DISSERTATION

ON

BARRIERS AND FACILITATORS IN IMPLEMENTING EMR

IN

USA, SAUDI ARABIA & INDIA

SUBMITTED BY

DR. AAYUSHI RAJESH SONI

PG/15/001

POST GRADUATE DIPLOMA IN HOSPITAL AND HEALTH MANAGEMENT

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UNDER THE GUIDANCE OF

PROF. NISHIKANT BELE

INTERNATIONAL INSTITUTE OF HEALTH MANAGEMENT & RESEARCH

ACKNOWLEDGEMENT

Hard work, guidance and perseverance are the pre requisite for achieving success. Support from The Supreme power helps us to proceed on the path to it. I wish to thank the Almighty that provided me with the energy I needed to complete this summer training.

I am thankful and obliged to the Senior Manager **Mr. Ajay Aiyar** –NTT DATA Services, EMR practices and IT Services Managers- **Ms. Archika Roy**, **Mr. Ramkishore Prabhuraj**, **Ms. Avishikta Sarkar**, **Mr. Rituraj Choudhary**, & **Mr. Venkateshwaro M**. & for giving me an opportunity to work on this project. It has been my good fortune to be benefited by their knowledge, guidance and deep insight without which this project would not have taken the exact shape .To them, I express my heartfelt regards.

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I am highly indebted to my mentor at IIHMR, Delhi **Prof. Nishikant Bele** for his valuable guidance and motivation on various aspects of the project.

SUMMER INTERNSHIP EVALUATION

FINAL EVALUATION FORM TIER – III - During PPT
(To be filled by Review Panel/ Project Sponsor/ Project Guide)

Intern Name: Dr. Ayushi Soni
Title : Barriers and Facilitators in Implementing EMR in USA, Saudi Arabia & India
Date : 3rd May, 2017 **Locations** : **Bangalore**

Project Guide: Archika Roy, Kannan R, Yogita Thakral
Project Sponsor : Ajay Aiyar

Competency Evaluation

Rehire Eligibility of the Candidate : Yes

Rating Explanation: 1=Weak 2=Poor 3=Average 4=Good 5=Outstanding

Competency	Rating	Remarks
Are the recommendation proposed in line with the project objectives.	5	
Does the quality of work done during the project meet the quality expectations of the Organization.	5	
Key parameters have been identified influencing the project delivery.	5	
Viability of recommendation implementation.	4	
Risks and mitigation factors identified.	4	
Is able to understand and articulate the important of the project towards achieving Dell Goals.	5	
Utilization of the project experience in one's professional career	4	
Is adept at Handling complexity and is process oriented	4	
Ability to deal with ambiguity	4	

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SUMMER INTERNSHIP EVALUATION

Other Salient features

Key Strengths	Areas of Improvement
Proactive, attentive, raises questions and outstanding performance	Need to learn more on US Healthcare domain

Recommendation:

Evaluate the overall performance based on information documented and discussed during the feedback review process. For the review period: __6th Feb to 5th May 2017_____

Performance	Performance Description
Outstanding	Very hardworking and adaptable to suggestions and advises. Exceptionally good learner.

Other Significant Remarks: ____
She has gained good knowledge and gives expert recommendation on the topic she has researched upon.

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SUMMER INTERNSHIP EVALUATION

Project Rating:

Performance Rating	1	2	3	4	5	6	7	8	9	10

* Individual performance should be rated on a scale of 1 – 10 (with 1 being the lowest and 10 being the Best)
* Commendations will be given to the Top 3 projects.

Signature:

Project Guide: Archika Roy, Kannan R, Yogita Thakral

Project Sponsor: Ajay Aiyar

Review Panel Members:

Rituraj Choudhury
M Venkat
M.P. Ramkishore

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EMR	Electronic Medical Records
CDR	Clinical Data Repository
CPOE	Computerized Physician Order Entry
GP	General Practitioners
HIMSS	Health Information Management Systems Society
HIPAA	Health Insurance Portability and Accountability Act
HMO	Health Maintenance Organizations
LIMS	Laboratory Information Management Systems
MOH	Ministry of Health
NHS	National Health Service
RIS	Radiology Information System
TAM	Technology Acceptance Model

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1. Organization Overview

NTT DATA is a top 10 global business and IT services provider and global innovation partner with 100,000+ professionals in more than 50 countries now with $16B in revenue.

Headquartered in Tokyo, NTT DATA puts emphasis on long-term commitment and combine global reach and local intimacy to provide premier professional services from consulting, system development to business IT outsourcing. Since 1967, NTT DATA has played an instrumental role in establishing and advancing IT infrastructure.

Originally part of Nippon Telegraph and Telephone Public Corporation, its heritage contributed to social benefits with a quality-first mindset. A public company since 1995, the company builds on this proven track record of innovation by providing novel IT solutions to bring results in greater quality of life for people, communities and societies around the world.

Their services include

- Industry specific consulting
- Digital Business services
- BPO & BaaS
- Business intelligence analytics & automation
- Application modernization, development & management
- Cloud services
- Infrastructure management, security & hosting

Their client list includes

- 50+ federal agencies & military branches, in 25 states & municipalities
- 50% of US hospital, top 10 health plans, millions of patient covered
- Top 25 leading financial institutes in North America
- Top 10 automotive companies worldwide
- Manufacturing customers in over 40 countries

NTT DATA has

- 100000+ professionals in 50+ countries
- 6000 research professionals and dedicated R&D facilities
- 9000 SAP professionals
- 10000 financial services and insurance specialists
- 15000 skilled manufacturing resources
- Trusted U.S government partner for 50+ years

NTT Group consists of major companies like Nippon Telegraph and Telephone Corporation, NTT Communications Corporation, Dimension Data plc, NTT DOCOMO, INC. and many subsidiaries all over the world. Taking advantage of this opportunity of this scale, NTT DATA achieved a number of significant successes by collaborating with NTT Group and it provided enormous creative synergy.

The goal of NTT has been to create a foundation for future business by incorporating a number of overseas companies in order to establish a framework through which we can provide our diverse services, as typical Japanese courteous service, worldwide to support our customers' needs. As one of the global innovators, NTT are always challenging more innovative business approach and enhancing our creativity by respecting diversity.

John W. McCain is the Chief Executive Officer of NTT DATA Services headquartered in Dallas, Texas, USA. He is a member of the NTT Holdings Global Strategy Committee and serves as senior vice president of NTT DATA Corporation.

Dan Allison is the President, Global Healthcare and Life Sciences. As head of the company's largest industry segment, Dan is responsible for leading the growth, profitability and transformation of the global healthcare business, which focuses on provider, physician, health plan and life sciences clients. Dan has more than 30 years of leadership experience in IT outsourcing and business process outsourcing services in various verticals, with a strong focus in healthcare.

- **Americas**

    a) **North America**

In North America, NTTDATA partnered with a range of businesses and government agencies providing a flexible array of engagement options, including consulting, managed services, outsourcing & the cloud. Leveraging strong technical know-how, practical industry insights, and global reach, it relentlessly drives improvement across systems and processes while increasing business flexibility. The company is focused on getting faster results with less risk, so its clients

can flex their businesses to respond to changing market dynamics and capitalize on growth opportunities.

b) Latin America

NTT DATA entered the Latin American market through the acquisition of the Value Team Group, a specialist in IT consulting and services. Today, the company provides a wide offering of customized services and end-to-end solutions. The aim is to enable customers to grow and stand out from the competition by adopting innovative IT concepts and technologies.

- **Europe and Middle East**

Over the past few years, we have expanded our IT service networks in Europe through the acquisition of a majority stake in itelligence, Cirquent, Value Team, Intelligroup and Keane.

NTT DATA Group offers best-in-class consulting services and enterprise solutions for industries in the manufacturing, banking, insurance, telecommunications, media, energy, retail, service and public sectors. Our consulting services range from business process consulting to conceptual design, implementation and integration, as well as the support, operation and maintenance of IT systems. Additional offerings include outsourcing, hosting and full-service solutions in the ERP environment.

- **APAC/ India**

NTT DATA positions APAC and India region as both an emerging market and the delivery resource pool to provide cost competitive and high quality service in our global strategy. The company address both multinational corporations and local client in this region. With global

capabilities, NTT DATA support multinational corporations, primarily in Healthcare, insurance, automotive and electronics industries in rapidly growing APAC market. In addition, NTT DATA offer the services to local clients in both financial and public sector by leveraging our accumulated experience across the world.

NTT DATA in Healthcare

Healthcare companies are balancing the quality and cost of care while serving a rapidly aging population and rising healthcare costs. At the same time, those firms are facing escalating competition, the feared patent cliff for many blockbuster drugs, and changing regulations and standards.

NTT DATA partners with some of the world's leading healthcare organizations to help them proactively manage their business through the use of information, data, and technology. In fact, its technology-enabled services support over thousands of organizations within the sector, enabling them to rapidly and cost-effectively adjust to dynamic market and regulatory demands.

Industry Recognition

- Positioned by Gartner in the "Leaders" quadrant of the Gartner Magic Quadrant for Data Center Outsourcing and Infrastructure Utility Services, North America for the fifth consecutive year.

- Ranked "#1 IT Services Provider to Healthcare Providers," by Gartner for the sixth straight year.

- Positioned as a leader in Everest Group's "IT Outsourcing in the Healthcare Provider Industry—Service Provider Landscape with PEAK Matrix Assessment" for a third consecutive year.

2. **Introduction**

Today, technology has become an integral part of any system. Healthcare is one of the sectors which has seen immense development with the use of technology. Technology has replaced the paper based communication with EMR system. With the help of information technology it has been possible to improve the quality of care, improve efficiency and effectiveness of the staff and also reduce some organizational costs.

Health information technology (HIT) and the use of electronic medical records (EMRs) has increased through efforts to achieve the following: reduce medical errors, provide more effective methods of communicating and sharing information among clinicians, lower national health care costs, better manage patient medical records, and improve coordination of care and health care quality. While adoption and implementation has increased significantly within the recent years, not all hospitals and healthcare organizations have chosen to adopt an EMR system. It varies widely country wise.

The primary aim of this research is to gain an understanding of the implementation of Electronic Medical Records (EMR) systems in **developed and developing countries**. There is a direct relationship between the income of the country and the use of electronic information and communication systems as part of healthcare systems hence the division between developed and developing countries.

A preliminary investigation suggests that developed countries have higher level of quality of care and higher adoption rate and usage of EMR systems when compared to developing countries.

This study provides a systematic evaluation of various dimensions of **EMR** in 3 countries- **USA (Developed), Saudi Arabia (High Income Developing) and India (Low-middle Income Developing)** and its correlates which is essential to understand reasons and barriers for success.

3. Objective

The objective of this systematic literature review is to better understand what are factors driving implementation of **EMR** in **USA, Saudi Arabia and India**

3.1 Positive drivers or promoters– factors that encourage EMR implementation, and

3.2 Negative drivers or hidden barriers – factors that discourage or impede EMR implementation.

4. Literature Review

4.1 EMR

4.1.1 The Health Information Management Systems Society has defined EMR as:-

"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"

4.1.2 EMR Environment

The EMR environment is a complex and sophisticated environment. Its foundation is the clinical data repository (**CDR**), a real-time transaction processing database of patient clinical information for practitioners. The controlled medical vocabulary (**CMV**) is critical because it ensures that the practitioners who use the EMR are accessing accurate and comparable data. The CMV normalizes data from a relational and definitional hierarchy that enables other components of the EMR to optimally operate. Without a functional CMV, the clinical decision support system (CDSS) and workflow components of the EMR will not perform as expected by the clinicians in the environment. The applications of the EMR environment are clinical documentation for all clinicians/practitioners, computerized provider order entry (CPOE) for all clinicians/practitioners. A foundation of EMR applications, required to improve patient safety and reduce or eliminate medical errors, is composed of the CDR, CPOE, pharmacy management system, and the electronic

medication administration record (eMAR), functionality normally found in the electronic clinical documentation systems of most vendors

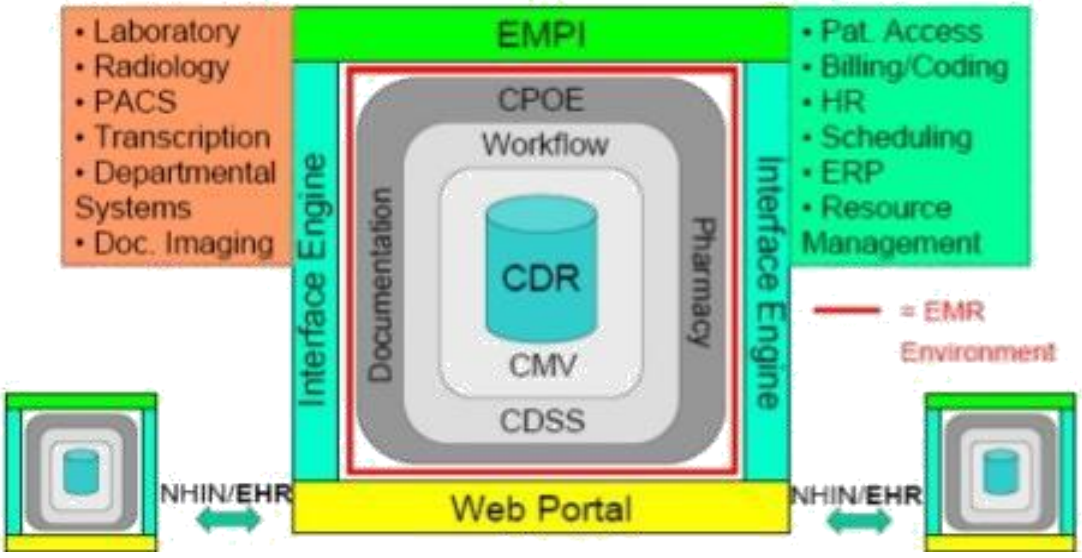


Figure 1: EMR Environment

These applications are tightly coupled with the CDR data schema and the CMV, CDSS, and workflow components. EMR applications are designed and built on the same architecture as the EMR components.

The EHR environment relies on functional EMRs that allow care delivery organizations to exchange data/information with other CDOs or stakeholders within the community, regionally, or nationally. Hence, EMR systems should be capable of performing a number of major functions. Seven functions have been determined by the Institute of Medicine of the National Academies (2003) as key capabilities for any EMR systems that should be performed.

<u>These functions are</u>:

1. Health information and data,

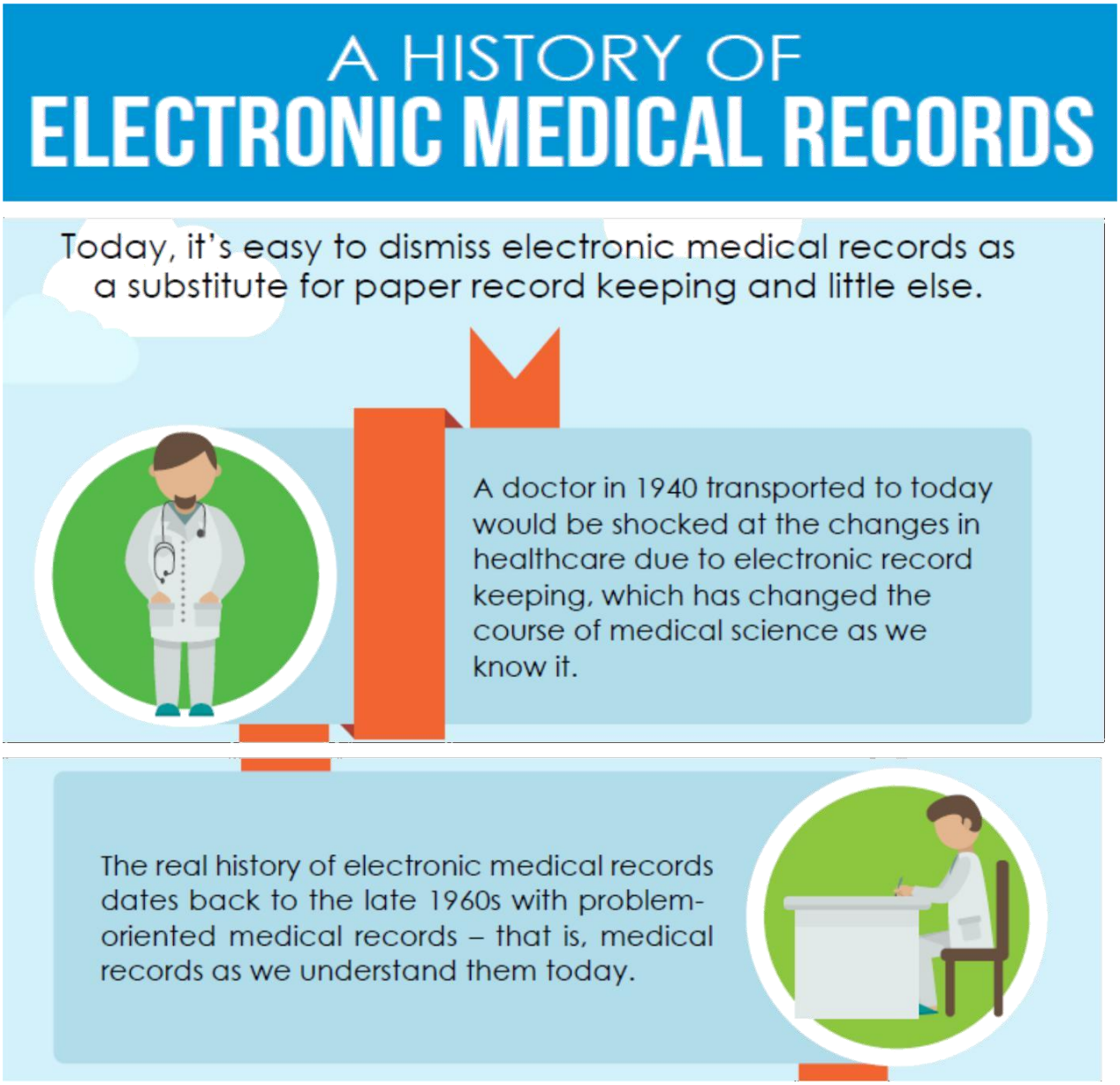
2. Result management,
3. Order management,
4. Decision support,
5. Electronic communication and connectivity,
6. Patient support,
7. Administrative process and reporting,

It is noteworthy that EMRs are created and maintained within an institution, such as a hospital, clinic or physician's office. In short, an EMR is a software application that captures and manages patient data digitally in a manner that is far more efficient, secure and accessible than a conventional paper-based record system. Since its inception, there have been rapid developments in the technology used to support medical care. The following section will demonstrate these developments since the late 1960s, when the concept of using technologies to better manage health data was first investigated, until the present time.

4.2 History of EMR

The idea of recording patient information electronically instead of on paper –the Electronic Medical Record (EMR) –has been around since the late 1960's, when Larry Weed introduced the concept of the Problem Oriented Medical Record into medical practice. Until then, doctor's usually recorded only their diagnoses and the treatment they provided. Weed's innovation was to generate a record that would allow a third party to independently verify the diagnosis. In 1972, the Regenstreif Institute developed the first medical records system. Although the concept was widely hailed as a major advance in medical practice, physicians did not flock to the technology. In 1991, the Institute of Medicine, a highly respected think tank in the US recommended that by the year

2000, every physician should be using computers in their practice to improve patient care and made policy recommendations on how to achieve that goal.



Larry Weed, MD's 'Problem-Oriented Medical Record' was a breakthrough in medical recording:

1960s

Dr. Weed's innovation allowed third party facilities to independently verify the diagnosis.

Before Dr. Weed's system, a doctor only had access to their diagnosis and the treatment provided.

Now, new doctor's had access to a patient's entire medical history.

The First Electronic Medical Records System

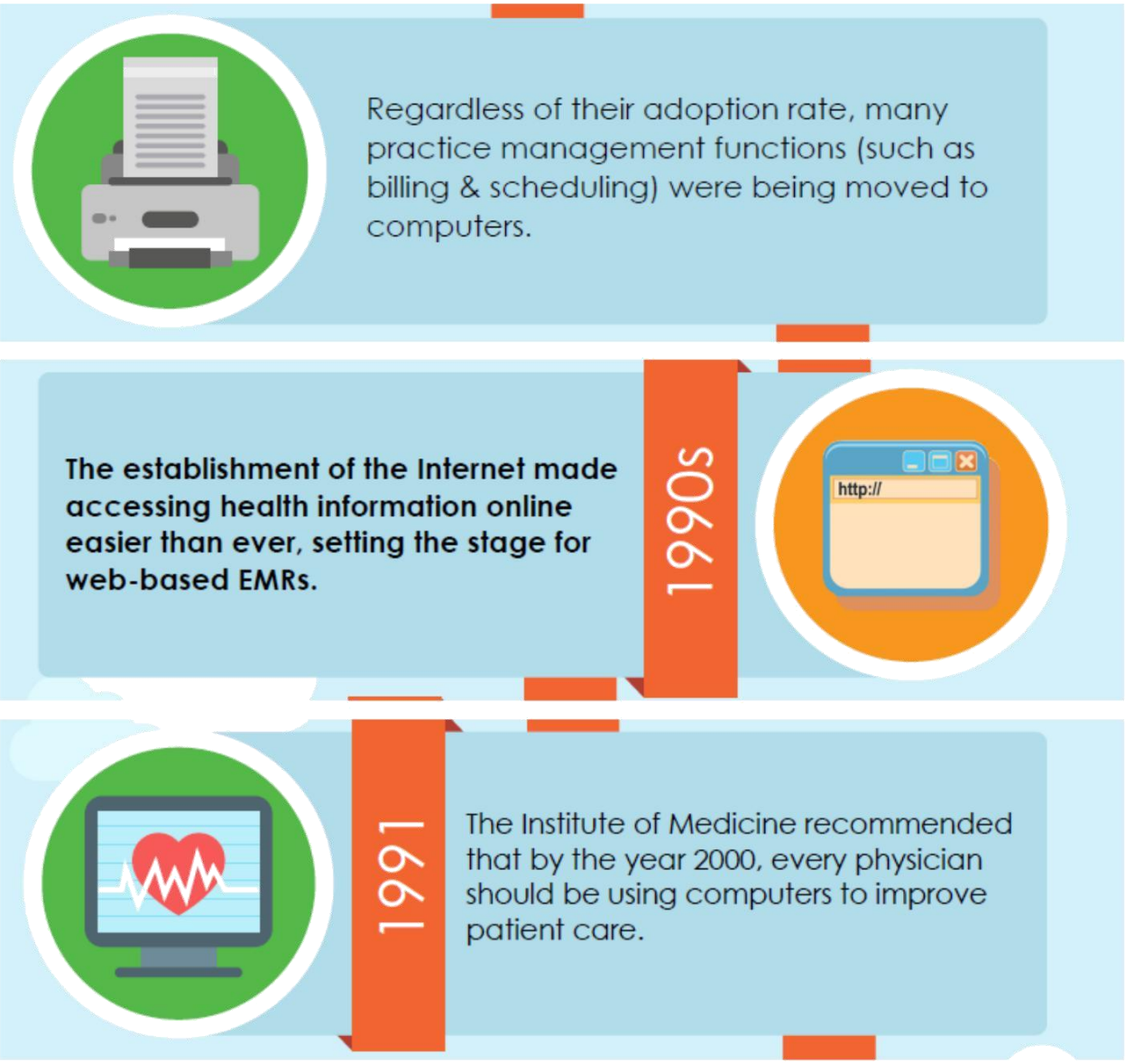
The Regenstreif Institute develops the first EMR system, but the system fails to attract many physicians.

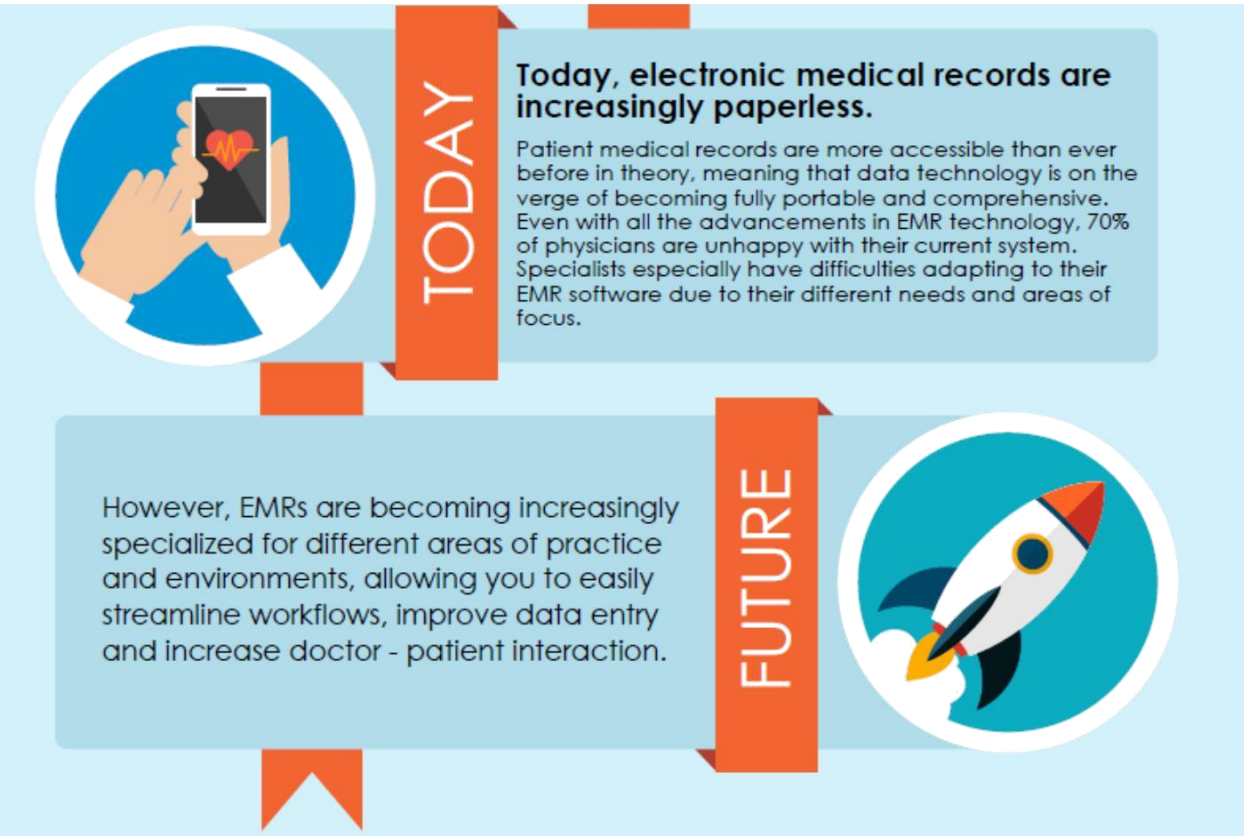
1972

By the late 1980s, low-cost PCs gave way to the wide spread adoption of EMR.

Large hospitals could now provide the same level of servicing for each patient without worrying about specific doctor-patient relationships. However, the technology didn't really gain traction with smaller facilities or private practices.

1980s


Regardless of their adoption rate, many practice management functions (such as billing & scheduling) were being moved to computers.
The establishment of the Internet made accessing health information online easier than ever, setting the stage for web-based EMRs.
1990s
http://
1991
The Institute of Medicine recommended that by the year 2000, every physician should be using computers to improve patient care.



4.3 Key Components of Electronic Health Records

4.3.1 Administrative System Components

An administrative system is a comprehensive and flexible system used to assist hospitals in managing and administrating its tasks more effectively. It covers both in-patient and out-patient operations. This system performs a number of major functions including registrations, admission, and discharge, and transfer (RADT), key components of EMR systems (National Center for Research Resources, 2006). These systems are often designed to be user-friendly by having an easy to use graphical user interface (GUI) which is totally menu-driven. The EMR registration component contains a unique patient identifier. A patient identifier typically consists of a numeric or alphanumeric sequence which is unidentifiable outside the organizations. Accurate patient

identification is fundamental to achieving the benefits of EMRs and ensuring patient safety. Moreover, the positive staff ID is needed to better control their log-in and protect patient privacy.

4.3.2 Laboratory System Components

Laboratory information management systems (LIMS) are computer-based application software intended to store and manage information generated as the result of the laboratory work. These systems are designed to control and manage test results, samples, standards, reports, laboratory staff, instruments, and work flow automation. Therefore, LIMS addresses the requirement of analytical services for laboratory and sample management. It can also help in providing more integrated environment by linking the analytical instruments in the lab to several workstations or computers. Each instrument has an interface like an integrator for the purpose of forwarding the data from the instrument to the personal computers. Then, the data is structured into meaningful information. Based on the type of report desired, this information is additionally classified and structured into different report formats. Consequently, LIMS can greatly enhance the quality of laboratory services. Hence, better efficiency and competitiveness of the laboratory can be achieved.

In fact, LIMS is extremely important for the successful implementation of EMRs in the contemporary healthcare system and healthcare organizations. LIMS should provide the personnel working in laboratories with an opportunity to have access to the health records of patients. They could also obtain information and add new information concerning patients' health. For instance, when tests are conducted in the laboratory, their results should be recorded in the electronic medical records of patients. First, the laboratory should obtain the tested material from patients. After that, the laboratory tests the material and makes records in the electronic medical records of

patients, while healthcare professionals interpret the results and define the necessary treatment for patients.

4.3.3 Radiology System Components

A radiology information system (RIS) is networked computer-based software used by the radiology department for the storage, management and distribution of patient medical imagery and related data. An RIS particularly valuable for managing radiological records and associated data in several locations and is frequently used in combination with a picture archiving and communication system (PACS). It complements an EMR system and is vital to efficient work to radiology practices. The software and the entire radiology system should provide accurate results of radiological studies and scanning of patients and add the findings of each scanning to the EMR of each patient. At the same time, the radiology system needs to examine patients, for instance to make an X-ray. In such a way, the radiology system obtains information about a patient.

The next step is processing the information. Healthcare professional or special software defines whether the patient has some health problems or not. As soon as the results of the X-ray are obtained, they are recorded in the EMR of the patient. Therefore, the system remains the same as was the case of the laboratory system in which patients are examined. The data is then collected and processed, and, finally, healthcare professionals record the results in electronic health records and take decision on the further treatment of patients.

4.3.4 Pharmacy System Components

The pharmacy system components record the drug and related medications prescribed for a patient during their visit of clinical care. At the same time, the pharmacy system needs to prevent the risk of the development of certain health problems, such as allergic reactions in patients. If such

problems are identified, patients are informed and they will not receive medication that may be potentially dangerous for them. For instance, if a patient gets a receipt from a physician, the medication should be safe and should help the patient to recover from his/her health problem. In such a situation, the pharmacy system should be able to test whether the prescribed medication will be safe for the patient or whether some changes have to be introduced, or some other medication should be used instead to ensure the patient's health. Therefore, the pharmacy system should have access to the electronic medical records. Otherwise, the risk of error arises when patients get prescriptions and use drugs without any analysis of their impact on the health of patients. The more detailed information the pharmacy system has about the condition of a patient's health the more effective the medication treatment may be.

4.3.5 Computerized Physician Order Entry

Computerized Physician Order Entry (CPOE) refers to electronically entering medication orders or other physician instructions in place of paper charts. CPOE is one of the most important components of any EMRs as it can assist in reducing errors related to illegibility of handwriting or transcription of medication orders. Medication errors were defined by the American Society of Health-System Pharmacists (1998) as:

"Any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the healthcare professional, patient, or consumer."

Some of the most common errors that can be reduced through CPOE are prescribing errors, including wrong drugs, form, dosage or frequency; incorrect route; and contraindicated drug use and interaction.

In the CPOE system, orders are incorporated with patient information such as laboratory and prescription data and further they are automatically checked for potential errors or patient harm. In this respect, healthcare professionals should be able to digitally record all the information about the health of patients into their EMRs. This means that healthcare professionals should be able to access patients' EMRs and make changes in the records in respect to any change in the condition of the patient

4.4 Integrating the components of EMR

For EMR system components and other associated software applications to accurately exchange and share data, Integration is a fundamental requirement. Although most EMR systems perform with similar features and functions across healthcare organizations, they can be considerably different in the way that these functions are assembled. EMR systems used in hospitals and their integrated delivery system are usually virtual systems created by gathering and sharing clinical data between several component systems like laboratories, radiology and pharmacy. The capability of an EMR system to perform advanced features such as computerized order entry and decision support mainly relies on the level of integration of its previously mentioned components. Therefore, integration between these heterogeneous component systems is fundamental in order to achieve successful implementation of EMR system.

Data from all components such as laboratory and radiology, reside on one central system. The central system represents a large database called a clinical data repository (CDR) in which patients' data reside. Integration requires that all the system components use a consistent format for coding data elements, representing a mechanism for the data movement from all components to the CDR.

The CDR is the major source of information for the entire EMR system and is accessible by all the EMR components. The most common method used to populate the CDR is through the use of interfaces to link each of the EMR components. Interfaces are special computer-based software designed to move data between systems. In order to obtain successful data-level integration, additional applications such as medical data dictionaries are required to resolve problems present in reconciling terms, data elements, and data formats between EMR component systems.

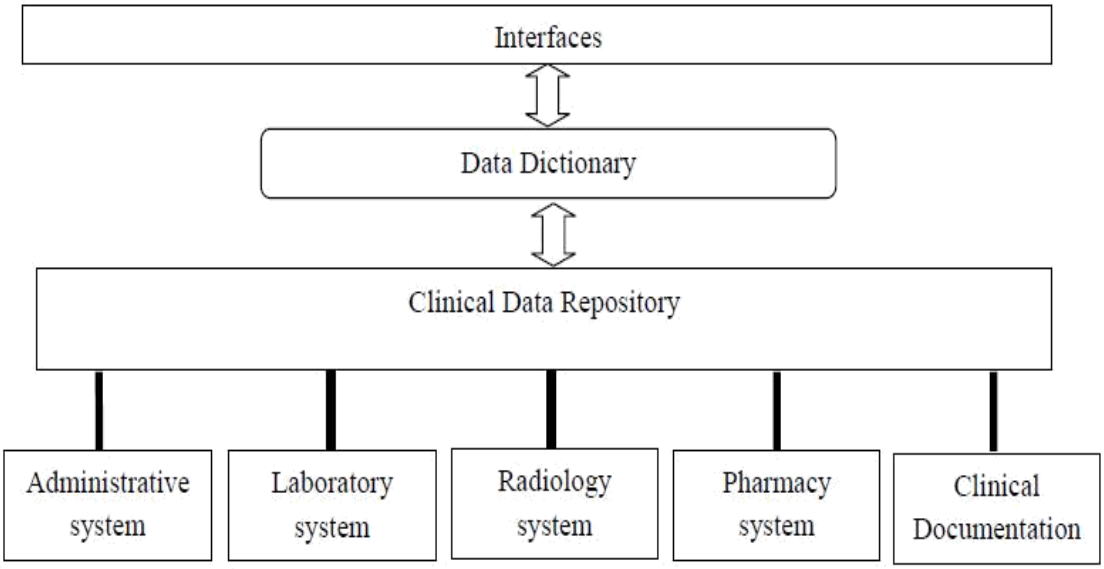


Figure 2: Data Integration Model

4.5 EMR Adoption

- **Why Adoption is necessary?**

Because the success of an EMR is dependent on the users of the EMR, it is important to motivate and enable these users to use the EMR. The level of user acceptance of the EMR and the users' ability to work with the EMR is what you could call **EMR adoption**. EMR adoption is faced with

a vast amount of barriers, which will be discussed later, which makes the process of EMR adoption a complex one.

In Rogers' theory of Diffusion and Innovation adoption is defined as: *"a decision to make full use of an innovation at the best course of action available"*. Translated to the healthcare setting this could be described as: *"A decision of a health care professional to make full use of the EMR at the best course of action available*".

4.5.1 Adoption models

To help hospitals achieve a higher adoption rate different adoption models have been made. In the following section we will describe different variants of the Technology Acceptance Model (TAM) and the EMR Adoption Model (EMRAM).

A] Technology Acceptance Models

The Technology Acceptance Model (TAM) is a model based on the Theory of Reasoned Action (TRA) of Ajzen and Fishbein's. It was developed by F. Davis and R. Bagozzi. The TAM shows the relation between system design features, perceived usefulness and perceived ease of use, the users' attitude toward using the system, and the users' actual system use [Figure]. Davis states that the model can be used to "**address why users accept or reject information technology and how user acceptance is influenced by system characteristics**". This model was expanded into the TAM2 and into the Unified Theory of Acceptance and Use of Technology (UTAUT) model. The TAM2 model splits the system design features into 5 different factors that can influence the perceived usefulness or the intention to use. The subjective norm can be influenced by the users' experience and voluntariness. These factors are:

1) Subjective norm,

2) Image,

3) Job relevance,

4) Output quality, and

5) Result demonstrability.

The definitions of these influencing factors can be found in Table**.**

Table: Influential factors TAM

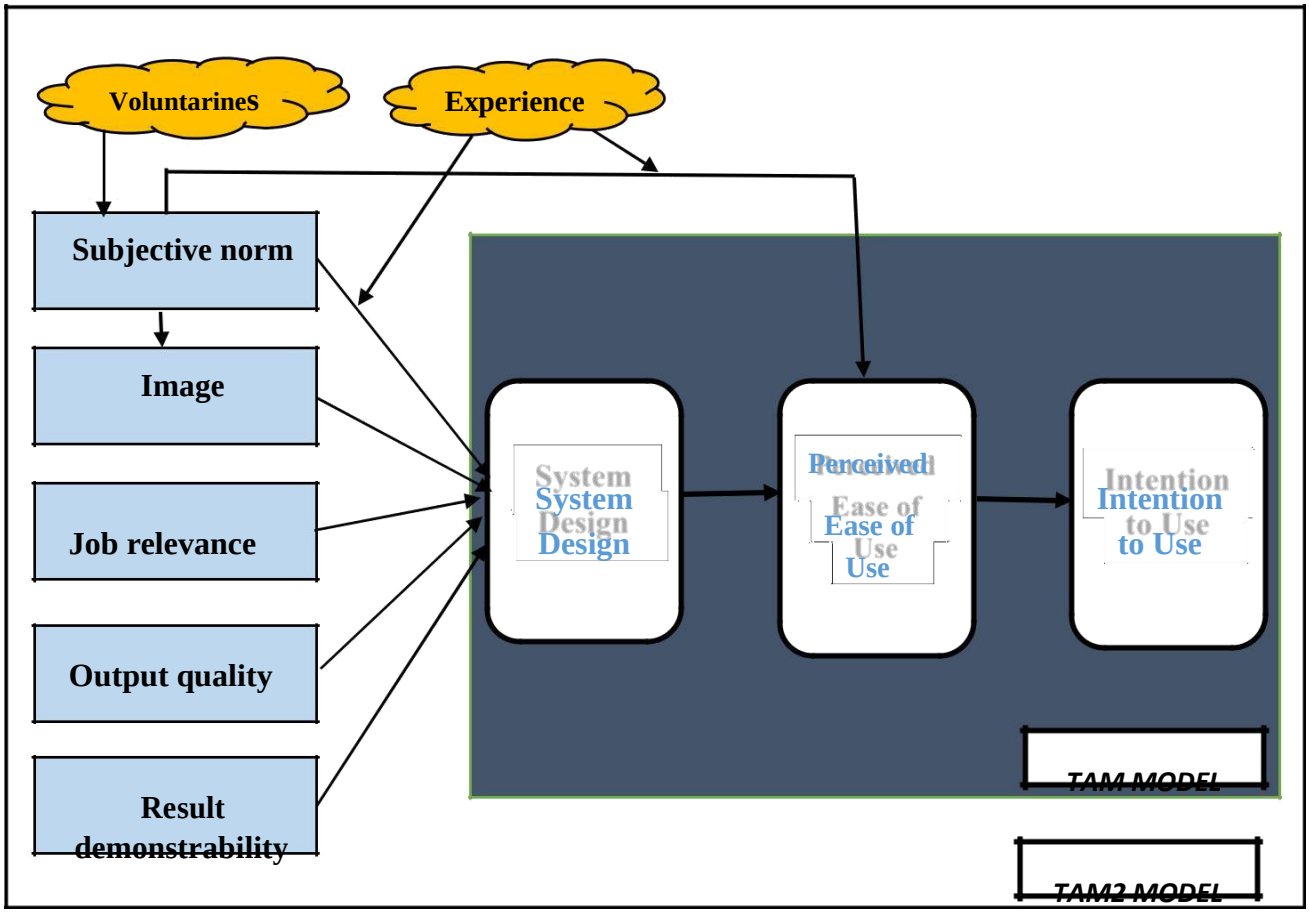
FACTOR	DEFINATION
Subjective norm	Person's perception that most people who are important to him think he should or should not perform the behavior in question.
Image	The degree to which use of an innovation is perceived to enhance one's status in one's social system.
Job relevance	Individual's perception regarding the degree to which the target system is relevant to his or her job.
Output quality	The degree to which an individual believes that the system performs his or her job tasks well.
Result demonstrability	Tangibility of the results of using the innovation.

Source: Theoretical models by Venkatesh V. - Technology Acceptance construct definitions.

The UTAUT model shows the influence of performance expectancy, effort expectancy, social influence, and facilitating conditions on the users' behavioral intention and actual use behavior. The UTAUT models also takes into account the effect of gender, age, experience, and voluntariness of use on the influencing factors. All three of these models show that the users'

perception or expectations of the system influence the actual use of the system, which can be called adoption. Taking these factors into account during the implementation of an EMR can influence the adoption rate.

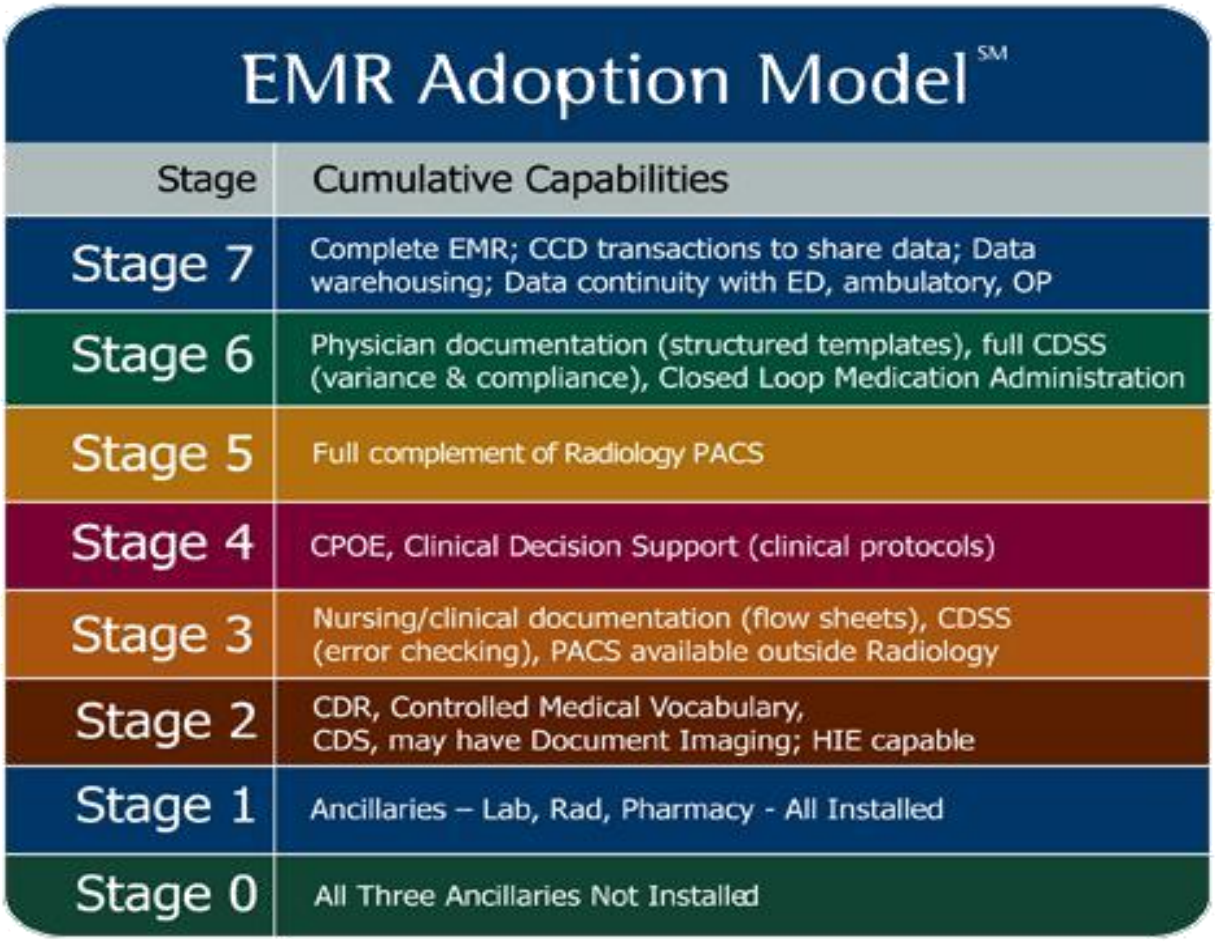
Figure: TAM & TAM2 MODEL



2] EMRAM: A strategic roadmap for effective EMR adoption and maturity

The Healthcare Information Management and Systems Society (HIMSS) Analytics has devised Electronic Medical Record Adoption Model (EMRAM) that incorporates methodology and algorithms to automatically score hospitals around the world relative to their Electronic Medical Records (EMR) capabilities. An eight-stage (0-7) model which measures the adoption and utilization of electronic medical record (EMR) functions. It helps in moving an organization closer to achieving a near paperless environment that harnesses technology to support optimized patient care by completing each stage below.

Figure:



Source: The Healthcare Information Management and Systems Society (HIMSS)

4.6 The Healthcare System in the USA

The U.S. health care system is unique among advanced industrialized countries. The U.S. does not have a uniform health system, has no universal health care coverage, and only recently enacted legislation mandating healthcare coverage for almost everyone. Rather than operating a national health service, a single-payer national health insurance system, the U.S. health care system can best be described as a hybrid system.

In 2014, 48 percent of U.S. health care spending came from private funds, with 28 percent coming from households and 20 percent coming from private businesses. The federal government accounted for 28 percent of spending while state and local governments accounted for 17 percent. Most health care, even if publicly financed, is delivered privately (DPE Research department, USA).

The public health system covers the elderly and low-income families while all other Americans mainly receive insurance coverage through employer-sponsored private insurance.

The Medicaid program covers poor families and the disabled. States are responsible to cover low-income pregnant women, children, the elderly and the disabled.

In addition, States can also increase their coverage. People over age 65 are covered by the Medicare program.

Children whose families are not eligible for the Medicare program but who cannot afford to purchase private health insurance are served under the State children's Health Insurance Program.

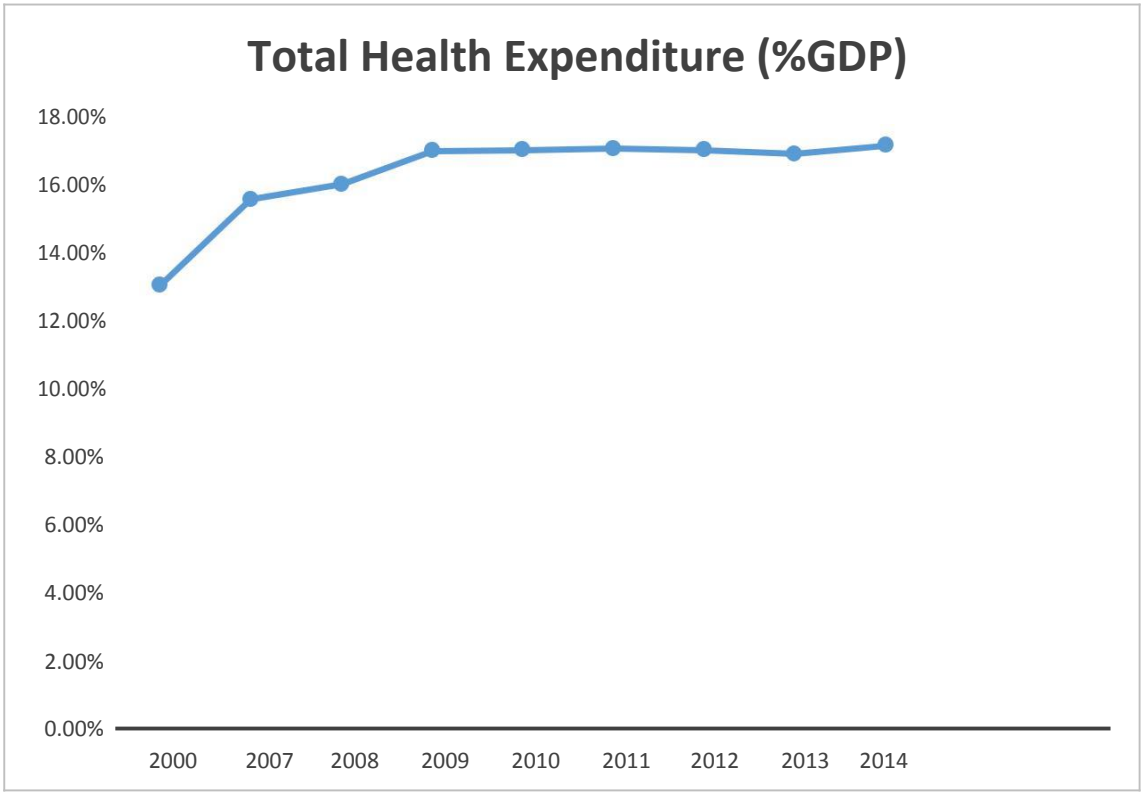
Health maintenance organizations (HMOs) are also well-known alternative to the previously mentioned health insurance plans because they offer lower cost healthcare services. HMOs provide

healthcare to their members through a network of general practitioners (GPs), hospitals and clinics. Members must choose a GP from a list of doctors in the HMO's network. GPs refer cases needed advanced care to hospitals or specialists.

4.6.1 Finance

Health expenditure in the United States is the highest in the world. The US government uses money generated from taxes to repay care providers who offer health services to patients enrolled in Medicare, Medicaid and SCHIP. There is also a tax subsidy of employer–based insurance. The total health expenditure in the US (%GDP) is 17.1 (see figure).

Figure 3:



Source: The World Bank 2014

4.6.2 EMR Systems in USA

Successful implementation and use of EMR is of growing importance because of the recent US economic stimulus plan. The American Recovery & Reinvestment Act of 2009 (ARRA) will give Medicare incentive payments for up to five years to physicians who are "meaningful users" of certified EMR technology. Stimulus rewards will be made available only to those practices that are successfully using EMR as determined in the definition of "meaningful use." According to the Healthcare Information and Management Systems Society (HIMSS), to be eligible for the payments, "physicians must use the technology in a meaningful manner, which includes e-prescribing; exchanging electronic health information to improve the quality of care; having the capacity to provide clinical decision support (CDS) to support practitioner order entry and, submitting clinical quality measures – and other measures – as selected by the Secretary of Health & Human Services (HHS). Further, physicians must meet the definition within a specified time frame, which … must be made increasingly stringent over time by the Secretary."

The EMR is almost universally used in health-care systems throughout the United States as a result of a federal government decision to financially reward systems using an EMR and to punish systems financially who are not using an EMR. A number of different providers offer large computerized systems to cover both in-patient and out-patient services

4.6.3 Adoption Rates

As of July 2016, 175 certified health IT vendors supply certified health IT to the 4,474 acute care hospitals, including Critical Access hospitals, participating in the Medicare EHR Incentive Program.

Of those 4,474 hospitals, 95% have 2014 certified edition technology. Cerner, MEDITECH, Epic Systems, Evident, McKesson, and MEDHOST supply 2014 certified technology to 92% of hospitals that have reported 2014 edition technology. Including Allscripts, Quadra Med, Prognosis, and Athena health, these 10 vendors altogether supply 2014 technology to 98% of hospitals.

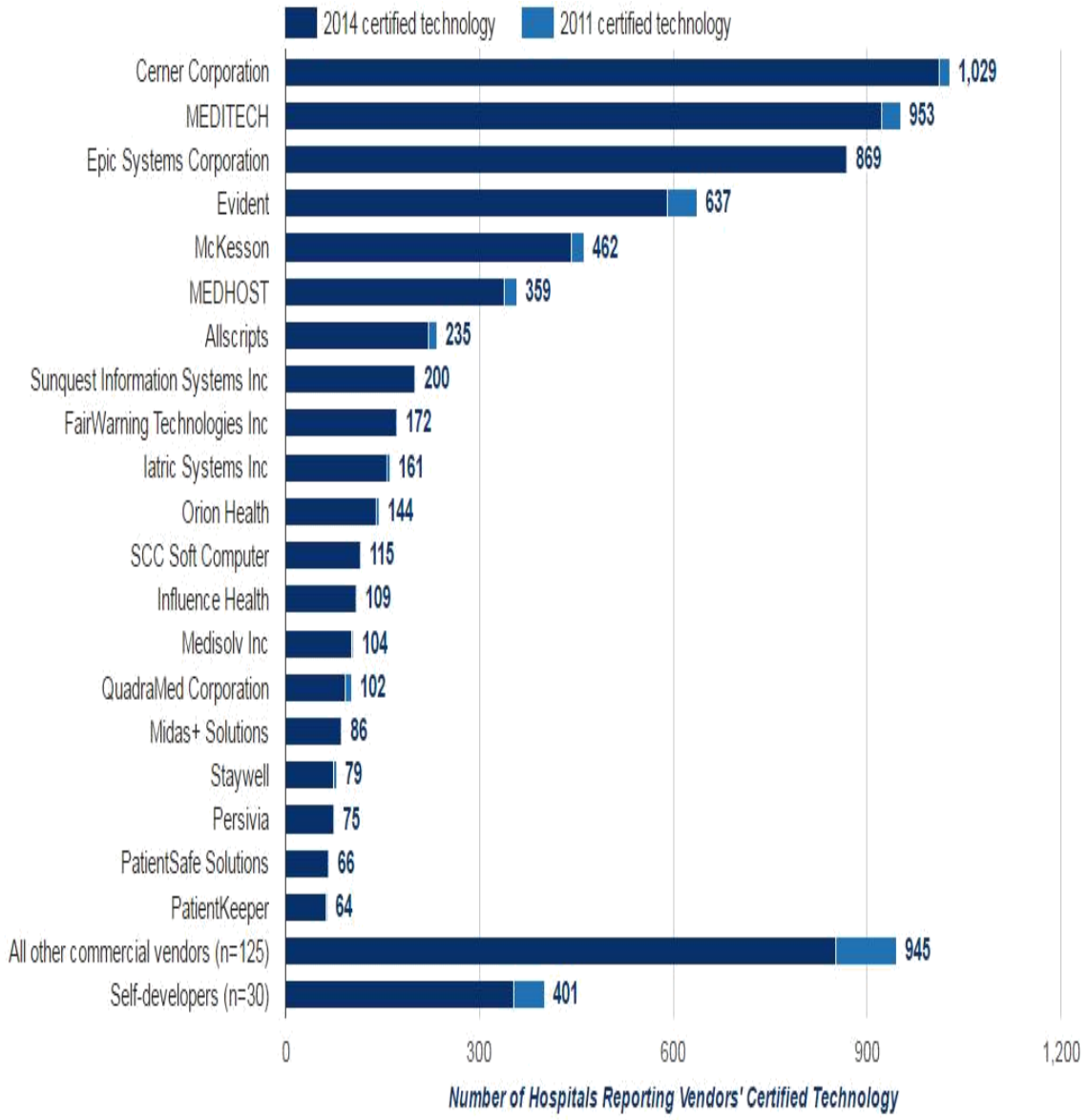


Figure 4

Source: Office of the National Coordinator for Health IT analysis of Medicare Electronic Health Record Incentive Program data, July 2016.

As of March 2016, over 9 in 10 hospitals eligible for the Medicare and Medicaid EHR Incentive Program have achieved meaningful use of certified health IT. When parsed by hospital bed size, the majority of hospitals within each hospital type are meaningfully using certified health IT. More than 90 percent of large, medium, small rural, and critical access hospitals were meaningfully using certified health IT, and more than 4 in 5 of small urban hospitals were meaningfully using certified technology. Children's hospitals have the lowest rate of meaningful use achievement, with over 2 in 3 children's hospitals having achieved meaningful use.

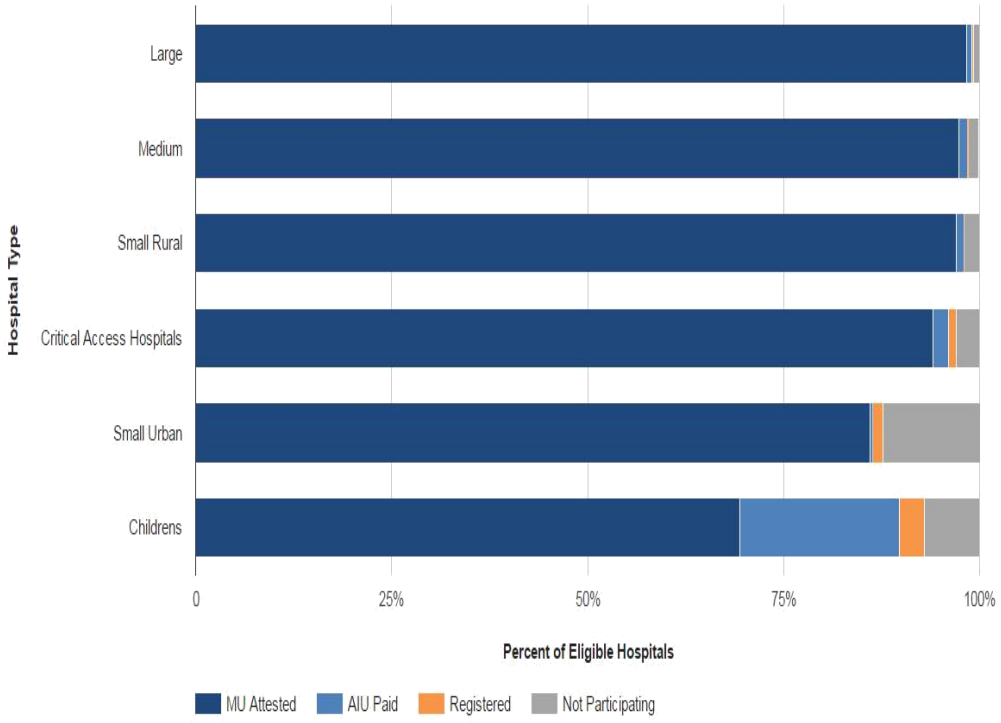


Figure 5 Source: Office of the National Coordinator for Health IT analysis of Medicare Electronic Health Record Incentive Program data, July 2016.

4.7 The Healthcare System in the Saudi Arabia

The Ministry of Health (MOH) in Saudi Arabia holds responsibility for planning, managing and providing health policies and the supervision of health programs. It is also responsible for monitoring health services in the private sector, as well as directing other government and private organizations on approaches to achieving the objectives of the government's health.

The government of Saudi Arabia provides free and full access to all publicly provided healthcare services to all Saudis and expatriates working in the public domain. The MOH in Saudi Arabia offers healthcare services at three levels: primary, secondary and tertiary (Ministry of Health, 2014). The primary healthcare (PHC) centers provide primary healthcare services such as preventive and curative care, while they refer the cases requiring more highly developed care to public hospitals (the secondary level of healthcare), or to specialized hospitals in cases needing more complex level of care (the tertiary level of healthcare).

At the current time the healthcare services in Saudi Arabia is mainly provided and financed by MOH, with a total of 244 hospitals (33,277 beds) and 2037 PHC centers (Ministry of Health, 2014). These provided services represent 60% of the total healthcare services in the country. The other government healthcare agencies include referral hospitals (e.g. King Faisal Specialist Hospital and Research Centre), army forces medical services, security forces medical services, Ministry of Higher Education hospitals (teaching hospitals), National Guard health affairs, Royal Commission for Jubail and Yanbu health services, ARAMCO hospitals, school health units of the Ministry of Education and the Red Crescent Society. Excluding referral hospitals, Red Crescent Society and the teaching hospitals, each of the previously mentioned agencies provides healthcare

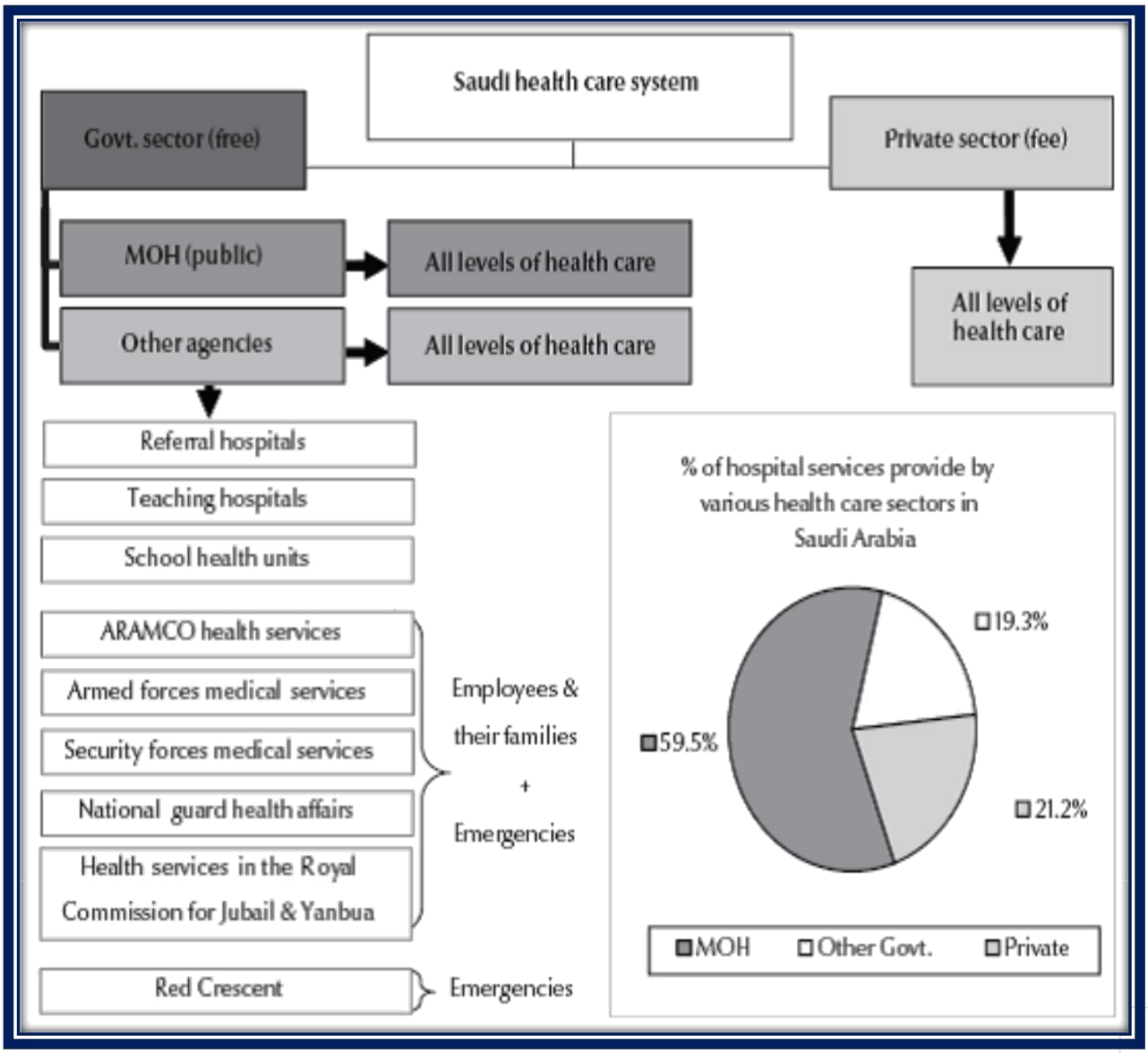
services to a defined people, usually employees and their families. It is worth noting that all of them provide healthcare services to all residents during times of crisis and emergency.

Additionally, the private sector also provides healthcare services, usually in large towns and cities, through a total of 125 hospitals and 2218 clinics and dispensaries (Ministry of Health, 2014).

The last official survey in 2010 placed Saudi Arabia's population at 27.1 million, compared with 22.6 million in 2004. It was estimated that the population growth rate was 3.2% per annum annually, for the period between 2004 to2010 (Central Department of Statistics and Information). Saudi citizens represent approximately 68.9% of the total population. It is estimated that 67.1% of the population is under the age of 30 years, while about 37.2% are under 15 years and an estimated 5.2% comprises the population over 60 years (as cited in Almalki, Fitzgerald & Clark, 2011).

According to United Nations projections, it is estimated that, by 2025 Saudi Arabia's population will reach 39.8 million (United Nations, 2003). Therefore, there will be an increasing demand on the necessary services and facilities including healthcare services as a result of this unprecedented growth in the population, while simultaneously creating economic opportunities

Figure: Healthcare System of Saudi Arabia



Source: Ministry of Health

4.7.1 Health Services in the Pilgrimage (*Hajj*) Season

Saudi Arabia has a distinctive location in the Islamic world, where the two holiest places of Islam, Mecca and Medina, are located. Annually, around two million pilgrims throughout the world perform the *hajj*. For instance, there were 2.3 million pilgrims, 69.8% of whom came from overseas countries during the 2009 *hajj* season (Ministry of Health, 2009). The annual host of such an event is a significant challenge that needs an intended and structured effort across many organizations and departments to ensure sufficient services, including healthcare services. During the *hajj* season, the healthcare services provide both preventive and medicinal care for all pilgrims, regardless of their nationality. For instance, in 2009, there were twenty-one hospitals, seven of which were seasonal. In addition, there were 157 PHC centers, of which 119 were seasonal.

Annually, the Saudi government represented by the MOH, tries to improve and enhance the delivery of healthcare services to pilgrims. Nevertheless, it should be noted that all healthcare services provided during this season are free of charge for all pilgrims. This creates significant demand on the healthcare budget in particular

4.7.2 Finance

Overwhelmingly, the finance for healthcare in Saudi Arabia is mainly provided from government revenue. The MOH is the main government financer of healthcare services in Saudi Arabia. The following table illustrates that there is a continuous increase of Saudi government expenditure on the MOH (in thousands of riyals):

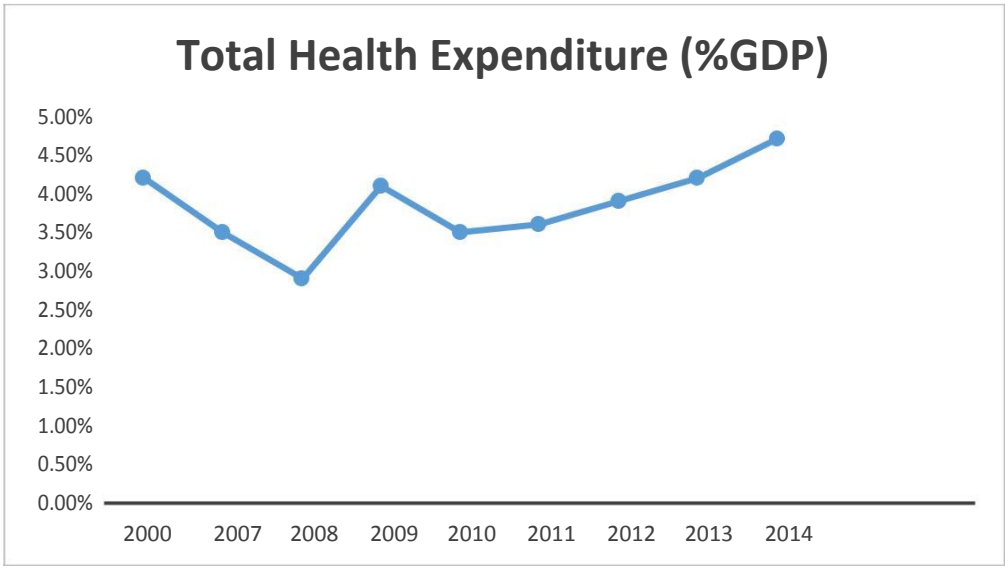
Table: Budget appropriations for the MOH in Saudi Arabia

Year	MOH Budget
2009	29 518 700
2010	35 063 200
2011	39 860 200
2012	47 076 447
2013	54 350 355
2014	59 985 360
2015	62 342 539

Source: Ministry of Health portal, Saudi Arabia

According to the World Bank, the total expenditure on public health during 2014 was 4.7% of the GDP i.e. 74.5% was public and 14.3 % was out of pocket. (See figure) (The World Bank, 2014).

Figure: Total public health expenditure in Saudi Arabia (%GDP)



Source: The World Bank 2014

4.7.3 EMR system in Saudi Arabia

The literature reveals that the Saudi MOH was interested in and conducted several initiatives in the field of HIS and wanted to implement EMR nationally. This interest in EMRs commenced due to a number of reasons. The MOH wanted to keep up with all the technological developments in the field of health, especially in relation to patient records. However, the literature indicates that until 2012, most of the MOH hospitals have had paper-based patients recording systems. There has been a dramatic increase in the amount of health information, because of the rapid growth in Saudi population.

Despite the increased interest and investment by the MOH in HIS, its uptake has been very low and most of the available systems are basic. Basic systems tend to focus on the administrative aspects such as admission and discharge dates rather than being patient-centered, such as patient selection by ensuring that services are offered to the right patient, ordering medications and providing notifications about allergies. Although the literature does not provide information on the exact number of hospitals in Saudi hospitals that have an EMR system, it is agreed that very few hospitals are in an advanced stage of HIS implementation.

4.7.4 Adoption Rates

The literature does not reveal the level of EMR system uptake at a national level in Saudi Arabia. So it is uncertain how many MOH hospitals have an EMR system and/or the level of such system uptake. The literature provides a number of studies in different hospitals in different cities focusing on EMRs implementation and issue related to their implementation. There are very good examples in the literature of a successful implementation of EMR system in some of the major Saudi

hospitals like National Guard Health Affair (NGHA), The Armed Forces hospitals, King Faisal Specialist Hospital and Research Center (KFSH & RC).

The NHGA has four hospitals and 60 primary and secondary healthcare centers in different regions of Saudi Arabia. The four hospitals are located in four different cities; Riyadh, Jeddah, Dammam and Ahsa. The NGHA health organizations have 2000 in-patients beds and serve 2.5 million out-patients and 60,000 in-patients annually. All four NGHA hospitals have EMR systems that are integrated with each other. There are five Armed Forces hospitals under the Saudi Ministry of Defense and Aviation and all five hospitals have a fully implemented and integrated EMR system. The KFSH & RC hospital in Riyadh has almost fully implemented an EMR system, and is reported to have the latest IT

EMRs in Saudi Arabia: A chronology of implementation milestones.

Year	Sector	Action
1988	MOH	First introduction of EMR systems in Saudi Arabia.
1993	KFSH&RC	First introduction of HIS and record health related information electronically
1993	MOH	Telemedicine and Internet technology was introduced in Saudi Arabia.
1999	NGHA	The first IT strategic plan for implementing HIS was developed for the NGHA hospitals
2000	MOH	A reform committee was formed to review the Saudi healthcare services, and highlighted the lack of appropriate HIS.
2001	NGHA	The hospital purchased a commercial EMR system to be implemented in all NGHA hospitals

Year	Sector	Action
2007	Ministry of Defense & Aviation	The north-western region of Tabuk Armed Forces hospital had its first operational EMR system within all Armed Forces hospitals in Saudi Arabia.
2008	MOH	1 billion US dollar was allocated for e-health development and implementation in Saudi Arabia.
2008	NGHA	In 2008, the NGHA started to implement EMR system in other sites, and was fully implemented and became operational in all four NGHA sites in 2010
2011	MOH	An Information and Communication Technology (ICT) team was assigned to develop a 10 year e-health strategic plan to improve the Saudi healthcare system and its services.
2011	MOH	The percentage level of EMR system implementation in 19 MOH hospitals, in the Eastern province of Saudi Arabia was identified to be 15.8%
2012	MOH	The level of EMR system implementation in 22 MOH public hospitals was: • 11 hospitals had fully implemented EMR system. • 8 hospitals had EMR implementations were in progress

Source: Health Informatics- An International Journal (HIIJ) Vol.3, No.2, May 2014

4.8 Healthcare system of India

India's Ministry of Health was established with independence from Britain in 1947. Government has made health a priority in its series of five-year plans each of which determines state spending priorities for the coming five years. The National Health Policy was endorsed by Parliament in 1983.It aimed at universal health care coverage by 2000, and the program was updated in 2002. The health care system in India is primarily administered by the states i.e. Health in India is state subject. India's Constitution tasks each state with providing health care for its people.

The health care system in India is universal. Public healthcare is free for those below the poverty line. That being said, there is great discrepancy in the quality and coverage of medical treatment in India. Healthcare between states and rural and urban areas can be vastly different.

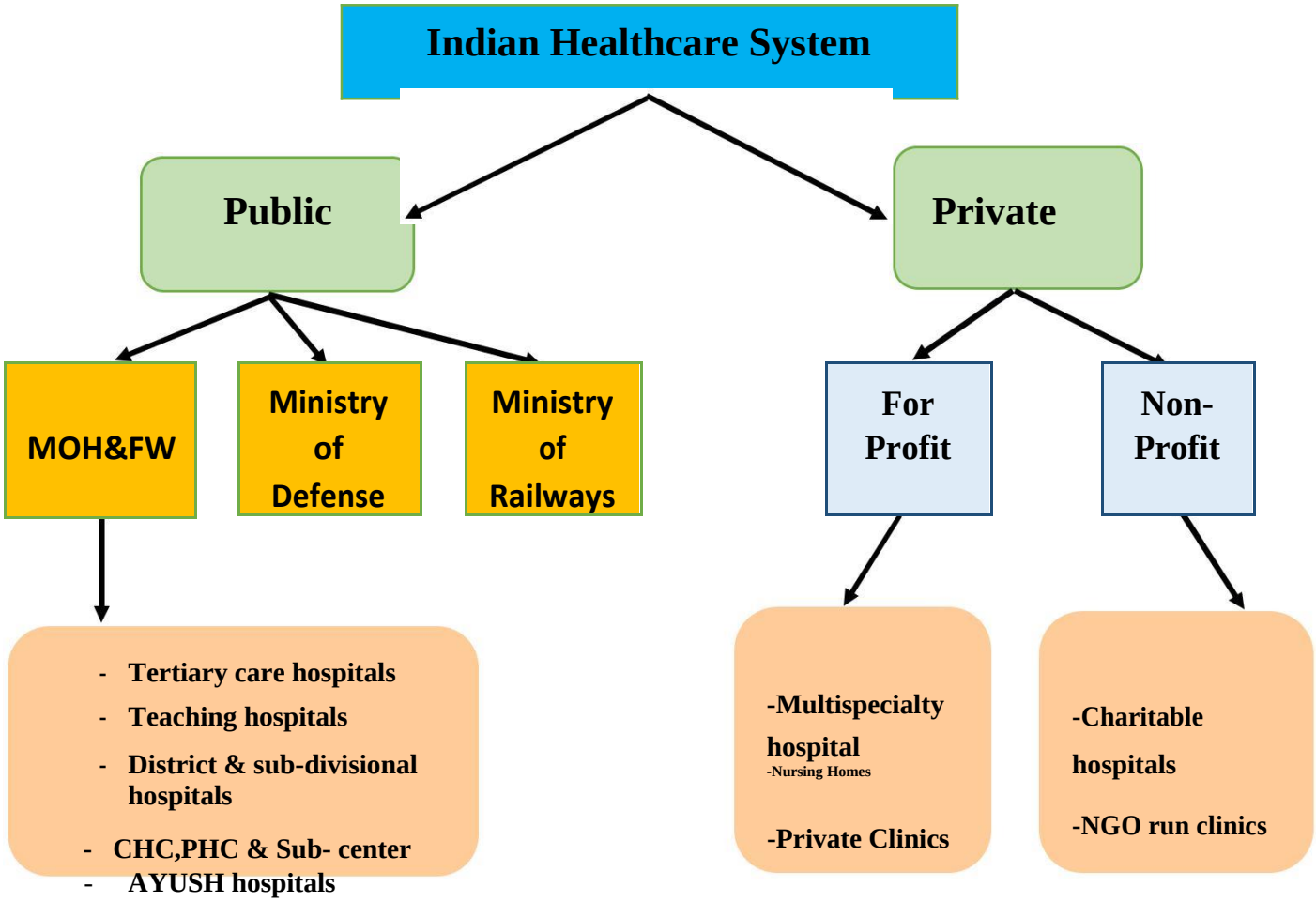
Rural areas often suffer from physician shortages, and disparities between states mean that residents of the poorest states, often have less access to adequate healthcare than residents of relatively more affluent states. State governments provide healthcare services and health education, while the central government offers administrative and technical services. In order to address lack of medical coverage in rural areas, the national government launched the National Rural Health Mission in 2005. This mission focuses resources on rural areas and poor states which have weak health services in the hope of improving health care in India's poorest regions.

Lack of adequate coverage by the health care system in India means that many Indians turn to private healthcare providers, although this option is generally inaccessible to the poor. To help pay for healthcare costs, insurance is available, often provided by employers, but most Indians lack health insurance, and out-of-pocket costs make up a large portion of the spending on medical

treatment in India. Penetration of health insurance in India is low by international standards. Private insurance is available in India, as are various through government-sponsored health insurance schemes. A 2014 Indian government study found that only about 17% of India's population was insured.

On the other hand private hospitals in India offer world class quality health care at a fraction of the price of hospitals in developed countries. This aspect of health care in India makes it a popular destination for medical tourists. India also is a top destination for medical tourists seeking alternative treatments, such as ayurvedic medicine. India is also a popular destination for students of alternative medicine.

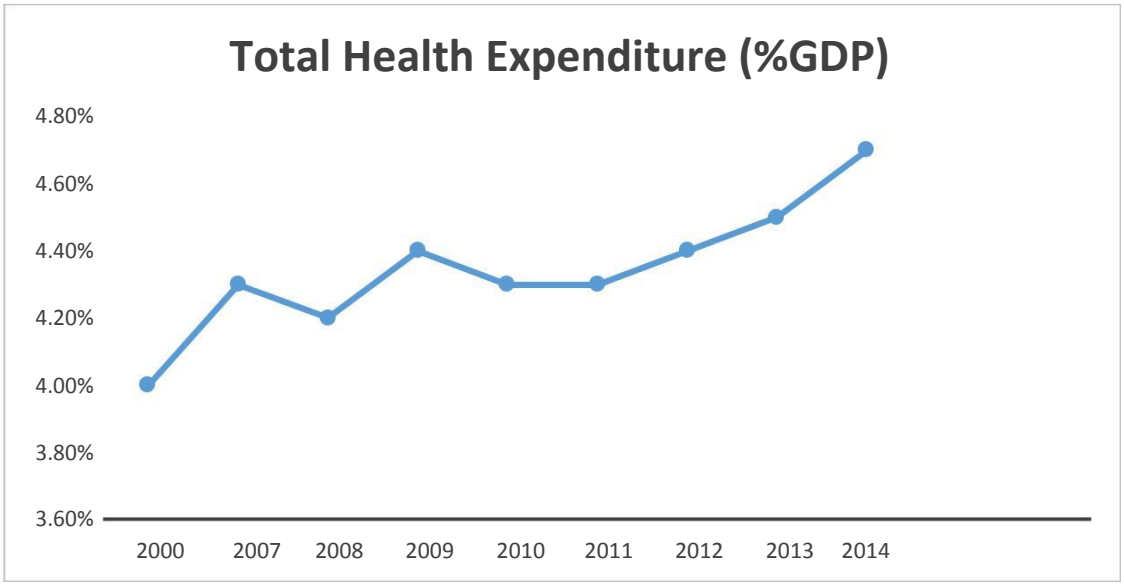
Figure: - Health system of India

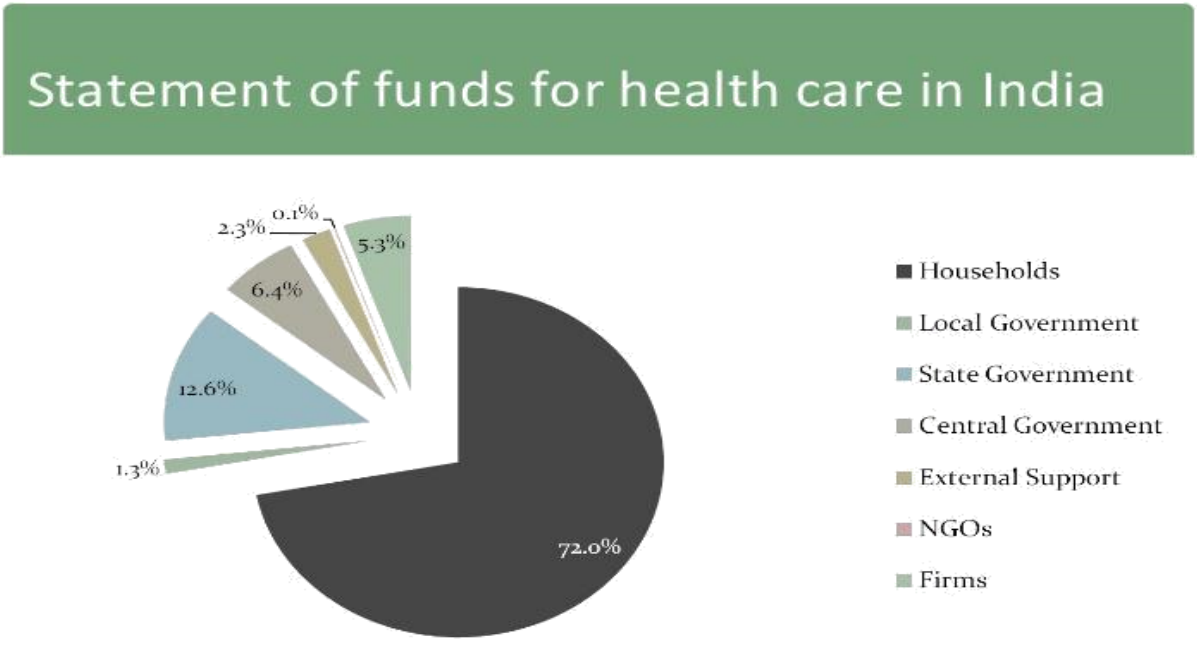


4.8.2 Finance

According to the World Bank, the total expenditure on public health during 2014 was 4.7% of the GDP

Figure: Total public health expenditure in India (%GDP)





Source: National Health Accounts, 2014

4.8.3 EMR adoption rates

India has a mixed system of healthcare consisting of a large number of hospitals run by the Central Government and State Government as well as the private sector. The level of use of ICT in the healthcare sector in the country has been lower in comparison to other countries. Both union and State Governments are working on several fronts to make use of the opportunities offered by ICT. Private sector hospitals are also in the process of implementing ICT projects, including electronic patient records.

Some of the corporate hospitals in India, such as Max Health, Apollo, Fortis, etc., have implemented integrated ICT systems in place, covering all aspects, i.e., registration and billing as well as laboratory and clinical data. Max Healthcare hospitals started implantation of EHR in its hospitals in 2009 and achieved Stage 6 level of the EMR Adoption Model, which is used by the HIMSS for assessment of the level of adoption of EMR systems in any hospital. Max Healthcare Group received the recognition for two of its hospitals—East Wing, Saket and West Wing, Saket, New Delhi in 2012.

The Apollo Group also has implemented EHR in its hospitals and achieved Stage 6 in the EMR Adoption Model for four of its hospitals located at Chennai, Nandanam, Aynambakkam, and Jubilee Hills. Sankara Nethralaya (SN) has implemented an EMR system in its hospitals and satellite clinics in Chennai. It engaged Tata Consultancy Services (TCS) for the implementation.

EMR providers in INDIA

PROVIDER	Hospital using EMR
IBA HEALTH	AIIMS, Coimbatore
WIPRO	APPOLO HOSPITAL,CHENNAI
Siemens	Artemis Health Sciences, Gurgaon
Karishma Software	Christian Medical College, Vellore
Sobha Renaissance IT Pvt. Ltd	Fortis Hospital, Mohali & Delhi
21st Century healthcare solutions	Manipal Hospital, Bangalore
CARE 21	Columbia Asia
Soft link International	Max Devki Devi Hospital, Delhi
Prognosys	P D Hinduja Hospital, Mumbai
Srishti Software	Ruby Hall Clinic, Pune
CDAC	PGIMER, Chandigarh
GE Healthcare	Sri Sathya Institute of Higher Medical Sciences, Bangalore

Source: *Indian Journal of Science and Technology Vol 9(3), January 2016*

4.9 Comparison of the Healthcare Systems

The three countries studied represent a mix of primary care and insurance system. The US system is different in its dependence on internal medicine and pediatrics for primary care and its highly distributed referral systems. The patients register with GPs, who usually serve as "gatekeepers" for referral for more advanced care.

Given the absence of universal coverage in the US, many Americans go without required healthcare services as a result of cost more often than other nations. The public healthcare system in the US covers only the elderly and low-income families while all other Americans mainly receive insurance coverage through employer-sponsored private insurance.

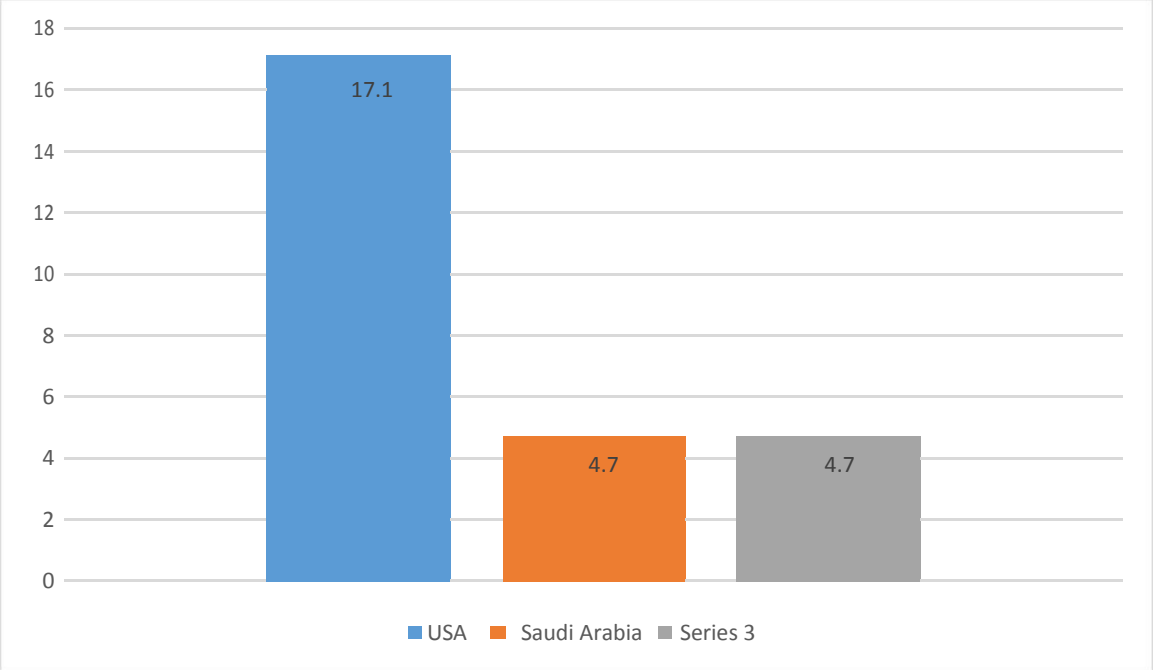
In Saudi Arabia, though medical services are provided free of charge at all three levels of care: primary, secondary and tertiary for all residents , GPs are the first point of care in Saudi Arabia, while they refer the cases requiring more advanced care to public or specialized hospitals.

The Saudi government provides all citizens and expatriates working within the public sector with full and free access to all publicly provided healthcare services. In addition, all other healthcare sectors including private hospitals provide free healthcare services to all residents during times of crisis and emergency, while the MOH covers the cost of these treatments in private hospitals. Moreover, the MOH provides free of charge healthcare services for all pilgrims during *hajj* season.

Whereas in India, health the responsibility of state governments, rather than the central federal government. Public health is free for those below poverty line at all three levels- Primary, Secondary and Tertiary. The private healthcare sector is responsible for the majority of healthcare in India. Most healthcare expenses are paid out of pocket by patients and their families, rather than through insurance. Penetration of health insurance in India is low.

In comparing the total expenditure in healthcare by these countries, US health expenditure appears as the highest. It was estimated that the total health expenditure in the US (%GDP) is 17.1, while the public expenditure on health is 53.1 % of the total expenditure (The World Bank, 2014). The total expenditure on health in Saudi Arabia and India appears extremely low compared to US with only 4.7% GDP. (The World Bank, 2014)

Figure: Total Expenditure on Health (%GDP)



Source: The World Bank, 2014

5. Methodology

A. **Eligibility Criteria**

Secondary literature in this research included academic journal, internet websites, government documents, publications, reports and periodicals. Articles, studies, and reviews were eligible for this review if they were published in the last six years, in English or published in academic literature.

B. Inclusion/exclusion criteria:

The date range for the initial search for USA was from 1/1/2011 to 1/1/2017, with the initial date being significant as it represents the beginning of the incentives for Meaningful Use being put into effect. The studies selected stated clearly what study design and method was applied in the paper.

Duplicate references were excluded, as were references without abstracts and full-text. Those did not specifically either relate to health or focus on electronic medical record, both were excluded. Commentary, editorial or news/presses, documentation, summary executive and report of conferences or any national/international policy and announcement and books, as well as papers described intentions to implementation, but not implementation experiences were not included.

The studies were accepted regardless of qualitative or quantitative research and health care setting. I also did not include the studies which are published in non-English language, or unpublished.

Databases: The data sources included PubMed, National Library of Medicine (NLM), Google scholar, and Cochrane. In each database, the search terms were searched.

C. Methods of study

Inclusion and exclusion criteria were compiled throughout the selection process to ensure studies selected were able to answer the research question. A checklist including 4 steps in selection process was set to exclude studies irrelevant. –

Step 1: Title of studies were skimmed based on results run out from the search terms in each database. If following terms "health informatics", "electronic medical records", "computerized", "health IT" or other informatics-related term appeared, the study was recorded in the database.

- Step 2: Inclusion and exclusion criteria helped to filter ineligible studies. For example studies published before 2011, and without abstract.

- Step 3: Abstracts of these eligible studies were reviewed according to criteria: clear information about study design, outcomes and whether function of computerized medical records mentioned in study links. Those studies which did not satisfy criteria were subtracted from database. Information collected from these studies was synthesized in a database format prioritized in order from the most relevant to the less relevant.

- Step 4: Information gathered in step 3 was synthesized systematically and elaborated by summarizing all the findings into 2 mainstreams: Negative and Positive factors. The review includes both qualitative and quantitative studies, hence, not all findings were measured statistically (i.e. in arithmetic), but are described as events, opinions, reasons or explanations.

Figure: - Stages of study selection process

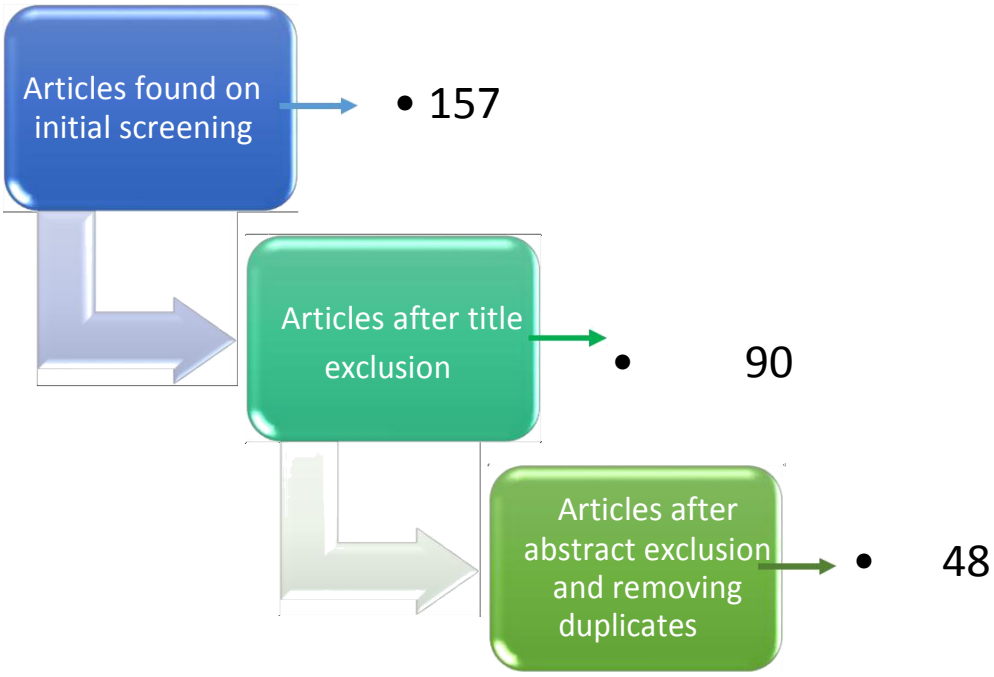
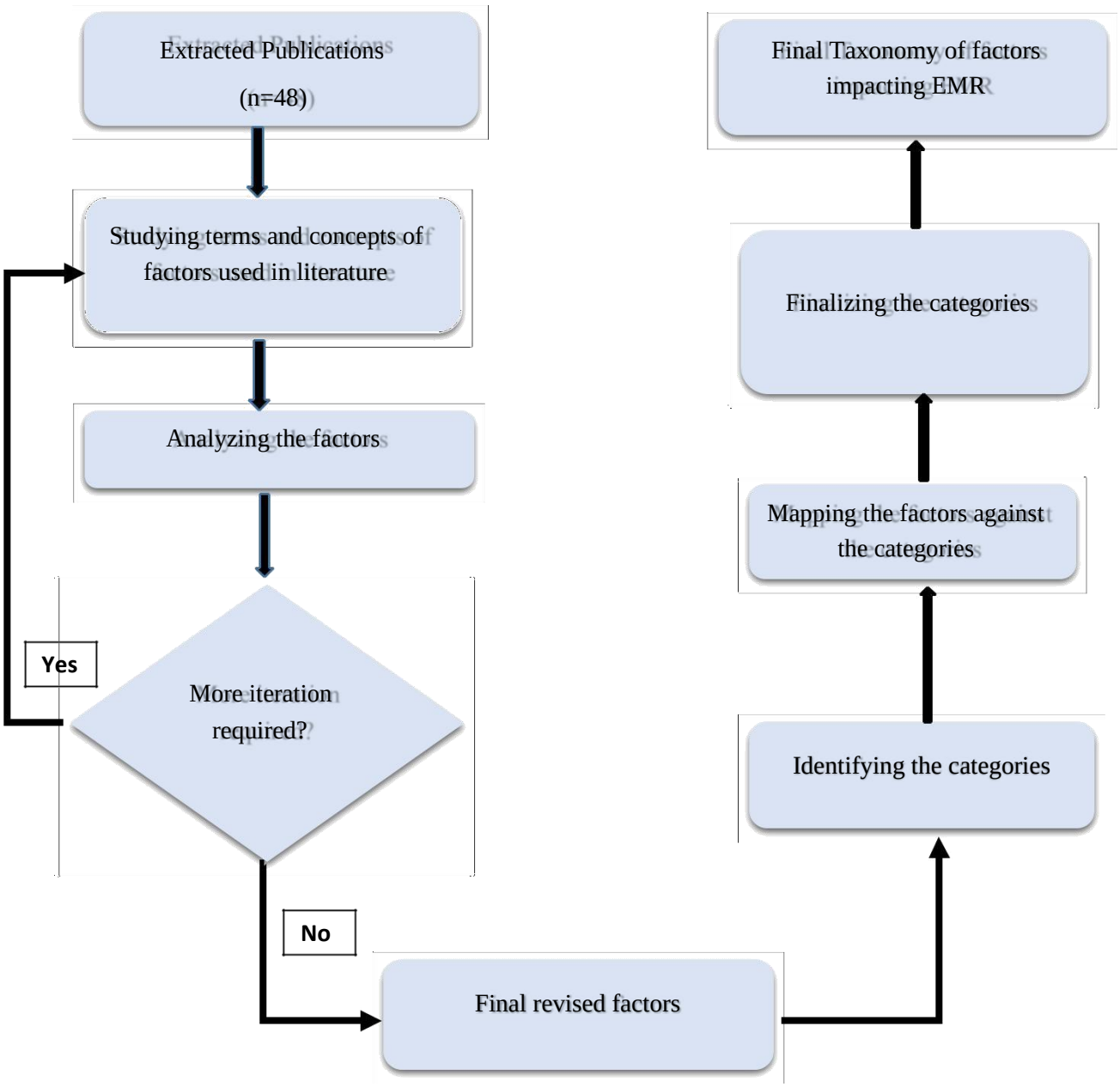


Figure: - Procedure for developing the Taxonomy of Factors affecting EMR Implementation



6. Results

Our systematic review identified **7** categories affecting EMR implementation to which we have mapped the various factors.

6.1 The categories are-:

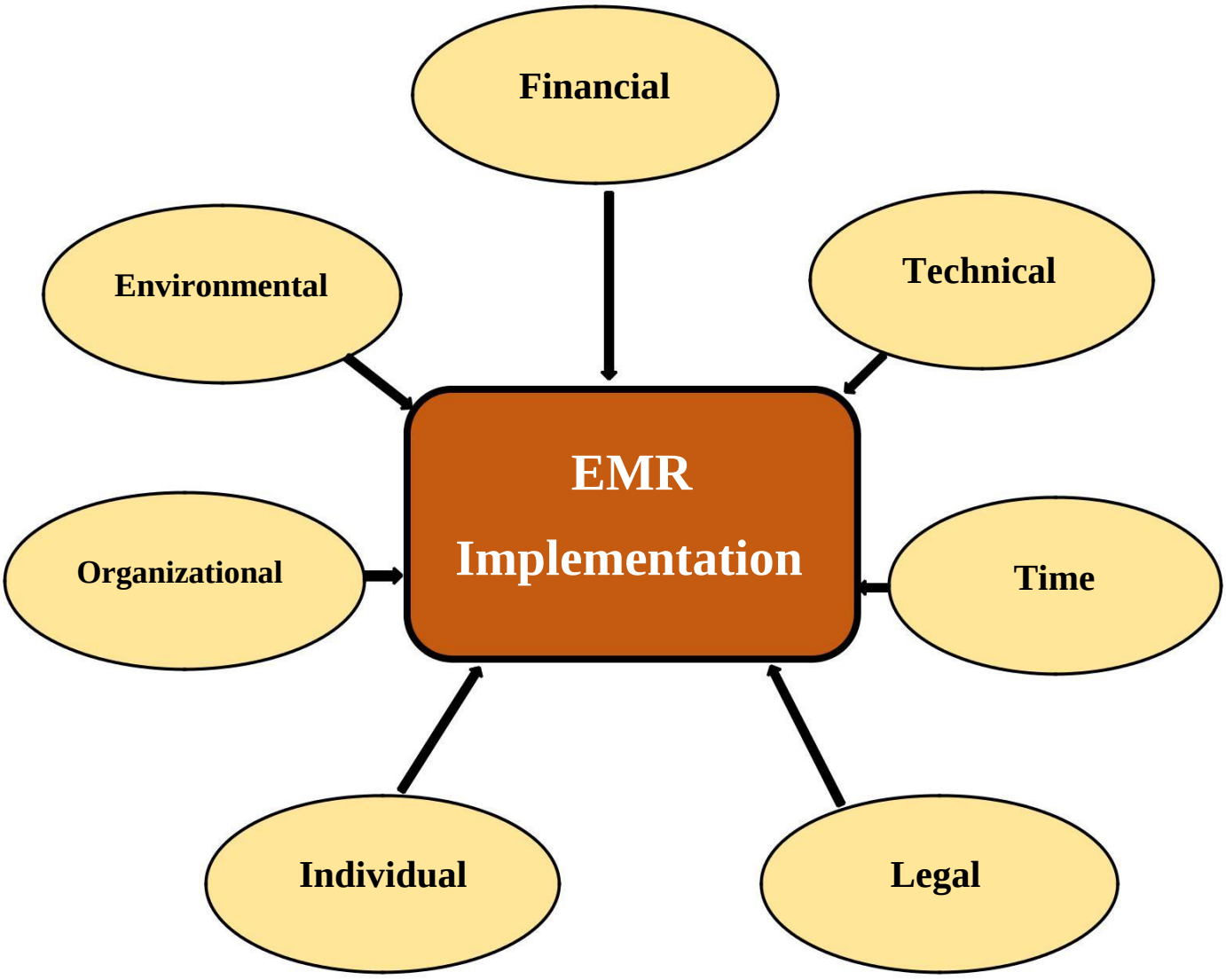


Figure: Taxonomy of Factors affecting EMR Implementation

Below described are the categories and the factors associated as found in our systematic review

1] Financial:-

Barriers- Financial burden of high startup costs and high ongoing costs acts as a major barrier in EMR adoption. Also lack of evidence of impact of IT on healthcare creates uncertainty on ROI which acts as a barrier. Another barrier is lack of financial resources especially in smaller hospitals and rural areas. Additional costs for hardware setup and expert requirement for the same adds to list for barriers.

Facilitators- Funding and incentives provided by the government and the insurance companies act as a facilitator. Electronic ordering which leads to less incorrect or duplicate orders has also been seen as a facilitator.

2] Technical:-

Barriers- Major reluctance to EMR by physicians is due to lack of required computer skills. This results in resistance to EMR. Due to the complexity in EMR end user require training and support is required. This will require them to invest time and efforts, which acts as a barrier. Also a less skilled user may perceive the system to be more complexed. Physicians are used to the paper system which gives them a free hand. Customizability for each one may not be possible and hence using the system acts as a barrier. Reliability and compatibility also act as a barrier to adoption. Some healthcare environments need portable devices, but in some cases EMR systems cannot run properly on these devices. Therefore, some subjects such as touch screen, memory and processor issues, navigation system impact on EMR adoption in healthcare environments which use portable devices. One of the major barrier in EMR adoption is language. Not all countries have English as

their first language. Since EMR is not customized in terms of language and has English as the default language, it acts as barrier to adoption.

Facilitators- Involvement of end user since the beginning of implementation process acts a major facilitator to improve the adoption rate. Proper training and support in technical arena would act as a facilitator. Involvement of end user in developing order sets also acts as a facilitator. Also electronic ordering leads to less incorrect or duplicate orders. Friendly user interface influences the user's attitude towards EMR. Availability of FAQ lists help users to learn the system more easily.

3] Time:-

Barriers- Physicians feel that they would rather not spend their time on implementing EMR but would invest it in treating patients. Switching from a paper-based record to an EMR, the transfer of records between systems takes a lot of effort and their valuable time. They also feel that the time required to learn the system would decrease their productivity. Due to complexity of the system and lack of computer skills, entering data would take more of the physician's time. Also, the increase in time required to enter data would reduce the time available during a consult.- More time per patient .i.e. for ordering and registration.

Facilitators- improved management and workflow resulting in overall increased efficiency, productivity and time taken at the end of the day-from the management's perspective. Anytime and anywhere accessibility to patient data

4] Legal:-

Barriers- Security issues, including confidentiality, integrity and availability, are the major concerns in EMR adoption. Health providers should have access to the patient's information,

which is stored in healthcare record. Main challenge for health care organizations is cloud computing. This is associated with security and privacy because medical records are highly sensitive and should be protected according to existing regulations. Some health providers are doubtful about storing patient's data in the EMR systems. They are worried that information in the EMR may be accessible to unauthorized people. Therefore, the consequences of EMR security beaches might lead to legal problems and it is very important as one of the biggest challenges in EMR adoption.

Facilitators- Legislation that will protect the privacy of the people without restricting appropriate data sharing and data usage will act as a facilitator.

5] Individual:-

Barriers- One of the major barrier which is common for both the developed and developing countries is Physicians outlook towards EMR. As discussed earlier perceived ease of use plays a major role in adoption of EMR. User's autonomy is also a key factor. For e.g. physicians like to treat patients based best on their judgements. Unfortunately there is a negative relationship between EMR adoption and Physicians autonomy. Other factors include age, race/ethnicity, beliefs, personal norms and computer literacy. Many physicians find it difficult to adopt to the technology. Also lack of belief in EMR that it will result in better patient care and clinical outcomes acts as a barrier. When they do not see the benefits they are reluctant to use it. Physicians feel that jotting down the details on a computer while treating or counselling a patient hinders the doctor-patient relationship which acts as a major barrier.

Facilitators- Involvement of end user from the beginning i.e. start of implementation project helps in adoption of EMR. Again perception of physicians about availability of the information anytime and anywhere which improves the workflow and patient care acts as a facilitator. Realizing that use of EMR reduces medication error and errors in lab orders. Also instant availability of right images of the right patient acts as facilitator.

6] Organizational:-

Barriers- Organizational factors are the practice characteristics i.e. Type (single/multispecialty), Ownership (privately owned/government), level of user involvement (role and responsibility), interactions with the health practitioners, management support, cultural changes etc. The management needs to have a clear goal behind implementation and has to maintain it, whether digitalization or revenue or better patient care. Unclear goals hinders the adoption. Most of the EHR implementations cause cultural shifts and therefore, people skills like leadership and communication are absolutely essential, lack of which acts as a barrier. EMR implementations need to consider the "people factor", which, if ignored, could be the top cause of project failure.

Facilitators- Proper management support, one vision with time bound goals acts as a major facilitator in EMR implementation. EHR implementation involves multiple factors such as technology, leadership, change management, training, and management and, therefore, it must support both technical and personnel-related components. Incentives and no provision for paper base records aid in adoption.

7] Environmental:-

Barriers- There are many factors in this category such as the geographical location i.e. whether the country is rich or poor or whether the site of implementation is urban or rural. Hospitals in

rural or remote area face some difficulties such as lower rate of occupancy and supports, more financial and social pressures. The rural hospitals may be the only option for local people, so they do not try to compete with the other hospital to adopt new technology. However, the urban hospitals are more likely to adopt EMR system compare to the rural hospitals. The hospital has problems with selecting a vendor. The vendor should be able to offer a mature and successful product and the vendor must be able to identify hospital workflows and adapt its product to these workflows. Also, membership or social proximity in a health system as a same social group is very important factor to facilitate EMR adoption. Information exchanges during formal and informal communication in the same social system impact on individual's behaviors. If the hospitals are members of the same health system, they can rapidly adopt a new technology. Therefore, a hospital with in focal health system is more eager to adopt EMR system compare to a hospital outside the focal health system

Facilitators- Support from workplace i.e. the entire hospital understanding the goal and aiming to achieve it acts as major facilitator. Support from government i.e. policies and regulations which aids in motivating the hospitals to implement EMR. Incentives programs from the government acts as major facilitator. No false promises to be made by the vendor. The vendor must be able to identify hospital workflows and adapt its product to these workflows. After implementation support from the vendor is also very important.

Barriers

The following table summarizes the barriers mapped to the 7 categories identified:-

Category	Factors
A] Financial	1] High startup costs 2] High ongoing costs 3] Hardware costs 4] Uncertainty over ROI 5] Lack of financial resources 6] Cost of hiring experts
B] Technical	1] Lack of Computer skills 2] Lack of training and support 3] Complexity of the system 4] Lack of hardware 5] Extracting and combining data 6] Lack of customizability 7] EMR performance issues 8] Standardization 9] Default Language Setup
C] Time	1] Time required for the implementation process 2] Time to learn the system 3] Time required to enter data 4] More time per patient (Registration and Ordering) 5] Time to convert the previous records
D] Legal	1] Security and privacy concerns 2] Legal liability concerns 3] Government policies and instability of government
E] Individual	1] Lack of belief in EMR 2] Need for control 3] Personal norms 4] Users autonomy 5] Resistance 6] Technology readiness 7] Race/ethnicity 8] Perceived ease of use 9] Satisfaction 10] Doctor-Patient relationship

Category	Factors
F] Organizational	1] Practice size 2] Practice type 3] Ownership 4] Level of user involvement 5] Management support 6] Culture 7] Unorganized workflows 8] Non-uniform goals/ Unclear Vision 9] Multiple stakeholders 10] Lack of leadership 11] Lack of incentives 12] Lack of participation
G] Environmental	1] Geographical Location (Rich /Poor) (Urban/ Rural) 2] Environment uncertainty network effects 3] Competition 4] Optional use of EMR 5] Vendor Efforts 6] Social proximity in a health system

Facilitators

The following table summarizes the facilitators mapped to the 7 categories identified:-

Category	Factors
A] Financial	1] IT Funding 2] Reduction in duplicate order errors 3] Incentives
B] Technical	1] Training and support 2] Use of order sets 3] Adoption of standards 4] Support from vendors 5] Friendly user interfaces 6] Access to FAQ list 7] Availability of information 8] Involvement of end user at every stage of implementation
C] Time	1] Overall increased productivity 2] Able to work from home 3] Time saved at the end of the day 4] Reduction of time taken in overall care process
D] Individual	1] Demonstrated utility of EMR 2] Reassurance regarding security and confidentiality issues 3] Facilitated selection of suitable EMR system 4] Perceived use for improvement in patient quality through better data management 5] Better patient flow management 6] Reduction in errors
E] Organizational	1] Management support 2] No facility for paper records 3] Clear management vision on EMR 4] Incentives

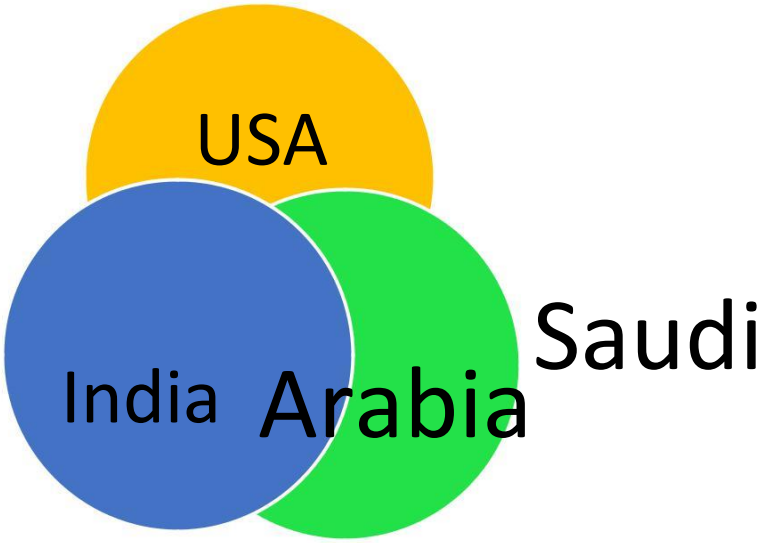
Category	Factors
F] Environmental	1] Support at workplace 2] Government policies 3] Multidisciplinary work processes 4] Collaboration of clinical staff and IT executives
G] Legal	1] Legislation that will protect the privacy of the people without restricting appropriate data sharing and data usage

7. Discussion

Countries across the world have implemented the EMR but with varying rate of successes. This study shows that developed countries such as USA have recorded remarkable success in implementation of EMRs, compared to developing countries. This scenario has been attributed to a number of factors such as relatively more resources allocated to EMR systems in developed countries and the approach used in implementation.

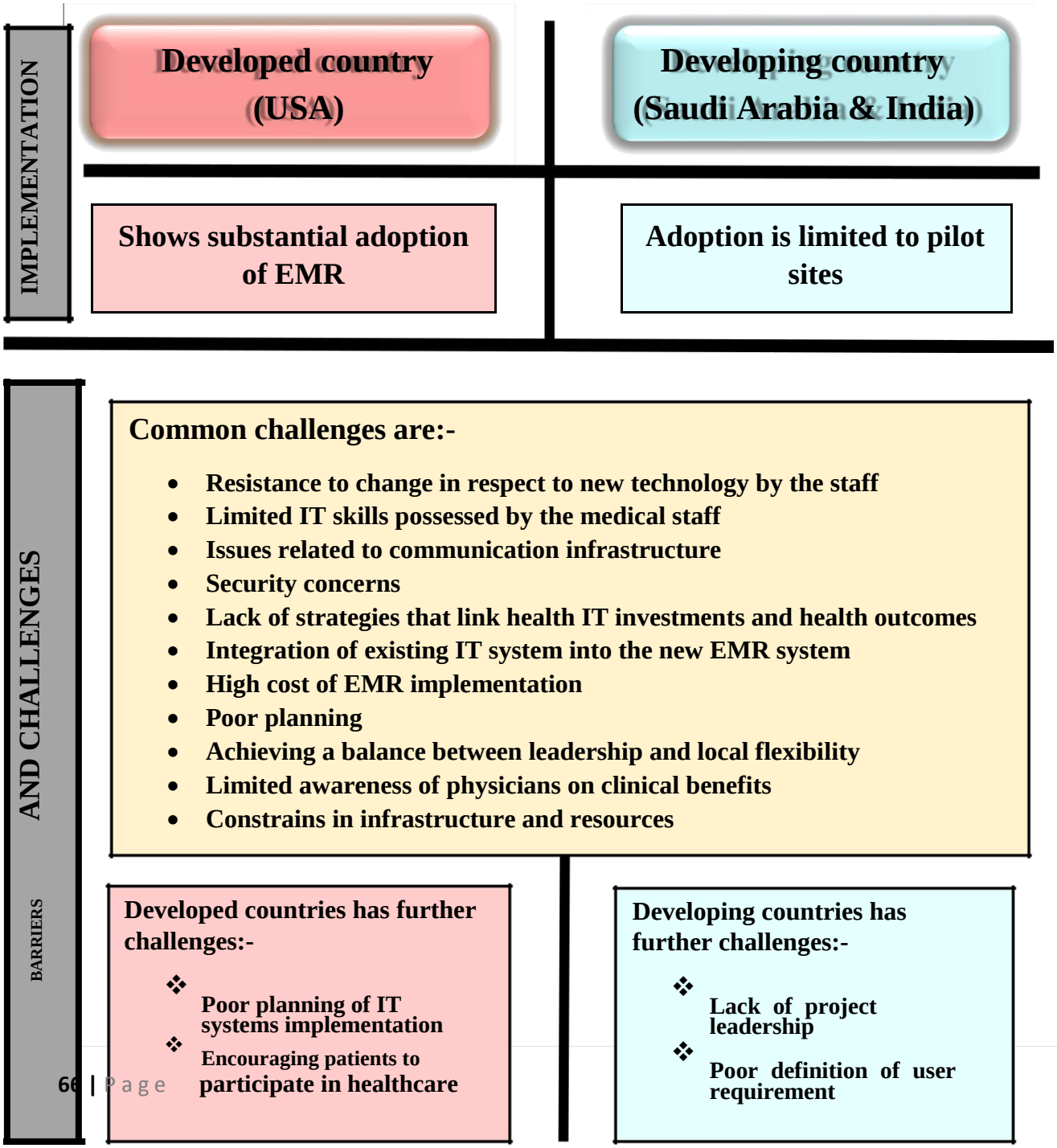
The literature shows that although the implementation rate is higher in USA then Saudi Arabia and India many factors are similar when it comes to adoption. Below are stated the similarities and differences in the barriers and the facilitators.

Figure: Venn diagram of factors affecting EMR implementation in USA, Saudi Arabia and India



7.1 EMR Comparison

The analysis and results of comparison between the three countries i.e. USA (Developed) and Saudi Arabia and India (Developing) in context to EMR implementation is illustrated in the figure below



BARRIERS AND CHALLENGES

- **Poor investments on heath technology due to lack of comprehensive strategies to link eHealth with healthcare outcomes**
- **High cost of implementation**
- **Lack of commitment to the use of standards to enable data sharing**
- **Lack of trust between organizations to share data**
- **Language issues**
- **Concerns of impeding learning and development of students**
- **Slow speed and nonresponsive technology systems**
- **Poverty associated challenges**
- **Poor general infrastructure of healthcare systems**
- **Lack of funds**
- **Limited basic education of both healthcare staff and patients**
- **Social and political instability**

FACILITATORS

Though there are similarities in the facilitators, the extent of benefits realized in USA is more than India and Saudi Arabia due to the level of implementation of EMR systems

8. Conclusion

The healthcare sector has seen tremendous transformation and improvement towards quality patient care. This can be majorly attributed to the technological advances, which has brought digital EMR for file management, record keeping and diagnosis of diseases.

Three countries were studied in this research in respect to EMR implementation. One of them was developed i.e. USA, one high income developing i.e. Saudi Arabia and one middle income developing i.e. India. The challenges, barriers and facilitators for EMR implementation in each of these countries were identified.

EMR has promising tools which are beneficial to the physicians, patient and the hospital. Some of them are reduction of medication error, billing errors, improved patient care and improved quality of care. However, its implementation has remained the most challenging issue. High startup costs, lack of standards, privacy, confidentiality etc. are some of the barriers hindering EMR implementation. To ensure successful implantation in health sector- organization structure, goal, vision, leadership, organization culture, workflow design, level of education and training, among others need to be considered.

The level of implementation in USA in higher when compared to Saudi Arabia and India. The reason being lack of trained manpower, finance, accessibility to health care services, lack of e-health development strategies and language issues.

Some of the lessons that should be learned from developed countries are how to develop information system standards, how to manage the costs of EHRs, how to enhance the participation of remote communities, and how to protect patient privacy and confidentiality.

Even though there are challenges with the implementation and maintenance of the systems; as long as the EMR systems are designed to accommodate the limited infrastructure and resources, they can turn out feasible.

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