

# EMR Adoption: A User Perception Study

Completed Research Paper

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## Abstract

Despite promise of significant benefits, inadequate user acceptance has frequently limited the impact of EMR implementations. Using an action research approach, our team is participating in an EMR implementation at Aravind Eye Care System (AECS), one of the largest eye hospitals in the world, to observe its current practices, measure user perceptions of EMR, plan interventions, and assess their impact. Our proximate research objective is to develop interventions based on sound conceptual foundations and empirical validation rather than in an ad hoc manner, to facilitate EMR acceptance and adoption by AECS hospital staff. The ensuing goal is to learn from the post intervention findings to develop guidelines for EMR implementations, particularly in a developing country context. In this paper we report on the first phase of this study, and these initial results show how even simple analysis of perception patterns can help to customize and shape intervention plans.

## Keywords

Healthcare, EMR, adoption, India, action research, interventions

## Introduction

There is significant interest in implementing Electronic Medical Records (EMRs) in view of the potential for cost savings and increased quality of care (Agarwal et al., 2010). The literature reports numerous EMR implementation efforts but adoption outcomes have been mixed (Najaftorkaman et al., 2015). While technical problems have contributed to some degree, one reason that has been frequently cited for this mixed outcome is inadequate end-user acceptance of the technology (Granlien and Hertzum, 2012). Developing countries face distinctive challenges in this regard (Sood et. al., 2008). Given the typical EMR user profile in healthcare organizations in such countries and the work environments in which they operate, acceptance and adoption of EMR is unlikely to happen organically and therefore, needs to be facilitated through planned intervention. The research objective of our study is to develop interventions based on sound conceptual foundations and empirical validation. Using an action research approach (Baskerville and Myers, 2004; Goldkuhl, 2012), we are participating in an EMR implementation at Aravind Eye Care System (AECS), one of the largest eye hospitals in the world, with the aim of observing the hospital's current practices, understanding user perceptions of the impending implementation, planning interventions leading to practical action, socially situating such interventions, and informing theory based on the effects of the suggested interventions. While the proximate desire is to facilitate EMR adoption at AECS, the larger goal is to learn from the post intervention findings to develop guidelines to help EMR implementations, particularly in a developing country context. In this paper, we report specifically on the initial phase of this study, which is based on individual and group interviews and a pre-implementation user survey. A distinctive aspect of our study is that the implementation site is a hospital

located in a developing country but whose medical performance is considered superior to counterparts in developed countries. Most EMR implementation studies have been situated in developed countries (e.g. Smith et al., 2013; Rimmerman and Colbert, 2014), and researchers have suggested the need for more studies in different countries including India (Najaftorkaman et al., 2015). There are reasons to surmise that differences between country contexts influence end-user assimilation of the technology. Also, developing country circumstances foster frugal innovations which can sometimes prompt institutions in developed countries to question their own expensive practices, resulting in reverse innovations (Srivastava and Shainesh, 2015).

We begin with a review of relevant studies on EMR adoption and pre-implementation user perceptions in the context of IT adoption. This provides a conceptual framework for the issues that need addressing in facilitating EMR adoption. A brief description of the hospital setting of our EMR implementation study is then provided. This is followed by a discussion of the methodology for the project and the results of the initial phase of the study.

## **Conceptual Underpinning**

We briefly review the EMR adoption literature, classifying it into three themes, and discuss reasons why EMR adoption may be different in a developing country context. Relevant literature on the relationship between user perceptions and system adoption is also reviewed. This will provide a conceptual foundation for guiding our assessment of end-user perception of EMR implementation at AECS, and in designing interventions.

### ***EMR Adoption***

EMR is a digital repository of patient data that is potentially shareable across multiple entities who may serve the same patient (Angst et al., 2010). However, due to systemic complexities and inadequate stakeholder participation, EMR implementations have often experienced mixed acceptance and success (Granlien and Hertzum, 2012). Barriers include poor usability, conflict between work procedures and EMR processes, lack of training, inadequate hardware, inadequate support of work processes etc. (Davidson and Heslinga, 2007; Banerjee and Bagha, 2014)

Three strands of research have dominated the EMR space. The first focuses on EMR as a technology, its intricacies and distinctive functional needs compared to other information systems. Examples include studies on EMR privacy and security, format standardization, query processing, etc. (Jain et al, 2012, Lee and Chang 2012; Li et al. 2012). A second strand is directed towards understanding factors which influence stakeholder perceptions of EMR. Expected benefits from EMR have been repeatedly emphasized in the literature and include the standardization of care, prevention of loss of patient records, ease of sharing records between different care givers, cost reduction, potential for patient-level analytics, etc. (Garrison et al., 2002; Erstad, 2003). The third strand focuses on impact studies, such as the impact of EMR on hospital operational efficiency, physician productivity or organizational financial performance (Sibona, 2011; Darr et al., 2003; Bhargava and Mishra, 2014). Interestingly, studies on antecedents, impact and challenges of EMR adoption have usually been conducted *after* system implementation. A few have compared pre and post implementation environments to understand the impact of EMR (Bhargava and Mishra 2014; Viswanath et al. 2010). However, studies of the use and impact of interventions prior to, and during, implementation, while recommended by researchers, are infrequent.

The majority of EMR studies, including those just cited, are situated in developed countries. There are reasons to conjecture that their findings may need to be adapted for a developing country context (Fraser et al., 2005). Characteristics such as literacy levels of patients, attitudes towards privacy, availability of different technologies, technical proficiency of hospital personnel, business practices, cultural traditions and institutional environments can be significantly different (Srivastava and Shainesh, 2015). Also, prior experience with EMR among hospital staff is limited in developing countries as the number of healthcare organizations implementing EMR are themselves few in number. Whatever little electronic information gathering occurs in these hospitals generally is geared towards meeting governmental reporting needs (Braa and Hedberg, 2002).

## **Pre-Implementation**

End users have certain pre-conceived notions about technology and its impact on their work prior to IT implementation. Research interest in pre-implementation issues stems from a desire to identify and address challenges, conflicts and users' resistance to IT implementation (Meissonier and Houz , 2010). Early studies focused on impact of systems on individual and organizational parameters including employee satisfaction, and characteristics in the employee's decision environment (Cheney and Dickson, 1982). A parallel stream of research focused on understanding the gap between technology being developed and managers' use of the technology. Lessons were aimed at increasing the probability of successful implementation and included the need to manage user expectations prior to implementation (Ginzberg, 1981). Several studies on pre-implementation issues were actually based on surveys conducted *post-implementation* (e.g. Olhager and Sell n, 2003), raising the possibility of recall bias. In contrast, Venkatesh and Davis (2000) collected data during the pre-use, post training period in creating their unified theory of technology acceptance. This reduces the likelihood of recall bias. For EMR specifically, computer anxiety and perceptions of organizational support were good predictors of post implementation behavior of physicians (Dansky et al., 1998). Patients on the other hand, perceived EMRs as offering benefits of reduced duplication of medication and tests, identifying drug interactions, and expediting accurate diagnosis. Individual perceptions about EMR, prior to implementation, are important especially if the individuals are important stakeholders (Venkatesh, et. al., 2011). Studies comparing perceptions of stakeholders and performance, pre and post-implementation, are not uncommon (see for instance Davidson and Heslinga, 2007; Bhargava and Mishra, 2014). However, our study is distinctive in that it analyses pre-implementation perceptions of EMR to design interventions aimed at affecting post-implementation perceptions in a purposeful manner, in a context where there is already a tremendous emphasis on efficiency and effectiveness. The post-implementation perceptions will then be analyzed to determine the efficacy of the interventions. This follows the well-established action research paradigm.

## **EMR Implementation Site**

Our team is participating in an EMR implementation project at the Aravind Eye Hospital. The Aravind Eye Care System (AECS) is a renowned chain of eye hospitals in India and has received several high profile awards, including the Gates Award for Global Health in 2008 and the Conrad Hilton Humanitarian Prize in 2010. It has a distinctive business model, staff recruitment and development process, and operational practices, driven by the guiding philosophy of its founder Dr. Venkataswamy, who named the hospital after Sri Aurobindo, one of the 20<sup>th</sup> Century's most revered spiritual leaders. Starting in 1976 with an 11 bed hospital, AECS has grown into a network of eye hospitals that have seen 32 million patients in 36 years and performed nearly 4 million eye surgeries, majority of them being very cheap or free. In 2012, AECS handled 2,838,689 outpatient visits and performed 349,274 surgeries. Each surgeon at Aravind conducts an average of 2000 surgeries a year. Their counterparts in the US conduct an average of 125 surgeries a year. The high number of surgeries, however, does not mean a compromise in quality but rather a unique combination of efficiency and delegation of non-core tasks. Aravind's journey through time has been captured in Mehta and Shenoy (2011).

One of the AECS sites had failed in its EMR implementation effort five years earlier. Despite this negative experience, the IT and management teams wished to implement EMR in the strong belief that it would yield significant benefits in quality of care and cost containment. The specific circumstances of AECS with its emphasis on very low cost care delivery to the poor, and the capabilities of their non-physician hospital staff, make these anticipated benefits particularly attractive. Of course, this assumes that hospital staff and physicians will adopt the implemented EMR despite the prior negative experience.

A core IT team functions from the main hospital site at Madurai while each hospital also has its own IT unit to take care of infrastructure support and maintenance. All end-user applications are designed, developed, built or bought by the central IT team at Madurai. Since all the hospitals are geographically within 330 kilometers, providing system central support has not been an issue thus far.

## Methodology

Our study uses an action research approach (Baskerville and Myers, 2004; Meissonier and Houzé, 2010) with the research team participating in the EMR implementation. Action research is based on the premise that organizational phenomena, such as EMR adoption, are best studied in their natural contexts as the knowledge resulting from planning interventions in such contexts, and their outcomes, are socially situated thus leading to a refined theory (Baskerville and Myers, 2004; Davidson and Heslinga, 2007). Given the long time that an EMR implementation takes, a multi-phased approach is being used in this study, something not uncommon in action research (Davidson and Heslinga, 2007). The *diagnostic stage* involves a qualitative study in the first phase to understand stakeholder's perceptions about their tasks, work flow, organization structure, culture, etc. and the interaction of such perceptions with the proposed EMR system. In the second phase, findings from the qualitative study have been used to develop and validate a model of factors which influence stakeholders' intention to use EMR, based on an end-user survey instrument. This paper primarily covers the first phase and some preliminary analysis of the survey results from the second phase. The third phase involves development of interventions based on a more detailed analysis of data from the first two phases. The *therapeutic stage* involves applying the interventions prior to and during implementation with the aim of ensuring smooth adoption by different stakeholders. The last phase consists of measuring user attitudes post-implementation and drawing lessons about the impact of the interventions. The survey provides quantitative data for testing the model of EMR use, providing a firm conceptual foundation on which to base the development of interventions. The EMR project is to be rolled out in a phased manner across the different sites of AECS, allowing us to repeat the *diagnostic-therapeutic cycle*.

### Phase-I: Qualitative Study

A series of individual one-on-one interviews (23), each lasting an hour on average, was conducted with different stakeholders. Interviewees were selected based on whether they were involved in AECS processes which are likely to be impacted by the EMR implementation and/or in the EMR implementation. Two patients were also interviewed to understand expectations of patients from Aravind as a hospital. This helped us to understand the larger social setting beyond just the technology implementation, as is required in conducting action research (Baskerville and Myers, 2004). Table A-1 in the Appendix summarizes the profiles of the interviewees.

Three focus group discussions each lasting about 2 hours, were also conducted to encourage deeper collaborative discussions on pre-implementation perceptions about EMR. The participants of the focus groups were chosen in consultation with one of the co-authors who is part of AECS. The job roles of these participants were amongst those which had a reasonably large proportion of employee strength. The chosen participants were not only known to be more pro-active in voicing their opinions about the organization, systems and processes, but because of their seniority in the organization were also aware of the capability of their peers in similar roles. Relevant aspects of these participants are summarized in Table A-2 in the Appendix.

The interviews and group discussions were transcribed and coded to reveal important factors as perceived by the stakeholders. Codes were used to denote different aspects in relation to patient flow process, tasks of different departments, dependencies between different departments, problems with the current manual system of case sheet maintenance, potential of EMR to resolve various clinical and administrative problems, etc. Two of the authors coded the transcripts independently and results were compared. While significant overlap (close to 70%) existed in the codes, codes for the non-overlapping segments were resolved through mutual discussion and deliberation. Triangulation has been achieved mainly through multimodal data collection. Empirical data from the interviews and group discussions have been strengthened by participant observation (one author is employed at AECS; another received treatment as a patient and was able to observe, first-hand, the workflow and activities performed at each stage of the treatment; three other authors also visited different AECS hospitals and observed the work flow), conversations, organizational reports, secondary sources and records. There is a high degree of standardization of processes and systems across different AECS hospitals.

## ***Analysis of the qualitative data***

The coded transcripts were used to identify factors in the operating environment and end-user perceptions about EMR's influence on them. These factors, and their manifestation in AECS hospital operations, are described below.

*Efficiency:* AECS being known for its efficiency, there is tremendous emphasis on work flow at all levels. AECS aims to minimize patients' waiting time while maximizing utilization of doctors' time. Mundane and diagnostic support activities are performed by the nursing staff. At AECS, efficiency is an important criterion for assessing individual and team performance, and patient flow statistics are displayed at each clinical unit. Both clinical and non-clinical staff are encouraged to view the statistics of their respective units and compare performance to other units. This encourages a healthy competition amongst units. For example, one important flow parameter is the "zero at ten" indicator which reflects the number of patients who registered before nine a.m. and left after receiving treatment by ten a.m. The ten a.m. mark was chosen to factor in the peak load that arises between 10 a.m. and 11.30 a.m. An EMR would have significant impact on many different dimensions of efficiency.

*Patient Safety:* Medication errors and adverse drug events are among the safety issues commonly encountered in hospitals. With a computerized physician order entry system, mistakes due to illegible writing can be eliminated. In a high-volume hospital such as AECS, it is difficult for nurses and other medical staff to track patients without proper identification. Currently, identification consists of a card which the patient carries with her as she moves around to different departments. The manual case sheet, however, is transferred among departments by hospital staff, resulting in possible loss or misplacement. This will not occur if the EMR is implemented.

*Patient Care:* While AECS physicians pay a lot of attention to caregiving, especially given the value system inculcated by the founder, they also care about utilization of their time. If the EMR is not perceived as significantly improving quality or speed of patient care, acceptance of the system will not be easy. Providing appropriate care includes identifying the patient correctly, being aware of his/her specific physical conditions such as hypertension and diabetes, familiarity with their individual needs, ensuring that they feel that they are being cared for with the sensitivity suitable for a patient undergoing eye treatment. In a large hospital like AECS, patient care is also about ensuring that the patient has been directed to the right department and has indeed reached the target department and initiated treatment.

*Patient Satisfaction:* Amongst the numerous duties of medical staff at AECS, interaction with the patient is a critical one particularly given that it aims to serve the poor and indigent. This interaction has a major impact on patient satisfaction. At AECS, a central tenet of this interaction is that full information should be made available to the patient and her family, especially on the symptoms, the diagnosis made, the possible options of medical care, etc. AECS believes that openness enhances patient trust and loyalty and helps build its brand. Some respondents believe that EMR can help improve this interaction by streamlining clinical processes and freeing up the doctors' time to better interact with the patient.

*Administrative Support:* Managers and administrative staff at AECS believed that, with the EMR, the flow of patients between departments can be managed better. Also, the medical complaints process, which is required for all hospitals, would be more streamlined with EMR. On high patient-load days, there is movement of AECS staff from one department to another based on patient loads. This entails dynamic staff reallocation by the senior manager of the patient care department. Some part of this activity is already performed with existing hospital management systems, but with the EMR, respondents believed, it will be easier to identify the patient movement among departments and reallocate staff.

*Technology Self-Efficacy:* Technology self-efficacy is the judgment an individual makes about her ability to use IT effectively. Perceptions about availability of training, support, and past experiences, are three important factors that influence a person's technology self-efficacy. In the context of EMR, technology self-efficacy can be viewed as confidence in using IT in general and confidence in using EMR specifically. AECS interviewees, in both individual and focus group meetings, had expressed confidence to use the EMR *contingent upon* ample training and support. But many felt that quality and quantity of training and support would depend on the competence of the IT department, a factor discussed below.

*Awareness:* Interviewees believed that inclination to use EMR is influenced by their level of awareness about EMR benefits and the extent to which management has communicated their intention to switch to

digitized records. The rationale behind the shift from existing methods has to be clear to users. Interviewees also mentioned how awareness initiatives can be designed to promote information about existing standards, functionality available in the EMR and the benefits that may arise from the system. Some of the AECS employees also acknowledged that they were aware of the potential implementation of EMR but were not sure what exactly the functionality would be and what would be the kind of devices they would be required to use.

*IT Department Competence:* Several AECS interviewees discussed their perceptions of the IT department, their helpfulness and responsiveness apart from their technical skills, and ability to understand health care. Having a technically sound IT department that can collaborate with all areas of a health system improves the likelihood of success of an EMR implementation. AECS operates in a “balkanized” technology mode where workflow specific systems are used by different departments. System integration is absent despite an appreciation for its need. It was evident from conversations that perception of the AECS IT department’s competence would impact the overall intention to use the EMR.

Qualitative analysis of the one-on-one and focus group interviews enabled us to identify factors that are relevant to end-user adoption of the EMR at AECS. It also gave us a starting point to construct a survey instrument to test a model of intention to use EMR.

## Phase-II: Survey

Based on the eight factors identified above, a survey instrument, consisting of 55 items, was created. The items measured the eight factors described in the preceding section, and a ninth – intention to use EMR. Items were either adapted from existing scales or in some cases, new items were developed based on the qualitative data analysis. The scales were validated through a pre-test with 9 individuals including three of the authors. The survey was administered to an end user community of 401 respondents across 8 stakeholder groups at the Madurai AECS hospital. Table 1 presents the percentage of respondents in each stakeholder group along with the respondents as a proportion of the number of employees in particular stakeholder groups. The items were in the native language (Tamil) as most of the non-physician staff were not familiar with English. Responses were on a 5-point Likert scale, with the extremes representing ‘disagree strongly’ and ‘agree strongly’. Sample questions are shown in Table A-3 in the Appendix. Building a model of ‘intent to use EMR’, using the eight factors, will be the subject of a subsequent phase of the study. In the following section, we present initial validity metrics and summary statistics from the survey. Our rudimentary analysis paints an approximate picture of the perception of the different user groups along these eight factors, suggesting areas for intervention.

<b>Stakeholder Group</b>	<b># of Respondents from Stakeholder Group as % of total Respondents</b>	<b># of Respondents from Stakeholder Group as % of Stakeholder Group Population</b>
Doctors (Doc)	16%	37%
Managers and Admin (Mgr)	4%	50%
Ward Nurses (W. Nurse)	17%	70%
Refractionists (Ref)	9%	38%
Counsellors (Coun)	3%	25%
OT Staff (OT)	23%	60%
MRD Staff (MRD)	11%	43%
OPD Nurses	16%	47%
Total	100%	

**Table 1. Stakeholder Representation in Survey**

### Preliminary Analysis of the Survey data

The Cronbach alpha values for the nine factors are shown below in Table 2 and indicate that, with the exception of *awareness*, the measurement instrument is reliable as the alpha values are all at or above 0.7 (Mohsen and Dennick, 2011). In our discussion below, we exclude awareness, but revisit it in conclusion.

	Efficiency	Patient Safety	Patient Care	Patient Satisfaction	Admin Support	Tech Self-Efficacy	IT Dept. Competence	Awareness	Intent to Use
no. of items	12	8	6	5	4	8	4	5	3
$\alpha$	.86	.81	.77	.89	.7	.75	.75	.52	.74

**Table 2. Cronbach Alpha for Factor Items**

To get an initial understanding of stakeholders' perceptions of the impending EMR implementation, response values of 1, 2 and 3 (Strongly Disagree, Disagree, Neutral) were placed in one category to signify negative perceptions. Similarly, response values of 4 and 5 (Agree and Strongly Agree) were placed in a second category to signify positive perceptions. Though this categorization is unsophisticated, it yields useful information about the pattern of perceptions among different user groups. Tables 3 and 4 summarize positive and negative perceptions, respectively. Although Table 4 is complementary to Table 3 - it can be derived from the latter if responses are relatively complete - it is useful to see the negative perceptions directly. Table 3 shows that 81% of *Doctors* had a positive perception of the potential impact of the impending EMR on *Efficiency*. Similarly, only 33% of *Doctors* had a positive perception of the potential impact of EMR on *Patient Satisfaction*. An examination across individual rows in Table 3 shows patterns of positive perception for the different factors within each user group. Columns show the pattern of positive perception for each factor across different user groups.

For instance, the column for Patient Satisfaction in Table 3 shows that a much smaller proportion of physicians have a positive perception of the impact of EMR on Patient Satisfaction compared to non-physicians. In an orthogonal view, the row for OT (operation theater) nurses in Table 3 shows that a larger proportion of them have a positive perception of EMR's potential impact on efficiency relative to impact on Patient Satisfaction. In Table 4, on the other hand, the row for Doctors shows that a significant portion of them (61%) are pessimistic about the ability of EMR to improve patient satisfaction, but only a small proportion are pessimistic about the ability of EMR to improve patient care, patient safety or efficiency. In the same way, a row-wise comparison of the different user groups indicates that in terms of a general perception of the impending EMR implementation, Ward Nurses have the fewest pessimists compared to the other groups. This row has low percentages for all the factors like efficiency, patient care etc. The column for IT Department Competency shows that, except for MRD (medical records department) staff, a good proportion of *all* other user groups have negative perceptions about the competence of the IT department to pull off the EMR implementation.

Drilling down from Tables 3 and 4, Figure 1 shows a more detailed pattern of perceptions across the different user groups for two factors, Efficiency and the IT Department Competence. The preponderance of response values of 4 and 5 in all the bars for the chart on top, suggests a distribution of perception that is tightly concentrated around a strongly positive value for each user group. By comparison, the chart below suggests a distribution of perception about the IT Department that is more widely dispersed around a lower average value, for each user group.

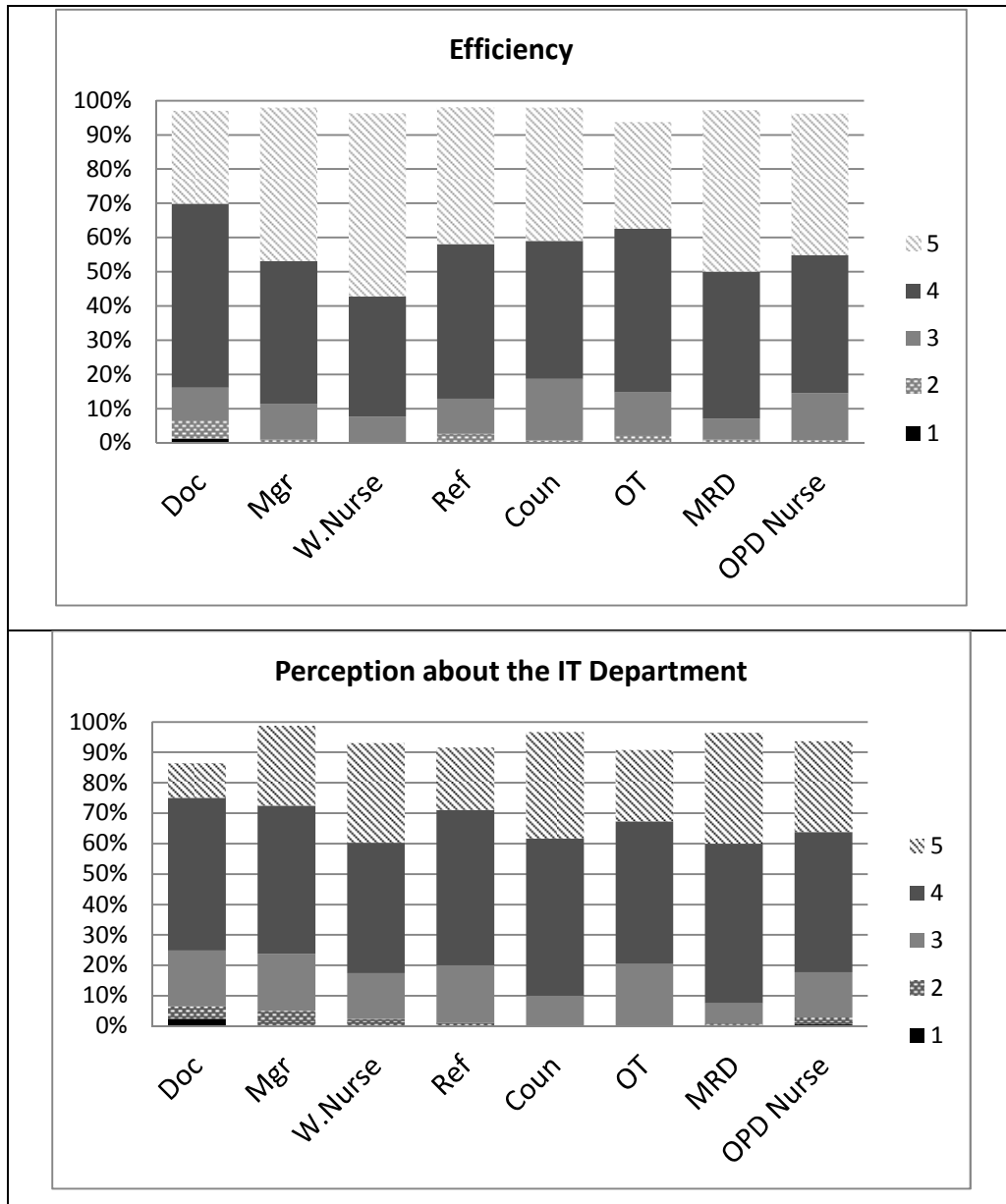
Positive Perception (4 or 5)	<i>Efficiency.</i>	<i>Patient Safety</i>	<i>Patient Care</i>	<i>Patient Satisfaction</i>	<i>Admin. Support</i>	<i>Tech. Self Efficacy</i>	<i>IT Dept. Competence</i>
Doctors	81%	75%	65%	33%	73%	80%	62%
Managers and Admin	86%	84%	72%	40%	92%	89%	75%
Ward Nurses	89%	87%	86%	81%	86%	87%	76%
Refractionists	85%	81%	71%	71%	85%	86%	72%
Counsellors	79%	83%	88%	78%	79%	92%	87%
OT Staff	79%	78%	72%	67%	73%	77%	70%
MRD Staff	90%	86%	84%	82%	87%	89%	89%
OPD Nurses	82%	80%	75%	70%	79%	81%	76%

**Table 3. Patterns of Positive Perceptions of EMR**

Negative Perceptions (1, 2, 3)	<i>Efficiency</i>	<i>Patient Safety</i>	<i>Patient Care</i>	<i>Patient Satisfaction</i>	<i>Admin. Support.</i>	<i>Tech. Self Efficacy</i>	<i>IT Dept. Competence</i>
Doctors	16%	20%	30%	61%	19%	15%	25%
Managers and Admin	11%	14%	23%	55%	6%	9%	24%
Ward Nurses	8%	8%	9%	11%	9%	7%	17%
Refractionists	13%	17%	25%	28%	13%	13%	20%
Counsellors	19%	17%	11%	18%	21%	6%	10%
OT Staff	15%	14%	22%	26%	20%	14%	20%
MRD Staff	7%	11%	13%	16%	9%	8%	8%
OPD Nurses	15%	15%	21%	25%	17%	14%	18%

**Table 4. Patterns of Negative Perceptions of EMR**





**Figure 1. Perception Distributions Across User Groups for Efficiency and IT Department**

Although this initial analysis is simple, it begins to suggest directions for interventions. For instance, the patterns above suggest that in designing interventions, the Physician user group at AECS will need broad-based attention, as a good proportion of them have negative perceptions of the EMR. Moreover, the intervention needs to address their negative perceptions across most of the factors. In contrast, intervention can take a more targeted approach for MRD staff, since the negative perceptions of a good proportion of them are focused on patient safety, patient care and patient satisfaction. The disaggregated patterns in Figure 1 provide a more refined view of perceptions and suggest specific segments of different user groups that need to be targeted through the interventions. In short, the patterns that emerge allow one to tailor the intervention plan for maximum effect instead of having a general one-size-fits-all approach. These interventions will be refined based on the theory-based model of intent to use EMR that is to be developed in the next phase of the study.

## Conclusion

The paper presents the findings and analysis of the diagnostic stage – the first two phases of an action research project on adoption of EMR in a hospital setting. The findings suggest that perceptions of EMR by different stakeholders, and hence their attitudes towards adopting and using EMR, are driven by different aspects of EMR's performance and capabilities. The survey helped identify specific types of interventions suitable for each stakeholder group. Subsequent phases will build on these findings. The next phase consists of developing and statistically validating a model, based on the eight factors identified here, on intent to use EMR. This will indicate the relative contribution of the different factors on intent to use and provide a rigorous foundation for the interventions which will be developed during this phase. The interventions will be implemented in a phased manner across multiple hospital sites of AECS. We believe this will affect awareness – the factor whose reliability was below accepted thresholds. A survey will be administered to measure post EMR implementation perceptions. Following the traditional 'planning-action-fact finding' paradigm of action research, our investigation will develop guidelines for effective intervention to increase the likelihood of EMR implementation success, especially in a developing country context.

## REFERENCES

- Agarwal, R., Gao, G., DesRoches, C., and Jha, A. K. 2010. "The digital transformation of healthcare: Current status and the road ahead," *Information Systems Research* (21: 4), pp. 796-809.
- Angst, C. M., Agarwal, R., Sambamurthy, V., and Kelley, K. 2010. "Social Contagion and Information Technology Diffusion: The Adoption of Electronic Medical Records in US Hospitals," *Management Science* (56:8), pp. 1219-1241.
- Banerjee, P. K., and Bagha, H. 2014. "EMR Adoption by Small Clinics in Malaysia: An Exploratory Study and Theoretical Explanation" in PACIS 2014 Proceedings. Paper 226.
- Baskerville, R. and Myers, M. D. "Special Issue on Action Research in Information Systems: Making IS Research Relevant to Practice – Foreword", *MIS Quarterly* (28:3), pp. 329-335.
- Bhargava, H.K. and Mishra, A.N. 2014. "Electronic Medical Records and Physician Productivity: Evidence from Panel Data Analysis," *Management Science* (60:10), pp. 2543-2562.
- Braa, J., and Hedberg, C. 2002. "The Struggle for District-based Health Information Systems in South Africa," *The Information Society* (18:2), pp. 113-127.
- Cheney, P. H., and Dickson, G. W. 1982. "Organizational Characteristics and Information Systems: An Exploratory Investigation," *Academy of Management Journal* (25:1), pp. 170-184.
- Dansky, K. H., Gamm, L. D., Vasey, J. J., and Barsukiewicz, C. K. 1998. "Electronic Medical Records: Are Physicians Ready?" *Journal of Healthcare Management/American College of Healthcare Executives* (44:6), pp. 440-454.
- Darr, A., Harrison, M. I., Shakked, L., and Shalom, N. 2003. "Physicians' and Nurses' Reactions to Electronic Medical Records: Managerial and Occupational Implications," *Journal of Health Organization and Management* (17:5), pp. 349-359.
- Davidson, E., and Heslinga, D. 2007. "Bridging the IT Adoption Gap for Small Physician Practices: An Action Research Study on Electronic Health Records," *Information systems Management* (24:1), pp. 15-28.
- Erstad, T. L. 2003. "Analyzing Computer-based Patient Records: A Review of Literature," *Journal of Healthcare Information Management* (17:4), pp. 51-57.
- Fraser, H. S., Biondich, P., Moodley, D., Choi, S., Mamlin, B. W., and Szolovits, P. 2005. "Implementing Electronic Medical Record Systems in Developing Countries," *Informatics in Primary Care* (13:2), pp. 83-96.
- Garrison, G. M., Bernard, M. E., and Rasmussen, N. H. 2002. "21st-Century Health Care: the Effect of Computer Use by Physicians on Patient Satisfaction at a Family Medicine Clinic," *Family Medicine* (34:5), pp. 362-368.
- Ginzberg, M. J. 1981. "Early Diagnosis of MIS Implementation Failure: Promising Results and Unanswered Questions," *Management Science* (27:4), pp. 459-478.
- Goldkuhl, G. 2012. "Pragmatism vs Interpretivism in Qualitative Information Systems Research," *European Journal of Information Systems* (21:2), pp. 135-146.

- Granlien, M. S., and Hertzum, M. 2012. "Barriers to the Adoption and Use of an Electronic Medication Record," *Electronic Journal of Information Systems Evaluation* (15:2), pp. 216-227.
- Jain, H., Thao, C., and Zhao, H. 2012. "Enhancing Electronic Medical Record Retrieval through Semantic Query Expansion," *Information Systems and eBusiness Management* (10:2), pp. 165-181.
- Lee, H., and Chang, S. 2012. "RBAC-MatrixBased EMR Right Management System to Improve HIPAA Compliance," *Journal of Medical Systems* (36:5), pp. 2981-2992
- Lewis, W., Agarwal, R., Sambamurthy, V. 2003. "Sources of Influence on Beliefs about Information Technology Use: An Empirical Study of Knowledge Workers," *MIS Quarterly* (27:4), 657-678.
- Li, J., Zhang, X., Chu, J., Suzuki, M., and Araki, K. 2012. "Design and Development of EMR Supporting Medical Process Management," *Journal of Medical Systems* (36:3), 1193-1203.
- Mehta, P., and Shenoy, S. 2011. *Infinite Vision: How Aravind Became the World's Greatest Business Case for Compassion*. San Francisco, CA: Berrett-Koehler Publishers.
- Meissonier, R., and Houzé, E. 2010. "Toward an IT Conflict-Resistance Theory: Action Research during IT Pre-Implementation," *European Journal of Information Systems* (19:5), pp. 540-561.
- Mohsen, T. and Dennick, R. 2011, "Making Sense of Cronbach's Alpha," *International Journal of Medical Education* (2), pp. 53-55.
- Najaforkaman, M., Ghapanchi, A.H., Talaei-Khoei, A., and Ray, P 2015. "A Taxonomy of Antecedents to User Adoption of Health Information Systems: A Synthesis of Thirty Years of Research," *Journal of the Association for Information Science and Technology* (66:3), pp. 576-598.
- Olhager, J., and Selldin, E. 2003. "Enterprise Resource Planning Survey of Swedish Manufacturing Firms," *European Journal of Operational Research* (146:2), pp. 365-373.
- Rimmerman, Curtis M, and Colbert, A. 2014. "Standardizing Electronic Medical Record Documentation," *Physician Executive* (40:4), pp. 44-46, 48.
- Srivastava, S. C. and Shainesh, G. 2015. "Bridging the Service Divide through Digitally Enabled Service Innovations: Evidence from Indian Healthcare Service Providers," *MIS Quarterly* (39:1), pp.245-267.
- Sibona, C., Walczak, S., Brickey, J., and Parthasarathy, M. 2011. "Patient Perceptions of Electronic medical records: physician satisfaction, portability, security and quality of care. *International Journal of Healthcare Technology and Management*, 12(1), 62-84.
- Smith, A. L., Bradley, R. V., Bichescu, B. C., and Tremblay, M. C. (2013). IT governance characteristics, electronic medical records sophistication, and financial performance in U.S. hospitals: An empirical investigation. *Decision Sciences*, 44(3), 483
- Sood, S. P., Nwabueze, S. N., Mbarika, V. W. A., Prakash, N., Chatterjee, S., Ray, P., & Mishra, S. (2008, January). Electronic medical records: a review comparing the challenges in developed and developing countries. *Proc. 41st Annual Hawaii Int'l Conference on System Sciences*, (pp. 248-248). IEEE.
- Venkatesh, V., and Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, 46(2), 186-204.
- Venkatesh, V., Zhang, X., and Sykes, T. A. (2011). "Doctors Do Too Little Technology": A Longitudinal Field Study of an Electronic Healthcare System Implementation. *Information Systems Research*, 22(3), 523-546.
- Viswanath, A., Singh, S.R., Winkelstein, P. 2010. "The impact of electronic medical record systems on outpatient workflows: A longitudinal evaluation of its workflow effects," *International Journal of Medical Informatics*, (79), pp. 778-791.
- Williams, F., and Boren, S. A. (2008). The role of electronic medical record in care delivery in developing countries. *International Journal of Information Management*, 28(6), 503.

## Appendix

Interviewee Code	Interviewee Designation	Profile
AD1	Manager	Around 10 years experience; Served in the spectacle division before becoming part of the training division
AD2	Surgeon; Director	Around 15 years of experience; Performing surgeon and Administrator; Manages the entire Madurai hospital
AD3	Senior Manager	Around 10 years of experience; Previously served as manager in various clinics, currently manages central operations division
AD4	Senior Manager	Around 30 years of experience; Has mainly served in the outreach division
AD5	Manager	Around 30 years of experience; Currently managing the medical records team
AD6	Director	Around 40 years of experience; Currently Director of hospital operations
AD7	Manager	Around 3 years of experience; Currently handles one specialty clinic
AD8	Manager	Around 10 years of experience; Currently manages the inpatient division
AD9	Manager	Around 5 years of experience; Currently in charge of patient care
AD10	External Consultant for EMR	Around 30 years of experience in the IT industry; External consultant for the EMR project
IT1	Manager	Around 10 years of experience; Previously served as a software programmer; Currently in charge of internal IT applications
IT2	Senior Manager	Around 25 years of experience; Previously served as Software Programmer Currently manages the entire IT department at Aravind
CL1	Nurse	Around 5 years of experience; Currently serving in the outpatient division
CL2	Refractionist	Around 5 years of experience; Currently serving in outpatient division
CL3	Counsellor	Around 5 years of experience; Currently counsels patients prior to surgery
CL4	Nurse	Around ten years of experience; Currently stationed at the cataract clinic
CL5	Nurse	Around 8 years of experience; Currently serving in the day care surgery clinic
PAT1	Patient	A cataract surgery patient prior to surgery residing in a location which was three hours journey from the hospital
PAT2	Patient	A cataract surgery patient post-surgery residing in a location which was overnight journey from the hospital
DOC1	Doctor-Surgeon	Around 20 years of experience; Currently serving as medical officer in cataract clinic
DOC2	Surgeon-Doctor	Around 4 years of experience; Currently serving in the cornea clinic
DOC3	Surgeon-Doctor	Around 15 years of experience; Currently serving in cataract clinic
DOC4	Surgeon Doctor	Around 5 years of experience; Currently serving in the intraocular lens clinic

**Table A-1. Profiles of Individual Interviewees**

<b>Group Code</b>	<b>Team</b>	<b>Work Description and Focus Group Membership</b>
FOC1	MRD Staff	Medical Records Department (MRD) team is an 80-member team which manages the physical records in three different locations in the hospital. They record basic patient information, locate paper records, allocate patients to different clinics based on queues, transfer patients to different departments, collect case sheets once the patient leaves. They maintain a quarter of a million physical case sheets. Five MRD department staff with 6 to 24 years of experience participated in the focus group.
FOC2	Refractionists	The total number of refractionists serving in the hospital is around 100. They are technically qualified medical personnel skilled in determining the refracting power of the eyes and correcting refracting defects. Refractionists are qualified to test using both automatic and manual methods. A team of five refractionists with 5 to 12 years of experience participated in the focus group.
FOC3	Operation Theatre Nurses	The total number of operation theatre staff in the hospital is 121. Most are internally qualified nurses who assist surgeons in the theatre, guide patients from pre-operative room to surgery, prepare patients for surgery, do post-surgery clinical treatment and guide patients to the post-operative ward. Most nurses are unmarried young girls who completed their school education and enrolled in the nursing school attached to the hospital. After completing their basic training they are assigned to different duties, of which operation theatre is one. A team of six operation theatre staff participated in the focus group. Their experience in the hospital ranged from 4 to 9 years.

**Table A-2. Focus Group Characteristics**

<b>Factor</b>	<b>Sample Questions</b>
Patient Safety	Errors like drug incompatibility and drug interactions can be reduced once we have the EMR.
Patient Care	EMR will help generate reminders for tests, medicine administration etc. This will make the job of the nursing staff easier.
Tech. Self Efficacy	I will use the EMR if I can call someone for help if I get stuck

**Table A-3. Sample Questions from Survey Instrument**