A Study on factors influencing attitude towards acceptance of Electronic Health Records

A dissertation submitted in partial fulfillment of the requirements

for the award of

Post-Graduate Diploma in Health and Hospital Management

by

Jyotsna Khatri

Enroll. Id: PG/10/081

International Institute of Health Management Research

New Delhi -110075

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Thank You
Jyotsna Khatri
PGDHHM

IIHMR, New delhi

Certificate of Internship Completion

Date: 02nd April 2012

TO WHOM SO EVER IT MAY CONCERN

This is to certify that Ms. Jyotsna Khatri has successfully completed her 3 months internship in our organization from January 2nd ,2012 to March 30th 2012. During this internship period she has worked in Vista Projects under the guidance of me and my team at DELL Services, Sector 125, Noida- 201301.

Comments (If any):

We wish her good luck for her future assignments

Dr. Fahad Mustafa Khan
Principal Consultant
DELL Services,
Sector 125,
Noida – 201301

Certificate of Approval

The following dissertation titled "**A Study on factors influencing attitude towards acceptance of Electronic Health Records**" is hereby approved as a certified study in management. It is 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

Dr. T Muthu Kumar_____ ____ _____

Dr. Fahad Mustafa Khan _____

_____ _____

Certificate from Dissertation Advisory Committee

This is to certify that **Ms. Jyotsna Khatri**, 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 "**A Study on factors influencing attitude towards acceptance of Electronic Health Records**" 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.

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Abbreviations

1	ANNOVA	Analysis of Variance
2	BCMA	Bar coded Medication Administration
3	CDO	Care Delivery organization
4	CDSS	Clinical Decision Support System
5	CEO	Chief Executive Officer
6	CFA	Confirmatory Factor Analysis
7	COW	Computer On Wheels
8	CPR	Computerized Patient Record
9	CPRS	Computerized Patient Record System
10	EFA	Exploratory Factor Analysis
11	EMR	Electronic Medical Records
12	EHR	Electronic Health Records
13	HIPAA	Health Insurance Portability & Accountability Act
14	HIT	Health Information Technology
15	ICT	Information Communication Technology
16	IS	Information System
17	IT	Information technology
18	MAR	Medical Administration Record
19	MUMPS	Massachusetts General Hospital Utility Multi Programming System
20	PACS	Picture Archival & Communication System
21	PHR	Patient Health Record
22	R & D	Research & Development
23	SPSS	Statistical Package for Social Sciences
24	SWOT	Strength Weakness Opportunities & Threats
25	TAM	Technology Acceptance Model
26	VA	Veteran Affairs
27	VHA	Veteran Health Affairs
28	VistA	Veteran Health Information Systems & Technology Architecture

Part 1 :Internship Report

(2nd January 2012 – 30th March 2012)

1.1.Organizational Overview

Dell Inc. (Dell) is a global information technology company that offers its customers a range of solutions and services delivered directly by Dell and through other distribution channels. Dell is a holding company that conducts its business worldwide through its subsidiaries. Dell Inc. was founded in 1984 and is headquartered in Round Rock, Texas.

Dell traces its origins to 1984; when Michael Dell created PCs Limited while a student at the University of Texas at Austin. The dorm-room headquartered company sold IBM PC-compatible computers built from stock components. Dell dropped out of school in order to focus full-time on his fledgling business, after getting about $300,000 in expansion-capital from his family.

In 1985, the company produced the first computer of its own design, the "Turbo PC", which sold for US$795. PCs Limited advertised its systems in national computer magazines for sale directly to consumers and custom assembled each ordered unit according to a selection of options. The company grossed more than $73 million in its first year of operation.

The company changed its name to "Dell Computer Corporation" in 1988 and began expanding globally. In June 1988, Dell's market capitalization grew by $30 million to $80 million from its June 22 initial public offering of 3.5 million shares at $8.50 a share. In 1992, Fortune magazine included Dell Computer Corporation in its list of the world's 500 largest companies, making Michael Dell the youngest CEO of a Fortune 500 company ever.

Dell has grown by both increasing its customer base and through acquisitions since its inception; notable mergers and acquisitions including Alienware (2006) and Perot Systems (2009). As of 2009, the company sold personal computers, servers, data storage devices, network switches, software, and computer peripherals. Dell also sells HDTVs, cameras, printers, MP3 players and other electronics built by other manufacturers. The

company is well known for its innovations in supply chain management and electronic commerce.

Perot Systems was an information technology services provider founded in 1988 by a group of investors led by Ross Perot and based in Plano, Texas, United States. A Fortune 1000 corporation with offices in more than 25 countries, Perot Systems employed more than 23,000 people and had an annual revenue of $2.8 billion before its acquisition in 2009 by Dell, Inc. for $3.9 Billion.

Perot Systems provided information technology services in the industries of health care, government, manufacturing, banking, insurance and others. Perot Systems was especially strong in health care industries with services such as digitizing and automating medical records.

The integration of Perot Systems has strengthened Dell Services, expanded its portfolio of capabilities, and established a strong foundation for future growth. The combined Dell Services business unit represents almost $8 billion in annual revenue. With more than 43,000 team members working in 90 countries, Dell Services operates 60 technology support centers around the world, 36 customer data centers and provides technical support for 14 million client systems and 10,000 Software-as-a-Service (SaaS) customers. Over the past year, the Services team met or exceeded all of its integration milestones, achieving more than $100 million in cost savings in fiscal year 2011 and capturing revenue synergies of more than $150 million, both surpassing original estimates.

At February 3, 2012, it held a worldwide portfolio of 3,449 patents and had an additional 1,660 patent applications pending. The Company also holds licenses to use numerous third-party patents. The Company designs, develops, manufactures, markets, sells, and supports a range of products, solutions, and services. It also provides various customer financial services to its Commercial and Consumer customers. During fiscal year ended February 3, 2012 (fiscal 2012), Dell acquired Compellent Technologies, Inc. (Compellent), Secure Works Inc. (Secure Works), Dell Financial Services Canada Limited and Force10 Networks, Inc. (Force10). In February 2012, the Company acquired AppAssure. In April 2012, the Company acquired Clerity Solutions.

Recent plans and acquisition

- In 2006, Dell acquired Alienware, a manufacturer of high-end PCs popular with gamers.
- The company acquired EqualLogic on January 28, 2008, to gain a foothold in the iSCSI storage market. Because Dell already had an efficient manufacturing process, integrating EqualLogic's products into the company drove manufacturing prices down.
- In 2009, Dell acquired Perot Systems, based in Plano, Texas, in a reported $3.9 billion deal. Perot Systems provided Dell with applications development, systems integration, and strategic consulting services through its operations in the U.S. and 10 other countries. In addition, the acquisition of Perot brought a variety of business process outsourcing services, including claims processing and call center operations.
- On February 10, 2010, the company acquired KACE Networks a leader in Systems Management Appliances. The terms of the deal were not disclosed.
- On August 16, 2010, Dell announced plans to acquire the data storage company 3PAR. On September 2, Hewlett-Packard offered $33 a share for 3PAR, which Dell declined to match.
- On November 2, 2010, Dell acquired Software-as-a-Service (SaaS) integration leader Boomi. Terms of the deal were not disclosed.
- In February 2011 the acquisition of Compellent by Dell was completed after the initial announcement of Dell's intention to buy the company was announced on 13 December, 2010
- On Friday February 24, 2012 Dell acquired Backup and Disaster Recovery software solution AppAssure Software of Reston, VA. AppAssure delivered 194 percent revenue growth in 2011 and over 3500% growth in the prior 3 years. AppAssure supports physical servers and VMware, Hyper-V and XenServer. The deal represents the first acquisition since Dell formed its software division under former CA CEO John

Swainson. Dell added that it will keep AppAssure's 230 employees and invest in the company.

- In March 2012, USA Today said that Dell agreed to buy SonicWall, a company with 130 patents. SonicWall which develops security products, is a network and data security provider.

- On 2 April, 2012, Dell announced that it wants to acquire Wyse, global market-leader for thin client systems.

- On 3 April, 2012, Dell announced that it has acquired Clerity Solutions. Clerity, a company offering services for application (re)hosting, was formed in 1994 and has its headquarters in Chicago. At the time of the take-over approx. 70 people were working for the company.

Business Segments

The Company operates in four segments: Large Enterprise, Public, Small and Medium Business, and Consumer. The Company's Large Enterprise customers include global and national corporate businesses. Its Public customers, which include educational institutions, government, health care, and law enforcement agencies, operate in their own communities. Its SMB segment is focused on helping small and medium-sized businesses by offering products, services, and solutions. Its Consumer segment is focused on delivering technology experience of entertainment, mobility, gaming, and design.

Enterprise Solutions and Services

The Company's enterprise solutions include servers, networking, and storage products. Servers and Networking portfolio includes rack, blade, and tower servers for enterprise customers and value tower servers for small organizations, networks, and remote offices. During fiscal 2012, it expanded its Power Connect campus networking product offerings with a suite of Dell Force10 data center networking solutions. It offers a portfolio of advanced storage solutions, including storage area networks, network-attached storage, direct-attached storage, and various backup systems. During fiscal 2012, it shifted more of its portfolio of storage solutions to Dell-owned storage products.

The Company's services include a range of configurable information technology (IT) and business services, including infrastructure technology, consulting and applications, and product-related support services. The Company offers a variety of services to its customers as part of an overall solution. It offers services that are tied to the sale of its servers, storage, and client offerings. These services include support and extended warranty services, managed deployment, enterprise installation, and configuration services. Its outsourcing services include data center and systems management, network management, life cycle application development and management services, and business process outsourcing services. It also offers short-term services that address an array of client needs, including IT infrastructure, applications, business process, and business consulting.

The Company will classify its services as Support and Deployment services, Infrastructure, Cloud, and Security services, and Applications and Business Process services. Support and deployment services are tied to the sale of its servers, storage, networking and client offerings, as well as multivendor support services. Infrastructure, Cloud, and Security services may be performed under multi-year outsourcing arrangements, subscription services, or short-term consulting contracts. These services include infrastructure and security managed services, cloud computing, infrastructure consulting, and security consulting and threat intelligence. Applications services include such services as application development and maintenance, application migration and management services, package implementation, testing and quality assurance functions, business intelligence and data warehouse solutions, and application consulting services.

Software and Peripherals

The Company offers Dell-branded printers and displays and a multitude of competitively priced third-party peripheral products, such as printers, televisions, notebook accessories, mice, keyboards, networking and wireless products, digital cameras, and other products. It also sells a range of third-party software products, including operating systems, business and office applications, anti-virus and related security software, entertainment software, and products in various other categories.

Client Products

The Company offers a variety of mobility and desktop products, including notebooks, workstations, tablets, smartphones, and desktop personal computers (PCs), to its Commercial and Consumer customers. Its Latitude, Optiplex, Vostro, and Dell Precision workstation lines of mobility notebooks and desktop PCs are designed with its Commercial customers in mind. The Vostro line is designed to customize technology, services, and expertise to suit the specific needs of small businesses. It also offers the precision line of mobile and desktop workstations for professional users. During fiscal 2012, it introduced the Vostro 3000 series notebooks, and the Dell Precision M4600 and M6600 mobile workstations, and made enhancements to Dell Latitude E-family of notebooks. For its Consumer customers, it offers the Inspiron, XPS, and Alienware lines of notebooks and desktop PCs. The Company targets sales of its Alienware line to customers seeking advanced multimedia capabilities for gaming. During fiscal 2012, it introduced desktops and notebooks in each of its consumer brands, including Inspiron and XPS notebooks.

Financial Services

The Company offers or arranges various financing options and services for its Commercial and Consumer customers in the United States and Canada through Dell Financial Services (DFS). DFS offers a range of financial services, including originating, collecting, and servicing customer receivables primarily related to the purchase of Dell products. DFS offers private label credit financing programs to qualified Consumer and Commercial customers and offers leases and fixed-term financing primarily to Commercial customers. Financing through DFS is one of many sources of funding that its customers may select.

Product Development

The Company focuses on developing technologies. It employ a collaborative approach to product design and development, in which its engineers, with direct customer input, design solutions and work with a global network of technology companies to architect system designs, and integrate technologies into its products. In fiscal 2012, it opened the Dell Silicon Valley Research and Development Center, bringing the total number of global research and development centers the Company operated to 12.

Manufacturing and Materials

Third parties manufacture the client products the Company sells under the Dell brand. Its manufacturing facilities are located in Austin, Texas; Penang, Malaysia; Xiamen, China; Hortolandia, Brazil; Chennai, India, and Lodz, Poland. Its manufacturing process consists of assembly, software installation, functional testing, and quality control. Testing and quality control processes are also applied to components, parts, sub-assemblies, and systems obtained from third-party suppliers. Quality control is maintained through the testing of components, sub-assemblies, and systems at various stages in the manufacturing process.

1.2. VistA project overview

The Veterans Health Information Systems and Technology Architecture (VistA) is an enterprise-wide information system built around an electronic health record, used throughout the United States Department of Veterans Affairs (VA) medical system, known as the Veterans Health Administration (VHA).VistA, is an integrated system of software applications that directly supports patient care. By 2008, the VHA was the largest single medical system in the United States, providing care to 5 million veterans, employing 180,000 medical personnel and operating in 163 hospitals, over 800 clinics and 135 nursing homes. By providing electronic health records capability, VistA is thereby one of the most widely used EHR in the world.

The VistA system is a public domain software, available through the Freedom of Information Act directly from the VA website, or through a growing network of distributors. The VistA software alliance is a non-profit trade organization that promotes the widespread adoption of versions of VistA for a variety of provider environments. VistA is a collection of about 100 integrated software modules. Name of few modules of VistA are mentioned below

- CPRS – Computerized Patient Record System
- BCMA – Bar Coded Medication Administration Module
- Pharmacy Module
- Lab Module
- Diet Module
- Radiology Module

1.3 Learning

The internship period was from 02nd January 2012 to 30th March 2012. During this internship period worked as an intern in VistA Project.

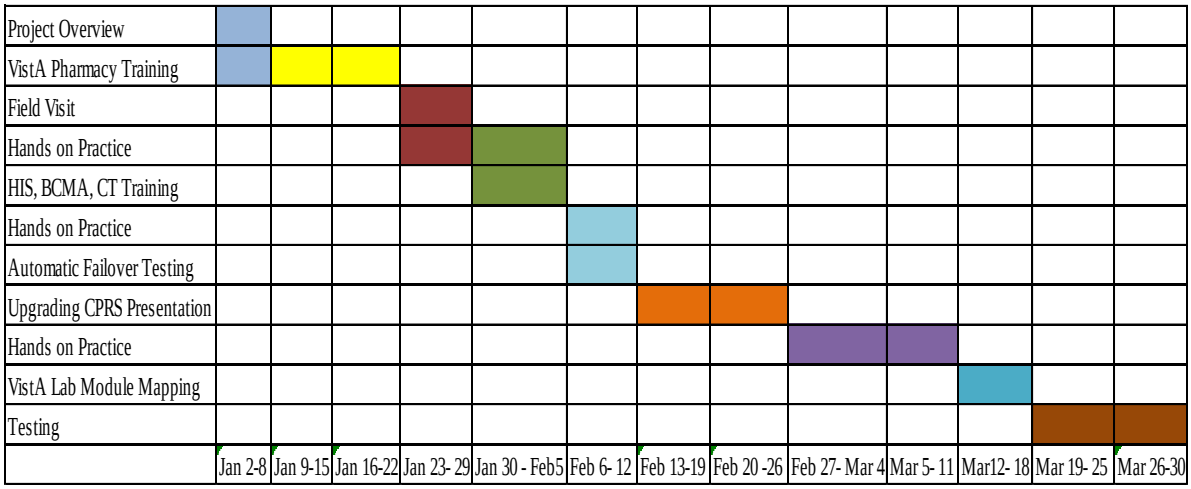

Figure 1. Gantt Chart showing work done during Internship Period

The internship period was from 02nd January 2012 to 30th March 2012. During this internship period worked as an intern in VistA Project. Received training on various modules of VistA and also Hospital Information Systems (HIS). The training was for a period of forty five days which was then followed by Hands on Practice sessions.

Initially received training on VistA Pharmacy module which included front end and back end operations. The front end operations included the verification of the orders prescribed by physicians from VistA CPRS. Verification process for inpatient, outpatient, and emergency drug orders were taught. The back end operations included drug build up, mapping of the drugs & wards etc.

After the training on VistA Pharmacy module, the ordering/ indenting process for the drugs which has reached reorder level and also general pharmacy work processes were taught. The entire VistA Pharmacy module training was for a period of 3 weeks which was followed by 4 days of hands on practice session.

At the end of first month, a field visit to the Customer site was organized to give an exact idea about the work processes and also the optimum space utilization in the department. This field visit gave the idea about the work process before Go Live. A mini knowledge assessment test was conducted by the Pharmacy Subject Matter Expert (SME).

After the training on Pharmacy process and VistA Pharmacy module, training on other modules like BCMA Module (Bar Coded Medication Administration), HIS(Hospital Information System), CPRS (Computerized Patients Record System), Diet and Laboratory module etc was given. This was followed by training on Clinical Transformation and Down Time policies.

BCMA training gave an overview about how the nurse will administer drug to the patient with Bar Code Scanner at patient bed side. The training session demonstrated most of the possible scenarios which a nurse can face while administering drug to the patient. HIS training gave entire idea about the features & functionalities present in it.

CPRS training gave idea about how the Physician works on the system. It explained how a physician enters chief complaint, allergies, examination details, places medication, lab, radiology, Admission, Discharge & Transfer orders etc. This training also included how nurses enter Assessment details, vitals and other details into the system.

After the training was completed on various modules explained above, one week of time was given for exploring and practicing on the same. This helped to understand more about the modules and the functionalities & features present in it. This Hands on training sessions gave an in depth knowledge about the various features and also to understand more about the application.

All the training sessions were very interactive which gave a chance to critically analyze various scenarios and ask questions to the trainers. Discussions during training sessions

helped to actively participate during the training sessions which helped to increase interest on VistA.

Knowledge assessment tests were conducted at the end of the training session and feedback was given on it. Feedback about the training sessions was taken after the training sessions were completed.

Support Team Operations

After implementation of VistA at the Customer site, it is important to keep it alive. It takes time to stabilize an application in any organization. It's the same with EHR. EHR deployment requires routine care and maintenance. There are numerous tasks that need to be undertaken on daily or weekly basis. Integrating EHR into an organization after a successful launch presents its own unique challenges. Continuing to ensure system integrity, organization compliance and overall usability decides the eventual outcome of this huge investment. Eventually Success or failure largely depends on the amount of support an organization provides.

During Internship it was observed, how the support team provides support to the customer's end users. Support team quickly resolves the incidents affecting the Customers' business. For this project a tool called OPAS is used.

The following types of support were observed:

1st line support : Project executes Service Desk function.

2nd line support : Project receives Tickets (Incident or Requests) from the Service Desk and works on the Tickets or, if needed, sends them to 3rd line support, which in this case can be the customer or another supplier.

3rd line support : Team gets involved only if specialist application knowledge is required. This is often done when the case requires changes in coding.

Automatic Failover testing

Automatic failover is automatic switching to a redundant or standby computer server, system or network upon the failure or abnormal termination of the previously active application server, system, or network. Failover and switchover are essentially the same operation. The mild difference is that failover is automatic and usually operates without warning, while switchover requires human intervention.

Systems designers usually provide failover capability in servers, systems or networks requiring continuous availability and a high degree of reliability.

As VistA Project team member was involved in Automatic failover testing to check whether failover is working in the right way.

Upgrading CPRS training material presentation

After 45 days of Internship which included rigorous training on various VistA modules, task was assigned to upgrade training materials of VistA CPRS module. This task was really challenging as the objective was to add animations to the existing presentation and also to use new screen shots of the CPRS application wherever required. The old CPRS presentations were prepared on the basis of US scenarios. For this upgrading work new screen shots were taken and new presentations were made to demonstrate step by step process which user has to follow. Animations were added to the presentations to make presentation user friendly. For doing this MS Power Point was used.

Testing

After training and hands on practice sessions , I became part of testing team. As a testing team member an overview of testing process was given. In the beginning test cases of 4 modules i.e. BCMA, CPRS, Pharmacy, diet was assigned to do hands on practice on them. Also as a testing team member, meetings were attended where Sprint issues were discussed. Sprint issues are the issues faced by the customer which need to be resolved within a given

time frame. Each sprint issues was assigned to a developer & a tester. Sprint issues were assigned which were resolved and submitted by the deadline.

This work gave an in depth knowledge about the work processes of various modules., how to design test cases, how to do testing and much more.

1.4 Lessons Learned

- VistA and its Modules
  - ✓ Open source Software, Mirth Integration engine, HL7 messaging
  - ✓ Pharmacy Module and its drug build up
  - ✓ Pharmacy space utilization and process optimization
  - ✓ VistA CPRS, BCMA, Diet and Lab
  - ✓ Configuration and Mapping Process

- Automatic Failover testing
  - ✓ What is AFT
  - ✓ How automatic failover testing
  - ✓ Why it is done.
- Testing
  - ✓ To do testing
  - ✓ To make test cases.
  - ✓ In-depth knowledge of various modules.

1.5 Project Work Plan

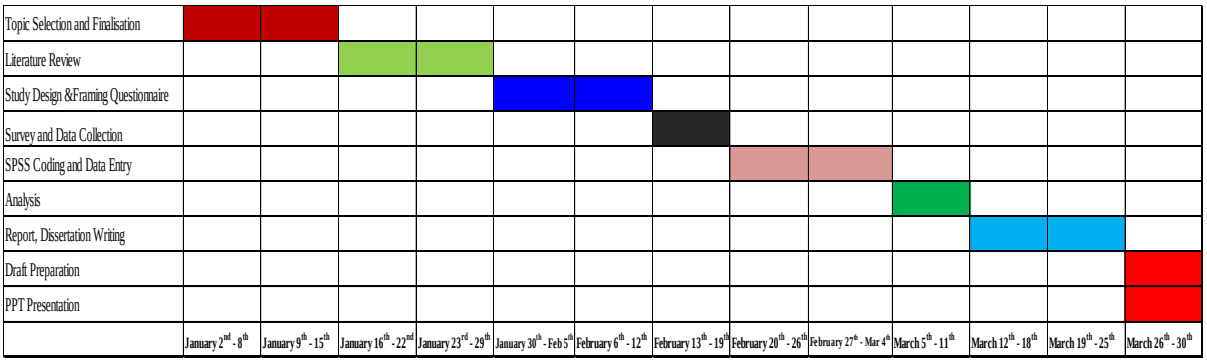

Figure 2 Gantt Chart showing Work done during Dissertation Period

Besides getting training on various modules of VistA, the dissertation project was also done. The dissertation topic was selected based on the topic which will benefit the organization and its customer. The topic was selected after doing complete research on ongoing project of the organization. The selected topic was approved by the mentor in the organization & Institute. When the final approval was received from the Institute, an in depth literature review was done on similar topics and also topics related to the objectives of the study. This literature review gave an idea about the real need of the study, what studies has been conducted on it till now etc. Based on various literature reviews questionnaire was framed.

Once the questionnaire was approved by the mentors, survey was conducted in hospital. Physicians and Nurses were interviewed and responses were collected in the pre designed questionnaire. This survey continued for five days.

The responses received from the survey were then entered into SPSS for analysis. Then the analysis was done and documented in the reports. All the other requisites were added in the report and the draft of report was made. After that print out was taken. Then finally the presentation was made from that draft of report.

Part 2

Dissertation Report

A study on factors influencing attitude towards acceptance of Electronic Health Records

Abstract

A study on factors influencing the attitude towards acceptance of Electronic Health Records

Healthcare industry has introduced a new concept of diffusion of IT in the form of EHR. It helps in producing permanent medical records. The benefits & barriers of EHR are well documented. However, literature says that some IT implementations in Healthcare setting has been unsuccessful due to lack of acceptance by the users. So, it is very imperative to know the acceptance and rejection of the information system implementation. There are many factors associated with this. But these factors are curbed and yet to be explored. Knowing these factors may lead to the success of the product implementations.

The objective of this study is to identify various factors influencing the attitudes of the clinical staff towards the acceptance of EHR. For this, we used a self-administered quantitative survey. Various literatures & theoretical framework as TAM was used to design the questionnaire. Then with the help of Factor Analysis, correlation & ANNOVA test, data was analyzed and results were obtained. It was found that Attitude of the clinical staff is directly & ultimately leading to the acceptance of EHR by them. The attitude in turn is being positively influenced by the sub-factors management support, training, communication, IT infrastructure (Organizational Factors), Prior computer skills (Individual Factors), usefulness & ease of use (Benefits). Moreover, EHR acceptance is directly influenced by management support, training & communication (Organizational Factors), prior computer skills (Individual factors).

Thus, Management support, communication, training, IT Infrastructure (Organizational factors); prior computer skills (Individual factors); usefulness & ease of use (benefits) were identified as facilitators to the EHR acceptance. Whereas, Professional autonomy & time were identified as barriers to the Acceptance of EHR.A significant contribution of this study is that a model called as ICT (EHR) acceptance model was developed depicting the factors influencing the attitudes of the users towards the acceptance of EHR. This can be used by healthcare institutions for assessing EHR readiness. These findings may also aid software developers in designing products to accomplish the demands of the users.

1. Introduction

1.1 India's 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 center 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.[44]

The two important factors that caused a revolution in the healthcare industry of India are:

1.1.1 Economic Factors

India's huge population of a billion people represents a big opportunity. The expanding middle class has more disposable income to spend. Hence they demand for better healthcare facilities. Hospitals in India are running at 80-90% occupancy.

With the demanding for healthcare for exceeding supply, India's healthcare industry is expected to grow by around 15% a year for the next six years. Hospitals in India conduct the latest surgeries at a very low cost. Medical tourism is also booming in India. Corporate entities entering the healthcare sector, introducing managerial practices and tools are showing a marked preference for professionals leading to the expansion of the hospital management education industry.[44]

1.1.2 Government factors

To encourage R&D government extended tax holiday to R&D companies. The benefit of full custom duty exemption for specific equipment is available for manufacturing activity to the extent of 25% of the previous year's export turnover. This will help the research based companies. All drugs and materials imported or produced domestically for clinical trials will be exempted from custom and excise duties. This will encourage foreign companies to produce drugs in India. [44]

1.2 SWOT Analysis of Healthcare Industry of India

Strength [1]

- Expertise in reverse technology
- Support at the state government level
- Emergence of biotech parks
- Incentives to develop business
- Natural competitive advantages of language
- Low cost and ever-expanding educated workforce

Weaknesses [1]

- The rising cost of healthcare delivery
- Limited access to life saving drugs

- Majority of private hospitals are expensive for normal middle class family
- Government is responsible to improve primary healthcare infrastructure

Opportunities [1]

- Greater incentives for original drug discovery will create opportunities for Indian companies to develop new competencies through collaborative research and global alliances.
- Big pharmacy and biotech companies to choose India as the preferred hub for their global R&D and manufacturing operations.

Threats [1]

- The increasing cost of drug discovery and development and the increasing time to market
- Declining R&D productivity.

1.3 Healthcare and IT [1,8]

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 centered 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." 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, modeling and improving clinical decision-making is not yet a priority.

1.4 Challenges [42]

Policy: Absence of clear, coordinated government policy to promote HIT adoption

Government funding: Almost 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.

Computer literacy: Low computer literacy among the government staff, and to a large extent in the private provider community.

Infrastructure and coordination: Lack of supporting infrastructure and coordination between public and private sector.

Legacy systems: Except for a few privately owned large hospitals, most patient records are paper based and very difficult to convert to electronic format.

Standards: 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.

Privacy: The Supreme Court of India has not addressed the specific right of privacy issue with respect to health information.

1.5 Medical Record [28]

Medical record can be defined as an orderly written document which includes patient's identification data, health history, physical examination findings, laboratory reports, diagnostic, treatment and surgical procedures and hospital course. When compiled, the record should contain sufficient data to justify the investigations, diagnosis, treatment, length of hospital stay, results of case and future course of action.

1.6 Purpose of the medical record [28]

- To provide a means of communication among physicians, nurses and other allied health care professionals.
- To serve as an easy reference for providing continuity in patient care.
- To furnish documentary evidence of care provided in the facility.
- To serve as an informational document to assist in the quality review of patient care.
- To protect the patient, physician, as well as the healthcare institution and its employees in the event of litigation.
- To render clinical and administrative data.

- To supply pertinent patient care information to authorized organizations and third party payers

1.7 Medical history [49]

A person's medical history is made up of many different pieces of information that tell the complete story about that individual's current and past health. A complete medical history record should include information on the person's:

• **Diagnosis** – for instance, if the individual has been diagnosed with mental retardation, cerebral palsy, depression, diabetes, hypertension, or any other medical or mental health conditions.

• **Known Allergies –** a list of any allergies that the person has, such as allergies to medications, foods, or bee stings.

• **Current Medications –** the names and doses of any medications the person currently takes.

• **Past and Present Illnesses** – information on any serious or chronic illnesses the person has experienced; for instance, if the individual has ever had tuberculosis or if the individual has asthma or diabetes.

• **Medication History –** a list of medications that the person used to take, as well as information about when these medications were started and stopped.

• **Current Doctors –** names, phone numbers, and specialties of the individual's current health care providers, including doctors, dentists, mental health specialists, and any other health care professionals.

• **Emergency Contact Information –** names and phone numbers of family members or others to call in case of an emergency.

• **Previous Surgeries –** information on any surgeries the individual has had.

• **Previous Hospitalizations –** dates and reasons for any previous hospitalizations.

• **Family Medical History –** information on any health conditions the person's close family members have been diagnosed with, including conditions such as cancer, heart disease, and mental illnesses.

• **Immunization Records** – information on immunizations that the individual has received, along with the dates that the immunizations were given.

• **Insurance Information –** health insurance member identification number and contact information.

These pieces of information may come from many different sources, but by compiling them into one document or folder, you can make sure that these important records are easily accessible to you, the person you support, and the person's health care providers

1.8 Electronic Medical Record [28]

It is an application environment composed of the clinical data repository, clinical decision support, controlled medical vocabulary, order entry, computerized provider order entry, pharmacy, and clinical documentation applications. This environment supports the patient's electronic medical record across inpatient and outpatient environments, and is used by healthcare practitioners to document, monitor, and manage health care delivery within a care delivery organization (CDO). The data in the EMR is the legal record of what happened to the patient during their encounter at the CDO and is owned by the CDO.

1.9 Electronic Health Record

It is a subset of each care delivery organization's EMR, is owned by the patient and has patient input and access that spans episodes of care across multiple CDOs within a community, region, or state (or in some countries, the entire country). The EHR can be established only if the electronic medical records of the various CDOs have evolved to a level that can create and support a robust exchange of information between stakeholders within a community or region. [28]

1.10 Advantages of an Electronic Health Record

- Easy access to information.
- Comprehensive and standardized documentation.
- Improved quality of patient care.
- Increased nursing efficiency.
- Improved process communication.

- Reduced medication errors.
- Reduced hospital costs. [34]

1.11 Obstacles

- Startup 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 EHR.
- Portability of the equipment is an issue associated with the use of EHR.
- Lack of standardized terminology, system architecture and indexing. [34]

1.12 Purpose of CPRS

The purpose of a patient record is "to recall observations, to inform others, to instruct students, to gain knowledge, to monitor performance, and to justify interventions". The many uses described in this statement, although diverse, have a single end goal— to further the application of health sciences in ways that improve the well being of patients. Yet, observational studies of physicians' use of the paper-based record find that the logistical, organizational, and other practical limitations reduce the effectiveness of traditional records for storing and organizing an ever increasing number of diverse data. A computer-based patient record is designed to overcome many of these limitations, as well as to provide additional benefits that cannot be attained by a static view of events.[23]

A **CPR** is a repository of electronically maintained information about an individual's lifetime health status and health care, stored such that it can serve the multiple legitimate users of the record. Traditionally, the patient record was a record of care provided when a patient is ill. Managed care encourages healthcare providers to focus on the continuum of health and health care from wellness to illness and recovery. Consequently, the record must integrate elements regarding a patient's health and illness acquired by multiple providers across diverse settings. In addition, the data should be stored such that different views of those data can be presented to serve many uses. [23]

A **computer-based patient-record system** adds information-management tools to provide clinical reminders and alerts, linkages with knowledge sources for health-care decision support, and analysis of aggregate data for outcomes research and improved management of the healthcare delivery system. To use a paper-based patient record, the reader must manipulate data either mentally or on paper to glean important clinical information. In contrast, a CPR system provides computer-based tools to help the reader organize, interpret, and react to data. [23]

1.13 Ways in Which a CPRS Differs from a Paper-Based Record

In contrast to a traditional patient record, whose functionality is tethered by the static nature of paper— a single copy of the data stored in a single format for data entry and retrieval— a computer based patient-record is flexible and adaptable. Data may be entered in a format that simplifies the input process (which includes electronic interfaces to other computers where patient data are stored) and displayed in different formats suitable for their interpretation. Data can be used to guide care for a single patient or in aggregate form to help administrators develop policies for a population. Hence, when considering the functions of a CPR, we do not confine discussion to the uses of a single, serial recording of provider–patient encounters. A CPR system extends the usefulness of patient data by applying information-management tools to the data. [23]

Inaccessibility is a common drawback of paper records. In large organizations, the traditional record may be unavailable to others for days while the clinician finishes documentation of an encounter. For example, paper records are often sequestered in a medical records department until the discharge summary is completed and every document is signed. During this time, special permission and extra effort are required to locate and retrieve the record. Individual physicians often borrow records for their convenience, with the same effect. With computer-stored records, all authorized personnel can also access patient data immediately as the need arises. Remote access to CPRS also is possible. When the data are stored on a secure network, authorized

clinicians with a need to know can access them from the office, home, or emergency room, to make timely informed decisions. [23]

Documentation in a CPR is usually more legible because it is recorded as printed text rather than as hand writing, and is better organized because structure is imposed on input. The computer can even improve completeness and quality by automatically applying validity checks on data as they are entered. For example, numerical results can be checked against reference ranges. Typographical errors can be detected if a datum fails a reference range check. Moreover, an interactive system can prompt the user for additional information. In this case, the data repository not only stores data, but also enhances their completeness. [23]

Data entered into a computer can be reused. For example, a physician could reuse her clinic visit note in the letter to the referring physician and the admission note. Reusability of data is one way that a CPRS increases efficiency of the provider's workflow.

Reuse of data also increases the quality of data. The more users and uses that depend on a data element, the more likely that it will be reviewed and be kept up-to-date.

The degree to which a particular CPR demonstrates these benefits depends on several factors:

- **Comprehensiveness of information**: Does the CPR contain information about health as well as illness? Does it include information from all clinicians who participated in a patient's care? Does it cover all settings in which care was delivered? Does it include the full spectrum of clinical data, including, clinicians' notes, laboratory-test results, medication details, and so on?
- **Duration of use and retention of data.** A record that has accumulated patient data over 5 years will be more valuable than is one that contains records of only the visits made during 1 month.
- **Degree of structure of data.** Medical data that are stored simply as narrative text entries will be more legible and accessible than are similar entries in a paper medical record. Non coded information, however, is not standardized, and inconsistent use of medical terminology limits the ability to search for data. Use of a controlled, predefined vocabulary facilitates automated aggregation and summarization of data

provided by different physicians or by the same physician at different times. Coded information is also required for computer-supported decision making and clinical research.

- **Ubiquity of access.** A system that is accessible from a few sites will be less valuable than one accessible from any computer by an authorized user. [23]

1.14 Critical success factors for EHR

- 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 EHR 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 EHRs.

Success of any Electronic Health Records (EHR) 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 EHR system. Critical success factors are the elements which are necessary to accomplish any goals. [15]

1.15 The Key to Successful EMR Implementation

The realization of any benefits from EMR implementation lies in the hands of physicians, nurses and other end users. User adoption is critical for any successful IT implementation. Reasons for slow EMR implementation include implementation costs, patient/record privacy concerns, reduced physician time with patients, unfavorable workflow changes, cumbersome EMR interface designs, loss of physician autonomy, and difficulty learning EMR systems. Unfortunately, user acceptance and resistance to change are the remaining effects from these EMR-related perceived barriers. **[43]**

1.16 EHR acceptance

Many hospitals maintain electronic records locally. The scope of data captured however is limited to basic demographics, registration and billing. Larger hospitals that store clinical data electronically store discharge summaries with information on procedures, orders and investigation reports. Despite the system's ability to also store detailed reports and clinical interpretation electronically, many hospitals do not use it. As a result, clinical follow-up is either very limited or not feasible. Industry analyst feel that the goal of hospitals in India is more to adopt the general concept of EHRs but that they are not utilizing all of its capabilities. **[41]**

1.17 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. **[41]**

1.18 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. **[42]**

1.19 Barriers to EHR Implementation in Medicine

While certainly poised for a period of great HIT adoption, barriers persist. They include physicians' limited IT knowledge, cultural barriers, and the need to secure patient privacy. Unlike other professions, where IT training is an integral part of studies, medical training in the United States is not multidisciplinary . As such it does not incorporate technology training into its curriculum. Upon completion of medical school, physicians typically find themselves buried by tens of thousands of dollars in school loans and face-to-face with the daunting task of starting their own practice. Anxiously prepared to start practicing medicine, physicians incorporate much of what they learned in medical school. Older generations, being trained to use paper records while in residency, continued to use paper records. At the dawn of EMR technology, many of these doctors found themselves simply not prepared and perhaps overwhelmed. Conversely, 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 EHR technology adoption and satisfaction. **[43]**

Conversely, while limited IT knowledge on behalf of physicians is speculated to inhibit EMR implementation, limited medical knowledge on behalf of IT professionals is also speculated to affect EHR adoption. With the ultimate goal for increased quality of patient

care, EHR 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. Common physician complaints center on an overly simplified user interface that limits the input of critical information. Consequently, physicians may not view EMR technology as useful or easy to use. In short, as physicians must learn the language of technology, so must IT professionals learn the language of medicine. [43]

Another barrier is the very 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. Paper records, for example, provide physicians with a limitless method of documentation. In addition, EHR technology typically requires large financial investments. Physicians, who are not trained to evaluate the return of such an investment, may shy away from it. [43]

Finally, the need to protect the security and privacy of patient records has also slowed the adoption of EMR technology. In fact, Fodersen cites maintaining privacy the most significant and immediate barrier to EMR adoption. At the heart of medicine, is the doctor-patient relationship. HIPAA provides regulations for securing healthcare coverage for workers in between jobs , 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 EMR technology. [43]

1.20 Problem Statement

Traditional usage of paper & files to carry the healthcare business has shown some disadvantages. Paper records & files may get damaged, lost and are constrained from being shared with their colleagues unless they are copied, hand-carried, mailed, or faxed to them.[33] These constraints pose a significant barrier for physicians in providing timely needed services for their patients.[48] The best way to avoid the constraints & provide better information management in hospitals is to produce electronic medical records which if once formed can be maintained for the whole life. This is done in hospitals by the implementation of EHR. It is very beneficial for patients, professionals, organizations & general public as well. EHR enables the patient to share its health related information with other healthcare professionals & provides the patient to have access to its own data to take health related decisions. Moreover, it promises to improve healthcare quality, efficiency & safety. But these improvements are highly dependent on the acceptance of EHR . There are several factors responsible for the acceptance of EHR. Identification of these factors will provide us with the factors acting as facilitators & barriers to the adoption. But these factors are still curbed and yet to be mined. This study will provide the factors affecting the adoption of EHR by the users in the clinical setting at the post implementation phase.

1.21 Rationale of the Study

After the implementation of EHR in the hospital, the crucial thing is to know the extent of its clinical adoption. This is an essential requirement for the top management of the hospital. Knowing the extent of adoption can help them to determine the success of clinical transformation in the hospital. As discussed above, the acceptance of EHR depends upon different factors. Several studies have been conducted during the pre-implementation phase of EHR to determine the factors affecting acceptance. Identifying factors during the pre-implementation phase is just a prediction. There is a need to determine the factors which are actually influencing the clinical staff towards the usage of EHR. This study has been conducted post implementation of EHR and has identified the factors which are affecting the achieved extent of clinical acceptance in real time. Moreover, this study will provide a clear idea of the type of organizational & type of individual factors influencing the acceptance of EHR. The acceptance of EHR will directly or indirectly decide the success of clinical transformation.

2. Literature Review

2.1 VistA & CPRS

Veterans Health Information Systems and Technology Architecture (VistA). The Veterans Health Information Systems and Technology Architecture (VistA) is an enterprise-wide information system built around an electronic health record, used throughout the United States Department of Veterans Affairs (VA) medical system, known as the Veterans Health Administration (VHA).VistA, is an integrated system of software applications that directly supports patient care. By 2008, the VHA was the largest single medical system in the United States, providing care to 5 million veterans, employing 180,000 medical personnel and operating 163 hospitals, over 800 clinics and 135 nursing homes. By providing electronic health records capability, VistA is thereby one of the most widely used EHRs in the world. [50]

Features

The VistA system is public domain software, available through the Freedom of Information Act directly from the VA website, or through a growing network of distributors. The VistA software alliance is a non-profit trade organization that both promote the widespread adoption of versions of VistA for a variety of provider environments. VistA is a collection of about 100 integrated software modules. Some of the modules included in VistA which enables the user with a number of advantages are as follows:

Computerized Patient Record System (CPRS) Module

The most significant is a graphical user interface for clinicians known as the Computerized Patient Record System (CPRS), which was released in 1997. In addition, VistA includes computerized order entry, bar code medication administration, electronic prescribing and clinical guidelines. CPRS provides a client–server interface that allows health care providers to review and update a patient's electronic medical record. This includes the ability to place orders, including those for medications, special procedures, X-rays, nursing interventions, diets, and laboratory tests. CPRS provides flexibility in a wide variety of settings so that a consistent, event-driven, Windows-style

interface is presented to a broad spectrum of health care workers. CPRS provides electronic data entry, editing, and electronic signatures for provider-patient encounters as well as provider orders. Its computer-based provider order entry (CPOE) capability is an important enabler in the migration from paper-based charting to electronic medical records (EMRs). [50]

Laboratory Module

Laboratory module enables the user with Ordering of tests and procedures on both patient and non-patient specimens, Collection and Accessioning of specimens into the Laboratory database, Processing and analysis in appropriate department or work areas, review and verification of results, Reporting of results and/or diagnoses for clinical health care treatment, Analysis and reporting of quality control data used in generating results and Providing management statistical data as well as requirements for accreditation by regulating bodies and agencies. [50]

Radiology Module

Radiology / Nuclear Medicine package is a comprehensive software package, designed to assist with the functions related to processing patients for imaging examinations. The Radiology / Nuclear Medicine package automates the entire range of diagnostic functions performed in imaging departments, including request entries by clinical staff, registration of patients for exams, processing of exams, recording of reports/results, verification of reports on-line, displaying/printing results for clinical staff, automatic tracking of requests/exams/reports, and generation of management statistics/reports, both recurring and ad hoc. The Radiology / Nuclear Medicine package automates many tedious tasks previously performed manually, providing faster, more efficient and accurate data entry and more timely results reporting. One of the important features provided by VistA is

VistA Imaging

The Veterans Administration has also developed VistA Imaging, a coordinated system for communicating with PACS (radiology imaging) systems and for integrating others types of image-based information, such as, pathology slides, and

scanned documents, into the VistA electronic medical records system. This type of integration of information into a medical record is critical to efficient utilization. [50]

Surgery Module

The Surgery package is designed to be used by Surgeons, Surgical Residents, Anesthetists, Operating Room Nurses and other surgical staff. The Surgery package is part of the patient information system that stores data on the Department of Veterans Affairs (VA) patients who have, or are about to undergo, surgical procedures. This package integrates booking, clinical, and patient data to provide a variety of administrative and clinical reports. [50]

Pharmacy Module

The Pharmacy package provides a method of management, dispensing, and administration of inpatient drugs within the hospital. Hospital Medications combines clinical and patient information that allows each medical center to enter orders for patients, dispense medications by means of Pick Lists, print labels, create Medication Administration Records (MARs), and create Management Reports. Hospital Medications also interacts with the Computerized Patient Record System (CPRS) and the Bar Code Medication Administration (BCMA) packages to provide more comprehensive patient care.

VistA was developed using the M or MUMPS language/database. The VA currently runs a majority of VistA systems on the proprietary Intersystem's Cache version of MUMPS, but an open source MUMPS (Massachusetts General Hospital Utility Multi-Programming System) database engine, called GT.M for Linux and Unix computers has also been developed. GT.M is an implementation of the Standard M programming system (M = MUMPS = Massachusetts General Hospital Utility Multi-Programming System). VistA is written in Standard M. GT.M is an implementation of M from Fidelity Information Services. In addition, the free and open source nature of GT.M allows redundant and cost-effective failsafe database implementations, increasing reliability for complex installations of VistA. [50]

2.2 Factors

Organizational Factors

Management Support

For any kind of change to be successful, management support is very crucial. In the healthcare setting where physicians & nurses are the end users, who are very less familiar with the usage of IT needs an excellent support to be able to use the new system well. Changing from a paper-based medical record to an EHR is a strategic change.[38] A strategic information system plan must integrate any clinical information technology into both the management infrastructure, as well as the technical infrastructure.[52] Healthcare facilities that have successfully implemented a fully operational EHR have had strong executive leadership, provided by either the CEO, high-level clinicians, clinical managers or board-level committees & senior executives. It is essential that people with clinical backgrounds lead the initiative. Moreover, physician involvement and sponsorship is vital.[4,6,21] Studies have also observed a positive relationship between management support and perceived usefulness.[2,16] Some studies have revealed that there is a significant correlation between management support & the attitude towards adoption of EHR.[40] Some studies emphasized the need for strong management support in the EHR implementation process. [41]

Communication

Top management and the physician leader must communicate IT strategy to all the employees and exhibit a strong commitment to incorporate IT.[15] The antidote to uncertainty is good communication. The governance team must control the content and flow of information related to the project. Adopting a communication plan that addresses project milestones, staff requirements and project vision is a key to success. Choosing a theme and name for the EHR project is another effective communication tool. [15]

Training

Most of the systems have failed because users were inadequately trained.[6] In many cases, physicians prefer to be trained one-on-one by the trainers. [6] However, team-based training [32] or in some cases staged training may be needed for complex systems.[36] Training programs should educate people on how to use the system. Also it should address attitudes and build enthusiasm for using the system.[36] Appropriate techniques, timing and high-quality training materials are required for successful system implementation & adoption.[32] Previous studies have noted that training positively influences the usefulness of the system. [27] Physicians were surveyed six months after EHR implementation and it was found that 23% did not believe they received adequate training. This perception was correlated with an overall decrease in EHR satisfaction.

IT Infrastructure

There must be strategies in place to nurture a new culture, including solid systems support and availability of technical staff. [37] Technical support was identified as an important contributing factor to the adoption of EHR system. [5] Superior IT infrastructure is associated with EHR adoption.[47] Most groups will need to upgrade their IT infrastructure while implementing EHR technology. IT infrastructure must be robust and reliable, with fast and reliable networking, enough of the correct end-user hardware, proper housing for server hardware and adequate help desk support.[15] Robust and reliable local area network allows local computers, printers and scanners to connect to the application and the database where patient data are stored. Creating a network that maximizes broadband speed to each workstation and works easily and reliably is a critical success factor[15] Twenty-four hour vendor support and technical assistance is necessary to ensure ease of use[6] Physicians expect immediate support without having to wait in line behind other customers[45]

Individual Factors

Prior computer skills

Some existing literature shows that computer skills have been identified as potential barrier to the adoption of technology.[16, 29, 53] Past research has found that physicians

who have basic computer skills are more likely to accept the EHR systems. Physicians concern about lack of computer skills is found to be a predictor which influences technology adoption among physicians. [16, 39]

Professional Autonomy

There is a substantial change in the organization with the implementation of EHR. The change of this magnitude may affect the positions & power of the people in the organization. [38] When the responsibilities, status & autonomy are adversely affected resistance is likely to occur. [4] The physicians may realize the benefit of EHR to improve patient care, but still they may have concerns about the facility's increased ability to monitor or control their work. [7] Though an EHR provides clinical decision support capabilities, the physicians want to maintain ownership of the clinical decision making processes. [21] Systems impact on physician autonomy was one of the top concerns physicians had about using the EHR. [27] Physician autonomy has strong negative direct influence towards intention to use technology, attitude towards EHR & on perceived usefulness of a technology. [41]

Benefits

Usefulness

An EHR system must provide clear benefits to the medical staff. [3, 6] Most of the systems often fail because they support the values of management and don't heed the values of staff and users.[37] In a survey which was conducted by the American Medical Association in 2001, only 13% of physicians responded that EHR would make it easier to practice medicine or to manage the medical practice. Successful EHR implementations have been associated with a focus on improving clinical processes and solving clinical problems with information technology. [21] Addressing physicians' immediate needs rather than emphasizing future predicted benefits of system use is critical in achieving EHR acceptance. Ongoing evaluation and modification based on medical staff feedback is a key for continued use of the EHR. [21]

Ease of Use

While some studies found ease-of-use as an important factor influencing technology adoption among physicians, others did not. And several other studies reported usefulness to be more important than ease-of-use. [11, 22] A survey was conducted that explored the reasons why an EHR system was underutilized by a group of primary care physicians. Thirty-five percent of physicians reported specific issues related to EHR usability. [9] The most common problems mentioned were issues with screen navigation, failure to access secondary functions and concerns with loss of data. In an American study, EHR system-specific issues were explored by Felt-Lisk and 30 colleagues. [26]

Attitude

Physicians' perception of and attitudes towards new technologies is a crucial element in the implementation of new technology projects in the current healthcare system.[17, 24] Physicians' perception and attitudes towards new technologies is a crucial element in the implementation of new technology projects in the current healthcare system. [17, 24] Other studies have reported findings regarding major predictors of attitudes towards adoption of technology. Some studies have found that physicians with prior knowledge of computers and informatics concepts have more favorable attitudes towards computers in healthcare. [14,20] Other variables found to be positively correlated with attitude include systems training, clinical specialization, and job satisfaction. [14, 20] Two separate studies measured the attitude of physicians towards accepting clinical information systems and other medical computer applications. [30, 10] They reported that age, gender, specialty, and general computer experience did not correlate with attitude. [30, 10] Physicians are accepting information systems that improve job performance or patient care processes, but resist those that have a negative impact on their autonomy. [3, 10] Evaluation was done on physician attitudes toward clinical information systems and found computer skills and experience to be predictors of computer acceptance. Age, gender and attitudes toward physician data entry were found to be non significant.

2.3 Theoretical Framework

Introduction

Technology implementation has touched every sector. Healthcare sector is also no exception. Healthcare sector is infusing technology by introducing the concept of EHR to provide medical records in electronic form. The whole idea is to make the processes more tuned without compromising the quality of patient care. But the fact is that healthcare professionals are not ready to accept & use the new system. There are several factors associated with it. Some studies have been conducted Pre-implementation & Post-implementation of HER. In these studies to show the acceptance & rejection of EHR with the factors associated with it, some models have been created. The following study has also made an attempt to identify the factors influencing the attitudes towards the acceptance of EHR. Also an attempt has been made to represent the factors in the form of a model. For this the framework of Universally accepted model TAM was used.

TAM has proven one the most widely used behavioral models in the information technology (IT) field and consistently demonstrates validity, reliability, robustness and simplicity. Additional studies concluded that TAM proved superior to other models when examining physician acceptance of information technology. It proved parsimonious yet incorporated a robust register of psychometric measures. [11] TAM was proposed by Fred Davis in 1985 at the MIT Sloan School of Management. [18] He proposed a conceptual model for technology acceptance in which he proposed that actual system use is predicted by user motivation which in turn is influenced by system features & capabilities.

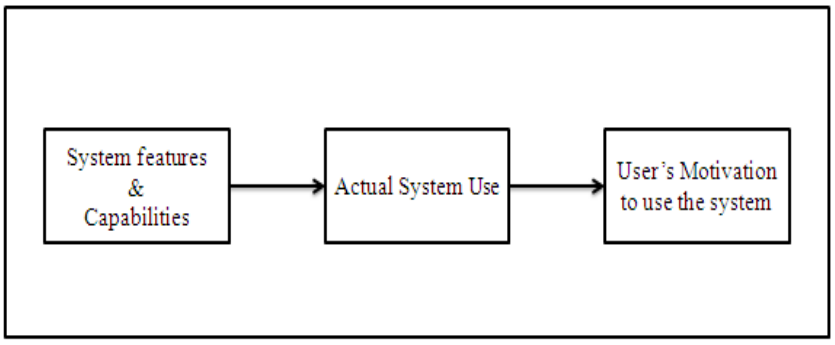

Figure 3.Conceptual Model for TAM

Davis used "Theory of Reasoned Action" made by Fishbein and Ajzen in 1975 and other related research studies and refined his conceptual model to propose TAM.

Origin & Evolution of TAM

Theory of Reasoned Action

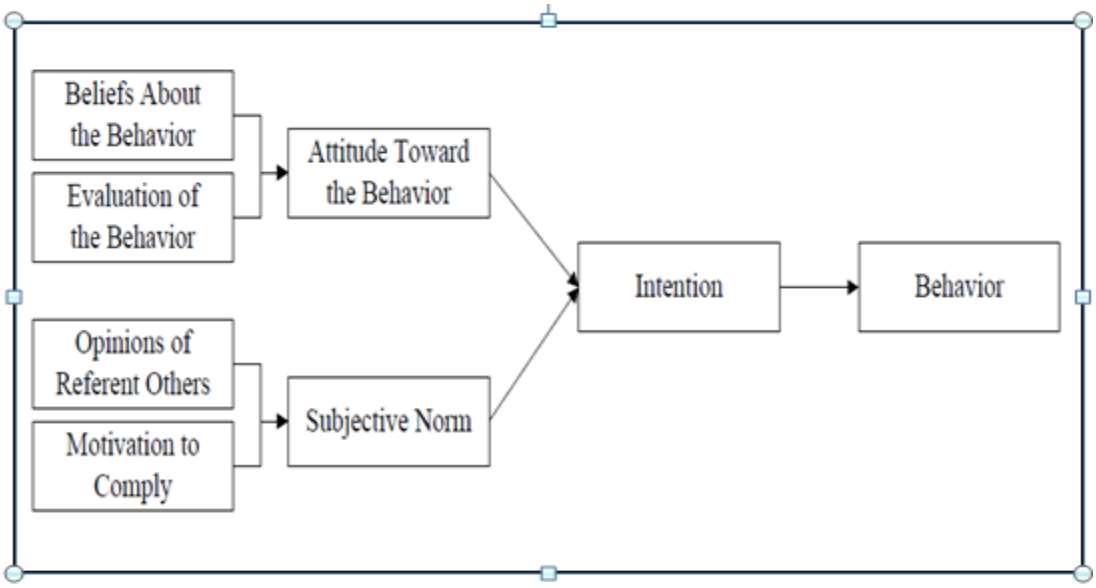

Figure 4. Model : Theory of Reasoned Action

According to this model a person's actual behavior could be determined by his or her Intention.[25] They referred to intention that a person has prior to an actual behavior as the

behavioral intention of that person and they defined it as one's intention to perform a behavior. They further proposed that Behavioral Intention could be determined by considering both the attitude that a person has towards the actual behavior and the subjective norm associated with that particular behavior. They defined both attitude towards the behavior and the subjective norm for a particular behavior:

Attitude towards a given behavior is defined as a person's positive or negative feelings about performing actual behavior.

Subjective norm is defined as the person's perception that most people who are important to him or her think he or she should or should not perform the behavior.

Attitude towards behavior is further influenced by beliefs about the behavior & also evaluation of behavior. Whereas, subjective norm is influenced by opinion of referent others & motivation to comply. The Theory of Reasoned Action thus, provided a model that could explain and predict the actual behavior of an individual.

Development of TAM

Ten years later Davis used this theory and modified it to make technology Acceptance Model, so that it can be used in the context of user acceptance of information system. Davis made two changes to Theory of Reasoned Action model. First is , he didn't take subjective norm into account in predicting the actual behavior of a person as Fishbein & Ajzen were themselves acknowledged that as the least understood aspect of TRA. So, he considered only attitude of a person towards given behavior. Second is, instead of taking several individual salient beliefs to determine attitude towards a given behavior. He referred to several other related studies & considered only perceived ease of use & perceived usefulness to predict the attitude of a user towards the usage of the system.

After referring to many such related studies it was concluded that people tend to use or not use a system to the extent that they believe it will help them to perform their job better and also that the beliefs of the efforts required to use a system can directly affect system usage behavior. Davis defined perceived ease of use & perceived usefulness as follows:

Perceived Ease of Use: The degree to which an individual believes that using particular system would be free of physical & mental effort.

Perceived Usefulness: The degree to which an individual believes that using a particular system would enhance his or her job performance.

For proving the association of perceived ease of use & usefulness with the attitude of the user towards the system, he decided to measure both of them . He developed measurement scales for them and proceeded with his experiments. By analyzing the results of the experiments he found that there is a positive correlation between the scales & self-predicted future usage. Moreover , Davis (1985) used regression analysis to determine the relationships which existed in the TAM model. He suggested that in contrast to what he initially predicted, perceived usefulness & perceived ease of use have a direct influence on attitude towards using which is influenced by system features. Perceived ease of use influences perceived usefulness which directly influences actual system use . Also, system directly influences attitude towards using the system.

This is depicted in the model below:

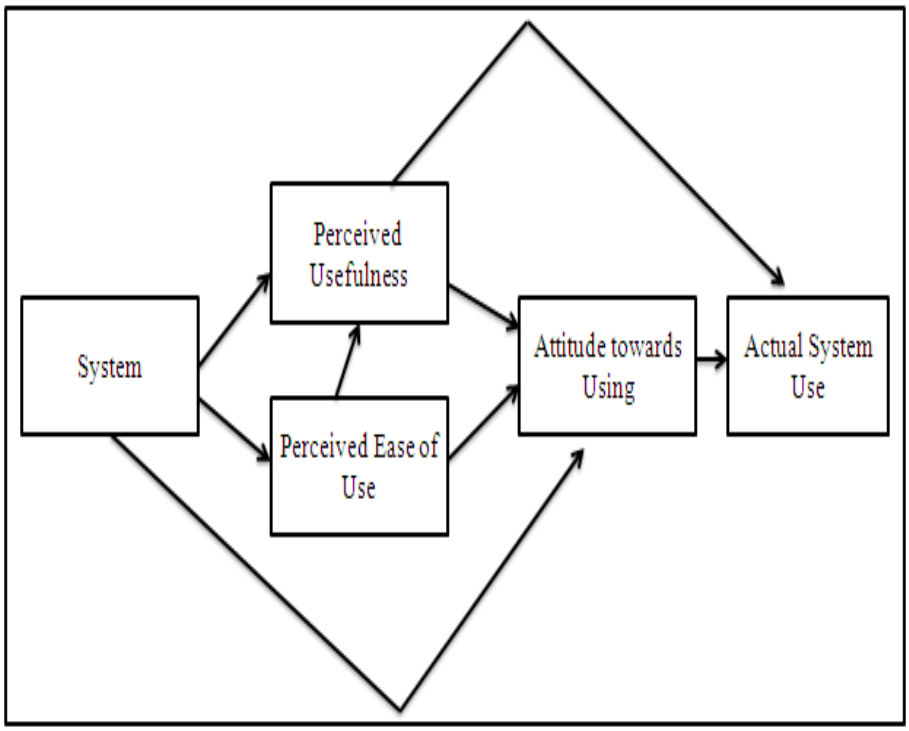

Figure 5. New Relationship formulation in TAM

Evolution of Final Version of TAM

On further development in TAM , behavioral intention as a new variable was introduced into it that would be directly influenced by perceived usefulness of the system. [19] According to Davis, there would be cases when an individual might form a strong behavioral intention to use the system without forming any attitude. This would give rise to a modified form of TAM which is shown below:

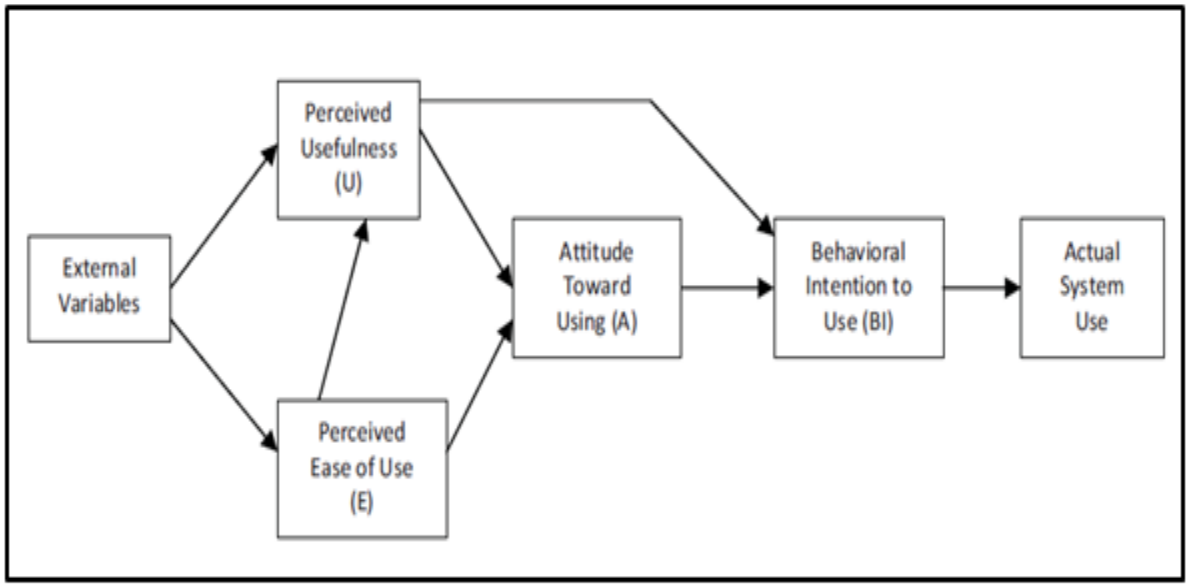

Figure 6. First Modified version of TAM

Davis , bagozzi and warshaw used the above model and conducted a longitudinal study with 107 users to measure their intention to use the system after one hour of the introduction of system and then again 14 weeks later. In both the cases , the results indicated a strong relationship between reported intention & self –reported system usage with perceived usefulness responsible for the greatest influence on the intention of the people. However, perceived ease of use was found to have small significant relationship which subsided over time. But the main finding was that both perceived ease of use & perceived usefulness have a direct influence on the behavioral Intention.. This eliminated the need for attitude construct in the model. The resultant final version of TAM model by eliminating attitude construct & introducing behavioral intention is shown below:

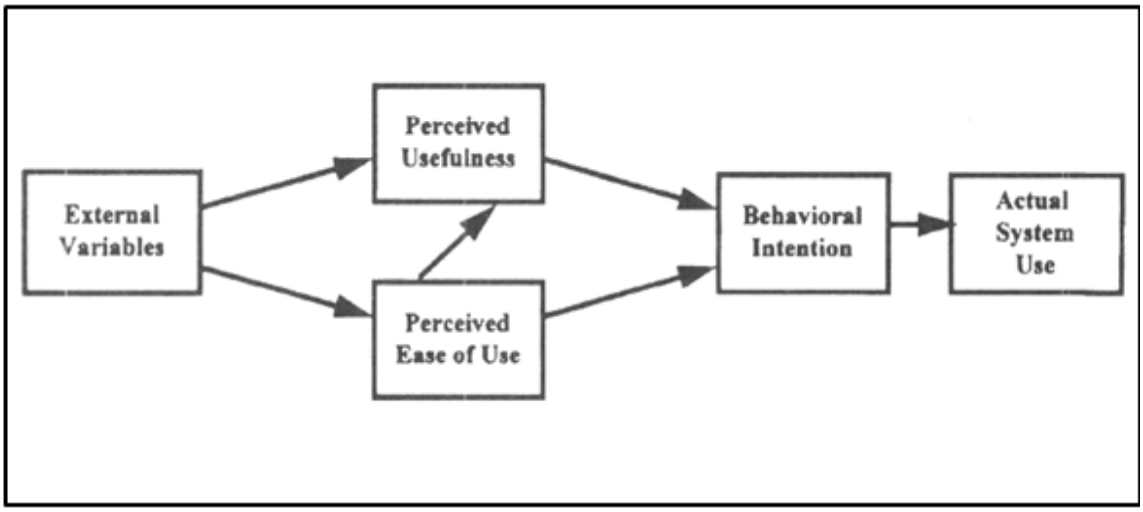

Figure 7. Final version of TAM

Thus, by eliminating attitude construct & introducing Behavioral Intention construct, the results which were obtained for the direct influence of perceived usefulness on actual system used in Table 3 could be explained very well. The other addition to TAM model was that there was consideration of some other factors named as external variables that might influence the beliefs of a person towards a system. External variables included system characteristics, user training, nature of implementation process. [51] This is how TAM was made which has now become a Universally accepted model to predict the acceptance & rejection of the information system.

3. Objectives of the study

3.1 General objective

To study the factors influencing the attitudes of clinical staff towards acceptance of Electronic Health Records.

3.2 Specific Objectives

- To identify the factors influencing attitude.
- To identify the factors influencing acceptance of EHR
- To identify the facilitators & barriers towards the acceptance of EHR.
- To propose an ICT (EHR) Acceptance Model for physicians & nurses in India.

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4. Hypothesis

After undergoing through the literature, we identified many factors to be included in the study. These include Organizational factors which includes management support, communication , training, IT infrastructure. It includes Individual factors which includes prior computer skills, professional autonomy, time & Benefits which includes usefulness & ease of use. Finally last but not the least we have Attitude & Overall attitude towards EMR Acceptance, which is the ultimate aim of the study.

Also we have chosen TAM as the theoretical framework of the study. With the literature review & the theoretical framework , some hypothesis have been proposed. The hypothesis are as follows:

- H1. EHR acceptance by physicians & nurses is dependent on management support.
- H2. EHR acceptance by physicians & nurses is dependent on communication.
- H3. EHR acceptance by physicians & nurses is dependent on training.
- H4. EHR acceptance by physicians & nurses is dependent on prior computer skills
- H5. EHR acceptance by physicians & nurses is dependent on Attitude.

5. Methodology

5.1 Study Design

In the study a cross-sectional self-administered quantitative survey based study design was employed. Quantitative survey based study design was used because it facilitated larger sample population. But it was more in line with time & budget constraints. Several statistical approaches have been applied to study and identify the relationship among the technology acceptance, various demographic characteristics, dependent & independent variables.

5.2 Variables

The variables included in the study are in the form of factors & sub-factors. The study includes both dependent and independent variables. The dependent and independent variables are not fixed. This is decided depending upon the relationship or research question to be analyzed. The variables are as follows:

Table 1. Variables used in the study

S.No.	Major Factors	Sub-Factors
1	**Organizational**	Management Support
		Communication
		Training
		IT Infrastructure
2	**Individual**	Prior Computer Skills
		Physician Autonomy
		Time
3	**Benefits**	Usefulness
		Ease of Use
4	**Demographic Measures**	Age
		Gender
		Years of Clinical experience
		Qualification
5	**Attitude**	
6	**EMR Acceptance**	

5.3 Sampling Method

Sample was selected by applying Simple Random Sampling method as it helps in making the generalizations from the results back to the population.

5.4 Study setting

The study was focused around an ABC Super Specialty hospital in which EHR has been implemented few months back. It is a 450 bedded hospital & consists of 15-20 departments. It comprises of approximately 500 physicians, 1200 nurses, 50 pharmacists including IP & OP and other administrative staff as well.

5.5 Nature of Respondents

The sample consists of the respondents who are the regular staff from various different departments of the same hospital described above. It doesn't include any of the visiting staff. The respondents in the study include physicians & nurses.

5.6 Sample size & Characteristics : Total sample size is 340

Physicians : 170

Nurses : 170

Table 2. Characteristics of respondents

Category	Component	No. of Physicians	No. of Nurses
Gender	Males	96	32
	Females	74	138
Age Group	21 - 30	81	158
	31 - 40	81	10
	41 - 50	8	2
Qualification	Diploma	0	126
	Graduate	75	44
	Post Graduate	95	0
Clinical Experience	0 - 2 yrs	63	70
	> 2 - 5 yrs	63	74
	> 5 - 8 yrs	28	16
	> 8 - 12 yrs	5	6
	> 12 yrs	11	4

5.7 Data Collection Techniques

The methods used for data collection were:

- *Questionnaire*

  The questionnaire consists of only closed ended questions. 5 Point likert scale was used to rate all the questions i.e. 1: Strongly Agree, 2: Agree, 3:Neutral, 4: Disagree, 5: Strongly Disagree.

- *Observation*

  During the survey & other visit to the hospital, some observations were made, which gave an idea that which factors influenced the adoption of EHR in the hospitals. Also some suggestions were given by physicians and nurses for the same.

5.8 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.

5.8.1 Factor Analysis

There are two types of Factor analysis i.e. Exploratory factor analysis & Confirmatory factor analysis.

EFA could be described as orderly simplification of interrelated measures. EFA, traditionally, has been used to explore the possible underlying factor structure of a set of observed variables without imposing a preconceived structure on the outcome (Child, 1990). By performing EFA, the underlying factor structure is identified.

CFA is a statistical technique used to verify the factor structure of a set of observed variables. CFA allows the researcher to test the hypothesis that a relationship between observed variables and their underlying latent constructs exists. The researcher uses knowledge of the theory, empirical research, or both, postulates the relationship pattern a priori and then tests the hypothesis statistically.

Factor Analysis and Principal Components Analysis are both used to reduce a large set of items to a smaller number of dimensions and components. These techniques are

commonly used when developing a questionnaire to see the relationship between the items in the questionnaire and underlying dimensions. It is also used in general to reduce a larger set of variables to a smaller set of variables that explain the important dimensions of variability. Specifically, Factor analysis aims to find underlying latent factors. Principal component factor analysis with varimax rotation was used to assess the construct validity of the instrument. Construct validity of the instrument is established when the convergent and discriminant validity of the constructs used in the instrument are found satisfactory. Thus, principal components analysis aims to summarize observed variability by a smaller number of components.

Purpose of factor analysis

- Latent factors (Factor Analysis)–Uncover latent factors underlying a set of variables
- Variable reduction (Principal Component Analysis)–Reduce a set of variables to a smaller number, while still accounting for "most" of the variance.

5.8.2 Reliability

The reliability of all the variables were assessed by the chronbach's alpha reliability coefficient.

Cronbach's Alpha testing reviews the reliability of scales used in a study. Ideally, the Cronbach's Alpha coefficient of a scale should be above .7

A commonly accepted rule of thumb for describing internal consistency using Cronbach's alpha is as follows

Table 3. Cronbach's alpha (α) Value Classifications

Cronbach's alpha	Internal consistency
$\alpha \geq .9$	Excellent
$.9 > \alpha \geq .8$	Good
$.8 > \alpha \geq .7$	Acceptable
$.7 > \alpha \geq .6$	Questionable
$.6 > \alpha \geq .5$	Poor
$.5 > \alpha$	Unacceptable

CI s 95% was calculated using the method suggested by Dawn lacobucci & Adam Duhachek(2003).

5.8.3 Correlation Analysis

Correlation analysis is used to measure and describe the linear relationship between two variables. SPSS was used to calculate Pearson correlation coefficients between factors obtained after factor analysis. Correlations are classified according to the strength of their r values.

When "r" value is higher than 0.300 is considered to have a moderate Positive Association. the value higher than 0.700 is considered to have very strong positive correlation.

Following table shows the Correlation ® value classifications:

Table 4. correlation (r) Value classifications

"r" Value	Association
+ .70 or Higher	A Very Strong Positive Association
+.50 to +.69	A Substantial Positive Association
+.30 to +.49	A Moderate Positive Association
+.10 to +.29	A Low Positive Association
+.01 to +.09	A Negligible Positive Association
.00	~ No Association ~
-.01 to -.09	A Negligible Negative Association
-.10 to -.29	A Low Negative Association
-.30 to -.49	A Moderate Negative Association
-.50 to -.69	A Substantial Negative Association
- .70 or Lower	A Very Strong Negative Association

Correlation analyses were conducted on all the factors obtained and with overall acceptance variable.

5.8.4 ANNOVA

An ANOVA is an analysis of the variation present in an experiment. It is a test of hypothesis that the variation in an experiment is no greater than that due to normal variation of individuals' characteristics and error in their measurement. In this the

variation will come from a number of sources depending upon the layout of the experiment. The concept behind experimental design and the formulation of an ANOVA model is to identify the sources of variation and construct the proper tests to compare them.

We are using here one way ANNOVA. In this we focus on the significance value. If the value of significance is <0.5, then the null hypothesis is rejected & vice versa.

6. Results & Findings

6.1 Analysis

As the factors were already identified from literature reviews and questions framed according to those identified factors. Factor analysis were conducted on those sets of questions to confirm that that were the components of a single factor. Confirmatory factor analysis (CFA) was conducted to verify the factor structure of a set of observed variables. CFA allowed confirming that there is a relationship between observed variables and their underlying latent constructs exists. Principal Components Analysis was conducted to reduce a set of variables to a single factor. 10 CFA were conducted to confirm the sub factors identified in the study. In this a Total variance table is obtained. There are two columns in Total variance explained table, namely (1) Initial Eigen values, (2) Extraction Sums of Squared loadings. The Initial Eigen values column shows the Eigen values of all components, the percentage of variance, and the cumulative percentage of the variance explained. Then SPSS extracts one factor as shown in second column Extraction Sums of Squared loadings. The rest of the components' values not meant for extraction were discarded by SPSS in this column. Then a component Matrix is made. There after KMO & Bartlett's test is done. This is done to test the validity of the scales used. Finally Cronbach's Alpha Reliability Test is done to check the reliability of the scales used. Each analysis conducted on various sub-factors considered under the major factors. These analysis are mentioned below

:

Organizational Factor

Management Support

Principle Component Analysis

Principal Component Analysis extraction method was conducted on Questions A1, A2, A3, and A4. On analysis it was observed that variance value lies above the accepted value that suggests that the Factor Analysis is accepted. The following component matrix shows that all the four statements can be taken as a single factor. Variance observed on analysis was 62.999% and all the four variables contributed to a single factor named as Management Support.

Total Variance

Table 5. Total Variance (Management Support)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.520	62.999	62.999	2.520	62.999	62.999
2	.636	15.912	78.911			
3	.523	13.084	91.995			
4	.320	8.005	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix

Table 6. Component Matrix[a] (Management Support)

	Component
	1
Provided Round the clock support Post Go Live	.829
Provided Adequate Support Staff	.821
Organized Systematic Training Workshop	.795
Vision Communicated effectively	.726

Extraction Method: Principal Component Analysis.

KMO & Bartlett's Test

The value for Kaiser-Meyer-Olkin measure for the set of variables should exceed 0.50, and it exceeds the critical value as shown:

Table 7. KMO and Bartlett's Test (Management Support)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.739
Bartlett's Test of Sphericity	Approx. Chi-Square	442.555
	df	6
	Sig.	.000

A value of .739 for the set of variables used in this study is considered good, and a value close to 1 indicates that the correlation pattern for this set of variables is good and would load with a distinct pattern of factors (Field, 2005).

Reliability Test

On reliability test, four items returned a Cronbach's Alpha of 0.803, which is substantially above the 0.7 threshold. The four items were combined into a single factor and named as Management support and was used for the correlation analysis. The table displayed in SPSS output file is shown below:

Table 8. Reliability Statistics (Management Support)

Cronbach's Alpha	N of Items
.803	4

Communication

Principle Component Analysis

Principal Component Analysis extraction method was conducted on Questions A5, A6. On analysis it was observed that variance value lies above the accepted value that suggests that the Factor Analysis is accepted. The following component matrix shows that two statements can be taken as a single factor. Variance observed on analysis was 79.791% and the two variables contributed to a single factor named as Communication.

Total Variance

Table 9. Total Variance Explained (Communication)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.596	79.791	79.791	1.596	79.791	79.791
2	.404	20.209	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix

Table 10. Component Matrix[a] (Communication)

	Component
	1
Go Live and Training sessions were well communicated in Advance	.893
Change in work process were communicated in advance	.893

Extraction Method: Principal Component Analysis.

KMO & Bartlett's Test

The value for Kaiser-Meyer-Olkin measure for the set of variables should exceed 0.50, and it exceeds the critical value as shown in

Table 11. KMO and Bartlett's Test (Communication)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.500
Bartlett's Test of Sphericity	Approx. Chi-Square	147.999
	df	1
	Sig.	.000

A value of .500 for the set of variables used in this study is considered good.

Reliability Test

On reliability test, two items returned a Cronbach's Alpha of 0.746, which is substantially above the 0.7 threshold. The two items were combined into a single factor and named as Communication and was used for the correlation analysis. The table displayed in SPSS output file is shown below

Table 12. Reliability Statistics (Communication)

Cronbach's Alpha	N of Items
.746	2

Training

Principle Component analysis

Principal Component Analysis extraction method was conducted on Questions A6, A7, A8, A9, A10, A11, A12. On analysis it was observed that variance value lies above the accepted value that suggests that the Factor Analysis is accepted. The following component matrix shows that six statements can be taken as a single factor. Variance observed on analysis was 64.158% and the six variables contributed to a single factor and were named as training.

Total Variance

Table 13. Total Variance Explained (Training)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.849	64.158	64.158	3.849	64.158	64.158
2	.780	13.000	77.158			
3	.643	10.720	87.879			
4	.317	5.283	93.161			
5	.235	3.910	97.071			
6	.176	2.929	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix

Table 14. Component Matrix[a] (Training)

	Component
	1
Adequate Hands on Training Provided	.858
Received adequate training on EHR	.812
Sufficient Training materials were supplied during training	.805
Day in Life scenarios were demonstrated	.802
Sufficient Training materials were supplied after training	.777
EHR Refresher course was effective and useful	.747

Extraction Method: Principal Component Analysis.

KMO & Bartlett's Test

The value for Kaiser-Meyer-Olkin measure for the set of variables should exceed 0.50, and it exceeds the critical value as shown in

Table 15. KMO and Bartlett's Test (Training)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.796
Bartlett's Test of Sphericity	Approx. Chi-Square	1236.915
	df	15
	Sig.	.000

A value of .796 for the set of variables used in this study is considered good.

Reliability Test

On reliability test, six items returned a Cronbach's Alpha of 0.882, which is substantially above the 0.7 threshold. The six items were combined into a single factor and named as Training and was used for the correlation analysis. The table displayed in SPSS output file is shown below

Table 16. Reliability Statistics (Training)

Cronbach's Alpha	N of Items
.882	6

IT Infrastructure

Principle Component Analysis

Principal Component Analysis extraction method was conducted on Questions A13, A14, A15. On analysis it was observed that variance value lies above the accepted value that suggests that the Factor Analysis is accepted. The following component matrix shows that three statements can be taken as a single factor. Variance observed on analysis was 59.596% and the three variables contributed to a single factor and were named as IT infrastructure.

Total Variance

Table 17. Total Variance Explained (IT Infrastructure)

Component	Initial Eigen values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.788	59.596	59.596	1.788	59.596	59.596
2	.698	23.256	82.853			
3	.514	17.147	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix

Table 18. Component Matrix[a] (IT Infrastructure)

	Component
	1
Computers at workplace connected with reliable Wireless/Local Area Network	.815
Adequate computers available at workplace	.788
In house IT team always available for resolving issues	.708

Extraction Method: Principal Component Analysis.

KMO & Bartlett's Test

The value for Kaiser-Meyer-Olkin measure for the set of variables should exceed 0.50, and it exceeds the critical value as shown in

Table 19. KMO and Bartlett's Test (IT Infrastructure)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.639
Bartlett's Test of Sphericity	Approx. Chi-Square	149.586
	df	3
	Sig.	.000

A value of .639 for the set of variables used in this study is considered good, and a value close to 1 indicates that the correlation pattern for this set of variables is good and would load with a distinct pattern of factors (Field, 2005).

Reliability Test

On reliability test, three items returned a Cronbach's Alpha of 0.653, which is substantially above the 0.65 threshold which is minimally acceptable. The three items were combined into a single factor and named as IT infrastructure and was used for the correlation analysis. The table displayed in SPSS output file is shown below

Table 20. Reliability Statistics (IT Infrastructure)

Cronbach's Alpha	N of Items
.653	3

Individual factor

Prior Computer skills

Principle Component Analysis

Principal Component Analysis extraction method was conducted on Questions B1, B2,B3. But on analysis we observed that B3 dint have much weightage and reliability was affecting due to that question. So, we removed that question and again did the analysis with B1 & B2. On analysis of that , it was observed that variance value lies above the accepted value which suggests that the Factor Analysis is accepted. The following component matrix shows that two statements can be taken as a single factor. Variance observed on analysis was 84.556% and the two variables contributed to a single factor named as Prior Computer skills.

Total variance

Table 21. Total Variance (Prior Computer Skills)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.691	84.556	84.556	1.691	84.556	84.556
2	.309	15.444	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix

Table 22. Component Matrix[a] (Prior Computer Skills)

	Component
	1
Knowledge of MS Office(MS Word/ MS Excel)	.920
Prior training on Basic Computer Course	.920

Extraction Method: Principal Component Analysis.

KMO and Bartlett's Test

The value for Kaiser-Meyer-Olkin measure for the set of variables should exceed 0.50, and it exceeds the critical value as shown in

Table 23. KMO and Bartlett's (Prior Computer Skills)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.500
Bartlett's Test of Sphericity	Approx. Chi-Square	219.185
	df	1
	Sig.	.000

A value of .500 for the set of variables used in this study is considered good.

Reliability Test

On reliability test, two items returned a Cronbach's Alpha of 0.817, which is substantially above the 0.7 threshold. The two items were combined into a single factor and named as Prior Computer Skills and was used for the correlation analysis. The table displayed in SPSS output file is shown below

Table 24. Reliability Statistics (Prior Computer Skills)

Cronbach's Alpha	N of Items
.817	2

Professional Autonomy

Principle Component Analysis

Principal Component Analysis extraction method was conducted on Questions B4, B5. On analysis it was observed that variance value lies above the accepted value that suggests that the Factor Analysis is accepted. The following component matrix shows that two statements can be taken as a single factor. Variance observed on analysis was 84.780% and the two variables contributed to a single factor named as physician Autonomy.

Total variance

Table 25. Total Variance (Professional Autonomy)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.696	84.780	84.780	1.696	84.780	84.780
2	.304	15.220	100.000			

Extraction Method: Principal Component Analysis

Component Matrix

Table 26. Component Matrix[a] (Professional Autonomy)

	Component
	1
Alerts from EHR interferes in Decision Making	.921
Alerts and Reminders are interfering in usage	.921

Extraction Method: Principal Component Analysis.

KMO & Bartlett's Test

The value for Kaiser-Meyer-Olkin measure for the set of variables should exceed 0.50, and it exceeds the critical value as shown in

Table 27. KMO and Bartlett's Test (Professional Autonomy)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.500
Bartlett's Test of Sphericity	Approx. Chi-Square	223.214
	df	1
	Sig.	.000

A value of .500 for the set of variables used in this study is considered good.

Reliability Test

On reliability test, six items returned a Cronbach's Alpha of 0.820, which is substantially above the 0.7 threshold. The two items were combined into a single factor and named as Physician Autonomy and was used for the correlation analysis. The table displayed in SPSS output file is shown below

Table 28. Reliability Statistics (Professional Autonomy)

Cronbach's Alpha	N of Items
.820	2

Time

Principle Component Analysis

Principal Component Analysis extraction method was conducted on Questions B6, B7, B8. On analysis it was observed that variance value lies above the accepted value that suggests that the Factor Analysis is accepted. The following component matrix shows that six statements can be taken as a single factor. Variance observed on analysis was 66.467% and the six variables contributed to a single factor and were named as time.

Table 29. Total Variance (Time)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.994	66.467	66.467	1.994	66.467	66.467
2	.624	20.785	87.252			
3	.382	12.748	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix

Table 30. Component Matrix[a] (Time)

	Component
	1
EHR Implementation increased workload	.874
Manual processes were consuming lesser time	.788
Entering Patient notes consumes time	.780

Extraction Method: Principal Component Analysis.

KMO & Bartlett's Test

The value for Kaiser-Meyer-Olkin measure for the set of variables should exceed 0.50, and it exceeds the critical value as shown in

Table 31. KMO and Bartlett's Test (Time)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.648
Bartlett's Test of Sphericity	Approx. Chi-Square	250.644
	Df	3
	Sig.	.000

A value of .648 for the set of variables used in this study is considered good.

Reliability Test

On reliability test, six items returned a Cronbach's Alpha of 0.748, which is substantially above the 0.7 threshold. The six items were combined into a single factor and named as Time and was used for the correlation analysis. The table displayed in SPSS output file is shown below

Table 32. Reliability Statistics (Time)

Cronbach's Alpha	N of Items
.748	3

Benefits

Usefulness

Principle Component Analysis

Principal Component Analysis extraction method was conducted on Questions C1,C2,C3,C4,C5. On analysis it was observed that variance value lies above the accepted value that suggests that the Factor Analysis is accepted. The following component matrix shows that six statements can be taken as a single factor. Variance observed on analysis was 61.431% and the six variables contributed to a single factor and were named as usefulness.

Total Variance

Table 33. Total Variance (Usefulness)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.072	61.431	61.431	3.072	61.431	61.431
2	.656	13.113	74.544			
3	.550	11.002	85.546			
4	.391	7.817	93.363			
5	.332	6.637	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix

Table 34. Component Matrix[a] (Usefulness)

	Component
	1
EHR improved communication between different stakeholders	.835
EHR improveduality of patient care delivered	.798
EHR reduced medication errors and improved patient safety	.789
EHR reduced patient record retrieval time	.770
EHR provides legible documents	.722

Extraction Method: Principal Component Analysis.

KMO & Bartlett's Test

The value for Kaiser-Meyer-Olkin measure for the set of variables should exceed 0.50, and it exceeds the critical value as shown in

Table 35. KMO and Bartlett's Test (Usefulness)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.821
Bartlett's Test of Sphericity	Approx. Chi-Square	652.832
	df	10
	Sig.	.000

A value of .821 for the set of variables used in this study is considered good.

Reliability Test

On reliability test, six items returned a Cronbach's Alpha of 0.842, which is substantially above the 0.7 threshold. The six items were combined into a single factor and named as Usefulness and was used for the correlation analysis. The table displayed in SPSS output file is shown below

Table 36. Reliability Statistics (Usefulness)

Cronbach's Alpha	N of Items
.842	5

Ease of use

Principle Component Analysis

Principal Component Analysis extraction method was conducted on Questions C6,C7,C8,C9. On analysis it was observed that variance value lies above the accepted value that suggests that the Factor Analysis is accepted. The following component matrix shows that four statements can be taken as a single factor. Variance observed on analysis was 62.312% and the six variables contributed to a single factor and were named as Ease of use.

Total Variance

Table 37. Total Variance (Ease of Use)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.492	62.312	62.312	2.492	62.312	62.312
2	.621	15.520	77.832			
3	.495	12.386	90.218			
4	.391	9.782	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix

Table 38. Component Matrix[a] (Ease of Use)

	Component
	1
Easy to detect and correct errors in patient records	.830
Usage of templates helped in making detailed and structured records	.792
Orders can be placed easily and quickly in EHR	.786
EHR gives instant access to patients graphs and charts	.748

Extraction Method: Principal Component Analysis.

KMO & Bartlett's Test

The value for Kaiser-Meyer-Olkin measure for the set of variables should exceed 0.50, and it exceeds the critical value as shown in

Table 39. KMO and Bartlett's Test (Ease of Use)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.776
Bartlett's Test of Sphericity	Approx. Chi-Square	405.578
	df	6
	Sig.	.000

A value of .776 for the set of variables used in this study is considered good.

Reliability Test

On reliability test, six items returned a Cronbach's Alpha of 0.797, which is substantially above the 0.7 threshold. The six items were combined into a single factor and named as Ease of use and was used for the correlation analysis. The table displayed in SPSS output file is shown below

Table 40. Reliability Statistics (Ease of Use)

Cronbach's Alpha	N of Items
.797	4

Attitude

Principle Component Analysis

Principal Component Analysis extraction method was conducted on Questions D1,D2,D3,D4,D5. On analysis it was observed that variance value lies above the accepted value that suggests that the Factor Analysis is accepted. The following component matrix shows that six statements can be taken as a single factor. Variance observed on analysis was 72.282% and the six variables contributed to a single factor and were named as Attitude.

Total variance

Table 41. Total Variance (Attitude)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.614	72.282	72.282	3.614	72.282	72.282
2	.834	16.679	88.962			
3	.275	5.493	94.454			
4	.162	3.247	97.701			
5	.115	2.299	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix

Table 42. Component Matrix[a] (Attitude)

	Component
	1
EHR helps me to retrieve detailed and structured clinical data of my patients	.905
All physicians and nurses should learn to use EHR effectively	.905
EHR technology support physician and nurses in providing efficient care	.903
I will encourage my colleagues for using EHR	.801
I am satisfied with computer based patient record	.721

Extraction Method: Principal Component Analysis.

KMO & Bartlett's Test

The value for Kaiser-Meyer-Olkin measure for the set of variables should exceed 0.50, and it exceeds the critical value as shown in

Table 43. KMO and Bartlett's Test (Attitude)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.805
Bartlett's Test of Sphericity	Approx. Chi-Square	1403.321
	df	10
	Sig.	.000

A value of .805 for the set of variables used in this study is considered good

Reliability Test

On reliability test, six items returned a Cronbach's Alpha of 0.899, which is substantially above the 0.7 threshold. The six items were combined into a single factor and named as Attitude and was used for the correlation analysis. The table displayed in SPSS output file is shown below

Table 44. Reliability Statistics (Attitude)

Cronbach's Alpha	N of Items
.899	5

Correlation Analysis

Table 45. Correlation Table between Organizational Factors , Individual Factors & Usefulness

	Management Support	Communication	Training	IT Infrastructure	Prior Computer Skills	Professional Autonomy	Time	Usefulness
Management Support	1	**.618****	**.601****	**.343****	.266**	.157**	-.162**	**.348****
Communication	.618**	1	**.658****	.278**	**.337****	0.075	0	.235**
Training	.601**	.658**	1	**.508****	**.336****	0.092	0.034	**.456****
IT Infrastructure	.343**	.278**	.508**	1	**.391****	-0.017	-0.065	**.420****
Prior Computer Skills	.266**	.337**	.336**	.391**	1	-0.047	0	**.340****
Professional Autonomy	.157**	0.075	0.092	-0.017	-0.047	1	.240**	.116*
Time	-.162**	0	0.034	-0.065	0	.240**	1	-.184**
Usefulness	.348**	.235**	.456**	.420**	.340**	.116*	-.184**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

C1. The correlation between Management support & Usefulness.

The variables in this particular correlation display a moderate positive association at 0.348. This correlation is significant at the 1 percent level.

C2. The correlation between Management support & Communication.

The variables in this particular correlation display a substantial positive association at 0.618. This correlation is significant at the 1 percent level.

C3. The correlation between Management support & Training.

The variables in this particular correlation display a substantial association at 0.601. This correlation is significant at the 1 percent level.

C4. The correlation between Management support & IT Infrastructure.

The variables in this particular correlation display a moderate positive association at 0.343. This correlation is significant at the 1 percent level.

C5. The correlation between Management support & Prior Computer Skills.

The variables in this particular correlation display a low positive association at 0.266. This correlation is significant at the 1 percent level.

C6. The correlation between Management support & Professional Autonomy.

The variables in this particular correlation display a low positive association at 0.157. This correlation is significant at the 1 percent level.

C7. The correlation between Management support & Time.

The variables in this particular correlation display a low negative association at -0.162. This correlation is significant at the 1 percent level.

C8. The correlation between Communication & Usefulness.

The variables in this particular correlation display a low positive association at 0.235. This correlation is significant at the 1 percent level.

C9. The correlation between Communication & Training.

The variables in this particular correlation display a substantial positive association at 0.658. This correlation is significant at the 1 percent level.

C10. The correlation between Communication & IT Infrastructure.

The variables in this particular correlation display a low positive association at 0.278. This correlation is significant at the 1 percent level.

C11. The correlation between Communication & Prior Computer Skills.

The variables in this particular correlation display a moderate positive association at 0.337. This correlation is significant at the 1 percent level.

C12. The correlation between Training & Usefulness.

The variables in this particular correlation display a Association at 0.456. This correlation is significant at the 1 percent level.

C13. The correlation between Training & IT Infrastructure.

The variables in this particular correlation display a substantial positive association at 0.508. This correlation is significant at the 1 percent level.

C14. The correlation between Training & Prior Computer Skills.

The variables in this particular correlation display a moderate positive association at 0.336. This correlation is significant at the 1 percent level.

C15. The correlation between IT Infrastructure & Usefulness.

The variables in this particular correlation display a moderate positive association at 0.420. This correlation is significant at the 1 percent level.

C16. The correlation between IT Infrastructure & Prior Computer Skills.

The variables in this particular correlation display a moderate positive association at 0.391. This correlation is significant at the 1 percent level.

C17. The correlation between Prior Computer Skills & Usefulness.

The variables in this particular correlation display a moderate positive association at 0.340. This relationship is significant at the 1 percent level of significance.

C18. The correlation between Professional Autonomy & Usefulness.

The variables in this particular relationship display a low positive association at 0.116. This relationship is significant at the 5 percent level of significance.

C19. The correlation between Professional Autonomy & Time.

The variables in this particular correlation display a low positive association at 0.240. This correlation is significant at the 1 percent level of significance.

C20. The correlation between Time & Usefulness.

The variables in this particular correlation display a low negative association at -0.184. This correlation is significant at the 1 percent level of significance.

Table 46. Correlation Table between Organizational Factors , Individual Factors & Ease of Use

	Management Support	Communication	Training	IT Infrastructure	Computer Skills	Professional Autonomy	Time	Ease of Use
Management	1	**.618****	**.601****	**.343****	.266**	.157**	-.162**	**.397****
Communication	.618**	1	**.658****	.278**	**.337****	0.075	0	**.347****
Training	.601**	.658**	1	**.508****	**.336****	0.092	0.034	**.319****
IT Infrastructure	.343**	.278**	.508**	1	**.391****	-0.017	-0.065	**.324****
Prior Computer	.266**	.337**	.336**	.391**	1	-0.047	0	**.399****
Professional	.157**	0.075	0.092	-0.017	-0.047	1	.240**	.115*
Time	-.162**	0	0.034	-0.065	0	.240**	1	-.219**
Ease of Use	.397**	.347**	.319**	.324**	.399**	.115*	-.219**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

C21. The correlation between Management support & Ease of Use.

The variables in this particular correlation display a moderate positive association at 0.396. This correlation is significant at the 1 percent level of significance.

C22. The correlation between Communication & Ease of Use.

The variables in this particular correlation display association at 0.347. This correlation is significant at the 1 percent level of significance.

C23. The correlation between Training & Ease of Use.

The variables in this particular correlation display a moderate positive association at 0.319. This correlation is significant at the 1 percent level of significance.

C24. The relationship between IT Infrastructure & Ease of Use

The variables in this particular correlation display a moderate positive association at 0.324. This correlation is significant at the 1 percent level of significance.

C25. The correlation between Prior Computer Skills & Ease of Use.

The variables in this particular correlation display a moderate positive association at 0.399. This correlation is significant at the 1 percent level of significance.

C26. The correlation between Professional Autonomy & Ease of Use.

The variables in this particular correlation display a low positive association at 0.115. This correlation is significant at the 5 percent level of significance.

C27. The correlation between Time & Ease of Use.

The variables in this particular correlation display a low negative association at -0.219. This correlation is significant at the 1 percent level of significance.

Table 47. Correlation Table between Organizational Factors , Individual Factors & Attitude

	Management Support	Communication	Training	IT Infrastructure	Prior Computer Skills	Professional Autonomy	Time	Attitude
Management	1	**.618****	**.601****	**.343****	.266**	.157**	-.162**	**.715****
Communication	.618**	1	**.658****	.278**	**.337****	0.075	0	**.516****
Training	.601**	.658**	1	**.508****	**.336****	0.092	0.034	**.488****
IT Infrastructure	.343**	.278**	.508**	1	**.391****	-0.017	-0.065	**.312****
Prior Computer	.266**	.337**	.336**	.391**	1	-0.047	0	**.388****
Professional	.157**	0.075	0.092	-0.017	-0.047	1	.240**	0.091
Time	-.162**	0	0.034	-0.065	0	.240**	1	-.107*
Attitude	.715**	.516**	.488**	.312**	.388**	0.091	-.107*	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

C28. The correlation between Management support & Attitude.

The variables in this particular correlation display a very strong positive association at 0.715. This correlation is significant at the 1 percent level of significance.

C29. The correlation between Communication & Attitude.

The variables in this particular correlation display a substantial positive association at 0.516. This correlation is significant at the 1 percent level of significance.

C30. The correlation between Training & Attitude.

The variables in this particular correlation display a moderate positive association at0.488. This correlation is significant at the 1 percent level of significance.

C31. The correlation between IT Infrastructure & Attitude.

The variables in this particular correlation display a moderate positive association at 0.312. This correlation is significant at the 1 percent level of significance.

C32. The correlation between Prior Computer Skills & Attitude.

The variables in this particular correlation display a moderate positive association at 0.388. This correlation is significant at the 1 percent level of significance.

C33. The correlation between Time & Attitude.

The variables in this particular correlation display a low negative association at -0.107. This correlation is significant at the 1 percent level of significance.

Table 48. Correlation Table between Attitude, Ease of Use & Usefulness

	Attitude	Usefulness	Ease of Use
Attitude	1	**.335****	**.348****
Usefulness	.335**	1	**.625****
Ease of Use	.348**	.625**	1

C34. The correlation between Ease of Use & Usefulness.

The variables in this particular correlation display a substantial positive association at 0.625. This correlation is significant at the 1 percent level of significance.

C35. The Correlation between Usefulness & Attitude.

The variables in this particular correlation display a moderate positive association at 0.335. This correlation is significant at the 1 percent level of significance.

C36. The Correlation between Ease of Use & Attitude.

The variables in this particular correlation display a moderate positive association at 0.348. This correlation is significant at the 1 percent level of significance.

Table 49. Correlation Table between ease of Use, Usefulness & Overall attitude about EHR

	Overall My attitude about EHR is positive	Usefulness	Ease of Use
Overall	1	.247**	.230**
Usefulness	.247**	1	**.625****
Ease of Use	.230**	.625**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

C37. The Correlation between Usefulness & EHR Acceptance.

The variables in this particular correlation display a low positive association at 0.247. This correlation is significant at the 1 percent level of significance.

C38. The Correlation between Ease of Use & EHR Acceptance.

The variables in this particular correlation display a low positive association at 0.230. This correlation is significant at the 1 percent level of significance.

Table 50. Correlation Table between Overall Attitude about EMR & Attitude

	Overall My attitude about EHR is positive	Attitude
Overall	1	**.726****
Attitude	.726**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

C39. The correlation between Attitude & EHR Acceptance.

The variables in this particular correlation display a very strong positive association at 0.726. This correlation is significant at the 1 percent level of significance.

Table 51. Correlation Table between Organizational Factors & Overall Attitude about EMR.

	attitude about EHR is positive	Management Support	Communication	Training	IT Infrastructure
Overall	1	**.561****	**.461****	**.373****	.274**
Management	.561**	1	**.618****	**.601****	**.343****
Communicati	.461**	.618**	1	**.658****	.278**
Training	.373**	.601**	.658**	1	**.508****
IT	.274**	.343**	.278**	.508**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

C40. The correlation between Management support & EHR Acceptance.

The variables in this particular correlation display a substantial positive association at 0.561. This correlation is significant at the 1 percent level of significance.

C41. The correlation between Communication & EHR Acceptance.

The variables in this particular correlation display a moderate positive association at 0.461. This correlation is significant at the 1 percent level of significance.

C42. The correlation between Training & EHR Acceptance.

The variables in this particular correlation display a moderate positive association at 0.373. This correlation is significant at the 1 percent level of significance.

C43. The correlation between IT Infrastructure & EHR Acceptance.

The variables in this particular correlation display a low positive association at 0.274. This correlation is significant at the 1 percent level of significance.

Table 52. Correlation Table between Individual Factors & Overall Attitude about EMR.

	Overall My attitude about EHR is positive	Prior Computer Skills	Professional Autonomy	Time
Overall attitude	1	**.366****	-0.014	-0.091
Prior Computer	.366**	1	-0.047	0
Professional	-0.014	-0.047	1	.240**
Time	-0.091	0	.240**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

C44. The correlation between Prior Computer Skills & EMR Acceptance.

The variables in this particular correlation display a moderate positive association at 0.366. This correlation is significant at the 1 percent level of significance.

6.2 ICT (EHR) Acceptance Model

From the results obtained in the above analysis, a model is proposed which is depicting the factors acting as facilitators to the attitude towards acceptance of EHR.

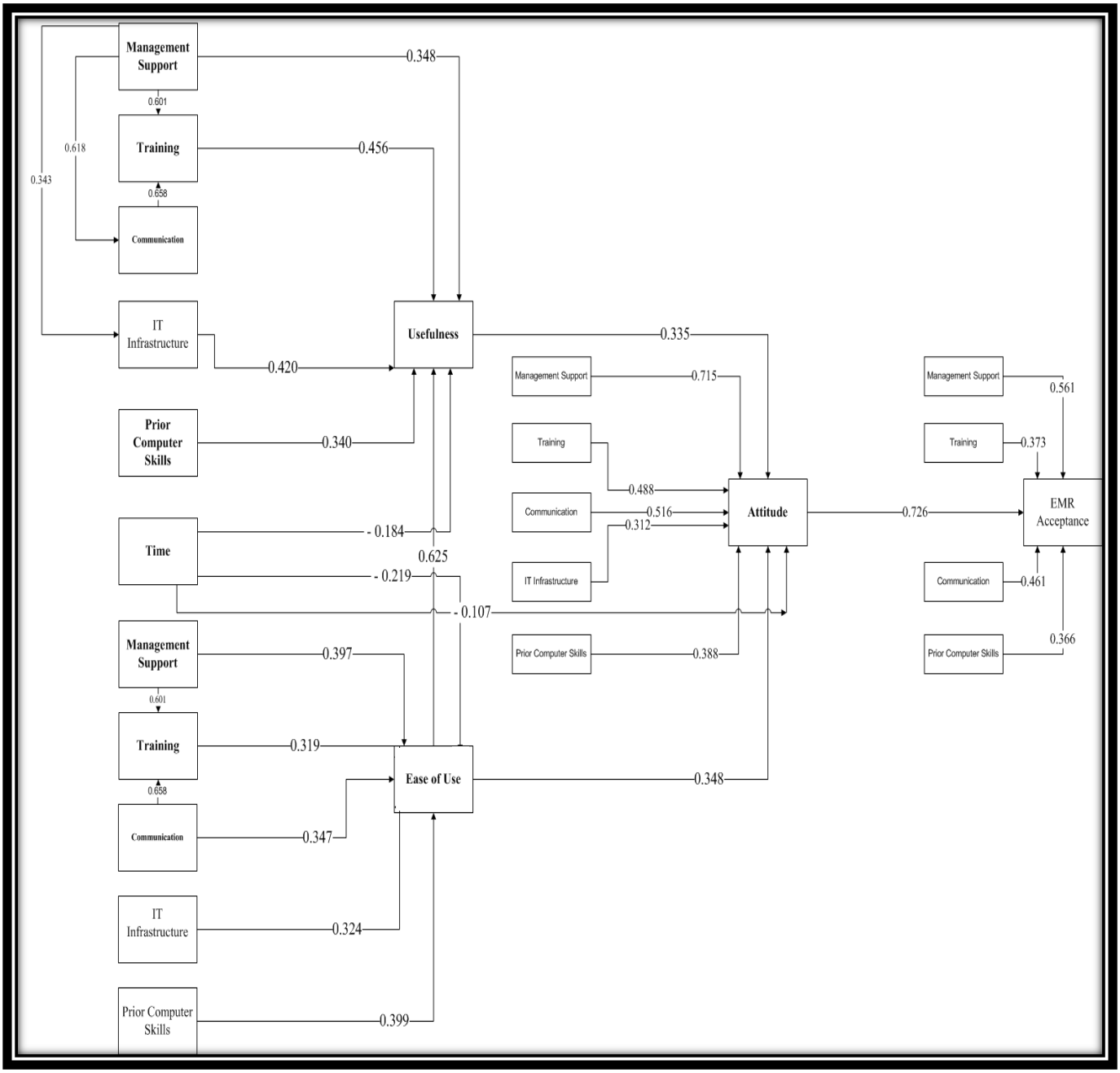

Figure 8. ICT (EHR) Acceptance Model .

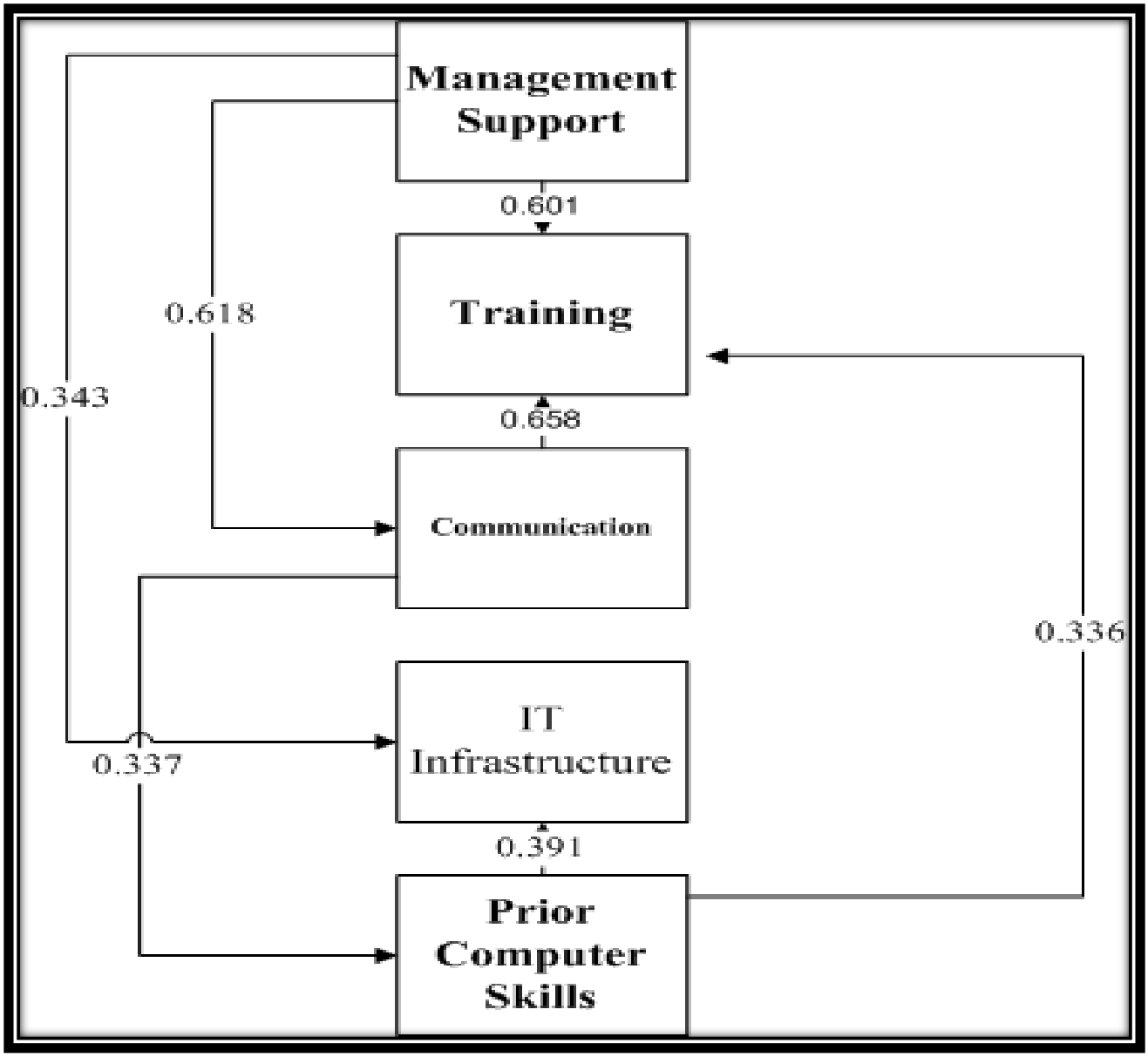

Figure 9. Correlation between Factors

6.3 Hypothesis Testing

Hypothesis

H1. EHR acceptance by physicians & nurses is dependent on Management Support.

Accepted

Table 53. ANOVA (Management Support & Overall Attitude about EMR)

Overall My attitude about EHR is positive

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	59.990	42	1.428	8.411	.000
Within Groups	50.433	297	.170		
Total	110.424	339			

On applying ANOVA to the variables in this relationship, we found that the value of significance is < 0.05. This shows that the hypothesis is accepted.

H2. EHR acceptance by physicians & nurses is dependent on Communication.

Accepted

Table 54. ANOVA (Communication & Overall Attitude about EMR)

Overall My attitude about EHR is positive

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	37.596	13	2.892	12.945	.000
Within Groups	72.828	326	.223		
Total	110.424	339			

On applying ANOVA to the variables in this relationship, we found that the value of significance is < 0.05. This shows that the hypothesis is accepted.

H3. EHR acceptance by physicians & nurses is dependent on Training.

Accepted

Table 55. ANOVA (Management Support & Overall Attitude about EMR)

Overall My attitude about EHR is positive

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	58.701	81	.725	3.615	.000
Within Groups	51.722	258	.200		
Total	110.424	339			

On applying ANOVA to the variables in this relationship, we found that the value of significance is < 0.05. This shows that the hypothesis is accepted.

H4. EHR acceptance by physicians & nurses is dependent on Prior Computer Skills.

Accepted

Table 56. ANOVA (Prior Computer Skills & Overall attitude about EMR)

Overall My attitude about EHR is positive

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	22.467	12	1.872	6.961	.000
Within Groups	87.956	327	.269		
Total	110.424	339			

On applying ANOVA to the variables in this relationship, we found that the value of significance is < 0.05. This shows that the hypothesis is accepted.

H5. EHR acceptance by physicians & nurses is dependent on Attitude.

Accepted

Table 57. ANOVA (Attitude & Overall Attitude about EMR)

Overall My attitude about EHR is positive

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	71.527	31	2.307	18.270	.000
Within Groups	38.897	308	.126		
Total	110.424	339			

On applying ANOVA to the variables in this relationship, we found that the value of significance is < 0.05. This shows that the hypothesis is accepted.

7. Discussion

In this we will discuss the main findings of this research project & how they are connected to the existing literature on acceptance of EHR.

It is discussed above that we have considered 11 sub- factors under 5 broad categories of factors. We will discuss the findings of each of these sub-factors and compare it with the findings of the previously conducted studies.

As far as Management support is concerned , several studies have revealed that there is a positive relationship between management support and perceived usefulness.[2,16] Some studies have shown that there is a significant correlation between management support & the attitude towards acceptance of EHR.[40] The results of this study are consistent with the results of the other studies. The study has shown that there is a positive relationship with usefulness & ease of use. Also it has shown a strong positive association with attitude towards using the system.

Communication being an important component for implementation & acceptance of EHR has shown a substantial positive association with acceptance of EHR. The same has been depicted in the other studies as well that communication & attitude are positively correlated.[15] In addition to that the study also shows that communication is strongly associated with ease of use..

Previously conducted studies have depicted that training positively influences the usefulness of the system.[27] This study results also match with that result showing that training is

associated with the usefulness. Moreover, the results also show that training has a strong positive association with ease of use.

The study has shown that IT Infrastructure has positive association with attitude. This result is consistent with the previously conducted studies, which has also shown a positive association with attitude.[40] In addition to that this study has shown that IT infrastructure is also positively associated with ease of use.

Past research has found that physicians who have prior knowledge of basic computer skills are more likely to accept the electronic Health record systems. The results of this study are consistent with the above results. Prior computer skills have shown a good association with EHR acceptance, attitude, ease of use & usefulness.

In the study professional autonomy has shown negative association with EHR acceptance, a weak but positive association has been shown with usefulness & ease of use and is significant . Also a positive association of Professional autonomy has been shown with attitude but as it is not significant , it cannot be accepted. Previously conducted studies have shown strong negative direct influence on intention to use technology, attitude towards EHR & on perceived usefulness of a technology.[41]

According to this study results, time has shown a negative association with ease of use, usefulness & attitude which is significant. Also time has shown negative association with EHR acceptance but it is not significant.

According to many studies conducted before EHR should provide clear benefits to the clinical staff.[4,5] Also studies have revealed that usefulness of the system leads to the acceptance of EHR. Several other studies reported usefulness to be more important than ease-of-use.[11] This study depicts that there is a positive association between usefulness & EHR acceptance. Moreover, usefulness is associated with many other factors like management support, communication , training, IT Infrastructure and last but not the least ease of use.

Some studies found ease-of-use as an important factor influencing technology adoption among physicians, others did not.[41] But this study reveals that ease of use & acceptance of EHR by clinical staff is associated which shows that ease of use leads to acceptance of EHR by the clinical staff. Moreover, ease of use is also associated with management support, communication , training, IT Infrastructure , prior computer skills & is strongly correlated with usefulness.

Attitude is influenced by many factors in this study. It has shown positive association with IT infrastructure, time, usefulness, ease of use & very strong association with management support communication & EMR Acceptance. But, it has shown no association with professional autonomy. The same results have been depicted in other studies as well. The

previously conducted studies also show that there is a negative association of professional autonomy with attitude.[4,7]

Table 58. Overall Attitude on usage of EHR

Category	Mean	N
Physician	3.72	170
Nurse	3.60	170
Total	3.66	340

The following table shows that both physicians and nurses have positive attitude about the usage of EHR.

8. 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 is to identify the factors influencing the attitude of the healthcare professionals i. e physicians & nurses towards the acceptance of EHR. The data gathered was analyzed. Then a model is made which shows the factors influencing the attitude and the acceptance of EHR by the clinical staff. The model depicts that Attitude of the clinical staff s

is directly & ultimately leading to the acceptance of EHR by them. The attitude in turn is being positively influenced by the sub-factors management support, training, communication, IT infrastructure (Organizational Factors), Prior computer skills (Individual Factors), usefulness & ease of use (Benefits). Among these factors management support (r=0.715), communication (r= 0.516), training (r=0.488) are strongly influencing the attitudes.

Moreover, EHR acceptance is directly influenced by management support, training & communication (Organizational Factors), prior computer skills (Individual factors). Among these management support (r= 0.516) is strongly influencing the EHR acceptance by the clinical staff.

Time has shown a negative association with ease of use, usefulness and attitude at a significant level. And attitude is positively affecting EHR acceptance. This shows that indirectly time is negatively influencing EHR acceptance. So, it is a barrier.

Professional autonomy has shown weak positive association with ease of use & usefulness and is significant. Moreover, it has shown weak positive association with attitude but is insignificant and a negative association with EHR acceptance. This shows that lack of professional autonomy is a barrier.

Thus, we identified that Management support, communication, training, IT Infrastructure (Organizational factors); prior computer skills (Individual factors); usefulness, ease of use (benefits) & attitude are facilitators to the EHR acceptance. Whereas, lack of Professional autonomy & time are barriers to the Acceptance of EHR.

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 is 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.

9. Recommendations

1. To communicate the Vision in detail to the users.
2. To give a brief overview of the complete system by communicating them about all the different modules in that system.
3. To make the users aware of the benefits of the complete system.
4. To demonstrate the entire change in work flows can be during the training sessions and also reinforce within the mind of the users. This will help to avoid confusion during Go- live.
5. To explain each & everything about the new system in place starting from vision to work processes in practice, benefits etc. the newly hired employees during the induction programme to avoid ambiguity among the users.
6. To provide proper and systematic training to all users & stakeholders.
7. To teach and reinforce the users about the shortcut methods / entering the fields in the template with the help of key board. (Now they uses the mouse for entering the fields and key board for text which consumes time)
8. To increase the number of systems (Laptops/Desktops) or COWs in the wards.
9. To provide low cost tablets to providers or to provide one Notebook at each patient bed side.
10. To make a separate training plan just for the service desk personnel's & provide proper & systematic training to them so that they are able to resolve most of the issues step by step
11. At least (two) days training should be given to give a complete picture of the system. These 2 days will include knowledge assessment also.
12. A step by step issue solving guide document can be given to those people so that they can solve minor issues and escalate only major ones.
13. Physicians & nurses should make themselves used to with the basic computer applications, so that they will find easy to use CPRS.

14. To make basic computer awareness as an important criterion in the " Conditions to Apply" for recruiting new employees.
15. To provide 5- 6 hrs of training to the currently working employees who are not sound with the basics of computer.
16. To make the Super Users/ End Users aware of the following 3 things about CDSS:
    - ✓ Alerts are beneficial and not threats, but it assists them in taking a right decision.
    - ✓ Benefits of CDSS.
    - ✓ Benefits & importance of giving proper comments/ justifications when such alert dialog box pops up.
17. To explain the end users, about step by step process of the crisis management. This will help them and they won't be panic when any problem occurs.
18. To choose the person as a leader who is having good communication & leadership skills, sound computer knowledge and work processes.
19. To provide all the Super users & End users with the suitable training materials and quick reference guides which should contain step by step process of operating the system.
20. To provide all the super users & end users with the animated presentations. The users can refer to these documents whenever they forget any step while operating the system. This will be of great help to them and feel comfortable in using the system.

10. Limitations

- Getting responses from the physicians & nurses was difficult.
- The implementation has been done just few months back.

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12. APPENDICES

Questionnaire

A Study on factors influencing the attitude towards acceptance of Electronic Health Records

Respected Sir / Madam,

I am a Post Graduate student pursuing PGDHHM in Healthcare IT (2nd Year) from International Institute of Health Management Research, Dwarka, New Delhi. As a part of my Dissertation I'm conducting a study to analyze the factors affecting adoption of EHR in a Multi Specialty Hospital. So I request you to spare some of your precious time for this.

- All responses will be kept strictly confidential. Completed surveys will be used for data entry and analysis. Only aggregated data will be used.
- No individual data or responses will be reported. Please check one (1) response for each question and **give your honest opinion**

Thank you for sparing your Valuable time.

Jyotsna Khatri

Details of the Respondent

-

1. Name of the Respondent:

2. Category: Physician / Nurse

3. Age: (1) 21– 30 years (2) 31– 40 years

(3) 41-50 years (4) above 51 years

4. Gender: Male/ Female

5. Qualification: Diploma/ Graduate/ Post Graduate/ Doctorate

6. Designation:

7. Department: 8. Clinical Experience:

This section is related to the factors affecting Successful adoption of EHR in a Multi-Specialty Hospital. Kindly rate and tick your response to the factors given below on five point scales correspond them

A1	Systematic training workshop	Critical	Very Important	Important	Slightly Important	Unimportant
A2	Round the Clock support for EHR after Go Live	Critical	Very Important	Important	Slightly Important	Unimportant
A3	Adequate support staff during Go Live	Critical	Very Important	Important	Slightly Important	Unimportant
A4	EHR vision was communicated effectively	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
A5	Communication of change in work processes well before Go Live	Critical	Very Important	Important	Slightly Important	Unimportant
A6	Communication about Go Live and Training sessions	Critical	Very Important	Important	Slightly Important	Unimportant
A7	Received adequate training on EHR	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
A8	Sufficient Training materials were supplied during training	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
A9	Adequate Hands on Training was provided	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
A10	Day in Life scenarios were demonstrated before Go Live	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
A11	EHR refresher course given 1 week before Go Live was effective and useful	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
A12	Sufficient Training materials were supplied after training	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
A13	Adequate computers are available in your workplace	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
A14	Computers at workplace is connected with reliable Wireless (WiFi) / Local Area Network	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
A15	In house IT team is always available for resolving Issues	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

B1	Prior training on Basic Computer Course	Critical	Very Important	Important	Slightly Important	Unimportant
B2	Knowledge of MS Office (Word/ Excel)	Critical	Very Important	Important	Slightly Important	Unimportant
B3	Usage of computers in your professional life	Critical	Very Important	Important	Slightly Important	Unimportant
B4	Alerts from EHR interferes in your decision making	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
B5	Alerts, Reminders which helps you in making decisions is interfering to your Authority	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
B6	Entering Patient notes into EHR consumes time	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
B7	EHR implementation increased my work load	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
B8	Manual processes was consuming lesser time than EHR	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
B9	Influence of colleagues made start using EHR	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

To what extent you agree with the following statements related to benefits and problems with Implementation of EHR in your organization

C1	EHR has improved the quality of patient care delivered.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
C2	EHR has reduced patient record retrieval time.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
C3	EHR has reduced medication errors & improved patient safety.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
C4	EHR has improved communication between different stakeholders.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
C5	EHR provides you with legible documents.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
C6	Orders (Lab, Pharmacy) can be placed easily and quickly in EHR	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
C7	It is easy to detect and correct errors in Patient Records	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
C8	Usage of Templates helped you in making detailed and structured records	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
C9	EHR gives instant access to graphs and charts of Patients	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

D1	EHR technology support physician and nurses in providing efficient care	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
D2	I will encourage my colleauges for using EHR	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
D3	I am satisfied with computer based patient record	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
D4	EHR helps me to retrieve detailed and structured clinical data of my patients	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
D5	All physicians and nurses should learn to use EHR effectively	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
D6	Overall My attitude about EHR is positive	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

- You Prefer Paper Medical Records to Electronic Records Yes/ No
- You have any prior experience on using Electronic Health Records Yes/No

Thank you for completing this survey.