Exploring Determinants Affecting Technology Adoption of Electronic Medical Records among Health Care Professionals in Mumbai

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Abstract:

Background: Implementation and use of Electronic Medical Record (EMR) systems has shown its effectiveness in supporting healthcare services of developed nations across the globe. The adoption of EMR Systems has transformed the way in which healthcare facilities, practitioners effectively interact among themselves and with patients by increasing efficiency, privacy, interoperability of health data. **Purpose:** Adoption of the Electronic Medical Record (EMR) in government and private hospitals is a concern for developing countries like India. The purpose of a study is to verify the awareness and uses of EMR system among the doctors, health care professionals in Mumbai and to discover the factors as well as challenges for this technology adoption and usage.

Methodology: This research is descriptive and exploratory in nature. The primary data is collected from 116 health care professionals in India in the form of structured questionnaire. Data is analysed in SPSS.

Results: Cost of the software, Time availability, technical competence of existing manpower and percentage footfall have significant impact on EMR adoption among the healthcare professionals in Mumbai. Given the rapid technological advancements of the last decade, Indian hospitals and healthcare professionals are still less than expected to implement Electronic Medical Records (EMR) systems. Indian government and private hospitals have limited IT infrastructure and medical record systems (Ayers et al., 2009).

Keywords: Electronic Medical Records, Technology Adoption, Health, Record Management

1. Introduction:

According to World Health Organization, Electronic Medical Record (EMR) system is electronic record system for health care practitioners such as doctors to record clinical information of patients such as identity, test results, prescriptions, medical history and treatment given (Chew et al., 1998). The EMR software is used daily to process payment and insurance payments, schedule appointments, exchange information inside the clinic with other employees, add new appointments, and update and document patient information. EMR software system replaced the traditional manual entry of medical information and manual filling of forms in paper chart binder (Sonkamble at el., 2021).

Electronic medical records (EMR) have changed the way it stores and manages traditional medical records. The digital way to maintain patient medical records has changed the healthcare industry, enabling physicians to keep all the information in one place with easy exchange of the data (Triantafillou, 2017). These systems are relatively new and the way EMR's are used will continue to evolve and develop as the organizations start to implement the systems (Keshta & Odeh, 2021).

EMR systems has potential to improve the quality and safety of patient care as well. Through an EMR program, it is easier to prescribe and order medication for patients online because doctors would know if any medication from another doctor has been approved for the patient. Having more comprehensive knowledge the staff can provide the patients with the healthy, effective and personalized treatment they deserve more easily. This research attempts to find out the awareness of EMR system among health care professionals and also to find out their knowledge and uses about electronic medical records in daily practice (Nowrozy et al., 2024).

2. Problem Statement

Poor acceptability of EMR system and its recent versions is a concern in present scenario. Efficiency and effectiveness of proper documentation as per Quality management system is restricted and is not improving. There are various barriers for adoption of latest version of EMR software among doctors and hospitals. The Research examines such factors and

barriers for technology up gradation in hospitals. During the pilot and preliminary study of medical practitioners and hospitals in India, it has been found that almost 31.3 % of doctors has not updated EMR or has not adopted latest technology since the day they have installed EMR software and 35.4% of doctors have not updated their EMR since last 10 years. This research study addresses this research problem. The growth rate for adaptation of EMR software is slow. The software is beneficial for the doctors however they are not adapting it as there are many barriers which we will study in the research. Here, we can see that the adaption of EMR software is 54.2 % who have started to use EMR recently since last 1-3 years. 27.1 % had started using 4-10 years ago and 18.8% have used it more than 11 years. It has been also found that 86% of health care professionals confirmed that there was no use of EMR for maintaining records of COVID-19 patients.

3. Literature Review:

Researchers Essuman, L. R., Apaak, D., Ansah, E. W., Sambah, F., Ansah, J. E., Opare, M., & Ahinkorah, B. O. (2020) examined factors associated with use of EMR software in public hospitals in the eastern region of Ghana. They surveyed 396 health care professionals in their study. The results revealed that 59% of healthcare professionals recorded low use of EMR software in their hospitals. Lack of technology competence, Poor communication and co-ordination between users, cost of EMR system and its revised version, lack of technical competence have significant negative relationship with EMR utilization (DeBry, 2001). Hence, we have considered cost as one of the factor under the study. Nicholas A. Kalogriopoulos, Jonathan Baran, Amit J. Nimunkar and John G. Webster (2005) suggested that devastating diseases like HIV requires constant care and treatment where EMR software plays significant role. Implementation of EMR enhances the quality of healthcare (Dutta et al, 2015).

The EMR system significantly improves data capturing and management of hypertension (HTN) and diabetes mellitus (DM) in health facility of Kenya with improved clinical decision making. Positive perception and attitude of healthcare workers leads to succesfsull implementation and utilization of EMR system. Quality and standardization of care is improved due to EMR (Essuman et al, 2020). This literature indicates the need of assessing the perception of the healthcare workers and hence the perception is taken as one element in this research.

P.J. Harrison, Sam Ramanujan (2011) have aimed to obtain a better understanding of the frameworks, they concentrated on the risks and benefits of EMRs in the existing legal environment. They witnessed that even though there are concerns that those who wish to exploit our personal health care data will still be able to do so, Electronic health care databases are here to stay, it is necessary to demand all reasonable measures while implementing EMR to protect our data from intrusion or error. So, it seems EMRs are both a great idea and a great threat to privacy.

Amitava Dutta, Deepa Krishnan, Ramkumar Veppathur Mohan, Sivaraman Ramanathan, Rahul Roy, Priya Seetharaman (2015) under their research paper "EMR Adoption: A User Perception Study" have analyzed that this research reflects the first two steps of the Hospital Action Research Program to Adopt EMR. The results indicates different stakeholder views of EMR(Electronic Medical Record) and thus their attitudes towards the adoption and use of EMR, are informed by different aspects of the efficiency and capabilities of EMR.

Sanjay P. Sood, Stacie N. Nwabueze, Victor W.A. Mbarika, Nupur Prakash, Samir Chatterjee, Pradeep Ray, Saroj Mishra (2008) reviewed the difficulties faced by developing countries towards development of Electronic Medical records. They have witnessed that for developing countries many challenges exist. They observed that the major technical challenges listed by implementers of EMR systems in developing countries were Lack of back-up systems in the event of computer loss, Poor system security leading to viruses and spyware, Unstable power supplies and lack of battery back-up, Inadequate data back-ups, Lack of technical support. Further the research stated that web-based systems for information management will be the first step in making systems workable. The research further stated that such systems can reduce the problems caused by regular power outages that can impact data storage, causing data storage and backup failure and damage.

Mohammed Rahman, Myung Ko (2012) have witnessed that a large number of researchers are zooming in on the issue of adoption of the EMR. Their study focused on factors such as costs, opposition from physicians and technical limitations. However, did not consider patients position in theoretical models. In this research they focused on the issue of the adoption of EMR from a patient's perspective.

HSF Fraser, P Biondich, D Moodley et al (2005) analyzed that when deciding on the developing and implementing EMR software in developed countries, the same needs to be validated on the field. It is further stated that specific outcomes, such as time to change patient management in response to new laboratory results, or better monitoring of patient compliance, should be measured. There is some evidence that of benefits patient care from access to communication, including the use of telemedicine consultations to improve diagnostic accuracy and to reduce unnecessary transfers of patients (Dhagarra et al., 2020).

Further research indicated that the critical challenge is to build well-designed, effective, low-cost systems by sharing resources, learning from the experience of each other, and reviewing our work. Chew et al (1998) decided to promote

computer literacy among doctors, and inter-institutional interaction in the health care profession. The researched states that the OphthWeb project is a multicenter and multidisciplinary initiative to build a regional (and global) high-performance networked EMR that supports ophthalmic patients' clinical treatment, as well as telemedicine growth. They witnessed that the EMR is no longer just a paper-free office that doctors see as wasted time in data entry.

Patient information is then taken to their office or home for analysis at any time of the day or night, for their own convenience. The doctor should carefully examine a patient's study and treatment plan, and consult with colleagues to find the best treatment choices. Patients have access to their own health records and indirectly help to promote the use of EMR to their health care providers (Shi et al., 2020).

Makoul et al. (2001) evaluated the patterns of physician-patient contact associated with the use of an Electronic Medical Record (EMR) program in an outpatient setting to provide a conceptual base for larger studies. This research also provides a concentrated report on contact patterns related to the use of an electronic or paper-based medical record in a sample of outpatient encounters.

Peter W. DeBry, MD (2001) studied critical concerns pertinent when choosing an ophthalmic EMR. He witnessed that there are a wide range of EMR products available for ophthalmology practice. He has also focused on company demographics and software capabilities of the major vendors. Jeremiah Scholl et al (2011) under their research paper "A case study of an EMR system at a large hospital in India: Challenges and strategies for successful adoption" have witnessed there are many different factors can affect the adaptation of EMR systems in large hospitals in developing countries. Such programs may be linked to a wide variety of possible benefits, and some of those benefits, such as minimizing patient waiting times, could even be greater for developing world hospitals than in the developed world. The study leads to an overall understanding of the situation in large hospitals in developing countries in terms of the adoption of EMR systems and provides information on approaches that can be used to enhance the adoption of EMR systems in specific contexts in developed and developing countries.

Richard Hillestad et al (2005) have compared health care with usage of IT in various industries. They focus to examine potential health and financial benefits of health information technology. They have also analyzed the potential health care benefits of EMR system. The further research stated that the inconsistent implementation of non-standardized, non-interoperable EMR programs would only postpone the ability to move closer to a transformed system of health care. Nishita Mehta, Anil Pandit (2017) under their research paper "Perceptions of EMR System by Doctors in Pune (India)" have tried to understand the perceptions of physicians about EMR and it helps to find out the methods that can be used to improve the adoption of EMR system. The study further states that the adoption rate of EMR is low even though it has the benefits of centralized medical record management. The key finding was to understand the problems for low EMR adoption rate. They observed that the major concern for physician was the high implementation cost of EMR and the returns are not certain which resulted in low adoption rate. Shabbir Syed Abdul (2008) made an attempt to understand what are the various needs and preferences of administrators and health staff, and how to coordinate them to implement an EMR program. The study also aims to find out what are the obstacles that managers' face and issues those end-users face as they shit their work from paper to computer and what are the approaches administrators follow to solve end user problems. The research further states that there are different reasons why they seem to be interested in EMR which may be related to their work priorities. The study overall aims to raise the level of awareness about the important issues for successful implementation of electronic medical records. Douglas J. Ayers et al., (2009) examined the role of network effects while adoption of EMR software. The further studied states the rate of adoption of technologies is subject to network effects. It also states that support for network effects is found; each unit increase in the adoption of EMR at market level is correlated with a substantial increase in the overall intention of physician adoption in that sector. Secondary analyzes suggest that the adoption of EMRs by specialists is highly predictive to the generalist adoption intentions in a given market. Amanda L. Terry, Amanda L. Terry, Judith Belle Brown, Amardeep Thind, Moira Stewart (2009) observed the mind set of primary health care practices while adoption of Electronic Medical Records. They witnessed that it is important to be aware and responsive about then factors that can affect in decision making of EMR software adoption. The study mentions the perceived barriers and facilitators in EMR adoption.

4. Hypothesis:

H01-There is no significant relationship between Age on adoption of EMR among Health Care Professionals in Mumbai
Ha1-There is a significant relationship between Age on adoption of EMR among Health Care Professionals in Mumbai
H02- There is no significant impact of cost on utilization of EMR software among Health Care Professionals in Mumbai
Ha2- There is significant impact of cost on utilization of EMR software among Health Care Professionals in Mumbai
H03- There is no significant impact of time availability on adoption of EMR among Health Care Professionals in Mumbai
Ha3- There is significant impact of time availability on adoption of EMR among Health Care Professionals in Mumbai
H04- Technical competence of health care professions do not significantly impact adoption of EMR among Health Care Professionals in Mumbai

Ha4- Technical competence of health care professions significantly impact adoption of EMR among Health Care Professionals in Mumbai

H05- There is no significant impact of demand of services/ percentage footfall of patients on adoption of EMR among Health Care Professionals in Mumbai

Ha5- There is significant impact of demand of services/ percentage footfall of patients on adoption of EMR among Health Care Professionals in Mumbai

5. Research Methodology and Data collection

This research primarily covers the awareness and uses of EMR among health care professionals. It also focuses on the factors influencing the doctors to purchase EMR and benefits of EMR. This is an exploratory research and through structured questionnaire.

This study is based on survey method. We have collected data from age group of 25 to 65 & more from all over India. I have used primary source for data collection. Under primary data source I have opted for Questionnaire. The data was collected through Google forms. The questionnaire consisted of all sorts of questions close ended; problems faced using EMR, factors influencing to purchase EMR so as to get relevant information from the health care professionals.

- **Conceptual Model**
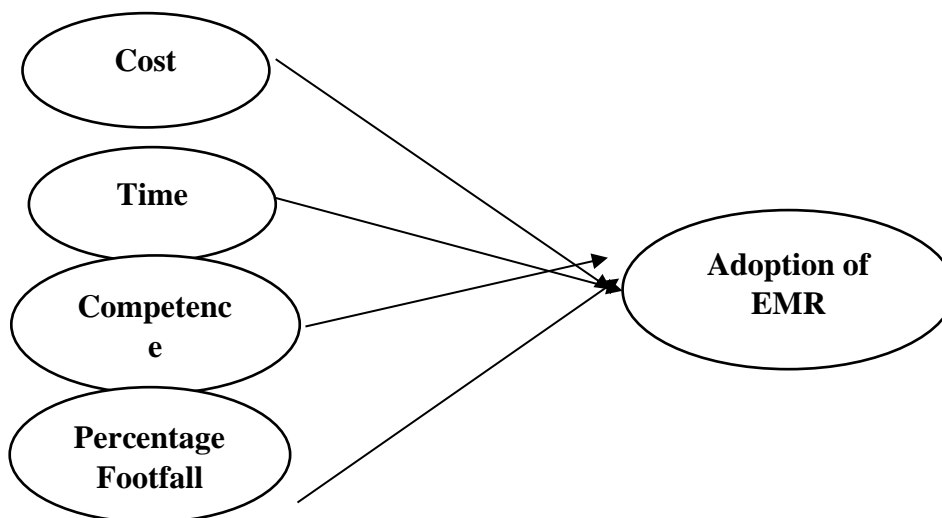
A questionnaire was circulated the health care professional. A Google form was created that conducted all the relevant questions that were necessary for the required research and was emailed the questionnaire to the doctors. The questionnaire which was sent to the health care professionals were specifically ophthalmologist as the EHNOTE Company provides software especially for ophthalmology. There were in total 17 questions forwarded. Questionnaire was formalized and concealed in nature, close ended questions. The questions were related to the awareness and uses and benefits of EMR software. It also included demographics like gender, age and state. There were questions regarding the major issues faced by the health professionals while using EMR. Further it included questions on Brand image and Cost to understand the perception of the doctors.

6. Data Analysis and Interpretation

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
USE OF EMR	Between Groups	.06	1	.06	.25	.615
	Within Groups	28.08	114	.25		
	Total	28.14	115			

The significance value of Gender and Usage of EMR is 0.615, which is greater than 0.05. So, we accept the Null Hypothesis. Hence, there is no significant relationship between Gender of the doctor and usage of EMR.

Summary.

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Usage of EMR software * Age	116	100.0%	0	0.0%	116	100.0%

Usage of EMR software * Age [count, row %, column %, total %].

Usage of EMR software	Age					Total
	25-35	36-45	46-55	56-65	65 & more	
YES	14.00	20.00	6.00	7.00	1.00	48.00
	29.17%	41.67%	12.50%	14.58%	2.08%	100.00%
	63.64%	51.28%	25.00%	31.82%	11.11%	41.38%
	12.07%	17.24%	5.17%	6.03%	.86%	41.38%
NO	8.00	19.00	18.00	15.00	8.00	68.00
	11.76%	27.94%	26.47%	22.06%	11.76%	100.00%
	36.36%	48.72%	75.00%	68.18%	88.89%	58.62%
	6.90%	16.38%	15.52%	12.93%	6.90%	58.62%
Total	22.00	39.00	24.00	22.00	9.00	116.00
	18.97%	33.62%	20.69%	18.97%	7.76%	100.00%
	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
	18.97%	33.62%	20.69%	18.97%	7.76%	100.00%

Chi-square tests.

Statistic	Value	df	Asymp. Sig. (2-tailed)
Pearson Chi-Square	12.95	4	.012
Likelihood Ratio	13.67	4	.008
Linear-by-Linear Association	10.87	1	.001
N of Valid Cases	116		

The significance value of Age Group and Usage of EMR software is 0.012, which is less than 0.05. So, we reject the Null Hypothesis. There is a significant relationship between Age of the doctor and usage of EMR.

Summary.

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Awareness of EMR * Age	106	91.4%	10	8.6%	116	100.0%

Awareness of EMR * Age [count, row %, column %, total %].

Awareness of EMR	Age					Total
	23-35	36-45	45-55	56-65	66 & above	
yes	14.00	30.00	20.00	19.00	7.00	90.00
	15.56%	33.33%	22.22%	21.11%	7.78%	100.00%
	70.00%	81.08%	95.24%	90.48%	100.00%	84.91%
	13.21%	28.30%	18.87%	17.92%	6.60%	84.91%
no	6.00	7.00	1.00	2.00	.00	16.00
	37.50%	43.75%	6.25%	12.50%	.00%	100.00%
	30.00%	18.92%	4.76%	9.52%	.00%	15.09%
	5.66%	6.60%	.94%	1.89%	.00%	15.09%
Total	20.00	37.00	21.00	21.00	7.00	106.00
	18.87%	34.91%	19.81%	19.81%	6.60%	100.00%
	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
	18.87%	34.91%	19.81%	19.81%	6.60%	100.00%

Chi-square tests.

Statistic	Value	df	Asymp. Sig. (2-tailed)
Pearson Chi-Square	7.39	4	.117
Likelihood Ratio	8.38	4	.079
Linear-by-Linear Association	5.88	1	.015
N of Valid Cases	106		

The significance value of Awareness of EMR software and age of doctors is 0.117, which is more than 0.05. So, we accept the Null Hypothesis. There is no significant relationship between Age of Doctors and Awareness of EMR software.

Alternate Hypothesis- There is a significant relationship between perception of doctors while buying EMR software and satisfaction level of doctors

Perception 1: Expensive software means good performance.
Perception 2: Good brand mean good quality.

Perception 3: More vendor experience means more preference.

Perception 4: Preference if reference or referral is given by NABH (National Accreditation Board for Hospitals & Healthcare Providers) / State Medical Council/ National Medical Council.

Model Summary (Satisfaction)

R	R Square	Adjusted R Square	Std. Error of the Estimate
.11	.01	-.08	.44

ANOVA (Satisfaction)

	Sum of Squares	df	Mean Square	F	Sig.
Regression	.10	4	.02	.12	.974
Residual	8.38	43	.19		
Total	8.48	47			

Coefficients (Satisfaction)

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	1.27	.30	.00	4.29	.000
Brand name	-.02	.08	-.05	-.29	.771
Vendor Exprience	.01	.07	.02	.16	.874
Referral	.02	.06	.05	.36	.721
Cost	-.03	.06	-.08	-.54	.594

Dependent variable = satisfaction

Satisfaction = 0.127 - 0.02 Brand name + 0.01 Vendor experience + 0.02 Referral -0.03 cost + error

1. Table shows that the P value is 0.771 which is more than the set significance value 0.05.
   So, we accept the Null Hypothesis. This implies that there is no association between brand name and satisfaction.
2. Table shows that the P value is 0.874 which is more than the set significance value 0.05.
   So, we accept the Null Hypothesis. This implies that there is no association between Vendor experience and satisfaction.
3. Table shows that the P value is 0.721 which is more than the set significance value 0.05.
   So, we accept the Null Hypothesis. This implies that there is no association between recommendation given by NABH/SMC/NMC and satisfaction.
4. Table shows that the P value is 0.594 which is more than the set significance value 0.05.
   So, we accept the Null Hypothesis. This implies that there is no association between Cost of EMR software and satisfaction.

Out of the doctors surveyed 54.4% think that they don't require EMR software, 20.6% feel it is expensive, 10.3% belong to the category complex to use, 10.3 % feels it slows down the operation and 4.4% are not well versed with computer. Out of 116 doctors surveyed 45.8% faced issued of costly maintance charges, 33.3% doctors face server issue and 20.8 % feel that it is a limitation of technical resources.
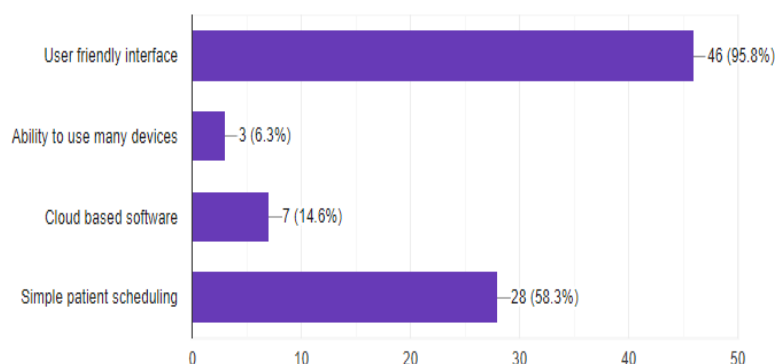
Here, we can see 46 health care professionals were influenced by EMR's user friendly interface. 3 belonged to the factor ability to use many devices, 7 preferred because of cloud based software and 28 for simple patient scheduling. Among the 116 doctors survey 43 people feel that EMR increases the productivity, 34 people for better communication, 35 people belonged to accuracy of data and 12 felt it increased security. Out of the people survey 77.1 % of the health care professionals were satisfied with the current EMR which they are using and 22.9 % are not satisfied with the current EMR which they are using. Out of the doctor's survey, 45.8 % of the health care professionals have after sales service for their EMR software and 54.2% of the doctors do not have after sales service.

7. Conclusion:

Cost of the software, Time availability, technical competence of existing manpower and percentage footfall have significant impact on EMR adoption among the healthcare professionals in Mumbai. From the survey that was conducted, we can see that the health care professionals (ophthalmologists) most of them are aware about the EMR (Electronic Medical Records) software however comparatively less doctors use the EMR software. EMR (Electronic Medical Records) software has many benefits but many doctors feel it is expensive. However, it is rising as the process is made in the health care sector. It is important to make the doctors aware about EMR (Electronic Medical Records) software as it saves a lot of time and unnecessary paperwork. The EMR software (Electronic Medical Records) system has allowed the health care professionals to organize their daily work better. Despite the great benefits there are some challenges and shortcomings which make the adoption of EMR (Electronic Medical Records) difficult. Slowing down the operation, complexity to use, lack of computer proficiency etc. these areas should be dealt with for better. Cost is the biggest and most important barrier preventing health care professionals from implementing EMR. There is a relationship between age and usage of EMR (Electronic Medical Records) software. We can also see that there is less number of companies offering after sales services so this can be a good opportunity for the EMR software vendors to focus on that part so that more doctors can be involved. Thus we can say that there is awareness among the health care professionals regarding EMR (Electronic Medical Records) software still the doctors are hesitant to use due to many reasons which should be focused on. EMR software offers significant potential for quality patient care but it has not yet fulfilled its potential.

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