statistical methods used for analyzing the data. Data were entered from the questionnaire into the SPSS data file for statistical analysis.

RESULTS AND FINDINGS

WORKFLOW OF THE HOSPITAL

Workflow can be defined as the process of completing a series of tasks. A workflow can be very simple and include one person, or it could be a sophisticated and dynamic series of processes among many people, groups or departments. Workflow in health care is an important term for today's physicians. The workflow describes the full process of how the office and patient work with each other. From the moment the patient calls to set up an exam, to the billing staff working on the claims, this is all inclusive in a true workflow. Office administrators are tasked with improving the workflow and making it more economical and time efficient.

Below is the workflow of the hospital before and after the implementation of HIS. Marked improvement and streamlining of workflows can be studied after the implementation of HIS. Not only its streamlines the workflows, optimum utilization of resources, less time in management and more time with the patient is possible. The chaos is reduced drastically during the peak hours at OPD. Hence, more patient satisfaction is seen when the turnaround time reduces.

WORKFLOW OF HOSPITAL BEFORE HIS IMPLEMENTATION

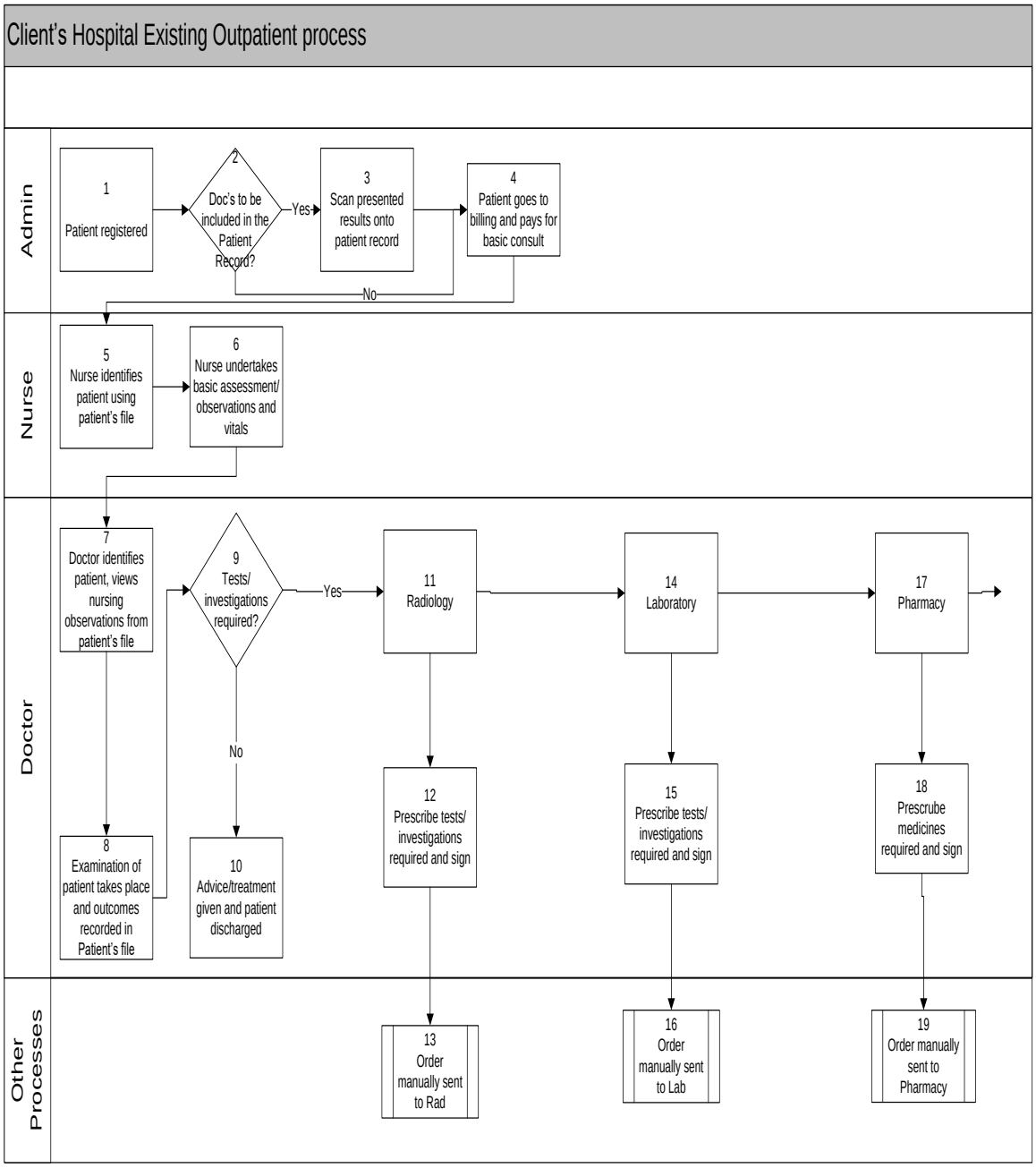


Fig.1 Workflow of Hospital before HIS Implementation

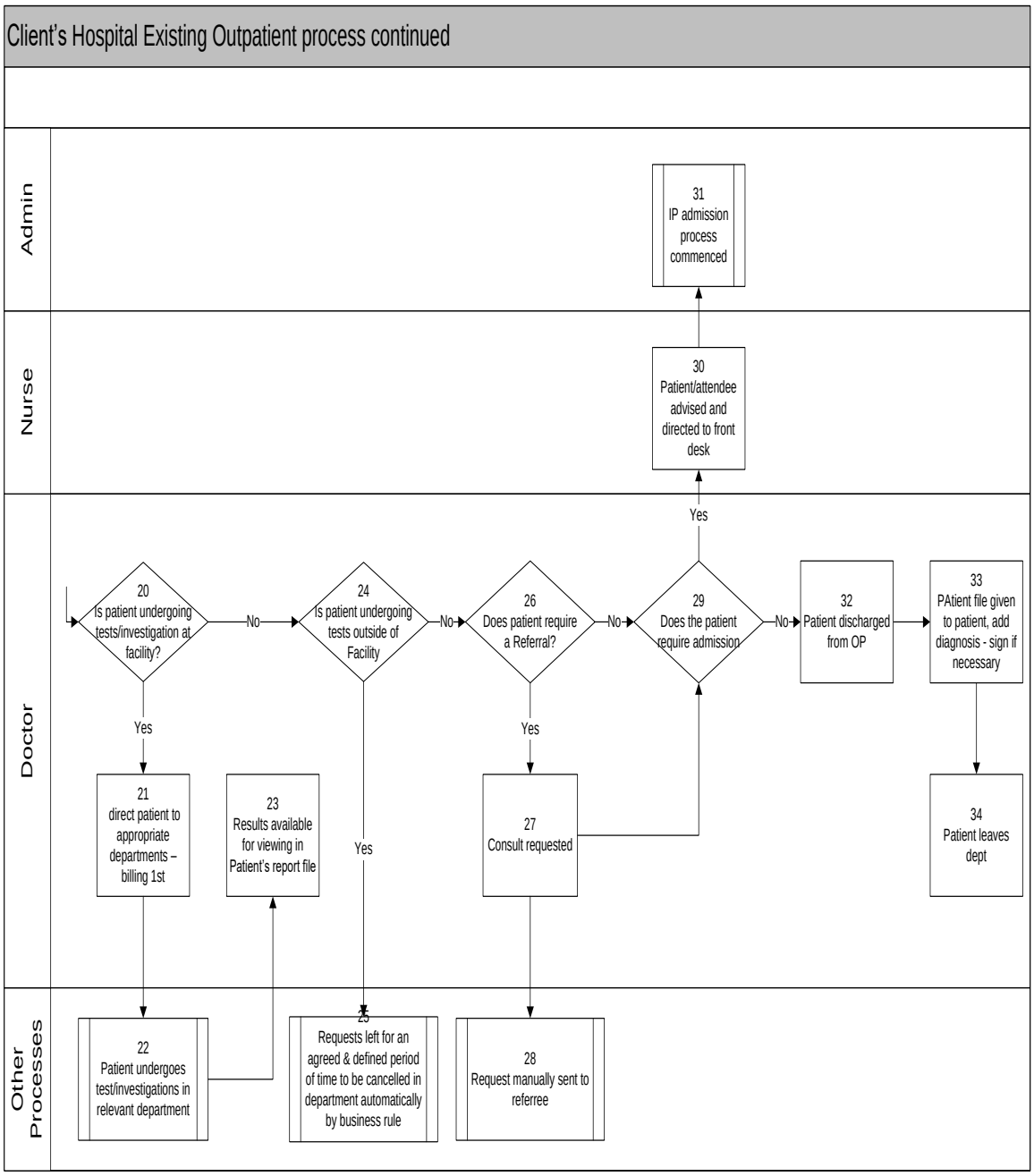


Fig.2 Workflow of Hospital before HIS Implementation continued

WORKFLOW OF HOSPITAL AFTER HIS IMPLEMENTATION

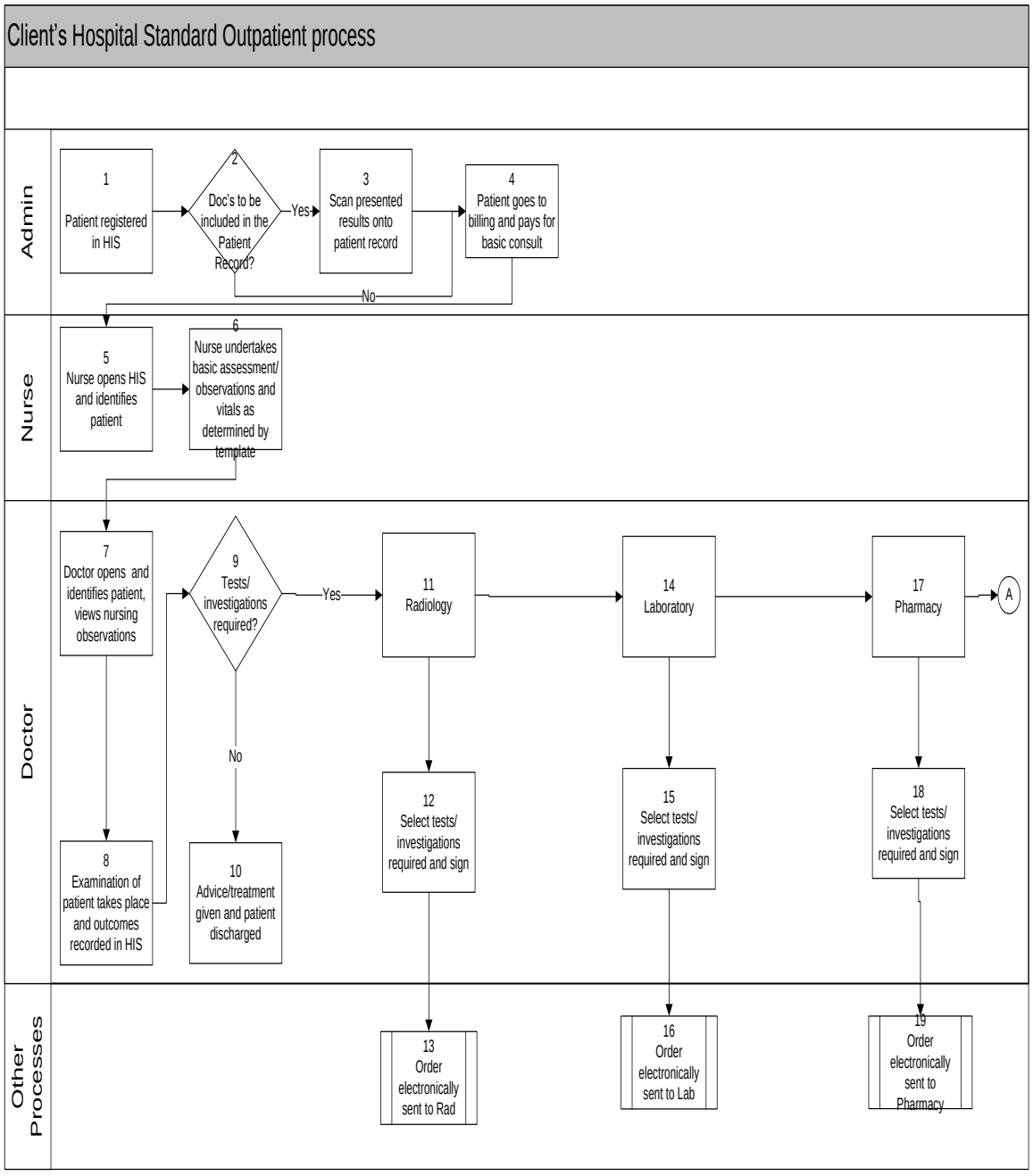


Fig.3 Workflow of Hospital after HIS Implementation

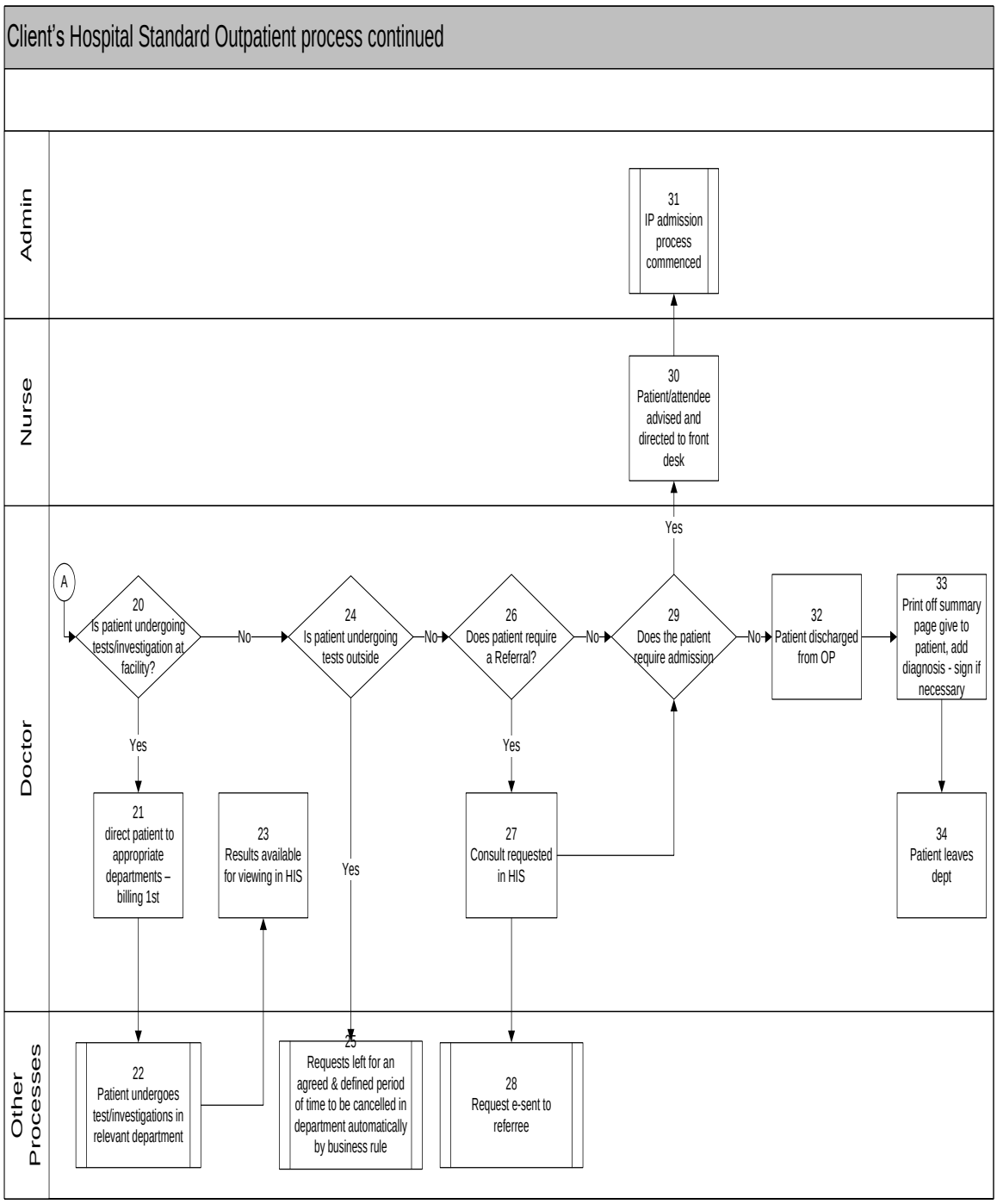


Fig.4 Workflow of Hospital after HIS Implementation continued

COMPARING TAT FOR OPD REGISTRATION & BILLING, ADMISSION & LAB SERVICES

Turnaround time is a vital measure of performance for a number of service industries. For hospitals, reducing the turnaround time leads to increased revenues as well as increased patient satisfaction. If a room is ready sooner, a waiting patient is required to spend less time in the emergency department. If the registration and billing is done faster for the patient, the patient satisfaction increases and quality of care rendered to the patient is also enhanced. Implementation of hospital information systems has been vital to reduction of the turnaround time affecting all the services of the hospitals – registration, billing, admission, lab investigation, discharge etc.

Below are the findings of the average time taken for OPD billing and registration of a patient before and after the implementation of the HIS. Primary data collection has been done before the implementation of the HIS in a pre defined format where the registration and billing time required has been taken for 30 patients and the average time is calculated.

Similarly post the implementation of HIS, 30 new episodes for OPD registration and billing were taken from the HIS and average time was calculated.

The pre designed format for recording the episodes have been the same for both pre and post implementation of HIS and a graph showing the average time for each has been discussed below.

The pre designed format consists of the patient starting the registration at the registration desk (**Start Time**) to the time till the payment has been made to the cashier (**End Time**). The patient name has not been mentioned due to confidentiality of the patient and for each episode the time has been calculated by:

TIME TAKEN = Start Time – End Time

AVERAGE TIME = Total time for 30 episodes / 30

The pre implementation data for OPD registration and billing was calculated during the month of January’13 and post implementation data was collected and analyzed during the month of March’13

OPD REGISTRATION & BILLING (BEFORE HIS IMPLEMENTATION)				
Patient's Name	**Start time**	**End time**	**Total Time**	**Average time**
Patient 1	9:00	9:10	0:10	**0:09**
Patient 2	9:15	9:23	0:08	
Patient 3	9:26	9:36	0:10	
Patient 4	9:40	9:45	0:05	
Patient 5	9:50	9:57	0:07	
Patient 6	10:00	10:10	0:10	
Patient 7	10:10	10:15	0:05	
Patient 8	10:20	10:27	0:07	
Patient 9	10:30	10:38	0:08	
Patient 10	10:45	10:56	0:11	
Patient 11	10:00	10:10	0:10	
Patient 12	10:12	10:18	0:06	
Patient 13	10:23	10:30	0:07	
Patient 14	10:35	10:47	0:12	
Patient 15	10:50	11:05	0:15	
Patient 16	11:10	11:15	0:05	
Patient 17	11:18	11:30	0:12	
Patient 18	11:35	11:45	0:10	
Patient 19	11:50	11:56	0:06	
Patient 20	12:00	12:11	0:11	
Patient 21	9:05	9:10	0:05	
Patient 22	9:15	9:23	0:08	
Patient 23	9:26	9:35	0:09	
Patient 24	9:40	9:47	0:07	
Patient 25	9:55	10:05	0:10	
Patient 26	10:15	10:22	0:07	
Patient 27	10:40	10:49	0:09	
Patient 28	11:00	11:15	0:15	
Patient 29	11:25	11:37	0:12	
Patient 30	11:50	12:03	0:13	

Table No.1 – OPD Registration and Billing episodes before implementation of HIS

The average time calculated has been done by adding the time taken individually by each patient divided by 30. The average time for OPD registration and billing before the implementation of HIS has been **9minutes.**

OPD REGISTRATION & BILLING (AFTER HIS IMPLEMENTATION)				
Patient's Name	**Start time**	**End time**	**Total Time**	**Average time**
Patient 1	9:10	9:15	0:05	**0:05**
Patient 2	9:20	9:25	0:05	
Patient 3	9:30	9:36	0:06	
Patient 4	9:40	9:47	0:07	
Patient 5	9:50	9:55	0:05	
Patient 6	10:00	10:05	0:05	
Patient 7	10:10	10:14	0:04	
Patient 8	10:20	10:26	0:06	
Patient 9	10:30	10:37	0:07	
Patient 10	10:45	10:50	0:05	
Patient 11	10:00	10:06	0:06	
Patient 12	10:15	10:20	0:05	
Patient 13	10:25	10:30	0:05	
Patient 14	10:36	10:42	0:06	
Patient 15	10:50	10:57	0:07	
Patient 16	11:05	11:12	0:07	
Patient 17	11:20	11:26	0:06	
Patient 18	11:30	11:38	0:08	
Patient 19	11:45	11:52	0:07	
Patient 20	12:05	12:11	0:06	
Patient 21	9:05	9:10	0:05	
Patient 22	9:15	9:21	0:06	
Patient 23	9:25	9:30	0:05	
Patient 24	9:35	9:40	0:05	
Patient 25	9:43	9:49	0:06	
Patient 26	9:52	10:00	0:08	
Patient 27	10:05	10:10	0:05	
Patient 28	10:25	10:32	0:07	
Patient 29	10:40	10:47	0:07	
Patient 30	10:50	10:55	0:05	

Table No.2 – OPD Registration and Billing episodes after implementation of HIS

The average time calculated has been done by adding the time taken individually by each patient divided by 30. The average time for OPD registration and billing after the implementation of HIS has been **5minutes.**

Hence it can be observed that a 4 minute (9 min – 5 min = 4 min) time gap can be accommodated by the implementation of HIS. These impacts on various factors like – Increase in patient satisfaction, more OPD revenue, lesser of human resource and more efficient workflows.

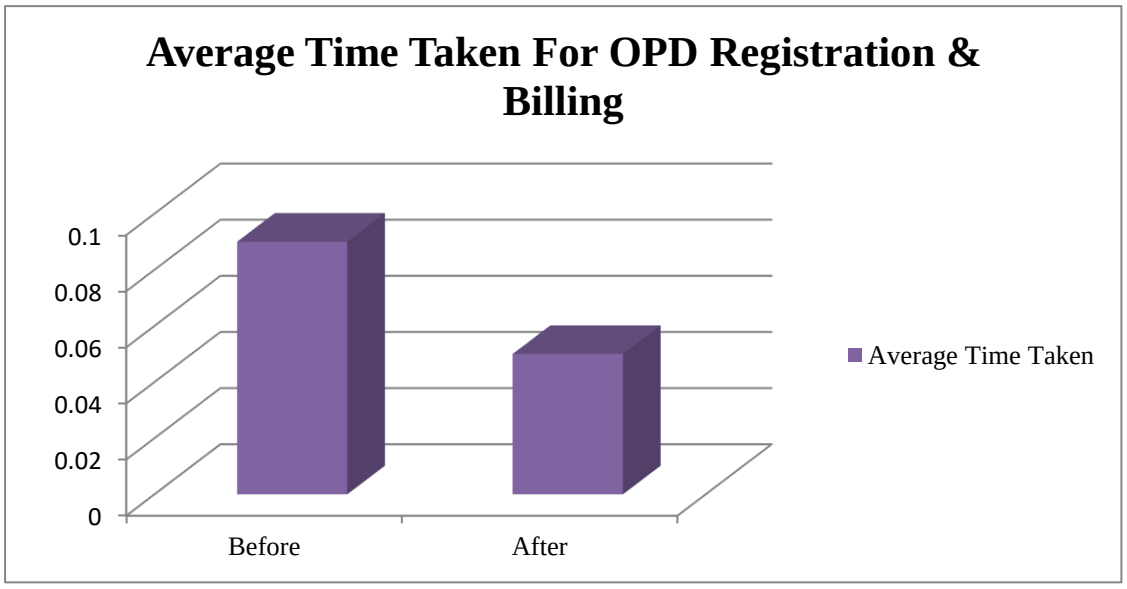


Figure 5 :- Average time taken for OPD registration & billing before and after implementation of HIS

Similarly turnaround time has been calculated and the impact of HIS implementation has been seen on the admission of the patient into IPD. Pre implementation data was collected in the month of Feb'13 and 20 episodes were recorded in a pre designed format and Post implementation data was collected in the month of March'13 (1 month after Go-Live) because IP admission was implemented only after one month of OPD registration and billing to ensure that the workflow is smooth. The implementation has been done in phases and the discharge process is still not automated.

The time has been calculated under the following heads:

1. Admission intimation given by consultant
2. Patient reaches admission desk with intimation slip
3. Bed availability is checked
4. Admission form is filled
5. Initial amount is taken
6. IP number is generated
7. Bed Allocated
8. Total Time Taken

The pre designed format for recording the episodes have been the same for both pre and post implementation of HIS and a graph showing the average time for each has been discussed below. A total of 20 episodes were recorded for IPD admission before and post implementation of HIS and the patient name has been kept confidential.

In both the scenario's predefined format has been used to enter the data and analyze it.

Similar to OPD registration and billing, IPD admission calculation is as follows for both pre and post implementation of HIS:

TOTAL TIME TAKEN = Bed allocated time – Admission intimation given by Consultant

AVERAGE TIME = Addition of total time taken by all 20 episodes/20

IP Admission episodes before implementation of HIS

Patient	Admission intimation given by consultant	Patient reaches admission desk with intimation slip	Bed availability checked	Admission form is filled	Initial amount is taken	IP no. Generated	Bed allocated	Time taken	Average time
1st feb'13									
1	10:30	10:35	10:42	10:47	10:50	11:05	11:10	00:40	
2	10:50	10:55	11:20	11:25	11:28	11:38	11:42	00:52	
3	11:30	11:35	11:50	11:55	11:58	12:05	12:10	00:40	
4th feb'13									
4	10:01	10:06	10:12	10:17	10:20	10:32	10:37	00:36	
5	10:35	10:40	10:49	10:58	11:02	11:15	11:20	00:45	
6	10:50	10:55	11:30	11:40	11:43	11:53	12:01	01:11	
7	11:35	11:40	12:15	12:30	12:32	12:45	12:50	01:15	
8	11:37	11:42	13:01	13:12	13:15	13:25	13:30	01:53	
7th feb'13									
9	10:20	10:25	10:35	10:45	10:48	10:58	11:02	00:42	
10	11:10	11:15	11:25	11:37	11:40	11:48	11:55	00:45	00:57
11	11:40	11:45	12:05	12:15	12:18	12:28	12:32	00:52	
12	12:05	12:10	12:40	12:50	12:57	13:10	13:15	01:10	
12th feb'13									
13	10:17	10:22	10:30	10:42	10:47	10:56	11:01	00:44	
14	10:30	10:34	11:10	11:22	11:27	11:30	11:34	01:04	
15	11:33	11:37	11:50	11:58	12:01	12:12	12:17	00:44	
16	11:55	12:01	12:25	12:34	12:37	12:50	12:55	01:00	
17	12:30	12:36	13:10	13:22	13:25	13:36	13:41	01:11	
15th feb'13									
18	10:11	10:15	10:23	10:35	10:38	10:48	10:52	00:41	
19	11:45	11:50	12:15	12:27	12:30	12:33	12:35	00:50	
20	11:50	11:55	12:45	12:57	13:01	13:12	13:15	01:25	

Table No. 3 – IP admission episodes before implementation of HIS

From the above data analyzed, before the implementation of HIS for an episode of 20 patients the average time calculated is **57 minutes per patient** for admission starting from doctor intimation of admission to bed allocation.

IP Admission episodes after implementation of HIS

Patient	Admission intimation given by consultant	Patient reaches admission desk with intimation slip	Bed availability checked	Admission form is filled	Initial amount is taken	IP no. Generated	Bed allocated	Time taken	Average time
4th March'13									
1	10:13	10:18	10:14	10:18	10:22	10:25	10:28	00:15	
2	10:45	10:50	10:46	10:50	10:52	10:55	10:59	00:14	
3	11:14	11:20	11:16	11:20	11:24	11:28	11:32	00:18	
4	11:20	11:24	11:35	11:40	11:42	11:45	11:48	00:28	
6th March'13								00:00	
5	10:02	10:07	10:03	10:05	10:10	10:13	10:15	00:13	
6	10:10	10:15	10:17	10:20	10:22	10:25	10:27	00:17	
7	11:43	11:47	11:45	11:49	11:52	11:56	11:58	00:15	
8th March'13								00:00	
8	10:12	10:17	10:14	10:17	10:20	10:25	10:29	00:17	
9	10:20	10:25	10:33	10:37	10:38	10:42	10:45	00:25	
10	11:40	11:46	11:42	11:48	11:51	11:56	11:59	00:19	00:15
11	11:52	11:57	12:03	12:05	12:07	12:11	12:13	00:21	
12	12:43	12:49	12:44	12:46	12:52	12:55	12:57	00:14	
11th March'13								00:00	
13	10:43	10:48	10:45	10:47	10:50	10:54	10:58	00:15	
14	11:14	11:19	11:16	11:20	11:23	11:27	11:30	00:16	
15	11:32	11:37	11:34	11:37	11:39	11:43	11:46	00:14	
16	11:47	11:52	11:48	11:52	11:55	11:59	12:03	00:16	
17	12:37	12:42	12:39	12:42	12:46	12:50	12:52	00:15	
13th March'13								00:00	
18	10:44	10:49	10:46	10:51	10:55	10:59	11:04	00:20	
19	11:36	11:42	11:38	11:42	11:44	11:48	11:50	00:14	

20	12:05	12:11	12:07	12:12	12:14	12:18	12:51	00:46	

Table No. 4:- IP Admission episodes after implementation of HIS

From the above data analyzed, after the implementation of HIS for an episode of 20 patients the average time calculated is **15 minutes per patient** for admission starting from doctor intimation of admission to bed allocation.

A drastic reduction in IP admission can be seen post the implementation of HIS. The figures have reduced from 57 minutes to 15 minutes, saving **42 minutes per patient.** The implementation not only saves time but increases patient satisfaction and reducing the discomfort to the patient which is caused by moving from one place to another. Since the system is integrated with all the departments all the information can be available at one desk where all the formalities can be acknowledged. HIS also aids in creating a brand name for the hospital of its efficient working and lesser time with the formalities which otherwise cause a lot of discomfort to the patient.

The graph below shows the average time taken before and after HIS implementation for patient admission:

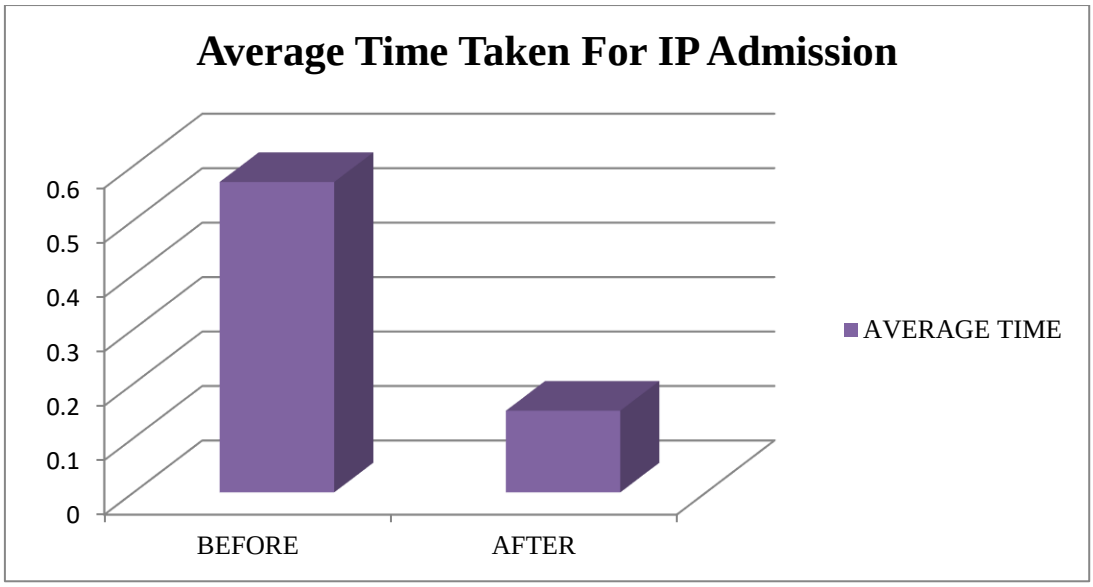


Figure 6:- Average time taken for IP admission before and after implementation of HIS

The turnaround time has been calculated and the impact of HIS implementation has been seen on the lab investigations that a particular patient undergoes. The **limitation** has been

that only those episodes were considered for which the patient had come to visit the consultant in the hospital and he/she recommended a lab investigation which is done within the hospital. Pre implementation data was collected in the month of Feb'13 and 20 episodes were recorded in a pre designed format and Post implementation data was collected in the month of March'13. Only 2 episodes were recorded per day for analyzing, so that proper recording of time can be done.

The time has been calculated under the following heads:

1. Intimation of test given by the consultant
2. Patient comes to lab reception with the intimation slip
3. Test charges are checked and explained to the patient
4. Patient details are taken
5. Initial amount for test is taken
6. Token and test receipt is generated and given
7. Patient goes to the sample collection room
8. Patient gives slip at the counter and entry is made
9. Patient's sample is collected
10. Total Time Taken

The pre designed format for recording the episodes have been the same for both pre and post implementation of HIS and a graph showing the average time for each has been discussed below. A total of 20 episodes each were recorded for Lab investigation pre and post implementation of HIS and the patient name has been kept confidential.

In both the scenario's predefined format has been used to enter the data and analyze it.

Similar to OPD registration and billing, IPD admission, Lab Investigation calculation is as follows for both pre and post implementation of HIS:

TOTAL TIME TAKEN = Patient sample collected – Intimation of the test given by the consultant

AVERAGE TIME = Addition of total time taken by all 20 episodes/20

Laboratory Episodes before implementation of HIS

	Intimation of test given by consultant	Patient comes to lab reception with test slip	Test charges are checked and explained to patient	Patient details are taken	Initial amount for test is taken	Token and test receipt is generated and given	Patient goes to sample collection room	Patient gives slip at counter and entry is made	Patient's sample is collected	Time Taken	Average Time
25th Jan'13											
1	10:43	10:47	10:52	10:57	11:00	11:10	11:13	11:17	11:25	0:42	
2	14:21	14:25	14:31	14:36	14:38	14:50	14:52	14:57	15:07	0:46	
28th Jan'13											
3	10:18	10:23	10:30	10:34	10:37	10:45	10:48	10:52	10:58	0:40	
4	15:06	15:10	15:16	15:21	15:23	15:31	15:33	15:38	15:42	0:36	
2nd Feb'13											
5	11:13	11:17	11:22	11:26	11:27	11:32	11:34	11:37	11:42	0:29	
6	16:02	16:06	16:10	16:14	16:15	16:19	16:21	16:28	16:35	0:33	
4th Feb'13											
7	10:21	10:24	10:29	10:33	10:34	10:40	10:42	10:45	10:54	0:33	
8	14:34	14:37	14:41	14:45	14:47	14:53	14:55	14:59	15:06	0:32	**0:36**
6th Feb'13											
9	12:09	12:13	12:17	12:20	12:22	12:30	12:32	12:38	12:50	0:41	
10	15:33	15:38	15:41	15:44	15:46	15:51	15:55	15:59	16:11	0:38	
8th Feb'13											
11	11:52	11:55	11:59	12:06	12:07	12:15	12:17	12:23	12:30	0:38	
12	14:17	14:20	14:25	14:31	14:32	14:38	14:40	14:46	14:52	0:35	
11th Feb'13											
13	10:11	10:14	10:19	10:23	10:24	10:30	10:32	10:38	10:44	0:33	
14	15:13	15:16	15:21	15:25	15:27	15:33	15:35	15:40	15:47	0:34	
13th											

Feb'13											
15	10:34	10:37	10:43	10:46	10:47	10:53	10:56	11:01	11:10	0:36	
16	14:55	14:59	15:03	15:08	15:10	15:18	15:20	15:26	15:33	0:38	
14th Feb'13											
17	10:52	10:56	10:59	11:04	11:05	11:12	11:14	11:20	11:26	0:34	
18	15:10	15:14	15:18	15:22	15:23	15:28	15:30	15:36	15:44	0:34	
18th Feb'13											
19	11:44	11:47	11:51	11:56	11:57	12:03	12:05	12:10	12:15	0:31	
20	15:32	15:36	15:42	15:46	15:48	15:55	15:57	16:04	16:09	0:37	

Table No. 5:- Laboratory episodes before implementation of HIS

From the above analyzed data, before the implementation of HIS for an episode of 20 patients the average time calculated is **36 minutes per patient** for getting a lab investigation done starting from intimation of test given by the consultant to the patient sample collection.

Laboratory episodes after implementation of HIS

	Intimation of test given by consultant	Patient comes to lab reception with test slip	Test charges are checked and explained to patient	Patient details are taken	Initial amount for test is taken	Token and test receipt is generated and given	Patient goes to sample collection room	Patient gives slip at counter and entry is made	Patient's sample is collected	Total Time Taken	Average Time
1st March'13											
1	10:09	10:13	10:15	10:17	10:18	10:21	10:22	10:26	10:32	00:23	
2	13:03	13:06	13:08	13:09	13:10	13:12	13:15	13:19	13:23	00:20	
5th March'13											
3	11:17	11:20	11:22	11:23	11:25	11:27	11:29	11:32	11:36	00:19	
4	13:05	13:08	13:10	13:12	13:13	13:15	13:17	13:20	13:25	00:20	
7th March'13											
5	10:54	10:57	10:59	11:01	11:02	11:04	11:06	11:09	11:14	00:20	
6	14:06	14:09	14:11	14:12	14:13	14:15	14:17	14:19	14:23	00:17	
											00:19
7	11:31	11:33	11:36	11:38	11:39	11:38	11:39	11:41	11:45	00:14	
8	13:52	13:56	13:58	13:59	14:00	14:01	14:04	14:06	14:11	00:19	
9th March'13											
9	12:04	12:07	12:09	12:11	12:13	12:14	12:16	12:19	12:24	00:20	
10	13:55	13:59	14:02	14:05	14:06	14:08	14:10	14:13	14:18	00:23	
14th March'13											
11	11:10	11:14	11:16	11:18	11:20	11:21	11:23	11:26	11:30	00:20	
12	15:03	15:08	15:10	15:12	15:13	15:15	15:17	15:20	15:24	00:21	

16th March'13										
13	12:17	12:20	12:22	12:24	12:25	12:26	12:28	12:31	12:35	00:18
14	15:22	15:25	15:27	15:28	15:29	15:30	15:32	15:32	15:38	00:16
18th march'13										
15	12:41	12:46	12:47	12:49	12:51	12:52	12:53	12:56	13:03	00:22
16	13:11	13:15	13:17	13:18	13:19	13:20	13:23	13:23	13:28	00:17
21st March'13										
17	10:36	10:41	10:43	10:44	10:45	10:46	10:48	10:51	10:56	00:20
18	16:02	16:06	16:08	16:10	16:11	16:12	16:15	16:18	16:22	00:20
25th March'13										
19	10:55	11:00	11:02	11:04	11:05	11:07	11:09	11:11	11:16	00:21
20	13:32	13:36	13:38	13:40	13:41	13:42	13:43	13:46	13:51	00:19

Table No. 6 :- Laboratory episodes after implementation of HIS

From the above analyzed data, after the implementation of HIS for an episode of 20 patients the average time calculated is **19 minutes per patient** for getting a lab investigation done starting from intimation of test given by the consultant to the patient sample collection.

A drastic reduction in lab investigation time can be seen post the implementation of HIS. The figures have reduced from 36 minutes to 19 minutes, saving **17 minutes per patient** to get the investigation done. The implementation not only saves time but increases patient satisfaction and reducing the discomfort to the patient which is caused by moving from one place to another. Since the system is integrated with all the departments all the information can be available at one desk where all the formalities can be acknowledged. HIS also aids in creating a brand name for the hospital of its efficient working and lesser time with the formalities which otherwise cause a lot of discomfort to the patient.

The graph below shows the average time taken before and after HIS implementation for patient lab investigation:

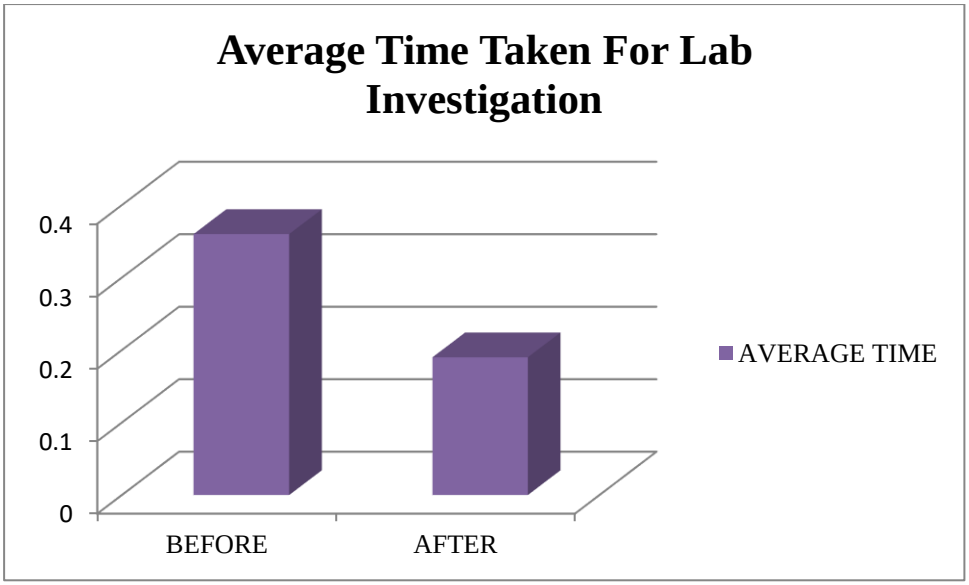


Figure 7:- Average time taken for lab investigation for a patient before and after implementation of HIS

REDUCING MEDICATION ERROR THROUGH E-PRESCRIPTION

Patient safety is a new healthcare discipline that emphasizes the reporting, analysis, and prevention of medical error that often leads to adverse healthcare events. The frequency and magnitude of avoidable adverse patient events was not well known until the 1990s, when multiple countries reported staggering numbers of patients harmed and killed by medical errors. Recognizing that healthcare errors impact 1 in every 10 patients around the world, the World Health Organization calls patient safety an endemic concern. Indeed, patient safety has emerged as a distinct healthcare discipline supported by an immature yet developing scientific framework. The resulting patient safety knowledge continually informs improvement efforts such as: applying lessons learned from business and industry, adopting innovative technologies, educating providers and consumers, enhancing error reporting systems, and developing new economic incentives.

Electronic prescribing or e-prescribing (e-Rx) is the computer-based electronic generation, transmission and filling of a medical prescription, taking the place of paper and faxed prescriptions. E-prescribing allows a physician, nurse practitioner, or physician assistant to electronically transmit a new prescription or renewal authorization to a community or mail-order pharmacy. It outlines the ability to send error-free, accurate, and understandable prescriptions electronically from the healthcare provider to the pharmacy. E-prescribing is meant to reduce the risks associated with traditional prescription script writing. It is also one of the major reasons for the push for electronic medical records. By sharing medical prescription information, e-prescribing seeks to connect the patients team of healthcare providers to facilitate knowledgeable decision making.

A "qualified" e-prescribing system must be capable of performing all of the following functions:

1. Generating a complete active medication list incorporating electronic data received from applicable drug plan(s) if available
2. Selecting medications, printing prescriptions, electronically transmitting prescriptions, and conducting all safety checks using integrated decision support systems
3. Providing information on formulary or tiered formulary medications, patient eligibility, and authorization requirements received electronically from the patient's drug plan.
4. Review patients' current medication list and medication history information within the practice.
5. Work with an existing medication within the practice, this can involve viewing details of a medication, remove a medication from the active medication list, change dose, etc., for a medication or renew one or more medications

E-prescribing offers clinicians a powerful tool for safely and efficiently managing their patient's medications. Compared to paper-based prescribing, e-prescribing can enhance patient safety and medication compliance, improve prescribing accuracy and efficiency, and reduce health care costs through averted adverse drug events and substitution of less expensive drug alternatives. This is of key importance because in 2000, the Institute of Medicine identified medication errors as the most common type of medical error in health care, estimating that this leads to several thousand deaths each year. E-prescribing also has the potential to improve beneficiary health outcomes. For providers who choose to

invest in e-prescribing technology, the adoption could improve quality and efficiency and could show promise in reducing costs by actively promoting appropriate drug usage; providing information to providers and dispensers about formulary-based drug coverage, including formulary alternatives and co-pay information; and speeding up the process of renewing medications. E-prescribing also may play a significant role in efforts to reduce the incidence of drug diversion by alerting providers and pharmacists of duplicative prescriptions for controlled substances.

More specifically, the benefits of e-prescribing to both patients and clinicians include:

a. Improving patient safety and quality of care - Illegibility from handwritten prescriptions is eliminated, decreasing the risk of medication errors while simultaneously decreasing risks related to liability. Oral miscommunications regarding prescriptions can be reduced, as e-prescribing should decrease the need for phone calls between prescribers and dispensers. Causes of medication errors include mistakes by the pharmacist incorrectly interpreting illegible handwriting or ambiguous nomenclature, and lapses in the prescriber's knowledge of desired dosage of a drug or undesired interactions between multiple drugs. Electronic prescribing has the potential to eliminate most of these types of errors. Warning and alert systems are provided at the point of care. E-prescribing systems can enhance an overall medication management process through clinical decision support systems that can perform checks against the patient's current medications for drug-drug interactions, drug-allergy interactions, diagnoses, body weight, age, drug appropriateness, and correct dosing. Based on these algorithms, the system can alert prescribers to contradictions, adverse reactions, and duplicate therapies. The computer can also ensure that clear and unambiguous instructions are encoded in a structured message to the pharmacist, and decision support systems can flag lethal dosages and lethal combinations of drugs.

b. Reducing time spent on phone calls and call-backs to pharmacies - According to estimates, almost 30 percent of prescriptions require pharmacy call backs. This translates into less time available to the pharmacist for other important functions, such as educating consumers about their medications. In response, E-prescribing can significantly reduce the volume of pharmacy call-backs related to illegibility, mistaken prescription choices, formulary and pharmacy benefits, decreasing the amount of time wasted on the phone.

This ultimately impacts office workflow efficiency and overall productivity in a positive manner.

c. Reducing time spent faxing prescriptions to pharmacies - Both prescribers and pharmacists can save time and resources spent on faxing prescriptions through a reduction in labor costs, handling costs, and paper expenses waste due to unreliability.

d. Automating the prescription renewal request and authorization process - With e-prescribing, renewal authorization can be an automated process that provides efficiencies for both the prescriber and pharmacist. Pharmacy staff can generate a renewal request that is delivered through the electronic network to the prescriber's system. The prescriber can then review the request and act accordingly by approving or denying the request through updating the system. With limited resource utilization and just a few clicks on behalf of the prescriber, they can complete a medication renewal task while enhancing continuous patient documentation.

e. Increasing patient convenience and medication compliance - It is estimated that 20% of paper-based prescription orders go unfilled by the patient, partly due to the hassle of dropping off a paper prescription and waiting for it to be filled. By elimination or reducing this waiting period, e-prescribing may help reduce the number of unfilled prescriptions and hence, increasing medication compliance. Allowing the renewal of medications through this electronic system also helps improve the efficiency of this process, reducing obstacles that may result in less patient compliance. Availability of information on when patient's prescriptions are filled can also help clinicians assess patient compliance.

f. Improving formulary adherence permits lower cost drug substitutions - By checking with the patient's health plan or insurance coverage at the point of care, generic substitutions or lower cost therapeutic alternatives can be encouraged to help reduce patient costs. Lower costs may also help improve patient compliance.

Allowing greater prescriber mobility - Improved prescriber convenience can be achieved when using mobile devices, that work on a wireless network, to write and renew prescriptions. Such mobile devices may include laptops, PDA's, tablet computers, or

mobile phones. This freedom of mobility allows prescribers to write/renew prescriptions anywhere, even when not in the office.

g. Improving drug surveillance/recall ability - E-prescribing systems enable embedded, automated analytic tools to produce queries and reports, which would be close to impossible with a paper-based system. Common examples of such reporting would be: finding all patients with a particular prescription during a drug recall, or the frequency and types of medication provided by certain health care providers.

PRIVACY, SECURITY AND CONFIDENTIALITY OF PATIENT RECORDS

Medical record is a systematized way of storing the required data, information and other relevant documents with the objective of making easy availability of necessary data at the time of its need. It is a systematic documentation of a single patient's long-term individual medical history and care. These records are intensely personal documents and so there are many ethical and legal issues surrounding them.

Medical record consists of information like name of patient, address, age, sex, occupation, disease, modes of diagnosis and recommendations made the by the concerned doctor in course of undergoing treatment This information contained in the medical record allows health care providers to provide continuity of care to individual patients. It helps patients to acquire the right and apt treatment. Moreover, it acts as a tool for the doctor who is looking into the patient.

IMPORTANCE:

- Systematic Medical records play a vital role in the field of delivering proper health services to the people. These are vital in both hospitals & public health.
- A caution is necessarily taken, in course of treatment as there must be a name and signature of concerned doctor who is involved in the treatment of any patient in medical record.
- A patient may derive a right treatment after quick and meaningful diagnosis of disease.
- It contributes towards knowing the health condition of people, ailment stricken areas, cause and effects of disease.
- Helps in attaining the health related information through thorough check up of such medical records.
- The government can avail such records in the direction of making short as well as long term health strategies.
- Through the study of medical record, preventive measures are to be timely adopted in order to save people from being ill.
- The epidemics and other disease tending to spread can conveniently be well informed in time.

Confidentiality, privacy and security of health information have always been at the forefront of the health record/information professionals' duties and responsibilities. The words confidentiality, privacy and security have often been used interchangeably. They are three distinct concepts:

Confidentiality is the obligation a health care agency has to ensure the patient's right to privacy is respected by limiting the disclosure or improper use of information without the patient's authorization.

Privacy is the right individuals have to control how their personal information is handled, that is, their right to determine what personal information is shared, when, how and with whom.

Security is the administrative, physical and technological safeguards a health care agency has in place to prevent accidental or intentional disclosure of personal health information by inappropriate access or by unauthorized individuals. It also includes the mechanisms in place to protect the information from alteration, destruction or loss.

GOALS OF INFORMATIONAL SECURITY IN HEALTH CARE

A cohesive informational security policy is lacking across institutions, counties, and states, and governmental and nongovernmental committees are grappling with difficult policy details that have far - reaching consequences. Although the establishment and implementation of security policies may be challenging, the goals can be simply stated:

1. To ensure the privacy of patients and the confidentiality of health care data (prevention of unauthorized disclosure of information)

2. To ensure the integrity of health care data (prevention of unauthorized modification of information)

3. To ensure the availability of health data for authorized persons (prevention of unauthorized or unintended withholding of information or resources).

SECURITY, PRIVACY & CONFIDENTIALITY OF PATIENT RECORDS THROUGH HIS

1. **User authentication** - issues relating to the identification of a user to the system and the ways in which the system might know that a user is who they claim to be.

2. **Physical security of data centre sites** - issues relating to the physical access to computer hardware; theft prevention; backup and disaster recovery; and the security of sensitive terminal locations, such as console or control, and of publicly accessible terminals.

3. **Access control to system resources** - issues of the physical devices and logical mechanisms, such as computer programs, that control access to system resources.

4. **Data ownership** - issues of whom own which data, the delegation of authority over data, and enunciation of the duties and responsibilities of data ownership.

5. **Data protection policies** - issues of minimally acceptable and consistent protections to be afforded by systems crossing organizational and functional boundaries, anticipated implementation barriers to those protections, and the punitive measures for organizational members abusing system privileges.

6. **Building security into systems** - issues of how to assure that security requirements are addressed in central and local participating systems, how to partition security responsibilities between central and local systems, and how to assure that security requirements remain satisfied as systems are modified or expanded.

7. **Security of hard copy materials** - issues of how to prevent security breaches from paper copies of sensitive electronic documents and data.

8. **Systems integrity** - issues related to the accuracy and reliability of system data, and the integrity and reliability of physical computer and network systems.

9. **User profiles** - issues related to defining user types and roles that serve to distinguish the functional needs and security levels of users.

10**. Legal and liability issues** - issues relating to the uses and misuses of the system that involve potential liabilities or legal concerns for participating organizations, including protections under existing computer crime laws, liabilities when a record is compromised, and requirements for user penalties under union contracts.

11. **Problem identification and resolution** - issues of system audits and audit ability, intrusion detection and notification of intrusions, and detection and notification mechanisms for other types of security problems.

12. **Network security** - issues relating to the security management of computer networks and the movement of data over such networks, including the security of bridges and routing equipment, the passing of authorization tokens, data encryption, electronic signatures, and no repudiation of messages.

13. **Informed consent** - issues related to the use of medical information collected about patients and obtaining consent from patients for desired and potential uses of medical data.

14. **Education of users** - issues related to the education of users regarding their responsibilities as system users and the risks conjured by their actions, including activities on the system and degrees of no vigilance.

PRIVACY & CONFIDENTIALITY:

1. Strict limits on access and disclosure apply to all personally identifiable health data, regardless of the form in which the information is maintained.

2. All personally identifiable health records to be under an individual's control. No personal information may be disclosed without an individual's uncovered, informed consent.

3. Health-record information systems to be required to build in security measures to protect personal information against both unauthorized access and misuse by authorized users.

4. Employers to be denied access to personally identifiable health information on their employees and prospective employees.

5. Patients to be given notice of all uses of their health information.

6. Individuals to have a right of access to their own medical and financial records, including rights to copy and correct any and all information contained in those records.

7. Both a private right of action and a governmental enforcement mechanism to be established to prevent or remedy wrongful disclosures or other misuse of information.

8. A federal oversight system must be established to ensure compliance with privacy laws and regulation.

IMPACT OF HIS IMPLEMENTATION ON PATIENT SATISFACTION

Healthcare in India is under a transformation phase. From visiting a Family Physician for all needs, people are now visiting hospitals which are supposed to provide the best medical care facilities along with the best consultants. The challenge lies for such hospitals to replace the “Family Physician” in a short time. Patient satisfaction survey is a process of determining the level of current services offered and identifying opportunities for business. The study could cover all hospitals / clinics and a performance measure could be determined.

Such an exhaustive study would require exhaustive time and resources, but should be helpful for the development of the healthcare service providers. The current study has been undertaken specifically for understanding the process involved. Post the

implementation of the HIS, a remarkable increase in the footfall of the patients has been seen. An effort was made to determine the satisfaction level of patients visiting.

a. History of Patient satisfaction surveys :

Studies of Patient Satisfaction within Healthcare originated in the USA in 1950s, since survey research was the preferred method of choice. However, such research, which continued till 1970s, in USA and Europe was undertaken with an academic perspective and had little commercial success. Lack of money and expertise hampered similar research by healthcare providers. With patients being redefined as Consumers of Healthcare, greater importance was placed on Patient satisfaction and related surveys.

b. Current Scenario :

In today's world, healthcare market is growing very fast and there is intense competition within the health care market to grab a lion's share. However, key to become a successful health care provider is utmost satisfaction of health care users; the patients. In the past 50 years there has been a great change occurring in the health care sector. Health care market is becoming more buyer's market rather than seller's market. Therefore it is becoming more consumer (patient) oriented.

Awareness about health is increasing tremendously among people in rural as well as urban areas. People today do expect high quality of medical care at the affordable cost. People show awareness about the technological, medical, physical facilities they get from a particular health service provider and the cost they have to pay for availing the services. Consumer of the health care sector is very alert and aware about his rights and the standards of services he is going to pay for.

c. Patient Satisfaction vs. Expectation :

Ultimate goal of any health care company should be patient rather customer satisfaction. Therefore these health care organizations take great efforts to keep their consumers (patients) satisfied. However one cannot measure patient satisfaction levels unless he has any idea about the patient expectations. So if we look at the patients as the consumers of health care services, health care organizations should have a good idea about the consumer expectations. If the patient expectations are fulfilled his satisfaction levels will

be greater. So surveying patient expectation ultimately leads to understand patient satisfaction.

d. Difficulties in defining Patient Satisfaction:

It will not be wrong to state that there is no agreed definition of the concept of Patient Satisfaction. This may be because “Satisfaction” is multi-dimensional.

Consumer councils worldwide have defined seven consumer principles to access the multi-dimensional nature of satisfaction, viz,;

1. Access
2. Choice
3. Information
4. Redress
5. Safety
6. Value for Money
7. Equity

However, Patient Satisfaction studies fail to focus on addressing questions specifically related to healthcare like

1. Safety
2. Psychological problems
3. Outcome of treatment
4. Patient Choice.

e. Factors Influencing Satisfaction:

Studies have shown that majority consumers (80% and above), express overall satisfaction with few respondents responding negatively to any given item. Patients appear very tolerant of deficiencies in healthcare and thus it may be reasonable to assume “that the quality of care is actually worse than surveys of patient satisfaction would seem to show”.

Overall, following parameters have been identified by various studies, as influencing satisfaction

- Past experiences on health services.
- Lifestyle/Lack of knowledge of alternatives
- Level of expectation
- Socio-demographic variables: (Elderly people tend to record greater satisfaction; women tend to be more satisfied than men, etc.).
- Quality of questionnaire and way of administering it.

f. Satisfaction Vs. Delight:

There is enough evidence, through management studies, which indicates that satisfying customers is not enough to retain them because even satisfied customers defect at a high rate in many industries. Healthcare providers must focus on "Customer Delight & Outrage" - emotions that are more intense than satisfaction or dissatisfaction.

- ***A Delighted patient*** will become a loyal 'apostle', telling others about his / her great experience.
- ***An Outraged patient*** will certainly not return and propagate negative aspects of the healthcare provider in an emotional way.

Since in healthcare, word-of-mouth advertising is the most effective way of communication, both a delighted and an outraged customer will have a very high positive / negative impact on the healthcare provider's business. Healthcare providers must work towards achieving Customer Delight and minimizing Outrage.

In a normal service industry, 'Exceeding Expectations' should work towards achieving Customer Delight. However, in healthcare, addressing customer's needs is equally important, as the needs themselves are very ambivalent. Building customer relationship is important to identify Patient needs. Researchers recommend that ***"Healthcare providers view Patients as People first and consumers second".***

g. Benefits of patient satisfaction survey:

Customer satisfaction surveys are very important to marketer because it is a significant determinant of repeat sales, positive word-of-mouth, and consumer loyalty. Customer satisfaction is very important for marketer as 1% increase in customer satisfaction can lead to 3% increase in market capitalization. It has been observed that it costs three to four times money to acquire new customer than to make repeat sales to an existing one.

- To estimate present level of the quality of services and medical facilities.
- This helps to improve further services and facilities that are not up to the mark.
- Efforts made to find out the views of the service users through patient satisfaction surveys even help to develop quality initiatives in many practices.
- It often helps to provide salient information for clinics and hospitals seeking to develop service provision.

A sample of 50 respondents was taken after the implementation of HIS and the responses were recorded in a structured questionnaire. The data was analyzed and the study findings are as follows:

The findings were as follows:

Demographic Profile	**Number in Total** (50)
Gender	
Male	18(36%)
Female	32(64%)
Age	
20-30	32(64%)
31-40	8(16%)
41-50	9(18%)
51-60	1(2%)

Table No.7: - Demographic Profile of the respondents

The table shows that out of the total respondents surveyed 64% were females and the rest were 32.00% users were males. Moreover maximum number of respondents (64%)

belonged to the age group of 20-30 years and minimum respondents (2%) belonged to above 50 years of age group.

a. Better patient care is possible with HIS?

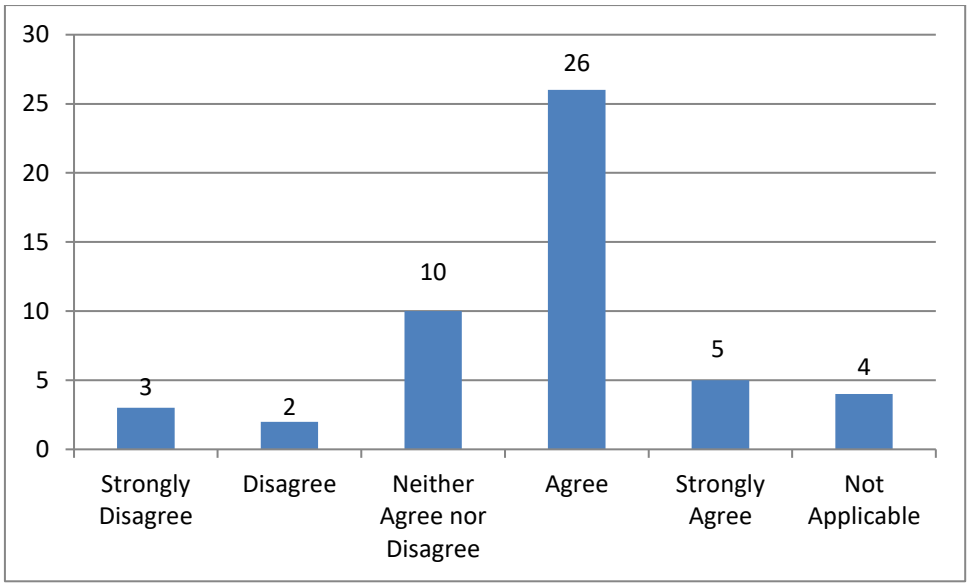


Figure No. 8: - View on Better patient care with HIS

HIS is a tool which gives access to quick and reliable patient care including patient's records demonstrating their medical details etc thereby improving overall patient care. The above chart illustrates that out of 50 respondents 31 of them agreed/strongly that better patient care is possible with HIS followed by 10 respondents with nonaligned response. Additionally there were 5 people who were not in consonance with the above statement. The respondents (4) who fall under category of N/A were those who did not respond to the question.

b. Has the waiting time reduced with the implementation of HIS?

One of the direct benefits of HIS is that it helps in improving the patient waiting time. 37 of 50 respondents agree/strongly agreed with the above statement, 8 were of neutral opinion followed by 2 respondents who disagreed with the statement. Further there were 3 of them for whom communication regarding patient data was not applicable.

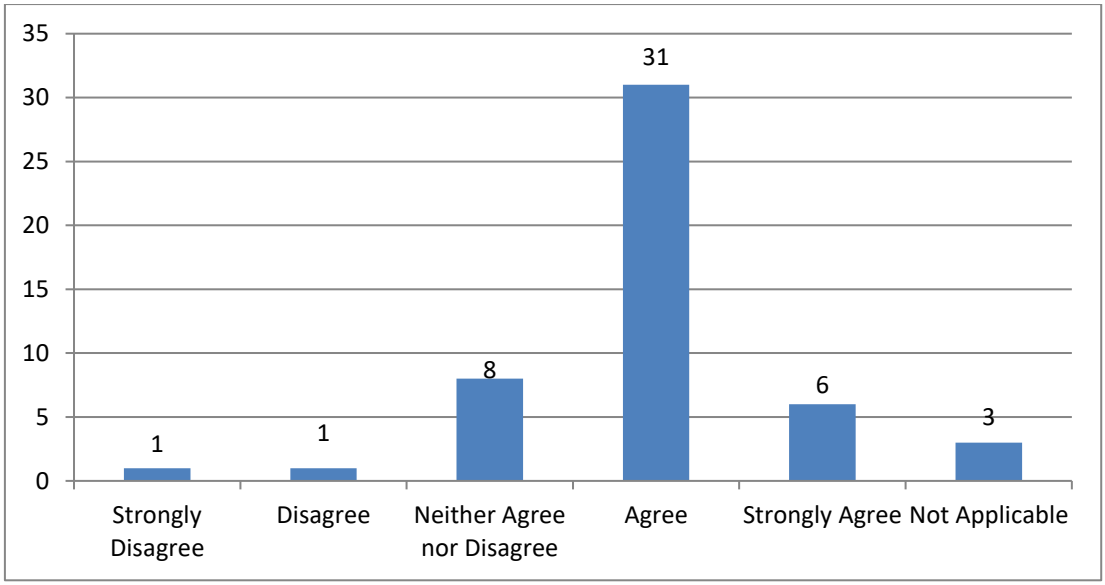


Figure No. 9:- Waiting time reduced with implementation of HIS

c. Scheduling of appointment has become easier?

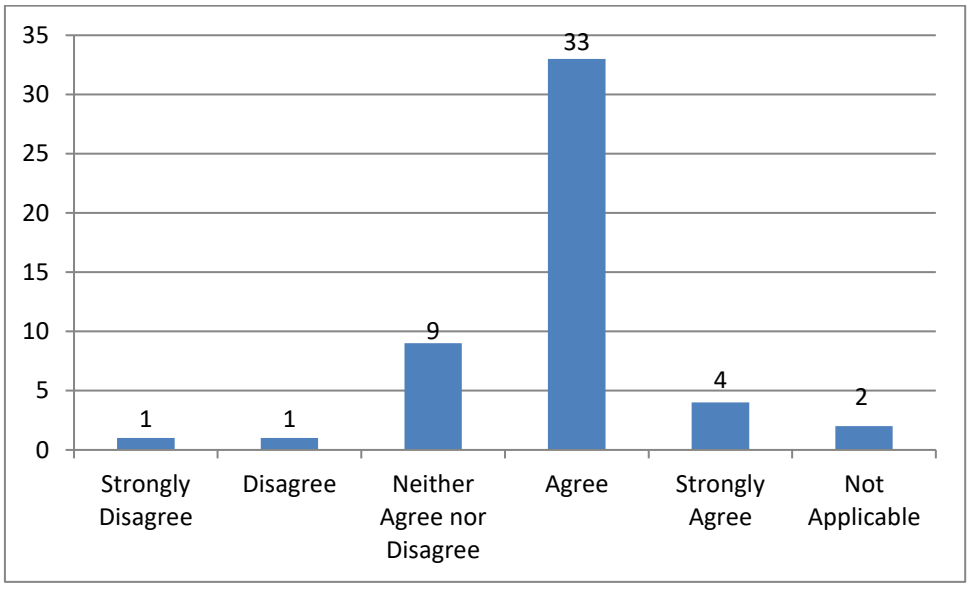


Figure No.10: - View on scheduling of appointments with HIS

HIS helps in improved flow of information and hence faster decision making. It was observed that 37(74%) agreed/strongly agreed to the fact that scheduling of appointments has made it easier for the patient to access the services at the hospital by pre- booking with 9 of the respondents with neutral opinion.

d. Has HIS made registration easier?

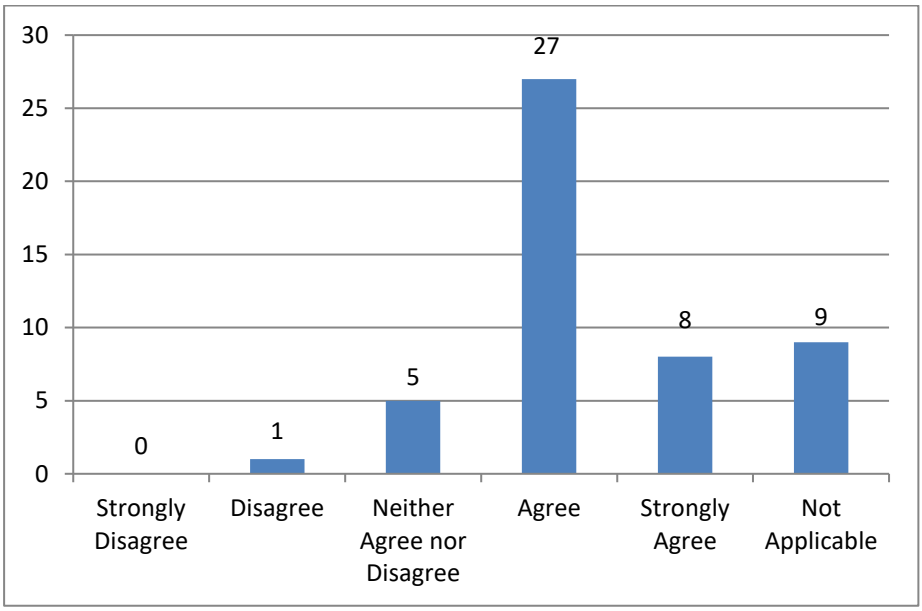


Figure No. 11: - View on easy and quick registration

Registration of patient is the principal activity in overall HIS. Every patient who approaches a hospital has to get registered prior to getting any consultation, treatment and investigation done from the hospital which can be retrieved any time. HIS makes all the above process streamlined. Maximum respondents (35) rated that HIS has made the patient registration easier with 5 of them of neutral opinion. Besides there were 9 respondents who did not respond.

e. Has retrieval of reports became easier?

HIS is bank of clinical/administrative records of the Hospital which can be retrieved at just single click. It can be observed from the chart that 37 respondents were in consonance (agree/strongly agree) with the fact that retrieval of reports became easier along with 6 of them who were neutral in their opinion. Besides in case of 6 respondents, the response was not there.

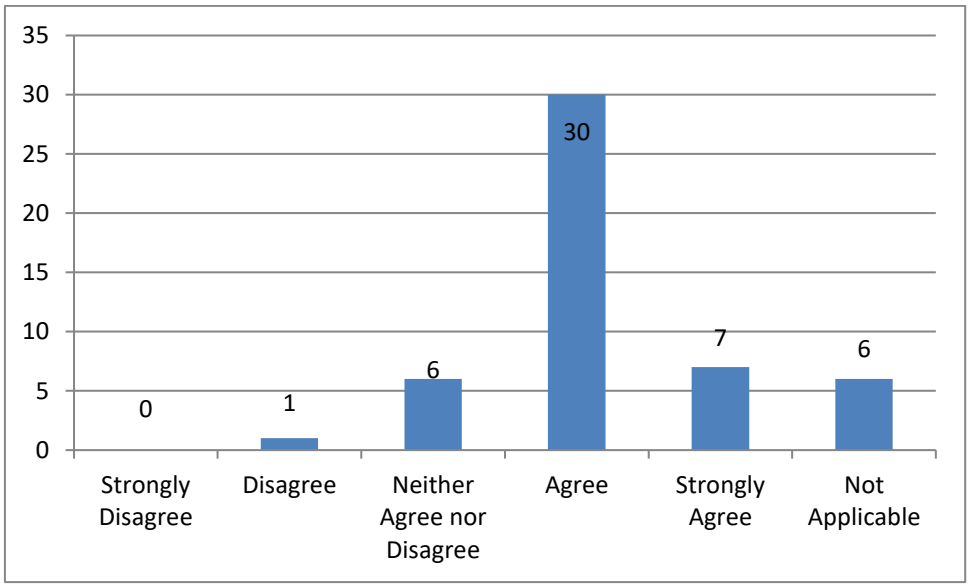


Figure No.12: - View on easy retrieval of reports

f. Has HIS made discharge process fast?

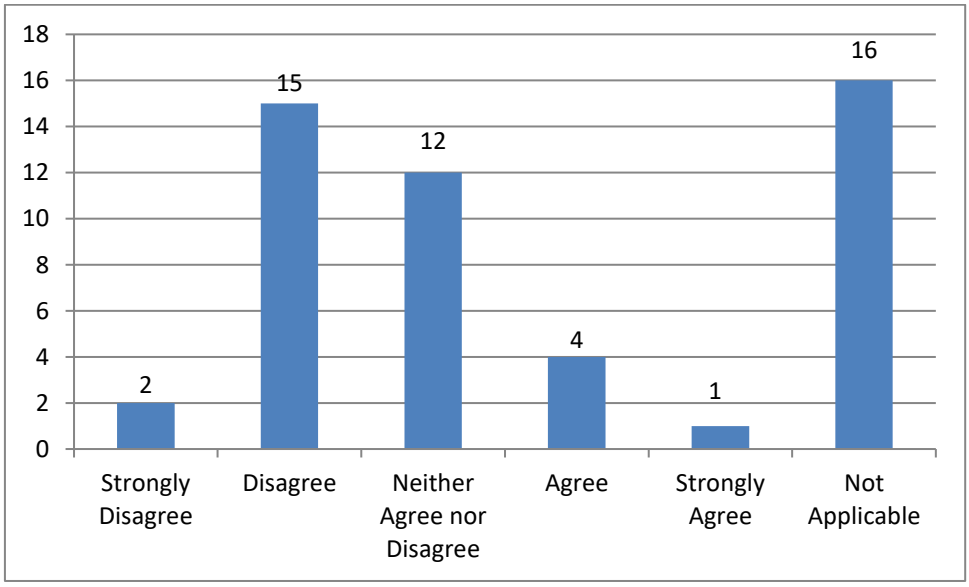


Figure No.13: - Perspective on Discharge Process

Discharge process is the last step during patient length of stay. As a patient is discharges they expect a timely and quality discharge from their care providers HIS makes all the discharge process make more efficient. It was observed that 17 people were satisfied with the timeliness of discharge process along with 12 of them with neutral response. Besides a small number of people (5) agreed to the statement that discharge process has become slow. The respondents (16) who did not respond to the question.

The study is indicative that the patient satisfaction scores have soared and has boosted the hospital from one of the lowest to at one point in the highest. It has also helped to achieve better process and communication goals and patients are happy with the experience and care. It has further improved the throughput, eliminated the bottlenecks and ensures resources are used in the most efficient way possible.

APPOINTMENT SCHEDULING THROUGH HIS

An effective appointment scheduling and rescheduling service is a great support to a busy healthcare practice. Patient scheduling and rescheduling is a time-consuming process. Healthcare entities looking to save valuable time and effort can outsource medical appointment scheduling to a medical billing company. Outsourcing helps healthcare professionals to streamline their patient appointment scheduling and rescheduling tasks. Moreover, they can completely focus on providing medical care, increasing productivity, improving workflow and enhancing work efficiency.

Appointment scheduling services include **paper based appointment scheduling, phone based appointment scheduling and web-based patient scheduling.**

Among these various options, web-based appointment scheduling and rescheduling has gained great popularity. It allows you to access patient schedules from the location of your choice utilizing the secure log in feature. It also prevails in terms of ease of use, accuracy, fewer delays, convenience, and greater flexibility. Above all, online appointment scheduling service is an excellent method for maintaining and tracking patient compliance and the services are available 24/7. Appropriately streamlined appointment scheduling and rescheduling services provide a wide range of benefits for medical professionals.

Today, there are several medical billing companies offering appointment scheduling and **appointment rescheduling** services that can help physicians manage their patient appointments efficiently.

The HIS implemented allows the receptionist to schedule and reschedule appointments for the patients over the phone. With the updated and timely availability of slots for consultants, the receptionist is able to easily respond to patient queries and make a booking with the ability to do quick registration on the phone so that the patient is not required to wait when he/she comes to the hospital. The patient need not wait in long queue for getting the appointment or seek any information regarding a consultant.

Here are some of the advantages of the HIS – appointment scheduling and re-scheduling that the hospital benefits from:

1. Reduced paperwork
2. Easy scheduling of recurring appointments
3. Easy appointment cancellation and rescheduling
4. Reduces no-shows
5. Easily tracks cancellations
6. Enables group scheduling
7. Easy to find the vacant scheduled time
8. Appointments can be viewed based on day, week, and month; or on the basis of treatment room; or providers
9. Helps to find out the availability of the doctor, medical assistants, nurses, and other resources of the medical office

10. Highest privacy for patient's appointment details
11. Improved patient compliance
12. Makes possible double and triple booking
13. Simplifies cross-scheduling, and the directing of patients to other offices
14. Patient information can be quickly and easily updated
15. Medical appointment scheduling benefits a medical practice greatly in terms of increased productivity, improved patient satisfaction, and better time management and increased revenue.

LIMITATION OF THE STUDY

1. The post implementation benefits cannot be proved for all the services being rendered in the hospital because the implementation will require 2 more months to complete but I intend to carry out the post implementation study and identify the gaps and benefits of HIS.
2. Given the time frame for the collection of data (3months), the episodes were restricted to 30 for each of the comparisons (pre and post implementation) and in some cases restricted to 20.

DISCUSSION AND CONCLUSION

Both the qualitative and quantitative results suggested that implementing a HIS is an enormous challenge for the health service. However, there was some evidence that HIS can improve some activities. The clerks considered HIS more efficient in the registration and admission of patients in the OPD. Furthermore, an important qualitative association emerged between the system and the easy retrieval of patients' record during second and third visits to the hospitals. These findings indicated that HIS changed the work of OPD clerks positively.

The debate about how information systems contribute to hospitals effectiveness and efficiency is ongoing. In hospital settings the nature of the organisation makes it difficult to assess the efficiency and effectiveness of the system. In hospitals a number of different factors can influence the contribution of a HIS system to the efficient running of the

services that it provided. This means that the impact can only be measured by assessing a range of individual activities carried out in each section, which is then added up in a collective process to form the whole impact on the outcomes measured.

It is clear on the basis of both qualitative and quantitative data that there is a need to develop a fertile ground before the implementation of HIS. 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.

The gross revenues have increased, patient satisfaction got better and streamlined workflows have helped the hospital work efficiently and effectively. The IP admission time for patient, lab investigations and OPD registration and billing have tremendously reduced and can be directly related to the implementation of HIS.

REFERENCES

1. Littlejohns, P., Wyatt, J.c. & Garvican, L.,Evaluating computerized health information systems: hard lessons still to be learnt, BMJ,Vol. 326, No. 7394, 2003, pp. 860-863.

2. Hammond WE, Making the boundaries clearer: revisiting information systems with fading boundaries, International Journal of Medical Informatics, Vol. 69, No 2-3, 2003, pp. 99-104.

3. Van de Ve1de, R. & Degoulet, P. Clinical Information Systems: A Component-Based Approach, Springer-Verlag, New York, 2002.

4. Sanders, D, Healthcare Analytics: Standing on the Brick of a Revolution, Journal of Healthcare Information Management, Vol. 16, No.4, 2002, pp. 17-21.

5. Ball, MJ., Hospital information systems: perspectives on problems and prospects, 1979 and 2002, International Journal of Medical Informatics, Vol. 69, No. 2-3, 2003, pp. 83-89.

6. McDonald, C.J. The Barriers to Electronic Medical Record Systems and How to Overcome Them', Journal of the American Medical Informatics Association, Vol. 4, No.3, 1997, pp. 213-221.

7. Haux, R., Ammenwerth, E., Herzog, W., & Knaup, P. Health care in the information society. A prognosis for the year 2013,International Journal of Medical Informatics, Vol. 66, Iss. 1-3,2002, pp. 3-21.

8. Drazen, E., Feeley, R., Metzer, J., Wolfe , H. 1980.Methods for evaluating costs of automated hospital information systems. Department of Health and Human Services, National Centre for Health Services Research, PHS no. 233-79- 3000.

9. Barriers to electronic health record use during patient visits. In: Linder, J. A., Schnipper, J. L., Tsurikova, R., Melnikas, A. J., Volk, L. A. & Middleton, B. Proceedings of AMIA Symposium, 2006: 499-503

10. Comparisons of Physicians' and Nurses' Attitudes towards Computers Connecting Medical Informatics and Bio-Informatics. In:Gordana, B., Ivor, K., Dejvid, Z., Ileana, L., Lidija, B.-Z. & Mladen, P. Proceedings of MIE2005 - The XIXth International Congress of the European Federation for Medical Informatics, 2005:608-613.

11. Electronic Medical Records : A Step into the future of Healthcare. 2010. (http://www.helium.com/items/1995112-electronic-medical-record-sytems-the-way-forward)

12. Felt-Lisk, S., Johnson, L., Fleming, C., Shapiro, R. & Natzke, B. Article on Toward Understanding EHR Use in Small Physician Practices , Health Care Financing Review: HCFA ORDS Publications, 2009.

13. Ludwick, D. A. & Doucette, J. Primary care physicians' experience with electronic medical records: barriers to implementation in a fee-for-service environment. Int. J. Telemedicine Appl., 2009,1-9.

14. Smith, Robert H. Article on Decision & Information Technologies, Center for Health information & Decision Systems, 2007,2(1B).

15. A Study of factors influencing physician adoption of Electronic Medical Records Technology, Audrey P. Price.

ANNEXURE

Name.....

Gender (M/F)..... Age .....years

Address.....

.....

Contact No. .....

S.No.	Questions	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree	Not Applicable

1	**Is better patient care possible with HIS?**						
2	**Has the waiting time reduced with the implementation of HIS?**						
3	**Scheduling of appointment has become easier with HIS?**						
4	**Has HIS made registration easier?**						
5	**Has retrieval of reports become easier with HIS?**						
6	**Has HIS made discharge process fast?**						

Comments if any

.....
.....
.....
.....
.....
.....

CASE STUDIES

International Institute of Health Management Research, New Delhi

2013

PERCEPTION

Most people assume everyone sees the world the same way. This can be expected because people are not able to compare what they see to what someone else sees. This assumption is incorrect. There is evidence that each person's perception of the world is different in minor ways. The concept of perception can be explained by answering three key questions:

1) What does a different perception entails mentally,

2) What provokes different perceptions to occur, and

3) How does this all fit together on a neurological level.

To come to the conclusion, perception must first be defined on a neurological level to use as background information.

Perception may not be what he/she thinks it is. Perception is not just a collection of inputs from our sensory system. Instead, it is the brain's interpretation of stimuli which is based on an individual's genetics and past experiences. The biological process of perception can help explain this definition. According to biologists, the process begins with stimuli, usually in the form of photons, vibrations or chemical reactions from the outside world, being picked up by the sensory systems. The stimulus is detected by a sensory neuron located on the surface of the body. This neuron converts the stimuli's light, sound, heat, etc. into action potentials. The action potential changes the membrane permeability of the neuron which allows it to transform into electric signs. The signs are conducted to a primary processing area and elaborated on eventually being converted into corresponding information regarding colour, shape, shade, etc. Next, this new information is brought to the thalamus (usually) where it is linked to older data containing similar experiences to form a complete message. The message is carried to its specific cortical centre to become perception. Therefore, perception is actually message constructed using outside inputs, inner-neuron processes and past, relevant information stored in the brain.

Perception is the process by which we attach the meaning to the world around us. Our world consists of the people, experiences and objects that influence us. Perception is unique to each person. No two people view the world exactly the same. No one can perceive 100% of all things at all times. The perception process consists of three stages, which are selection, organization and interpretation.

- **Selection:** It is the first stage in perception process. In this stage we select the stimuli to which we attend.
- **Organization:** It is the second stage in the perception process. In this stage we mentally arrange the stimuli, so that we can understand or make sense out of the stimuli.
- **Interpretation:** It is the third stage in the perception process. The interpretations are subjective and based on our values, needs, beliefs, experiences, expectations, involvement, self concept and other personal factors.

The perceptual process allows us to experience the world around us. This overview of perception and the perceptual process, will give more idea about how to detect the stimuli in the environment to actually take action based on that information.

What Is Perception?

Perception is the sensory experience of the world around us and involves both the recognition of environmental stimuli and actions in response to these stimuli. The perceptual process helps to gain the information about properties and elements of the environment that are critical to our survival. Perception not only creates experience of the world around; it allows acting within the environment.

Perception includes the five senses; touch, sight, taste smell and taste. It also includes what is known as proprioception, a set of senses involving the ability to detect changes in body positions and movements. It also involves the cognitive processes required to process information, such as recognizing the face of a friend or detecting a familiar scent.

The perceptual process is a sequence of steps that begins with the environment and leads the perception of a stimulus and an action in response to the stimulus. This process is continual, but spends great time thinking about the actual process that occurs when he/ she perceive the many stimuli that surround him/ her at any given moment.

The process of transforming the light that falls on the retinas into an actual visual image happens unconsciously and automatically. The subtle changes in pressure against the skin that allow to feel object occur without a single thought. The perception process can be explained as follows:

The Steps in the Perceptual Process are

1. The Environmental Stimulus
2. The Attended Stimulus
3. The Image on the Retina
4. Transduction
5. Neural Processing
6. Perception

7. Recognition
8. Action

1. **The Environmental Stimulus**

   The world is full of stimuli that can attract the attention through various senses. The environmental stimulus is everything in the environment that has the potential to be perceived. This might include anything that can be seen, touched, tasted, smelled or heard. It might also involve the sense of proprioception, such as the movements of the arms and legs or the change in position of the body in relation to objects in the environment.

2. **The Attended Stimulus**

   The attended stimulus is the specific object in the environment on which attention is focused. In many cases, the focus on stimuli that is familiar is, such as the face of a friend in a crowd of strangers at the local coffee shop.

3. **The Image on the Retina**

   Next, the attended stimulus is formed as an image on the retina. The first part of this process involves the light actually passing through the cornea and pupil and onto the lens of the eye. The cornea helps focus the light as it enters the eye, and the iris of the eye controls the size of the pupils in order to determine how much light to let in. The cornea and lens act together to project an inverted image on the retina. The image on the retina is actually upside down from the actual image in the environment. At this stage of the perceptual process, this is not terribly important. The image has still not been perceived, and this visual information will be changed even more dramatically in the next step of the process.

4. **Transduction**

   The image on the retina is then transformed into electrical signals in a process known as transduction. This allows the visual messages to be transmitted to the brain to be interpreted. The retina contains many photoreceptor cells. These cells contain proteins known as rods and cones. Rods are primarily for seeing things in low light, while cones are associated with detecting colour and shapes at normal light levels. The rods

and cones contain a molecule called retinal, which is responsible for transducing the light into visual signals that are then transmitted via nerve impulses.

5. **Neural Processing**

   The electrical signals then undergo neural processing. The path followed by a particular signal depends on what type of signal it is (i.e. an auditory signal or a visual signal). Through the series of interconnect neurons located throughout the body, electrical signals are propagated from the receptors cells to the brain.

6. **Perception**

   In this step of the perception process, the stimulus object in the environment is perceived.

7. **Recognition**

   Perception doesn't just involve becoming consciously aware of the stimuli. It is also necessary that the brain to categorize and interpret what it is sensing. The ability to interpret and give meaning to the object is the next step, known as recognition.

8. **Action**

   The final step of the perceptual process involves some sort of action in response to the environmental stimulus. This could involve a variety of actions, such as turning your head for a closer look or turning away to look at something else.

CASE STUDY 1

PHYSICIAN'S PERCEPTION ON EHR

International Institute of Health Management Research, New Delhi

2013

INTRODUCTION

Electronic Health Record (EHR) systems have the potential to bring huge benefits to patients and are being implemented in health systems across the developed world. Storing and sharing health information electronically can speed up clinical communication, reduce the number of errors, and assist doctors in diagnosis and treatment. Patients can have more control of their own healthcare. Electronic data also have vast potential to improve the quality of healthcare audit and research. However, increasing access to data

through EHR systems also brings new risks to the privacy and security of health records. But the success of any EHR Implementation depends on the Acceptance by Physicians and other healthcare professionals.

OBJECTIVE

To study the physicians perception on EHR.

RATIONALE OF THE STUDY

Despite the positive effects of EMR usage in medical practices, the adoption rate of such systems is still low and meets resistance from physicians. The process of EMR implementation should be treated as a change project, and led by implementers or change managers, in medical practices. The quality of change management plays an important role in the success of EMR implementation.

Despite the high expectations and interest in EMRs worldwide, their overall adoption rate is relatively low and they face several problems. They are seen as contrary to a physician's traditional working style, they require a greater capability in dealing with computers and installing a system absorbs considerable financial resources. According to Meinert, the slow rate of adoption suggests that resistance among physicians must be strong because physicians are the main frontline user-group of EMRs. Whether or not they support and use EMRs will have a great influence on other user-groups in a medical practice, such as nurses and administrative staff. As a result, physicians have a great impact on the overall adoption level of EMRs.

Therefore, the rationale of this study is to study the impact of factors which affect perception by physicians to the adoption of Electronic Medical Records (EMRs).

STUDY DESIGN

The study is divided in following stages**:**

- Survey Physicians
- Compilation of the data and data analysis.

METHODOLOGY

Survey was conducted among Physicians who were trained for CPRS.

Sample Size

A sample size of 30 physicians was taken randomly from a sample of 40 Physicians who have undergone training on CPRS to evaluate their perception of the CPRS/ EHR.

Questionnaire

A well-structured questionnaire in English was used for the purpose of primary data collection. Close ended questions were included in the questionnaire. The questions were related to computer awareness as well as EHR.

- Sample was taken by convenience sampling.
- Physician team covered were :
  - ✓ Junior Residents
  - ✓ Senior Residents
  - ✓ Consultants
  - ✓ Specialists

Procedure

- The data collection was chiefly done using the primary sources.
- The data collection was carried out through the help of questionnaire in the field.
- To collect data using primary sources one can go for several methods such as observation, interview and questionnaire.
- The method undertaken in this study was questionnaire as it was apt for the project.

RESULTS AND ANALYSIS

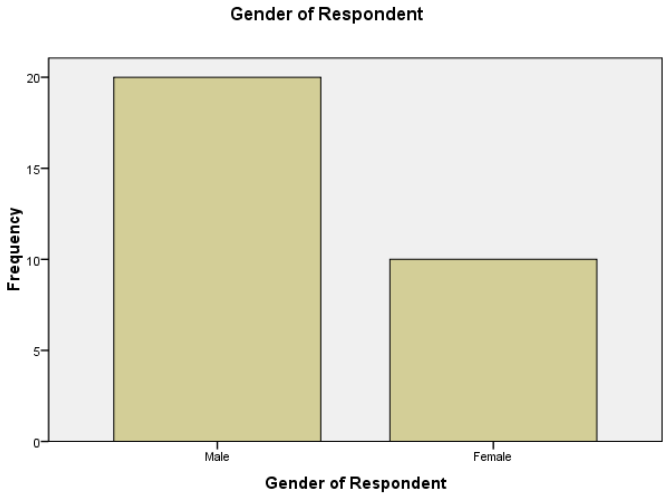
Observations

- In this survey out of the 30 respondents, 20 were male physicians and 10 were female physicians. & 12 physicians were below the age of 30 years and only 3 above the age of 60 years.

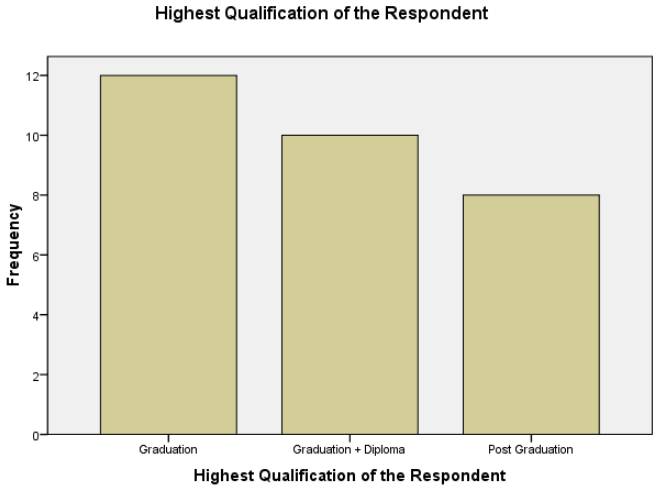
- Out of the 30 respondents, majority were graduates with only 8 with post graduate physicians.
- 29 out of 30 physicians responded agreed that computers are effective in delivering quality healthcare.
- 10 physicians out of the 30 surveyed were not satisfied with the CPRS training delivered.
- 20 physicians were having the opinion that using of EHR will increase their workload.
- Only 10 out of the 30 physicians surveyed did not find EHR user friendly. However majority agreed.
- 22 physicians were convinced and responded that EHR is useful and will help them in their work.
- Main concern of the hospitals is usually medication errors, 20 physicians agreed that using of EHR will reduce the medication errors by the system generated alerts.
- Out of the 30 physicians, 16 use computer in daily life and 13 don't find difficulty in using computers whereas 14 physicians who don't use computer daily, all the 14 found difficulty in using computer during EHR training.
- Out of the 17 physicians who had difficulty in using computers, 10 agreed that EHR is user friendly whereas 7 did not agree.

Gender of Respondent

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	20	66.7	66.7	66.7
	Female	10	33.3	33.3	100.0
	Total	30	100.0	100.0	

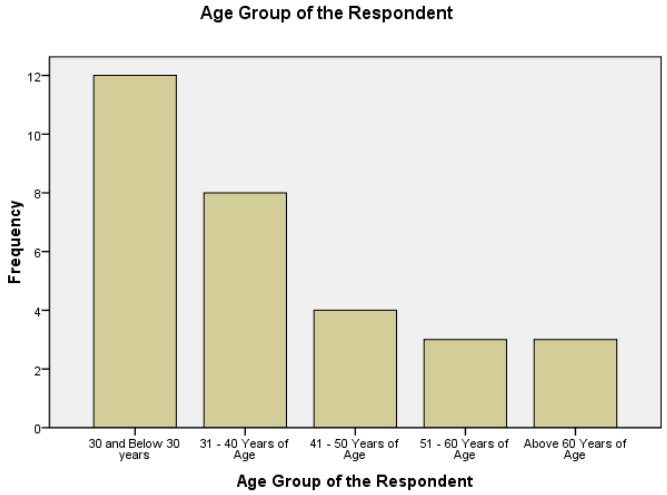


HQ Highest Qualification of the Respondent					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Graduation	12	40.0	40.0	40.0
	Graduation + Diploma	10	33.3	33.3	73.3
	Post Graduation	8	26.7	26.7	100.0
	Total	30	100.0	100.0	

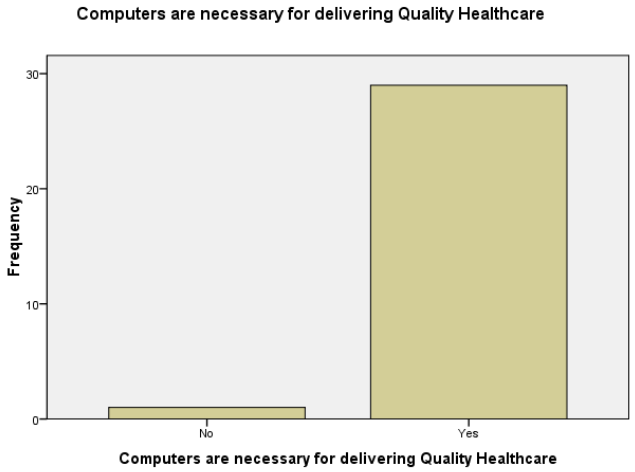


Age Group of the Respondent					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	30 and Below 30 years	12	40.0	40.0	40.0
	31 - 40 Years of Age	8	26.7	26.7	66.7
	41 - 50 Years of Age	4	13.3	13.3	80.0

	51 - 60 Years of Age	3	10.0	10.0	90.0
	Above 60 Years of Age	3	10.0	10.0	100.0
	Total	30	100.0	100.0	

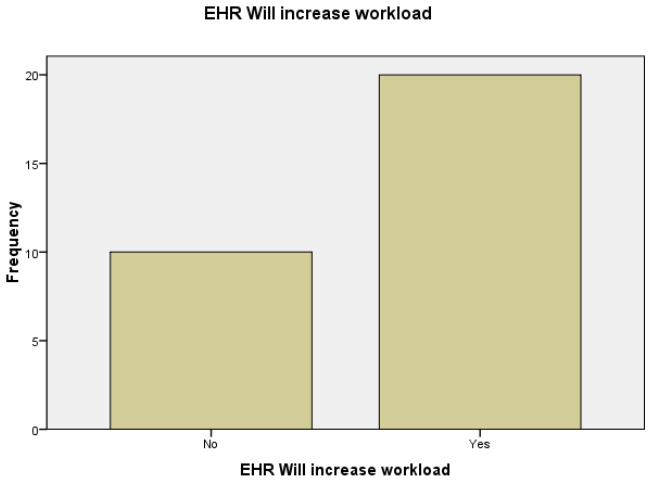


Computers are necessary for delivering Quality Healthcare					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	1	3.3	3.3	3.3
	Yes	29	96.7	96.7	100.0
	Total	30	100.0	100.0	

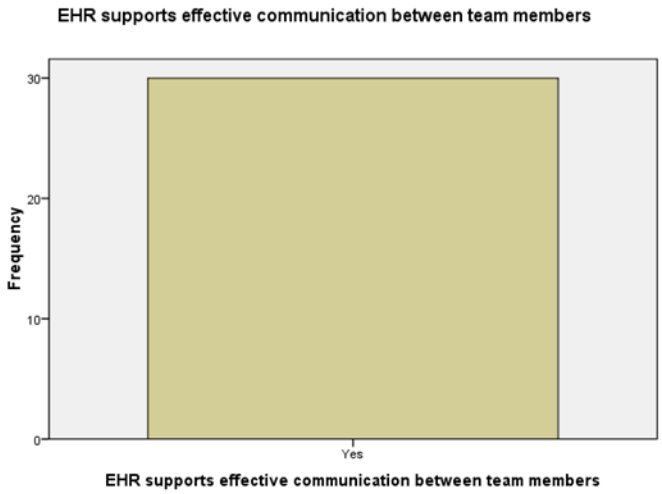


Satisfied with EHR Training Received					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	10	33.3	33.3	33.3
	Yes	20	66.7	66.7	100.0
	Total	30	100.0	100.0	

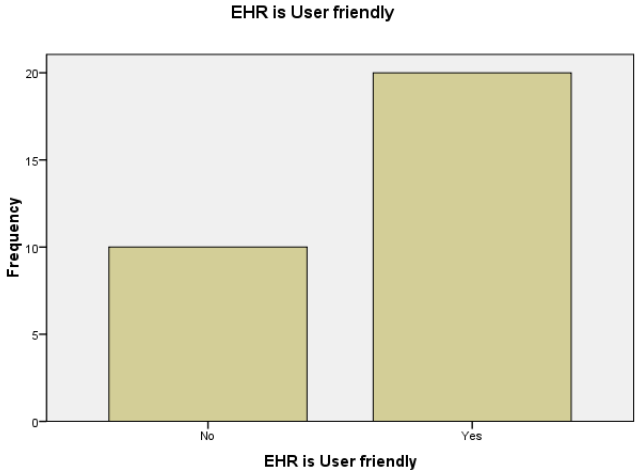
EHR Will increase workload					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	10	33.3	33.3	33.3
	Yes	20	66.7	66.7	100.0
	Total	30	100.0	100.0	



EHR supports effective communication between team members					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	30	100.0	100.0	100.0

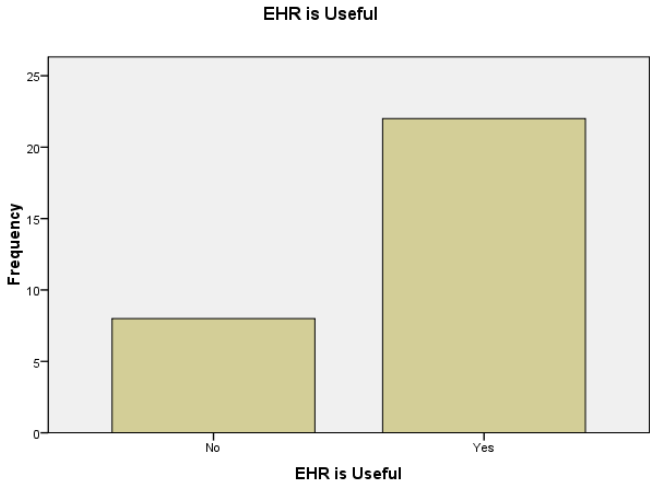


EHR is User friendly					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	10	33.3	33.3	33.3
	Yes	20	66.7	66.7	100.0
	Total	30	100.0	100.0	

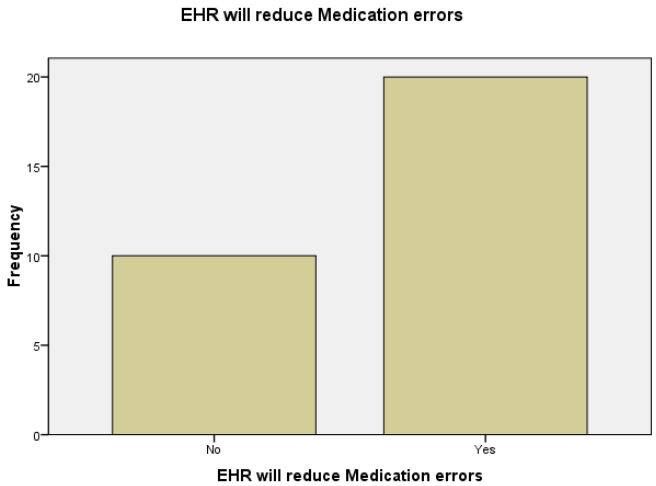


EHR is Useful					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	8	26.7	26.7	26.7

	Yes	22	73.3	73.3	100.0
	Total	30	100.0	100.0	

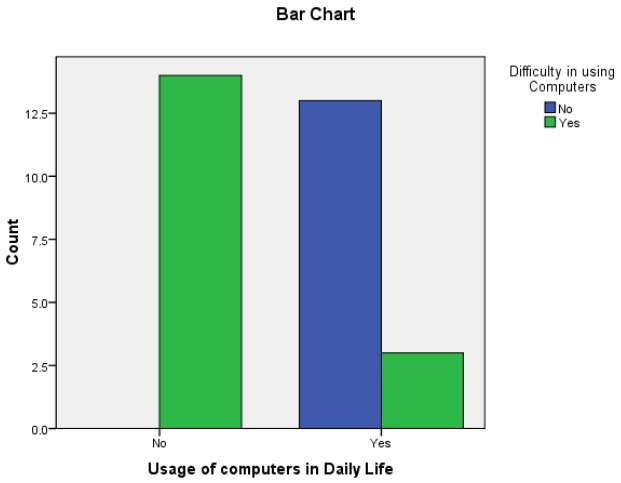


EHR will reduce Medication errors					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	10	33.3	33.3	33.3
	Yes	20	66.7	66.7	100.0
	Total	30	100.0	100.0	

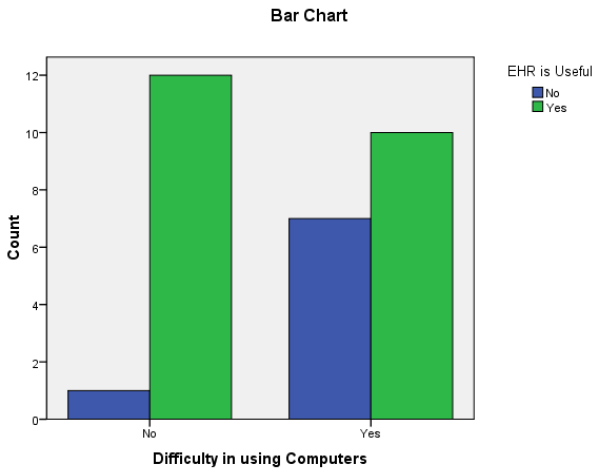


Usage of computers in Daily Life * Difficulty in using Computers Crosstabulation			
Count			
		Difficulty in using Computers	Total
		No	Yes	

Usage of computers in Daily Life	No	0	14	14
	Yes	13	3	16
Total		13	17	30



Difficulty in using Computers * EHR is Useful Crosstabulation				
Count				
		EHR is Useful		Total
		No	Yes	
Difficulty in using Computers	No	1	12	13
	Yes	7	10	17
Total		8	22	30



DISCUSSION

From the study, we can conclude that physician's perception about EHR is dependent on usage of computers in daily life and not dependent on factors like age, gender, highest qualification. Most of the physicians have a perception that EHR implementation will increase the workload. This is because most of the physicians lack basic computer skills. This can be achieved by giving a basic computer awareness program before EHR training. Even if, most of the physicians think EHR increases their workload, but they think it is going to increase the quality of healthcare delivered, there will be an effective communication between the team members.

RECOMMENDATIONS

- More change management efforts should be made so that the physicians develop a positive attitude.
- The new workarounds should be discussed with them so that they develop interest.
- Regular feedbacks should be taken while training and later suitable changes should be made.
- Before initiating the CPRS training an orientation process should be carried out regarding the entire EHR.
- The training sessions should be scheduled so that its comfortable for their staff to attend.
- Identify the right super user or train the trainer.
- Train the super user on all the modules that are going to be implemented and make them thorough with the downtime policies.
- All the training session should include hands on practice.
- We recommend hereby that all the physicians and nurses have to practice on HER with patient's case sheet.
- Benefits of the new system has to be communicated to all the users of the hospital.

ANNEXURE

Physician Perception on Electronic Health Records

1) Respondent No :
2) Gender : Male __ Female__
3) Age Group :
    a) __ Under 30 years of age
    b) __ 30 – 39 years of age
    c) __ 40 - 49 years of age
    d) __ 50- 59 years of age
    e) __ Above 60 years of age

4) Qualification :
    a) __ Graduation
    b) __ Post Graduation / PG Diploma
    c) __ PG + Super Specialisation
5) Do you use computers in your daily life Yes / No
6) Do you find difficulty in using computers Yes / No
7) How often do you use computers
    a) Daily
    b) Once in 3 days
    c) Weekly
    d) Once in a fortnight
    e) Monthly Once
8) Do you have access to Internet Yes/ No
   If Yes, then where:
    a) Home
    b) Work
    c) Internet Café
9) For what purpose do you use Internet
    a) Email
    b) Drug Information
    c) Journals
    d) Literature
10) Do you think computers are necessary for delivering Quality Healthcare Yes / No
11) Are you satisfied with the EHR Training you have received Yes / No
12) Do you think EHR will increase your workload Yes / No
13) Do you think EHR supports effective communication between team members Yes / No
14) Do you think EHR is User friendly Yes / No
15) Do you think EHR is Useful Yes/ No
16) Do you think EHR will reduce Medication errors Yes/No

CASE STUDY 2

NURSES PERCEPTION ON EHR

International Institute of Health Management Research, New Delhi

2013

INTRODUCTION

The implementation and use of EHR technology have raised numerous challenges, including enduser acceptance. In complex healthcare environments it is important to understand end-user perceptions of the usability, usefulness, and acceptance of the technology. Most research on EHR acceptance has focused on physicians less is known about nurses' acceptance of EHR technology and its different functionalities. Some challenges to acceptance and use may be temporary and visible only during the short-term adaptation phase that immediately follows implementation. But the success of any EHR implementation depends on the Acceptance by Nurses and other healthcare professionals.

OBJECTIVE

To study the nurses perception on EHR.

RATIONALE OF THE STUDY

The push toward implementation of electronic health records (EHR) has raised issues related to the acceptance of the technology. This is particularly important where nurses experience high workload. Patient care is critical and complex, decisions often need to be made quickly, and interventions must be implemented in a timely manner. In this study, we report data on EHR acceptance nurses and analyze factors related to design and implementation of the technology that can contribute to acceptance.

STUDY DESIGN

The study is divided in following stages**:**

- Survey Nurses
- Compilation of the data and data analysis.

METHODOLOGY

Survey was conducted among Nurses who were trained for CPRS.

Sample Size

A sample size of 30 nurses was taken randomly from a sample of 50 Nurses who have undergone training on CPRS to evaluate their perception of the CPRS/ EHR.

Questionnaire

A well-structured questionnaire in English was used for the purpose of primary data collection. Close ended questions were included in the questionnaire. The questions were related to computer awareness as well as EHR.

- Sample was taken by convenience sampling.
- Nurses team covered were :
  - ✓ Staff Nurse
  - ✓ Senior Staff Nurse
  - ✓ Team Leader
  - ✓ Nursing Supervisor
  - ✓ Infection Control Nurse
  - ✓ Assistant Nursing Superintendent

Procedure

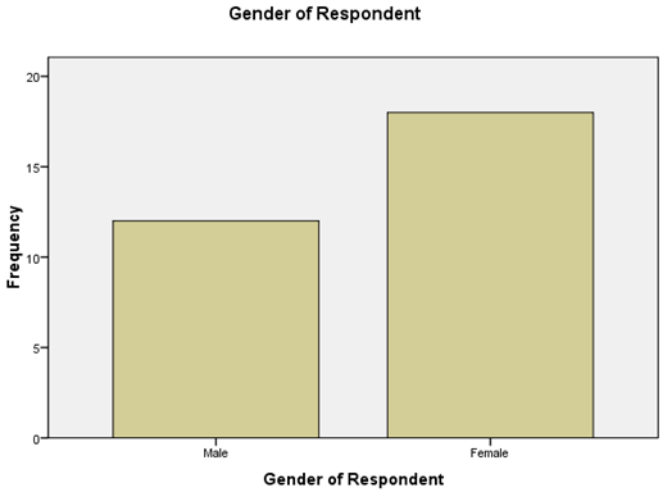
- The data collection was chiefly done using the primary sources.
- The data collection was carried out through the help of questionnaire in the field.
- To collect data using primary sources one can go for several methods such as observation, interview and questionnaire.
- The method undertaken in this study was questionnaire as it was apt for the project.

RESULTS AND ANALYSIS

Observations

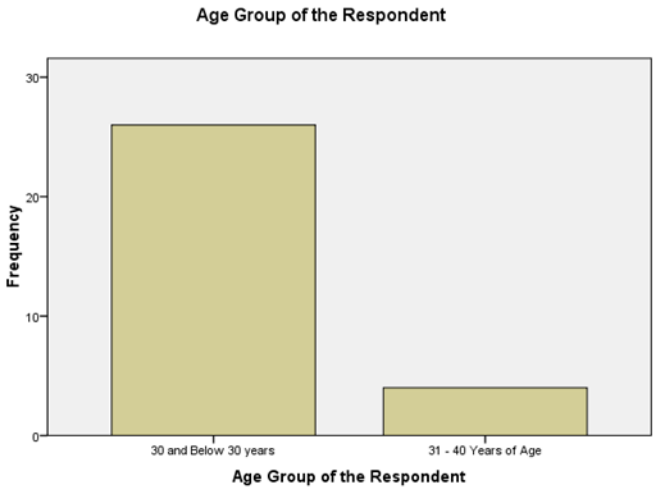
- In this survey out of the 30 respondents, 12 were male nurses and 18 were female nurses. & 26 nurses were below the age of 30 years and only 4 between the age of 31-40 years.
- Out of the 30 respondents, majority were diploma holders and only 8 were graduates.
- 22 out of 30 nurses responded agreed that computers are effective in delivering quality healthcare.
- 23 nurses out of the 30 surveyed were satisfied with the CPRS training delivered.
- All 30 nurses were having the opinion that using of EHR will increase their workload.
- Only 5 out of the 30 nurses surveyed found EHR user friendly. However majority disagreed.
- Only 11 nurses were convinced and responded that EHR is useful and will help them in their work.
- Main concern of the hospitals is usually medication errors, 27 nurses agreed that using of EHR will reduce the medication errors by the system generated alerts.
- Out of the 30 nurses, 27 use computer in daily life and 5 don't find difficulty in using computers.
- Out of the 5 nurses who had difficulty in using computers, all the 5 agreed that EHR is not user friendly.

Gender of Respondent					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	12	40.0	40.0	40.0
	Female	18	60.0	60.0	100.0
	Total	30	100.0	100.0	

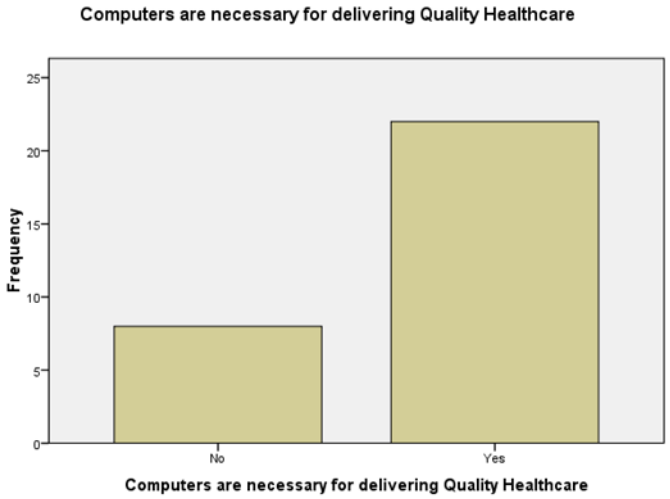


Highest Qualification of the Respondent					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Diploma	22	73.3	73.3	73.3
	Graduation	8	26.7	26.7	100.0
	Total	30	100.0	100.0	

Age Group of the Respondent					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	30 and Below 30 years	26	86.7	86.7	86.7
	31 - 40 Years of Age	4	13.3	13.3	100.0
	Total	30	100.0	100.0	

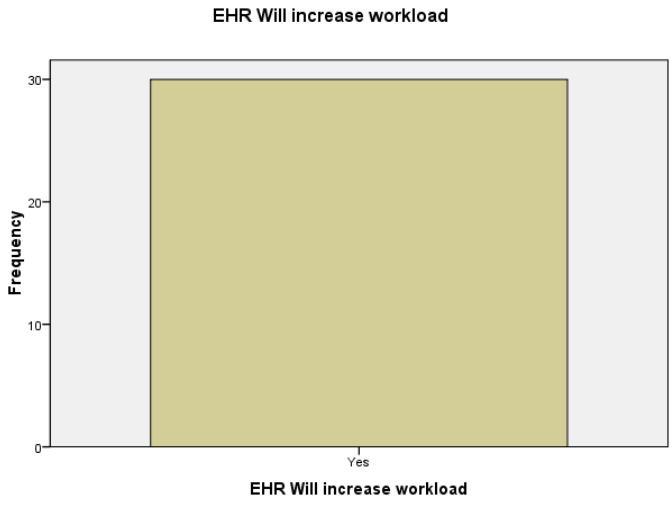


Computers are necessary for delivering Quality Healthcare					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	8	26.7	26.7	26.7
	Yes	22	73.3	73.3	100.0
	Total	30	100.0	100.0	

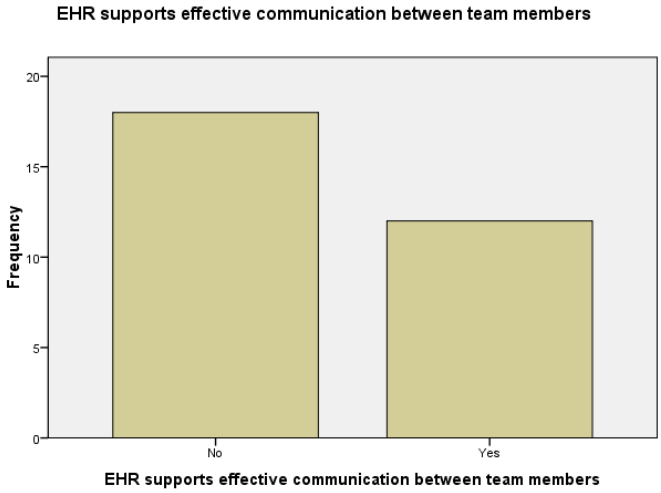


Satisfied with EHR Training Received					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	7	23.3	23.3	23.3
	Yes	23	76.7	76.7	100.0
	Total	30	100.0	100.0	

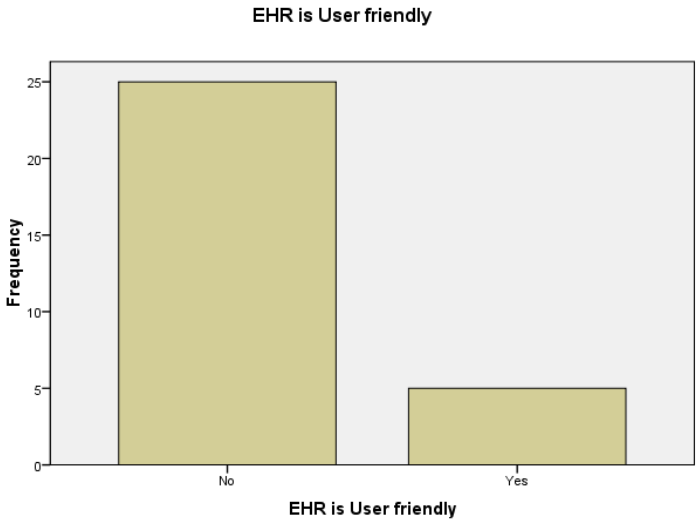
EHR Will increase workload					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	30	100.0	100.0	100.0



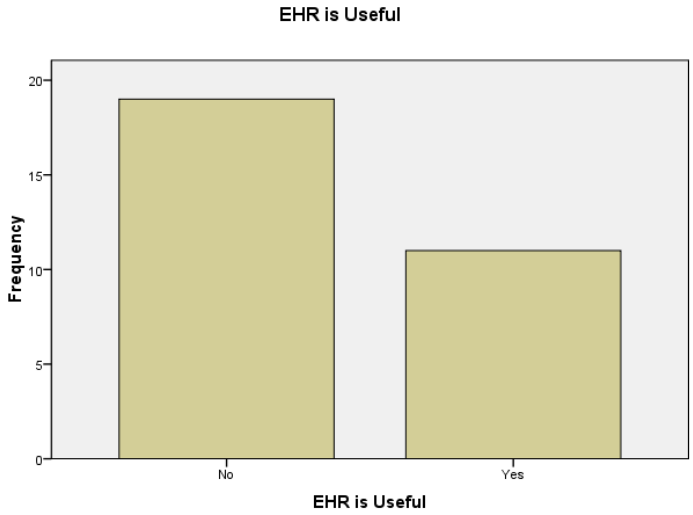
EHR supports effective communication between team members					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	18	60.0	60.0	60.0
	Yes	12	40.0	40.0	100.0
	Total	30	100.0	100.0	



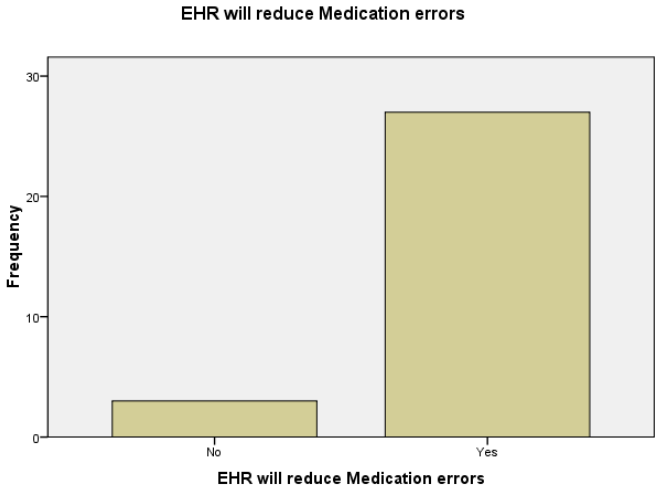
EHR is User friendly					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	25	83.3	83.3	83.3
	Yes	5	16.7	16.7	100.0
	Total	30	100.0	100.0	



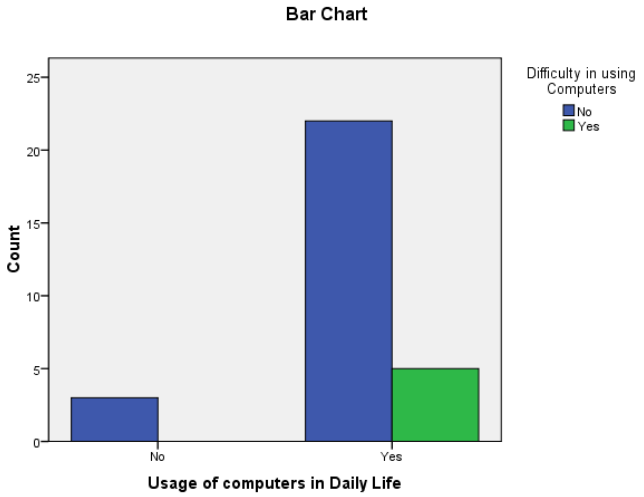
EHR is Useful					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	19	63.3	63.3	63.3
	Yes	11	36.7	36.7	100.0
	Total	30	100.0	100.0	



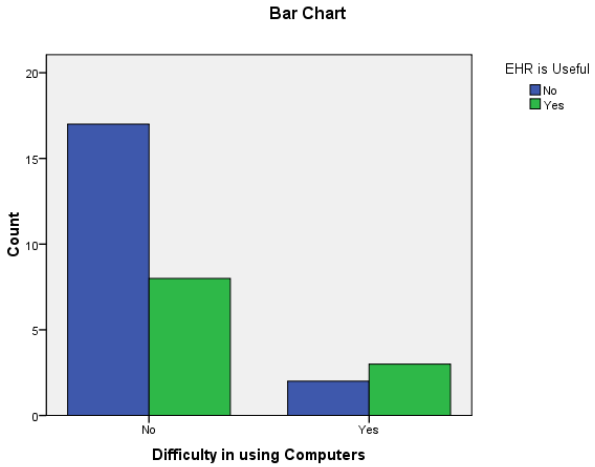
EHR will reduce Medication errors					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	3	10.0	10.0	10.0
	Yes	27	90.0	90.0	100.0
	Total	30	100.0	100.0	



Usage of computers in Daily Life * Difficulty in using Computers Crosstabulation				
Count				
		Difficulty in using Computers		Total
		No	Yes	
Usage of computers in Daily Life	No	3	0	3
	Yes	22	5	27
Total		25	5	30



Difficulty in using Computers * EHR is Useful Crosstabulation				
Count				
		EHR is Useful		Total
		No	Yes	
Difficulty in using Computers	No	17	8	25
	Yes	2	3	5
Total		19	11	30



DISCUSSION

As the hospital was using HIS and nurses were use to this HIS, most of them don't find any difficulty in using computers. The training session for nurses was planned for 5 days where there was more teaching and very limited hands on training. Owing to that most of the nurses didn't find EHR user friendly or useful. Perception is dependent on prior computer skills and training which they received.

RECOMMENDATIONS

- More change management efforts should be made so that the physicians develop a positive attitude.
- The new workarounds should be discussed with them so that they develop interest.
- Regular feedbacks should be taken while training and later suitable changes should be made.
- Before initiating the CPRS training an orientation process should be carried out regarding the entire EHR.
- The training sessions should be scheduled so that its comfortable for their staff to attend.
- Identify the right super user or train the trainer.
- Train the super user on all the modules that are going to be implemented and make them thorough with the downtime policies.
- All the training session should include hands on practice.
- We recommend hereby that all the physicians and nurses have to practice on EHR patient's case sheet.
- Benefits of the new system has to be communicated to all the users of the hospital.

ANNEXURE

Nurses Perception on Electronic Health Records

1. Respondent No :
2. Gender : Male __ Female__
3. Age Group :
   a) __ Under 30 years of age
   b) __ 30 – 39 years of age
   c) __ 40 - 49 years of age
   d) __ 50- 59 years of age
   e) __ Above 60 years of age
4. Qualification :
   a) __ Graduation
   b) __ Post Graduation / PG Diploma
   c) __ PG + Super Specialisation
5. Do you use computers in your daily life Yes / No
6. Do you find difficulty in using computers Yes / No
7. How often do you use computers
   a. Daily
   b. Once in 3 days
   c. Weekly
   d. Once in a fortnight
   e. Monthly Once
8. Do you have access to Internet Yes/ No
   If Yes, then where:
   a. Home
   b. Work
   c. Internet Café
9. For what purpose do you use Internet
   a. Email
   b. Drug Information
   c. Journals
   d. Literature
10. Do you think computers are necessary for delivering Quality Healthcare Yes / No
11. Are you satisfied with the EHR Training you have received Yes / No
12. Do you think EHR will increase your workload Yes / No
13. Do you think EHR supports effective communication between team members Yes/No
14. Do you think EHR is User friendly Yes / No
15. Do you think EHR is Useful Yes/ No
16. Do you think EHR will reduce Medication errors Yes / No

CASE STUDY 3

COMPARISON STUDY

Comparison between the Physician and Nurses Perception on EHR

International Institute of Health Management Research, New Delhi

2012

COMPARISON BETWEEN THE PHYSICIAN AND NURSES PERCEPTION ON EHR

From the previous case studies done on the Physician and Nurses perception on EHR, the data collected was compared and analysed to see how the perception varies with category. The following observations have been made:-

	Comparison of Responses - Physicians and Nurses		
	(Respondents given response ' Yes ' for following Questions)	**Category**	
	Questions	Physicians	Nurses
Q10	Computers are necessary for delivering Quality Healthcare	29	22
Q11	Satisfied with EHR Training Received	20	23
Q12	EHR Will increase workload	20	30
Q13	EHR supports effective communication between team members	30	12
Q14	EHR is User friendly	20	5
Q15	EHR is Useful	22	11
Q16	EHR will reduce Medication errors	20	27

For the questions from 10 to 16, the following responses were recorded. A major contradiction is seen with the EHR being user friendly. 20 physicians found it to be user friendly in contrast of just 5 nurses finding it user friendly. That could possibly be because the lack of basic training of computer usage. Also, it was observed that only 11 out of the 30 nurses considered EHR to be useful in contrast to 22 physicians who were of the opinion that it will be useful.

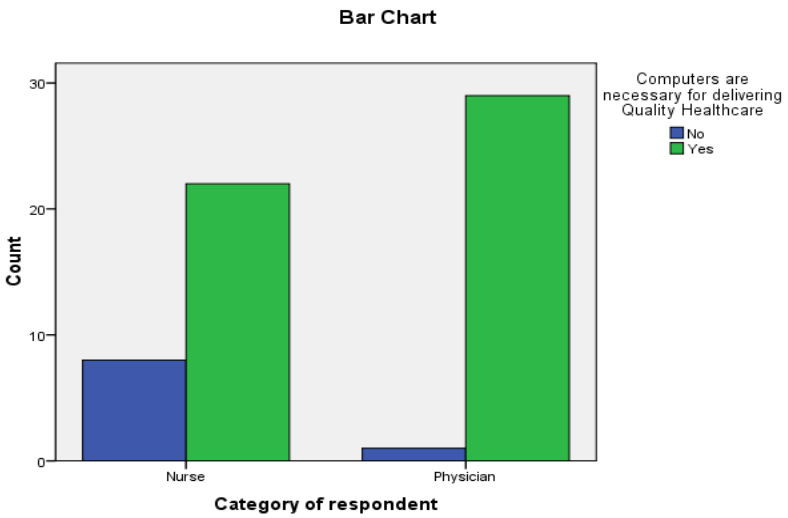
The cross tabulations resulted in the following **observations:**

1. A positive response is seen from both the categories i.e. the physicians and the nurses that EHR is useful in delivering quality healthcare.
2. An approximately equal number of physicians and nurses were not satisfied with the EHR training received which can be accounted for not giving the basic computer training before starting the EHR training and other modules.
3. An important observation was regarding the EHR increasing the workload. All the 30 nurses interviewed were of the opinion that using of EHR will increase their workload and about 20 physicians of the 30 also responded the same.

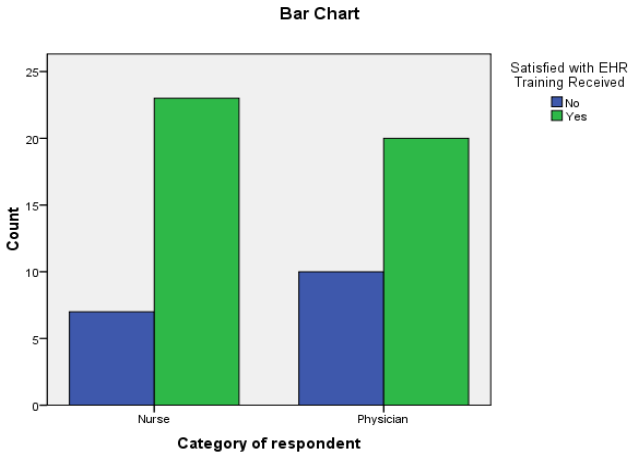
4. All the physician respondents responded that the EHR will help in effective communication between the team members however the nurse's respondents gave a mixed review.
5. Most of the physicians were quite positive about the EHR being useful and user friendly, however the nursing respondents were not.
6. The nurse's respondents were of the strong opinion that using EHR will reduce medication errors with 27 nurses saying yes. This can be accounted to the otherwise medication errors caused due to similar sounding drugs and poor handwriting of the physicians.

CROSS TABULATIONS

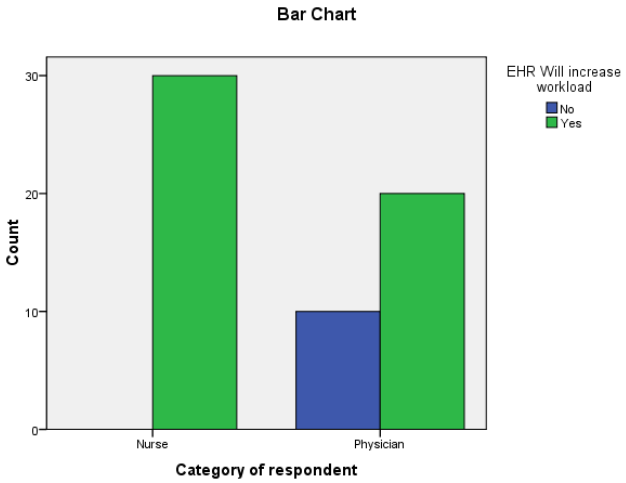
Category Category of respondent * Q10 Computers are necessary for delivering Quality Healthcare Crosstabulation				
Count				
		Computers are necessary for delivering Quality Healthcare		Total
		No	Yes	
Category of respondent	Nurse	8	22	30
	Physician	1	29	30
Total		9	51	60



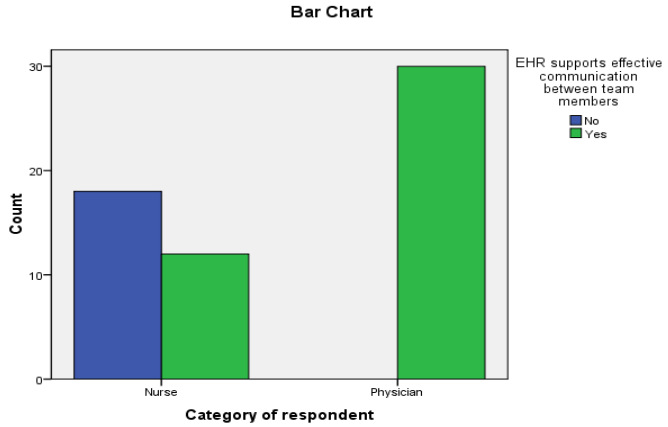
Category Category of respondent * Q11 Satisfied with EHR Training Received Crosstabulation				
Count				
		Satisfied with EHR Training Received		Total
		No	Yes	
Category of respondent	Nurse	7	23	30
	Physician	10	20	30
Total		17	43	60



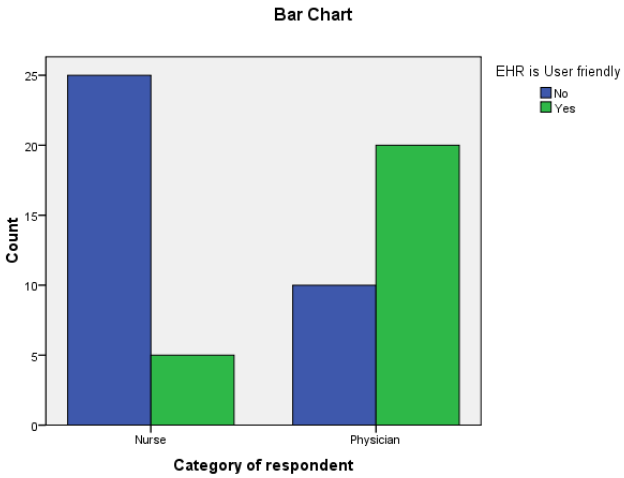
Category Category of respondent * Q12 EHR Will increase workload Crosstabulation				
Count				
		EHR Will increase workload		Total
		No	Yes	
Category of respondent	Nurse	0	30	30
	Physician	10	20	30
Total		10	50	60



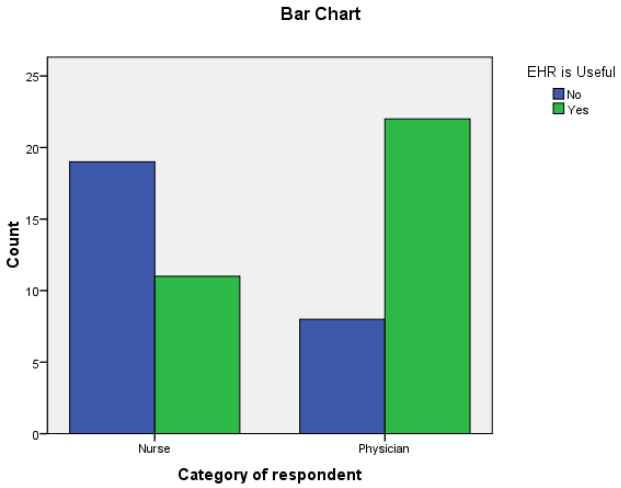
Category Category of respondent * Q13 EHR supports effective communication between team members Crosstabulation				
Count				
		EHR supports effective communication between team members		Total
		No	Yes	
Category of respondent	Nurse	18	12	30
	Physician	0	30	30
Total		18	42	60



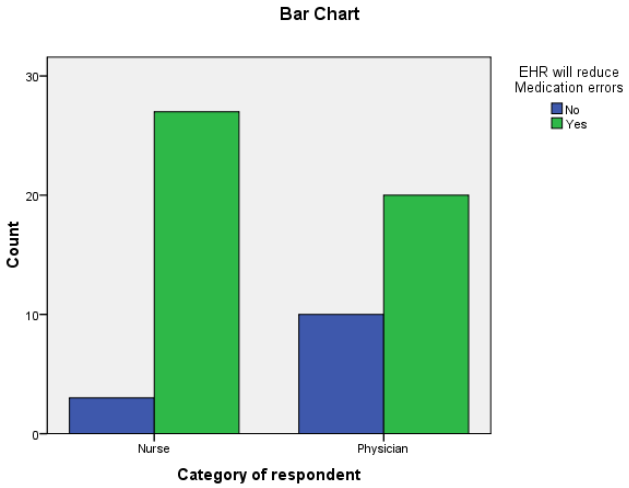
Category Category of respondent * Q14 EHR is User friendly Crosstabulation				
Count				
		EHR is User friendly		Total
		No	Yes	
Category of respondent	Nurse	25	5	30
	Physician	10	20	30
Total		35	25	60



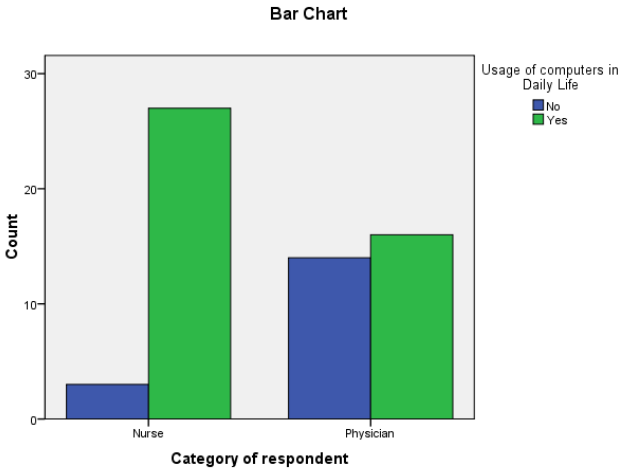
Category Category of respondent * Q15 EHR is Useful Crosstabulation				
Count				
		EHR is Useful		Total
		No	Yes	
Category of respondent	Nurse	19	11	30
	Physician	8	22	30
Total		27	33	60



Category Category of respondent * Q16 EHR will reduce Medication errors Crosstabulation				
Count				
		EHR will reduce Medication errors		Total
		No	Yes	
Category of respondent	Nurse	3	27	30
	Physician	10	20	30
Total		13	47	60



Category Category of respondent * Comp_Daily Usage of computers in Daily Life Crosstabulation				
Count				
		Usage of computers in Daily Life		Total
		No	Yes	
Category of respondent	Nurse	3	27	30
	Physician	14	16	30
Total		17	43	60



DISCUSSION

In this we will discuss the main findings of this case study and how they are connected to the existing literature on acceptance of EHR. From the above comparison, it can be said that qualification and usage of computer in daily life are critical determinants of the perception. These factors directly or indirectly reflect on the responses and thereby help in providing recommendations to bring about the change. However it is observed that both the physicians and nurses believe that EHR usage will increase their workload. It can be attributed to the fact that in the following months the perception will change as the respondents will get use to the software or if the basic computer training is given first followed by the EHR training.

This case study also indicates that there are other external factors governing the acceptance of EHR by the physicians and nurses.

CONCLUSION

Throughout the world there has been a paradigm shift where healthcare sector have realized the importance of using ICT in hospitals & other healthcare organizations. It is believed that it will embrace the goal to deliver high quality care with greater efficiency & accuracy. ICT includes a set of effective tools to collect, store, process & exchange health related information. It is believed that ICT could improve safety, quality & cost efficiency of healthcare services. It may happen that depending upon the treatment the patient may have to visit multiple providers throughout the treatment. This requires timely & efficient exchange of information. With ICT in place in the clinical setting , the issue of efficient exchange of information can be easily mitigated. However, implementation of ICT in the healthcare setting is a major challenge. To make ICT implementation a success in a clinical setting, one of the most important factor is the acceptance & use of ICT in the same.

The aim of the study was to study the perception about EHR and to identify how these influence the attitude of the healthcare professionals i. e physicians & nurses towards the acceptance of EHR.

The attitude in turn is being positively influenced by the perception.

LESSONS LEARNED

- Success of Implementation is directly related to end user interest and commitment.
- Even after providing adequate training and putting effort, issues can exist because the acceptance depends on the user attitudes and perception.
- Workflow changes/ clinical transformation are difficult in established locations.
- IT support team with sound technical and functional knowledge should be on site.
- Lack of motivation & peer influence creates reluctance to the usage of the new system.
- Lack of communication about vision & benefits creates ambiguity in the minds of users.
- Lack of infrastructure makes the users irritated.
- According to physicians more time is consumed in making records in the system.