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Internship Training

At

AKHIL SYSTEMS PVT. LTD., NEW DELHI

FACILITATORS & BARRIERS IN ADOPTION OF ELECTRONIC MEDICAL RECORDS: A COMPARATIVE ANALYSIS

By

VARSHA PRASAD

PG/19/099

Under the guidance of Dr. Anandhi Ramachandran

Post Graduate Diploma in Hospital and Health Management
2019-21

International Institute of Health Management Research
New Delhi

COMPLETION OF DISSERTATION

The certificate is awarded to

Ms. Varsha Prasad

in recognition of having successfully completed her 3 months dissertation with effect from March 15, 2021 to 15 June, 2021 and has successfully completed her Project on

Facilitators & Barriers in Adoption of Electronic Medical Records: A Comparative Analysis

At

Akhil Systems Pvt. Ltd., New Delhi

She comes across as a committed, sincere & diligent person who has a strong drive & zeal for learning.

We wish her all the best for future endeavours.

Head Human- Resources

Ms. Shweta Gupta

TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Ms. Varsha Prasad,** a student of PGDM (Hospital & Health Management) from International Institute of Health Management Research, New Delhi has undergone internship training at Akhil **Systems Pvt. Ltd., New Delhi** from **15th March to 15th June.**

The Candidate has successfully carried out the study designated to her during internship training and her approach to the study has been sincere, scientific and analytical.

The Internship is in fulfilment of the course requirements.

I wish her all success in all her future endeavours.

Ms. Divya Aggarwal
Associate Dean
Academic and Student Affairs
IIHMR, New Delhi

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CERTIFICATE OF APPROVAL

The following dissertation titled **"Facilitators & Barriers in Adoption of Electronic Medical Records: A Comparative Analysis"** at **"Akhil Systems Pvt. Ltd., New Delhi"** is hereby approved as a certified study in management carried out and presented in a manner satisfactorily to warrant its acceptance as a prerequisite for the award of **PGDM (Hospital & Health 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. Ajay Sood

Dr. Rupsaa Banerjee

Dr. Sumant Swain

CERTIFICATE FROM DISSERTATION ADVISORY COMMITTEE

This is to certify that **Ms. Varsha Prasad,** a graduate student of the **PGDM (Hospital & Health Management)** has worked under our guidance and supervision. She is submitting this dissertation titled **"Facilitators & Barriers in Adoption of Electronic Medical Records: A Comparative Analysis"** at **"Akhil Systems Pvt. Ltd., New Delhi"** in partial fulfilment of the requirements for the award of the **PGDM (Hospital & Health 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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CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled **"Facilitators & Barriers in Adoption of Electronic Medical Records: A Comparative Analysis"** at **"Akhil Systems Pvt. Ltd., New Delhi"** and submitted by **Ms. Varsha Prasad**, Enrolment No. **PG/19/099** under the supervision of **Dr. Anandhi Ramachandran** for award of PGDM (Hospital & Health Management) of the Institute carried out during the period from **15th March to 15th June.** embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other Institute or other similar institution of higher learning.

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ABSTRACT

FACILITATORS & BARRIERS IN ADOPTION OF ELECTRONIC MEDICAL RECORDS: A COMPARATIVE ANALYSIS

Key words: Electronic medical record, Electronic health record, EMR, EHR, EMR adoption, Facilitators, Barriers, Challenges

Electronic Medical Records (EMRs) have placed the foundation of digitalization in healthcare sector. With the advent of EMRs there have been vast developments in field of healthcare with respect to both clinical a well as administrative processes. EMR's have been very helpful in improving the patient care, ensuring patient safety and in streamlining the workflows involved in healthcare facilities. They integrated the processes of different departments of the hospital very efficiently, at the same time they are securing the patient data. Despite of such huge potential of EMRs the adoption rate is insignificant as a lot of challenges are associated with the implementation of EMRs. Different countries are working very thoroughly in order to uplift the healthcare system of their respective nations. Successful adoption of EMR is one such significant step to ensure this objective.

This study is an attempt to identify the facilitators and barriers associated with EMR adoption in Australia, Canada, India and USA. Australia and USA are frontiers in EMR adoption and on the basis of learning from them, a roadmap is suggested which can be useful for successful adoption of EMRs in India. This is a literature-based study for which research papers were selected on the basis of certain criteria. On the basis of the result from the literature conclusion have been provided which justifies the research objectives. The facilitator's which are very crucial for successful implementation of EMR are identified and are suggested so that EMRs can be utilized efficiently.

Acknowledgement

I, hereby take this opportunity to express my immense gratitude to various personnel of **Akhil Systems Private Limited, Delhi**. I am thankful to **Mr. Sanjay Jain (MD)** for providing me opportunity to developing deep understanding about EMRs and HIS. I am obliged to **Ms. Rekha Jain (MD)** and **Ms. Shweta (HR)** for providing me an opportunity to work in one of the best Healthcare IT organization for HIS and EMR.

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LIST OF ABBREVIATIONS

S.NO.	ABBREVIATIONS	FULL FORM OF ABBREVIATIONS
1.	HIS	Hospital Information System
2.	CMS	Clinical Management System
3.	LIS	Laboratory Information System
4.	RIS	Radiology Information System
5.	EMR	Electronic Medical Record
6.	Covid-19	Novel CorronaVirus-19
7.	SARS-CoV-2	Severe Acute Respiratory Syndrome – Coronavirus-2
8.	VCS	Virtual Care Solution
9.	RPM	Remote Patient Monitoring
10.	NDHM	National Digital Health Mission

INTERNSHIP REPORT

Introduction

Akhil Systems Pvt. Ltd. (ASPL) is the foremost provider of advanced health information systems and facilities that automates the administrative and clinical operations of healthcare organizations of all sizes. Their high-quality solutions easily simplify decision making by rationalize Processes, Procedures, Policies and work flows. It also assists in carrying out Healthcare standards and compliances to advance the quality of service and better care outcomes.

Since its inception in 1994, Akhil Systems has become industry leader for offering inclusive and cost-effective healthcare software solutions by mechanizing needs of clinical, administrative and financial areas in paperless environment.

With hundreds of successful implementations in India and overseas. ASPL's presence can be felt in Dubai, Myanmar, Bahrain, Qatar, Philippines, Bangladesh and many more countries.

Vision of ASPL

We intend to provide the best services to our clients and want to achieve worldwide excellence in Healthcare IT industry by providing our world-class Healthcare ERP solutions.

Mission of ASPL

To develop, innovate and provide robust Healthcare ERP solutions using latest technologies worldwide as per the client's vision with quick implementation and affordable cost.

Journey So Far

- Provided solution from 20 Beds to 1800 Beds Hospital
- Software Running 24 x 7 in Hospitals for last 25 years.
- Recognized as 20 Most Promising Solution for Healthcare 2016 by Silicon India Magazine.
- Awarded "Best HIS & HMIS Provider of the Year" at 4th Annual e-Health Healthcare Leaders Award on 12th March, 2015 at New Delhi.
- Recognized as "Company of the Year'14 – Healthcare HIS" by CIO Review Magazine.
- Winner of "Best HIS and HIMS Provider of the Year – 2013" by e-India Award.

Organizational profile

The organization structure of ASPL is as follows-

Figure 1.2.1: Organization Profile, ASPL

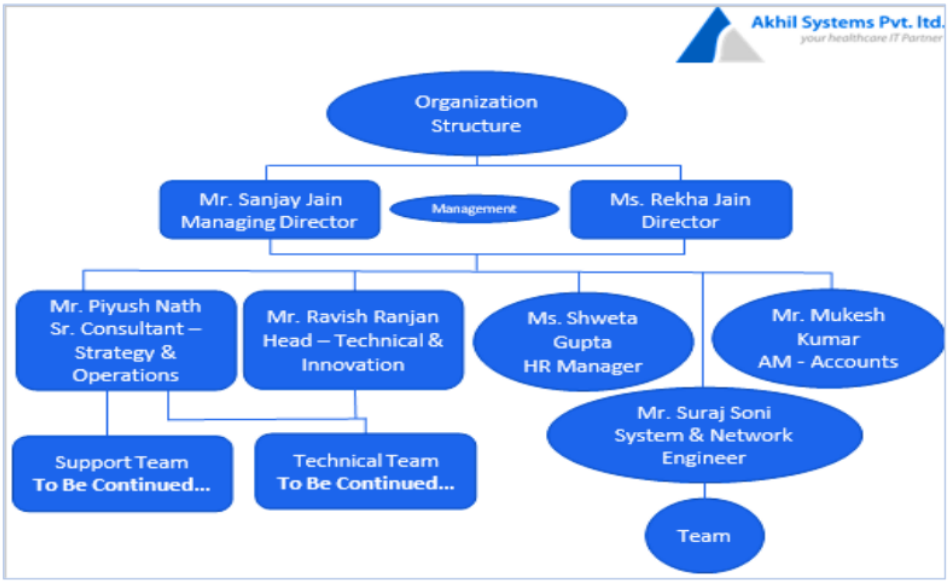
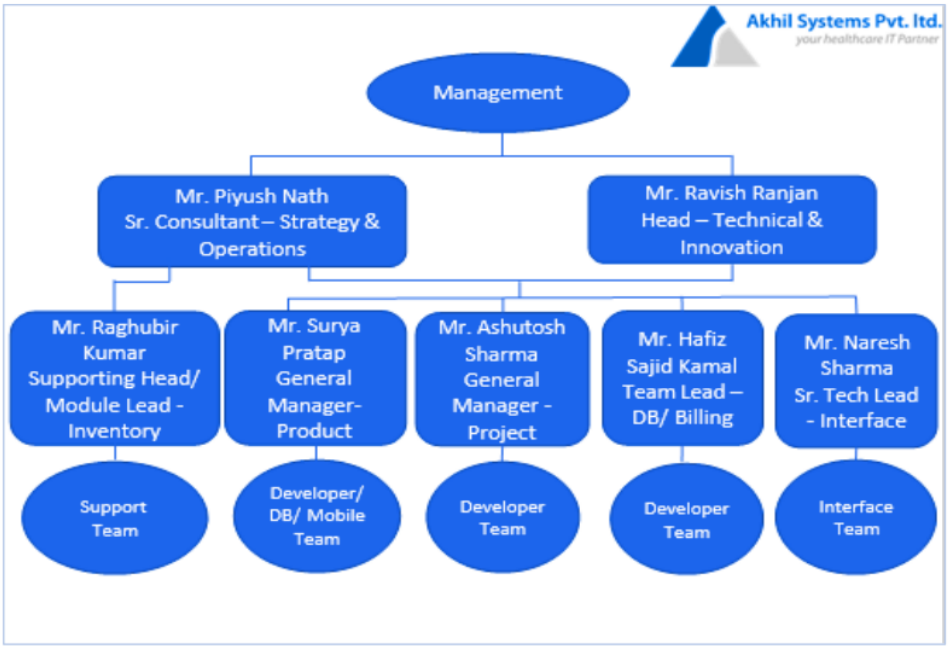


Figure 1.2.2: Organization management profile, ASPL



Services provided by ASPL

ASPL provides one of the pioneer hospital information system (HIS/EMR) companies with more than 25 years of experience in the single domain of healthcare, specialized in delivering management information systems for hospitals, medical colleges, clinics, diagnostic centres and pharmacy chains.

The products provided by ASPL are-

- **Hospital Information System -** Akhil Systems MIRACLE HIS is a comprehensive and complete solution designed that automates the clinical and administrative functions and enables the healthcare providers to improve their operational effectiveness, consequently reducing costs and medical errors, while enhancing quality of care. The product has been designed with modular architecture to cater to the requirements of the various departments and specialties of the hospital such as OPD, IPD, Emergency Care, Nursing Care, Pharmacy, Laboratory, Radiology, Inventory Management, Operation Theatre and many more.

- **Clinical Management Systems** – ASPL offers CMS for clinics and offer modules as per the customer requirement.

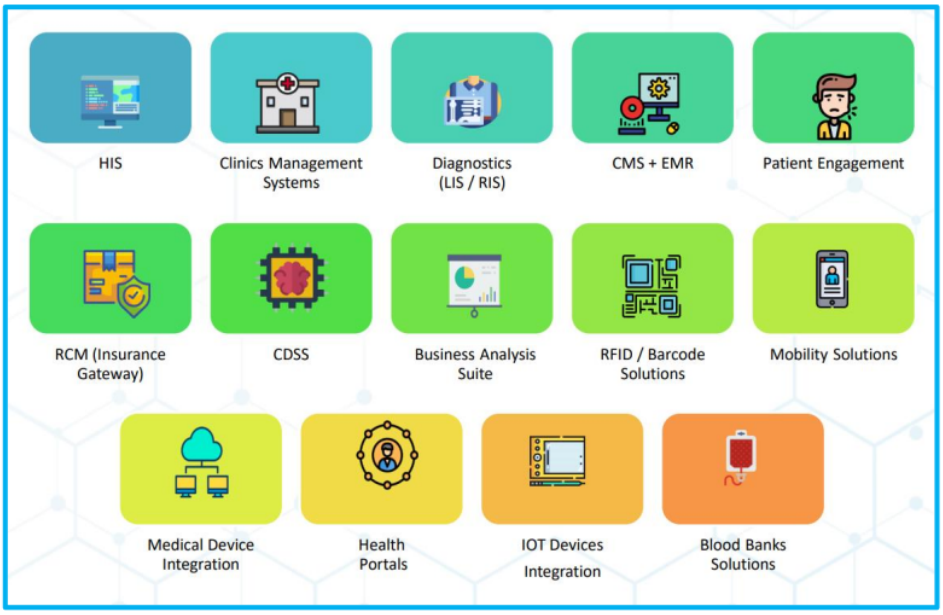
- **Diagnostics System (LIS/RIS)** – It comprises of LIS/ RIS modules as per requirement. In LIS, it provides multi-site, multi-facility specimen/sample tracking and lab support, accurate, up-to-the-minute patient data and charge information. Automatic generation of collection lists, labels and worksheets, instant comparison and statistical analysis of test results, on-line patient inquiries, reports, and summaries, integrated inventory management and maintenance scheduling for laboratory instruments/equipment, Lab Register Maintenance, Equipment's Interface for capturing of result etc.

  In RIS, software suite for managing medical imagery and associated data. RIS in HIS is especially useful for managing radiological records and associated data in multiple locations and is often used in conjunction with a picture archiving and communication system to manage work flow and billing. RIS can track a patient's entire workflow within the radiology department. Images and reports can be added to and retrieved from electronic medical records (EMRs) and viewed by authorized persons.

- **Insurance gateway-** For patient portals, mobile apps.
- **Mobility Solutions -** Miracle Mobility Solutions is state of art innovation for real time patient health records accessible from anywhere, anytime. It offers a user's-friendly Patient, Doctor's & Feedback App .
- **Medical Device Integration -** It offers all major integration such as lab machines, PACS, X-rays and other medical devices.
- **Health Portals -**A digital platform for real-time patient health records accessible from anywhere, anytime. It is integrated with MIRACLE HIS and provide real time information for patient to view their case records, lab reports, appointments and many more.

Some of the other products are –CDSS, Business Analysis Suite, RFID / Barcode Solutions, CMS + EMR integration, Patient Engagement Platforms, IOT Devices Integration & Blood Banks Solutions.

Figure 2.3: Services provided by ASPL



Departments worked & Key learnings

Digital Marketing Department – This department is responsible for creating contents for marketing purpose in the social media platforms. It comprises of the content creators , marketing team and the designers.

Role & Responsibilities

- To create written content for digital marketing purpose.
- To provide suggestions related to design of posts for marketing purpose.

Key Learnings

- To write efficiently by marketing point of view.
- Importance of good designs in order to enhance customer engagement with the digital platforms.

Functional Department – This department takes care of the functional requirements in the software by the clients. Also, maintain the all the documentation needed to be done related to it and management activities.

Role & Responsibilities

- To involve in demonstration of software for clients.
- Involved in documentation of functional documentations like SRS document, feature document.

Key Learnings

- Understood the formal way of documentation.
- Gain knowledge about the modules involved in HIS.
- Presentation and demonstration skills.

Implementation & Support Department- The implementation department is responsible for carrying out the whole process of HIS or any other product implementation , that is from the planning to the go- live phase. In order to efficiently implement the system, support team is provided for training and queries purposes. Also, any challenged faced by the client are handled by the support team initially, which if persists are then passed further to the implementors and developers.

Role & Responsibilities

- To provide EMR and ward modules training to users.
- To handle the queries raised by user.
- To check any bottlenecks at the user part related to information system and acknowledge them to implementation team

Key Learnings

- Understood the process of HIS implementation.
- Gain knowledge about the clinical modules involved in HIS.
- Exposure about how real time projects is handled and implementation are carried out.

DISSERTATION REPORT

FACILITATORS & BARRIERS IN ADOPTION OF ELECTRONIC MEDICAL RECORDS: A COMPARATIVE ANALYSIS

INTRODUCTION

In present scenario, when technology is introducing a whole new revolution worldwide, healthcare is one of the foremost domains that have vast influence of these technology interventions. There are plenty of technologies that are being introduced in healthcare, in order to enhance the patient safety. In addition to this, technology is proving efficacious in the efficient and effective utilization of healthcare resources also. Healthcare industry is one of the most transforming industries and with the advent of Electronic Medical Records (EMR's) there is a whole new revolution in the healthcare sector. The transformation resulting from the adoption of digital technologies led to an increase in personalization in healthcare sector. The acceptance of digital technologies in healthcare is basically because of better functioning and EMR's (1). It would not be wrong if it is considered that EMR's lay down the foundation for digitalization in healthcare.

History and Background

Electronic Medical Record: EMR's are the digitalized medical records of any patient which comprises of patient's history, diagnosis, test, treatment, medical images and relevant information of patient's traditional medical record. EMR's hold huge potential to facilitate the safety, efficacy, workflows, continuity of care in the healthcare.

The concept of EMR was presented by Larry Weed in the at 1960s. The idea was to record patient's information in electronic form as an alternative of on paper (2). The first EMR

was developed by the Regenstrief Institute on 1972 (2). At that time, it was welcomed as a major advancement in healthcare. Due to the high cost associated with it, this EMR primarily used by government hospitals.

These EMRs are unique electronic documents (3) with components such as Patient registration, Scheduling, Documentation of patient encounters, Prescriptions, documentations management, lab reports (requesting & receiving), interoffice communications (2).

EMRs and Digital technologies during Covid-19

Covid -19 is the infectious diseases which is caused by SARS - CoV - 2. It is one of the most transmittable diseases to have knockout us in decades (4). Covid 19, had undeniably stimulated a digital Healthcare revolution that has been building since the past decade

Covid -19 is the infectious diseases which is caused by severe acute respiratory syndrome Corona virus 2 (SARS - CoV - 2). It is one of the most contagious diseases to have hit us in decades (4). Covid 19, had undoubtedly stirred a digital Healthcare revolution that has been building since the past decade (5). Despite or the long range of benefits EMR have the EMR in its current state poses significant barriers which were evident during the pandemic (6)

Along with a varied range of digital Healthcare technologies that have been uses in handling the Healthcare sector telemedicine have flourished like never before. Furthermost countries however were lacking in terms of regulatory framework in direction to authorize, integrate and reimburse telemedicine services (7)

Each country has work upon the progress of its own response and approach to pandemic. The research is now focused on care, treatment and immediate response (8). One such concept which rise as a result of global pandemic is Screening clinic in which the medical

care is driven by EMRs, the cause behind this was to bring an all-electronic clinic with an online patient screening and registration tool so that infection spread can be reduced (8). Covid-19 have emphasized upon the significance of digitalization in every compass of life including the Healthcare sector (9). By concentrating in the virtual mode of care, it is possible to make health care delivery accessible and convenient for remote places also (9).

There are a lot of digitalized sources of care resulted. Because of this pandemic a number of digital interventions had done in order to strengthen the healthcare system. One of the most encouraged digital health solutions that had been witnessed during covid-19 are virtual care solutions (VCS), they provide active care opportunities to patients from their homes. They are very accommodating in founding a link between the Healthcare provider and the patient Telemedicine EMR software's are one of the examples of VCS, telemedicine EMR software comprises of integration between the telemedicine and EMRs (10).

Telemedicine technology had assisted during covid-19 to a great extent it has helped to link up providers and patients with the help of Telecommunication & video consultations. The adaptation rate of these telemedicine EMR software had increased rapidly due to covid-19 pandemic as both clinicians & patients found it a healthy and safe platform to provide care solutions which had been helpful in reducing the infection rate also (10).

The pandemic has affected mental health of individuals to a great extent, some researchers have even showed correlation between covid and mental stress caused by it, teleconsultation have proved its efficiency in terms of Psychiatric services also (43).

In addition to this, remote patient monitoring (RPM) is also an influential platform that resulted in in that had been using before pandemic but the adoption rates rise post

pandemic. In case of paediatric this tech has been very efficient during pandemic (44.) RPM is a prevailing platform which allows the physician to effectively monitor patient conditions outside of the hospital various sort of health monitors such as BP monitors thermometers digital scale science real-time data to provided so that they can keep track of patient's condition these are mainly the IOT based devices which can be used for patient monitoring and are very effective when people are not able to have access in the Healthcare services (10).

The digital health Technologies that had been used in covid ranges from the tracker used for infection spread (14,15). From operative robots by the government by the Indian government in order to in addition to this Indian government has also used drones to spread disinfectants several Technologies the use of technology is decentralized decision-making bridging communities with local governments across cities and towns (11).

There are a large number of benefits that EMR have over the traditional paper-based patient records, these are summarized as follows (19)-

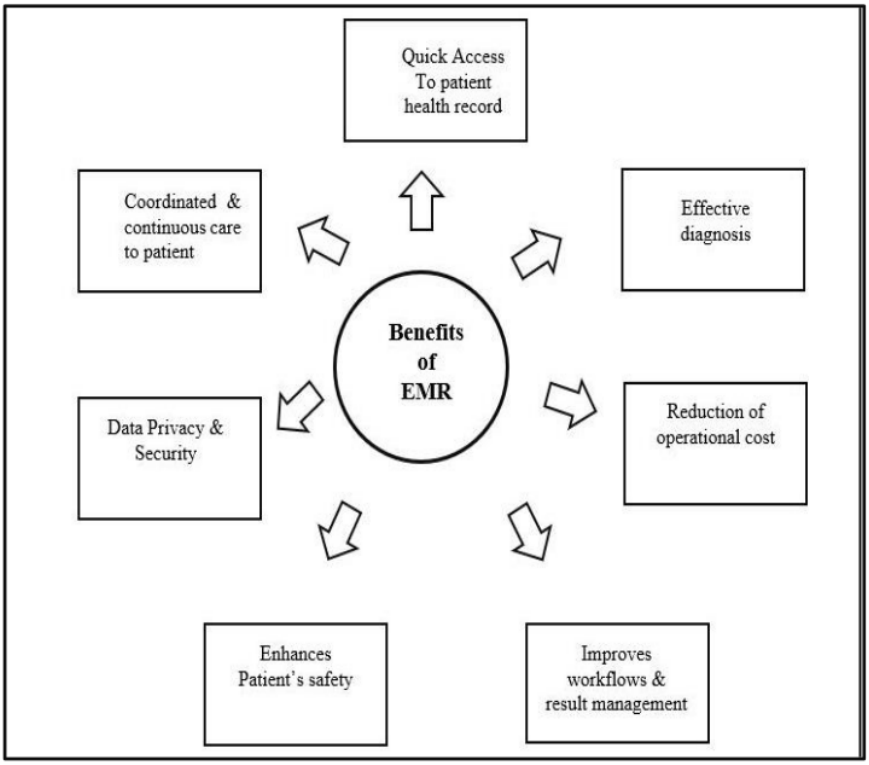
- EMR Enables quick access to health records of patients.
- Improves the interaction between the different department within a healthcare organization as well as between the patient and the healthcare provider.
- EMR's are very useful in providing coordinated care to patient as they provide comprehensive information regarding the patient health.
- They help in streamlining the workflows of the healthcare facilities. They are very helpful in the efficient flow of patient's information within a healthcare facility.
- Helps in using the available healthcare resources efficiently.
- EMR's also enhances the patient safety by reducing the patient identification errors and associated medication errors.

- There are certain cases where duplication of processes such as laboratory investigations, radiology and similar processes are reported, EMRs are very useful in order to prevent duplication of procedures.
- EMRs offer improved follow up information for patients.
- Helps in effective diagnosis of the patient.
- Enhances the accountability of the healthcare providers.
- Improves the result management as well as patient care.
- On long run, EMR are very useful in reducing the operational cost associated with traditional paper-based health records.
- If EMR's are implemented for long run then they also lead in reduction of operational cost of the healthcare facility.
- An EMR system integrated with financial accounting software's is useful for monitoring the financial activities within the system, this reduces the cases of forgery & false claims related to health insurance with the help of Audit trial mechanism (45).
- They are more secure on comparison to the paper-based health records.
- Enhances the privacy of the patient's data.

Despite of these long list of benefits which are provided because of EMR's, the rate of adoption of EMR's is quite low in several countries (41). In India itself, EMR adoption is still at its nascent stage, except a very few facilities there is reluctancy in adoption of EMRs. With the advent of Information technology-based solutions during global pandemic Covid-19, there have been increase in adoption of information systems, e-health records, tele solutions and overall digital adoption among healthcare facilities worldwide, in India it is evident from NDHM that the government is encouraging to establish digitalization in healthcare domain (22,36). To adopt a technology-based

solution is only one aspect of the development in healthcare domain but to effectively utilize it for improving the existing workflow and covering the loopholes of traditional system is of equal importance. There is certain challenge that needed to be addressed for effective implementation of EMRs among the healthcare facilities.

Figure 2.1: Benefits of EMR



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Objectives of the study

The specific objectives of the study are-

- To identify the factors facilitating adoption of EMRs among healthcare providers.
- To identify the barriers associated with EMR's adoption among the healthcare providers.
- To formulate a roadmap based on the above for effective adoption of EMR by healthcare providers in India.

Rationale

There have been a lot of research carried out in understanding the adoption of EMR's in healthcare but still there are certain aspects that needed to be understood. There are many factors that have been underlined in the literature as reasons for successful adoption of EMR. While EMRs have been adopted in many countries globally, Australia, Canada and USA are forefront in successful adoption. The purpose of the current study is to explore the factors acting as facilitators and barriers in EMR adoption in Indian healthcare system, on comparison to study the adoption factors of EMR in Australia, Canada and USA's healthcare, reported in the literature. On the basis of it, to suggest a plausible roadmap for successful adoption of EMR in the India based on the learnings from them.

LITERATURE REVIEW

There have been many research papers available which have studied about EMRs and their adoption but out of the studies only 15 studies are there which have emphasized upon the facilitators and barriers associated with adoption of EMR with reference to Australia (1,16), Canada (8,23,32), India (1,17) and USA (25,31,33). Most of the research papers which were reviewed for the study purpose were comprises of interview and survey of physicians, other healthcare workers and administrators of healthcare facilities.

Similar review had been done for Australia by A. Hossein & Ghapachi. He had discussed the factors affecting successful implementation of EMR and in addition to this, he had categorized these factors into different categories for better understanding. The results were helpful for policymakers, IT professionals, healthcare workers & system developers of EMR.

Table 2.2: Literature Review

Source Author (Country)	**Year**	**Methodology** (Study design & sample size)	**Findings**	
			Facilitators	**Barriers**
G. R. Stream (USA)	2009	A survey was conducted in which questionnaire was send to physicians of different specializa-tion out of which 120 responses were reported and constitutes the final sample size.	• Reimburs ement for using e-health records • Adequate technical support • Performan ce based incentives	• Lack of standards • Cost factors-Ongoing & upfront cost • Technical limitations • Lack of computer literacy • Time needed for training
Albert B, M. Broekhuis (Canada)	2010	A systematic literature review was conducted after filtering out 22 articles were finalized for review purpose.	• Proper change process • Provision of financial incentives • Proper communic ation regarding safety & security of EMR implement ation • Support & leadership from managem ent	• High startup and ongoing cost associated with EMR implementa tion • Un-certainment regarding ROI • Lack of financial and other resources • Lack of training • Lack of computer literacy • Privacy and security concerns

				• Insufficient Management support • System Complexity
J. Scholl (India)	2011	A case study-based study was conducted at SN eye hospital, Chennai. 30 Semi-structured interviews were conducted among a wide range of actors.	-	• Users' resistance to change • Lack of computer literacy
K. Kenny (USA)	2011	This was a quantitative study for which sample size was 289 comprises or physicians and nurse practitioners.	• Supportive management • Positive organization culture	• Time consuming • Cost factors- Ongoing & upfront cost • Loss of productivity during implementation of EMR • Patient resistance • Lack of understanding about user needs • Un-certainment regarding ROI • Privacy & security concerns • Incompliance of EMR with existing workflows
J. B. Brown, A. Thind (Canada)	2011	This was a descriptive qualitative study for which 19 participants (Physicians,	• Good team communication	• Lack of consistent data

		interprofessional healthcare providers & administrative staff people) were interviewed. In addition to this both individual as well as team analysis was conducted.	• Proper guidance & Encouragement of EMR adoption • Assigning clear responsibilities of EMR	• Inconsistency in using EMR • Technological challenges
M. Price, A. Singer (Canada)	2013	Study design for this study was quanti-tative. Discussions and interviews were carried out with clinicians and other staff members of the healthcare facilities in order to study the challenges associated with EMR adoption. The sample size for the study was 57.	• Good quality data • Regular feedback to user	• Lack of awareness & usability of EMR. • Lack of proper training. • High cost • Poor quality data •
P. Nambisan, G.L. Kreps (USA)	2013	Systems approach was used to look at the three levels – macro, meso & micro levels for EMR adoption.	• Communication mechanism implementation • Cultural change such as customer & entrepreneur orientation • Good communication policies • Facilitating learning environment • User involveme	• Lack of computer literacy • Physician resistance • Cost factors • Communication gap amongst various actors • Lack of understanding about user needs • Lack of promotional efforts, post implementation

			nt in adoption factor • Organization commitment & support	
F. Chang, Nishi G, (Canada)	2015	This was a literature-based study for which the data was collecting through research databases and government websites of Canada which provide information about EMR adoption in Canada. 12 articles were finalized for the study.	• Proper change management approach • Ensuring proper training • Collaborative culture • Unified business & clinical aspects • Good quality of data	• Lack of computer literacy • Lack of compatibility with other systems • Lack of policies related to electronic health • Training limitations • Security concerns
M. Sharma, H. Aggarwal (India)	2016	Bibliographic literature was obtained from different hospital across India to carry out this study. In addition to this articles and research papers related to e-health records adoption have been considered for the study purpose.	• Funding Source • Proper IT infrastructure • Clear policy and framework regarding EMR	• Lack of computer literacy • Legal issues • High cost • Lack of standards • Lack of proper IT infrastructure

			implement ation	• Privacy & security concerns • Lack of clarity in existing policies regarding EMR implementa tion
J.A. Milstein, V. Patel (USA)	2017	The study was based on data gathered from Annual survey of AHA for IT adoption (Dec, 2015-Mar,2016). The survey questionnaire was sent to 6290 hospitals out of which 3538 responses were received, contributing to final sample size.	• Proper training and awareness about EMR use • Performan ce Incentives	• Cost factors- Ongoing & upfront cost • Physician resistance • IT infrastructu re
N. Mehta, A. Pandit, India	2017	The study design was both quantitative and qualitative (mixed). 250 private practitioners were involved for the study purpose which were related to different specializations.	• Proper training • Balance managem ent and leadership regarding Implemen tation of EMR	• Security & Privacy issues • Associated cost • Staff resistance • Lack of adequate training • Software & hardware incompatibi lity • Lack of proper IT infrastructu re

V. Modi (India)	2017	The study design here was descriptive & exploratory. Both primary as well as secondary data was collected for the study. The primary data comprise of data collected by interviewing 50 clinical & other operational staff of the clinic/ hospital while the secondary data was collected from different websites, research journals, articles & case studies.	• Management support • Proper training • Awareness about EMR	• Data for successful implementation of EMR
P. Miles, A. Hugman (Australia)	2019	Observational study among four sites.	• Financial support for providing adequate infrastructure • Incentives for using EMR • User training	• Doctor's rigidity to use EMR • Lack of communication between users and IT department • Poor integration with clinical workflows • Lack of technical support • Lack of constant feedback • Medio-legal issues associated with the patient's data transfer & storage.

Ankit S., S. Jadhav (India)	2020	Cross sectional study design was adopted for the study. A questionnaire was developed on the basis of TAM. A total of 145 response of physicians were recorded and analyzed.	• Positive attitude towards using EMR • Customization of EMR in order to align with healthcare facility workflow • Reliability of EMR • Monetary incentives for using EMR	• Complex usability • Lack of consistent data
Anna J., C. Donnelly (Australia)	2021	The study was done quantitatively by interviewing clinical and administrative staff of a cancer centre. Their response was recorded, analysed and concluded in the study. Sample size for the study was 20 out of which 2 were in administrative or research role while 15 were in clinical role.	• Awareness about EMR • Standardization and completeness of data • Familiarity with the platform • User training	• Poor communication from IT department • Feature completeness • Reliability of EMR • Lack of infrastructure • Lack of technical support

METHODOLOGY

Key research question: What are the factors associated with EMR adoption among healthcare providers? Articulate a roadmap for successful adoption of EMR for healthcare providers.

The research design used was literature-based study. The literature data used for the study was retrieved from published scientific journals. Data bases used for the research purpose were PubMed, Google Scholar, Academia, Research Gate, Science Direct, Web of Science, EBISCO. After initial search was carried out, the keywords were identified.

Thereafter, identified abstract and articles were reviewed. After removal of the duplicates the articles and abstracts were reviewed again in order to check whether they address the research questions, resulting articles were studied, at last, results were documented.

Study Design: The study design is literature-based study.

Study Data: Literature data was retrieved from published scientific journals.

Data Bases Used: PubMed, Google Scholar, Academia, Research Gate, Science Direct, Web of Science, EBISCO

Search terms used for the retrieval of articles were combination of the following terms–

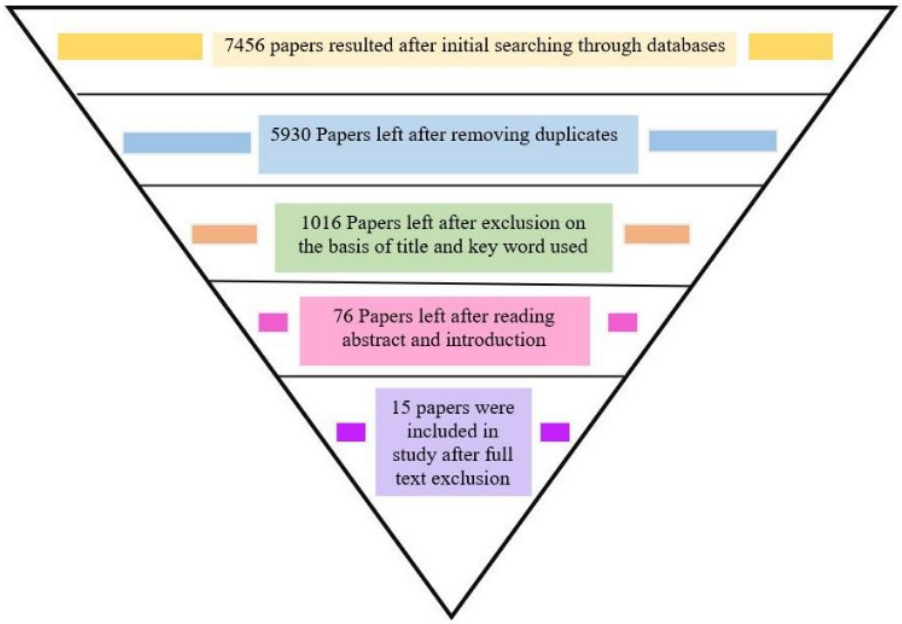
- Australia
- Barriers
- Canada
- Challenges in adoption
- Electronic health record
- Electronic medical record
- EMR / EHR adoption
- EMR/EHR
- Facilitating factors
- Healthcare information systems
- India
- USA

Inclusion criteria for the research papers/ journals which were reviewed –

The research papers which had been considered for review purpose included followed criteria's-

- **Time** – Only research papers / journals which are published after 2008 were considered
- **Geographic Location –** Australia, Canada, India and USA,
- The research papers / journals must comprise of – Electronic medical records adoption
- **Language**- English
- Only papers which were available as **free full text** were selected for study purpose.

Figure 2.3: Stages of Study selection process



RESULTS

By reviewing the 15 articles 28 facilitators and 37 barriers (would be signified as factors, collectively) affecting EMR adoption of healthcare provider were identified. Out of them there were some common facilitators & barriers while the some of the facilitators & barriers were country specific. Comprehensive checklists have been provided separately for both facilitators and barriers, indicating the prevalence of these factors in the respective country.

Facilitators in adoption of EMRs

Table 2.4.1 : Checklist of facilitators associated with EMR adoption

Facilitators	Australia	Canada	India	USA
Adequate technical support				✔
Assigning clear responsibilities of EMR		✔		
Awareness about EMR	✔		✔	✔
Clear policy & framework regarding EMR implementation			✔	
Collaborative culture		✔		
Completeness of data				
Customization of EMR			✔	
Entrepreneur orientation				✔
Facilitating learning environment				✔
Familiarity with the platform	✔			
Financial support	✔			
Funding			✔	
Good quality data		✔		
Incentives for using EMR		✔		✔
Leadership from management		✔	✔	
Organization commitment & support				✔
Performance based incentives				✔
Positive attitude towards using EMR			✔	
Positive organization culture				✔
Proper change management approach		✔		✔
Proper communication		✔		✔
Proper guidance and encouragement for EMR adoption		✔		
Proper IT infrastructure			✔	
Proper Training	✔	✔	✔	✔
Regular feedback to user		✔		
Reliability of EMR		✔	✔	✔
Standardization of data		✔		
Support from management			✔	

Unified business & clinical aspects		✔		✔
User involvement in adoption process of EMR				✔

Common Facilitators: There are certain facilitators which are common in most of the countries and are helpful in accelerating the adoption of EMR by healthcare providers. In addition to this, these factors ensure efficient use of EMR by their successful adoption. The common facilitators which were resulted from this study are "Awareness about EMR", "Incentives for using EMR" (16,18), "Leadership from management" (18,19), "Proper change management process" (18,25,32), "Proper communication", "Proper training" (1,16,32,33), "Reliability of EMR" (17) & "Unified business and clinical aspects" (32).

Country Specific Facilitators: The common facilitators have already been discussed, there are certain facilitators that specific countries have identified and are working in order to enhance EMR adoption. Literature reviewed for Australia suggested that the factors like "Familiarity with the platform" & "Financial support" (16) are uniquely identified as facilitators which accelerated the EMR adoption in this country.

Similarly, studies from Canada have emphasize upon "Proper guidance & encouragement for EMR adoption", "Good quality data", "Collaborative culture" & "Assigning clear responsibilities of EMR" as their star points for successful adoption of EMR (31).

In India, factors such as "Clear policy & framework regarding EMR implementation", "Customization of EMR", "Positive attitude towards using EMR", "Proper IT infrastructure" & "Support from management" constitute the specific facilitators for EMR adoption among Indian healthcare providers (17).

Studies related to USA have suggested that factors such are “Adequate technical support” (26), “Entrepreneur orientation”, “Organization commitment & support”, “Performance based incentives”, “Positive organization culture” & “User involvement in the adoption process of EMR” have significantly contributed to make USA as frontier in successful EMR adoption by healthcare providers of the nation.

Table 2.4.2 : Checklist of barriers associated with EMR adoption

Barriers	Australia	Canada	India	USA
High start-up and ongoing cost associated with EMR implementation		✔	✔	✔
Lack of awareness and usability of EMR		✔	✔	
Lack of computer literacy		✔	✔	✔
Lack of consistent data		✔		
Lack of financial and other resources				✔
Lack of promotional efforts, post implementation	✔			
Lack of technical support	✔		✔	
Medio- legal issues associated with the patient’s data transfer & storage.		✔		
Un-certainment regarding ROI				✔
Communication gap amongst various actors			✔	
Complex usability			✔	
Data for successful implementation of EMR	✔			
Feature completeness	✔			✔
Incompliance of EMR with existing workflows		✔		
Inconsistency in using EMR		✔		
Insufficient Management support			✔	

Lack of clarity in existing policies regarding EMR implementation	✔			
Lack of communication between users and IT department	✔	✔		
Lack of compatibility with other systems		✔	✔	
Lack of consistent data	✔			
Lack of constant feedback	✔		✔	
Lack of infrastructure	✔	✔	✔	✔
Lack of policies related to electronic health			✔	✔
Lack of standards				✔
Lack of understanding about user needs				✔
Loss of productivity during implementation of EMR				✔
Patient resistance			✔	✔
Physician resistance	✔			
Reliability of EMR		✔	✔	
Security concerns			✔	
Software & hardware incompatibility			✔	
Staff resistance		✔		
System Complexity		✔	✔	✔
Technical limitation		✔		
Technological Challenges				✔
Time constrains				✔
Time needed for training		✔	✔	
Training limitations		✔		✔

Common Barriers: There are certain common barriers which were identified in the literature and are common for most of the countries in adoption of EMR by healthcare provider. These are the factors which hamper the EMR adoption or reduce the efficient utilization of EMR. These barriers which are prevalent in more than one country that have been considered common barriers for this study The common barriers which were resulted from this study are "High startup and ongoing cost associated with EMR implementation"(18,19,25,26,31,33), "Lack of awareness and usability of EMR", "Lack

of computer literacy" (3,18,25,26,32)**, "**Lack of compatibility with other systems", "Lack of constant feedback", "Lack of IT infrastructure", "Lack of technical support", "Feature completeness", "Lack of policies related to electronic health", "Patient resistance", "Reliability of EMR", "System complexity"(17), "Time needed for training" & "Training limitations".

Country Specific Barriers: Not all countries have same loopholes associated with EMR adoption. There are certain barriers which are there for one country and not other. With reference to this study factors such as "Lack of promotional efforts post implementation", "Data for successful implementation of EMR", "Lack of clarity in existing policies regarding EMR implementation" & "Physician resistance" (16) constitute as barriers in adoption of EMR by healthcare providers in Australia.

In Canada the unique barriers as per reviewed literature were "Technical limitation", "Staff resistance", "Inconsistency in using EMR", "Incompliance of EMR with existing workflows", "Medio-legal issues associated with the patient data transfer & "lack of consistent data for EMR implementation" (23,31).

Factors such as "Communication gap among various actors", "Complex usability", "Insufficient management support", "Lack of policies related to e-health records", "Security concerns", & "Hardware and software incompatibility" have the major impacts that makes the successful implementation of EMR challenging (17,19).

In USA, "Lack of financial & other resources", "Un-certainment regarding ROI", "Lack of standards", "Lack of understanding about user needs", "Loss of productivity during implementation of EMR", "Technological challenges" & "Time constrains" were identified as factors which are have hampered EMR adoption (25,27,31,33).

DISCUSSION

This study presents the finding of factors which affect EMR adoption by healthcare providers. These factors comprises if facilitators and barriers which either accelerate the EMR adoption or hamper the adoption of EMRs. As this was a comparative study, the findings suggest that there are some common factors associated with EMR adoption while some countries focus on specific factors in order to uplift the adoption of EMRs buy their healthcare providers.

Common factors associated with EMR adoption

The factors identified in the study suggested they are certain common factors associated with adoption of EMR s. The findings suggest that "Incentives for using EMR" (16, 18), "Proper training of EMR" (1,16,32,33) & "Leadership from management" (18, 19) are three major factors that facilitate the EMR adoption by healthcare providers. As evident from the study incentives work as external motivator factor that motivate the providers in using EMR. Along with it, proper training overcomes the technical barriers such as EMR usability (17) & "System complexity" (18). There are certain barriers also which are prevalent in almost all countries, study suggest that the major factors associated with challenging adoption of EMR are "High startup cost & ongoing cost associated with EMR implementation"(18,19,25,26,31,33), "Lack of computer literacy" (3,18,21,25,26,32), "Lack of infrastructure" (1,3,33,19) & "System complexity" (18) which hinders EMR adoption irrespective of the country.

Also, there are certain factors which are not common in all four countries but between 2 or more than 2 countries which facilitate or hinder EMR adoption. Study suggest that Patient resistance is also considered as a common barrier in India and USA as the ultimate user is going to be patient, EMRs are all about their data. Therefore, if patients do not provide content in using EMRs then Physicians hesitate to adopt them. Similarly, In India

and USA there are other factors also which challenged EMR adoption such as "Lack of policies related to electronic health" (3,32), On the other hand, In Australia & Canada the healthcare providers have been reluctant in using EMR as “There is lack of communication between users and IT department" (1,25) which is not seen in the case of former countries.

The study suggests that besides the common facilitators which are concluded in the previous literature, other facilitators are country specific which signifies that each of the discussed country have focused upon different aspects in order to enhance the adoption of EMR. While, a lot of similarity have been seen between the barriers associated with Canada & India. It included "Time needed for training"(26), "Reliability of EMR"(1), "Lack of awareness and usability of EMR" & "Lack of compatibility with other systems”.

Factors associated with EMR adoption in Australia

The findings of the study suggests that Australia have emphasized upon the "technical factors" and "financial support"(16) in order to outstand the adoption of EMR by their healthcare providers. Similarly, there are certain factors hamper EMRs adoption initially there were "lack of Adequate data and promotional efforts post implementation"(16) which are highlighted as key barriers in EMR adoption in Australia. Also, the "lack of clarity" and "physician resistance" are common barriers in Australia. Physicians are among the largest group that actually used EMR therefore their resistance have affected the adoption of EMR to a huge extent.

Factors associated with EMR adoption in Canada

Factors which have been crucial in enhancing adoption of EMR in Canada are related to organization mainly as it emphasizes on "Collaborative culture” (32), “Proper guidance

& encouragement for EMR adoption" & "Assigning clear responsibilities of EMR". which are very useful in overcoming the barriers encountered in EMR adoption in Canada (32) such as "Staff resistance"& "inconsistency in using EMR" Canada had also worked in ensuring the availability of "Good quality data" which is helpful for reported "Lack of consistent data for EMR implementation" barrier in Canada.

Factors associated with EMR adoption in India

The research related to Indian healthcare system with reference to facilitators in adoption of EMR of healthcare providers have highlighted the unique factors that accelerate EMR adoption such as "Customization of EMR" & "Positive attitude towards using EMR"(17). Indian healthcare providers are reluctant in using EMR because of the "Security concerns"(3,19), "Hardware & Software incompatibility" and "Communication gap between various actors"(25) which are not prevalent much in other countries associated with the study.

Factors associated with EMR adoption in USA

USA being the frontier in EMR adoption have focused on certain facilitators which are related to technical, organizational as well as Individual point of view. "Adequate technical support" (26), "Entrepreneur orientation", "Organization commitment & support", "Performance based incentives", "Positive organization culture" & "User involvement in the adoption process of EMR" (25). The barriers which were identifies uniquely for USA in the study are mainly related to technological challenges which are faced by healthcare providers during EMR implementation. "Time constrain" and "Loss of productivity during implementation of EMR" (31) are the additional barriers associated with EMR adoption in US.

CONCLUSION

Information technology such as EMRs have a huge potential in uplifting the healthcare sector such as they improve patient care, patient safety, improves the exiting workflows and reduce operational cost associated with use of paper-based traditional health records, if utilized for long run. Despite of such huge potential of EMRs, their adoption is still a point of concern in certain countries. In India itself, the adoption of EMR by health providers is limited to few healthcare facilities. Even if the health records are implemented, they are either underutilized due to inefficient adoption or are restricted to provide patient clinical details. There are certain factors associated with adoption of the factors which play important role in facilitating EMR adoption, by considering and emphasizing on these factors' efficient adoption of EMR can be targeted in India.

Figure 2.6: Roadmap for successful adoption of EMR by healthcare providers in India

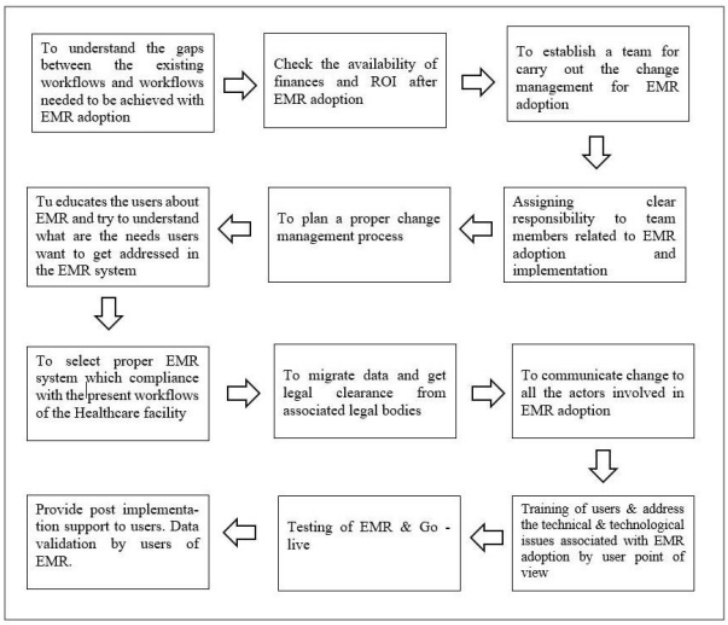


Figure 3 provided with the roadmap for successful adoption of EMR by healthcare providers in India. The roadmap suggested here is recommended on the basis of facilitators identified in EMR adoption in Australia, Canada & USA.

The foremost step that is needed to be taken before adoption of EMR in any healthcare facilities in to comprehend where they position in terms of technical & technological aspects. Basically, a gap analysis is needed to be carried out before considering the EMR adoption so that a clear picture can be derived about readiness of healthcare facility for EMR adoption. In addition to this it is likewise imperative to safeguard where does the healthcare facility positions in terms of finance sources. In their study Meghana Sharma, had discussed the importance of financial back up. When the organization analyses the cost, factor associated with EMR implementation, the return on investment is equally important. Boonstra A. had acknowledged uncertainty in ROI regarding EMR implementation as one of the foremost barriers in USA. So, when the financial analysis is carried out in terms of both investments as well the profit & conceivable returns which are supposed to get by EMR adoption.

The subsequent step is to create a team to carry out the process of adoption in a well-managed and smooth way which would eliminate the possible loopholes and minimize the associated challenges. The team created must be comprises of Clinicians, nursing staff, para-medical workers, administrative workers, IT persons, Managers and Top-level management as well. A well-coordinated change management process is needed to be planned. It is suggested to assigning clear responsibilities to team member. For instance, the management is needed to be involved in communicating the changes to different departments, clinicians and para- medical staff can help in designing of workflows in EMR which would be crucial step in understanding the user requirements and planning the product as per user's need.

It is not necessary that all the users have idea about EMR and what it is about so it is the responsibility of Project team to aware users about EMR, its potential and usability. This is followed by selection of EMR which is in accordance with the prevailing workflows. The EMR selection depends upon many factors such as size of healthcare facilities, services provided by healthcare facilities & estimated budged. After the selection of the EMR system the next step is to get clearance from the associated legal bodies for implementation of such system. As the data needs to be migrated into the EMRs, it is required that the process is in accordance with the legal policies.

Communication is the key of EMR adoption, it is necessary that at all step changes are communicated to all the actors whether primary or secondary followed by training of users, which is considered as very significant facilitator, while for EMR adoption, in certain cases training limitations have made the whole process of EMR adoption very challenging. It is necessary to understand the associated technical & other issues which user is facing in this step as it helps in battling with the system complexity, by continuous feedback from user, the EMR can be configured in order to enhance efficient adoption by the healthcare providers.

The EMR system needed to be tested before the Go-live phase so that any bugs or system discrepancy can be reported. One of the drawbacks associated with current adoption of

EMR is lack of support after live phase of EMR system. It is endorsed that the EMR vendors should provide post implementation support to users, also the data needed to be validated in order to validate the reliability of EMR.

RECOMMENDATIONS

Recommendations for Government

- To regularize the processes related to digitalization in healthcare sector.
- There should be a proper channel regarding clinical adoption of EMR to accumulate the functionality from the patient registration process to discharge intervals of patient, in and out.
- To encourage the use of EMRs in medical colleges, this would aware and educate the future doctors and reduce challenges while adopting EMRs.
- To organize mass training programs for doctors and other healthcare providers regarding computer and related tools such as data entry & other basic computer operations.
- To provide monetary or non-monetary incentives to those healthcare facilities which would be implementing EMRs.

Recommendations for EMR Vendors

- They are recommended to design their products which align with existing workflows of healthcare facilities,
- To provide proper training to users before implementation.
- To consider user requirements in the initial phase and try to deliver application that enhance the usability of the system regarding clinical desires.
- Post implementation support should be provided to users.

Recommendations for Healthcare facilities Management

- To educate the healthcare providers about EMR.

- They should provide clear picture of their requirements to vendors.
- To provide support to healthcare providers while adoption of EMR.
- It is suggested, to carry out the adoption process in phases rather than in one go.
- To maintain the data properly so that while implementation consistent data should be available.
- To evaluate the selection criteria and implementation plan of EMR system.
- To ensure proper communication between the IT team and different actors involved in using EMR.

Recommendations for healthcare providers

- To actively participate in the process of EMR adoption.
- They should have positive outlook regarding the change rather than being resistant to it.
- To participate in training sessions provided by vendor so that they can understand the system working.

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