

Explore the Key Organizational Barriers and Provide Facilitates to Implement EHR Systems: A Systematic Approach

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Abstract – The main objective is to determine the principal organisational barriers and appropriate facilitates activities for the adoption of the Electronic Health Record (EHR) systems. The Primary and secondary data are collected from the peer-reviewed journals from the period of January, 2000 to May, several databases such as ‘EBSCO’, ‘PubMed’, ‘BioMed’, ‘CINHAL’, ‘Cochrane library’ and ‘Web of Science’, were used to search for the systematic literature. We extracted papers from the above databases through PRISMA guideline and synthesised findings through thematic analysis. The data are collected by using the systematic process and we have extracted roughly (n=2,097) journals which were mainly focused of EHR implementation process and techniques. Finally, we have included 13 articles through rigorous screening process. The study includes thirteen articles that have been considered different organisational barriers perceived by the physicians such as organisational structure, technical, social, attitudinal, psychological, legal and financial. Along barriers, some prospective change management activities are considered to overcome some barrier related interventions. Finally, our findings has revealed some fundamental organisational barriers and some change management activities which helped to overcome the typical problems and provided the effective EHR implementation strategies for hospitals.

Keywords: Electronic Health Records, Electronic Medical Record, Meaningful use

I. INTRODUCTION

In 2004, George W. Bush announced that every American hospitals and care settings should adopt the EHR systems by 2014. After the President’s announcement, the Department of health and Human Service (DHHS) has established the Office of National Coordinator (ONC) and the Health Insurance Portability and Accountability (HIPPA) to play the significant role for establishing and promoting the health information standards to achieve their goal (Simborg, 2008). The purpose of promoting EHR by those administrations was reasoned for supporting health care quality and reducing costs. In addition the decision support system by EHR alerts physicians to reduce the potential errors and take appropriate decision for further enhancement of the quality of care and reducing costs (Berner *et al.*, 2005).

In past studies, although the researchers identified the beneficial effects of EHR adoption by physicians such as the improving the quality of care, patient safety

improvement, evidence-based decision making and reimbursement, greater patient engagement etc., the adoption rate of this system in U.S.A. was very slow (Blumenthal and Taveneer, 2010).

So, our research was conducted to get better and sound understanding of the EHR adoption and its ‘Meaningful Use’ to overcome the barriers. Here, ‘Meaningful Use’ of the EHR systems mainly relay on improving quality, safety and efficiency; reducing health disparities; improving care coordination; strengthening data handling; and overall maintaining privacy and security of patient health information. In order to address the principal barriers related issues, this research outlined some strategic solutions using change management activities to overcome barriers. This research finding might be helpful for the health care providers who are currently using EHR systems.

Through the brief discussion about barriers and facilities of EHR adoption, this research tried to investigate the following question:

1. What are the key organisational barriers to implement the fully functional EHR systems?
2. What organisational change interventions need to be taken to implement the EHR systems?

II. METHODS

The systematic review process has been chosen for this research because this process is less biased, by starting with the formulation of clear research questions. By maintaining these predetermined criteria, this approach is conducted through the search of relevant evidence in specific database sites, which is finally judged through quality appraisal tools to reach a clear conclusion (Bigby and Williams, 2003).

A. Search Strategy

In this research, we have mainly used the EBSCO host which carried out a collaborate search between Medline (which included search databases of PubMed, BioMed, Health Service Research) Web of Science and Cochrane library for English language journals. For key word search we used phrasal search such as “electronic health record*”,

“Meaningful Use*”, “computerized patient record*”, “change management*”. By using truncation (*), we did not miss out any other form of words such as by adding truncation on implement* which includes implementation, implemented etc. Wildcard (?) is very important so that the search does not miss out any spelling errors such as ‘computerized’, where the US spelling is ‘computerized’ and the UK spelling is ‘computerized’. In the geographical region section, the author has set up peer reviewed U.S.A based articles.

B. Data Extraction

In the data extraction process, the first reviewer (M.A) has extracted all the data from various databases and follows PRISMA method to extract them properly. The second reviewer (S.F) assessed the validation of studies and checked all inclusion and exclusion process. After applying Boolean operation of the key words, we have finally gained 2,097 articles from the above databases. By removing duplicate articles through End Note 380 articles were recruited for the screening test.

In the final stage of the screening process, 90 articles remained after the title and abstract screening process. In this phase the full text search has given the comprehensive ideas about EHR systems, barriers, change management etc. Finally, 12 articles have chosen after examining full text screening process.

C. Data Analysis

According to Holloway and Tordes (2003), qualitative approach for data analysis is complex and diverse and so, the thematic analysis is widely considerate of qualitative analysis because this analysis can easily familiarized data reader, generating initial codes and searching theme among the code to produce final report. In this research, thematic analysis used to identify themes which represented the fundamental ideas of the common barrier related issues of EHR adoption and some important change management issues to overcome the organisational barriers. Though the extracted data from the included journal were very diversify, the theme of their research outcomes were identified properly. Finally, all the reviewing themes were synthesizing properly through narrative description.

D. Quality Appraisal

Quality appraisal or critical appraisal is the most important part of this systematic process where the research is systematically judged in accordance with its trustworthiness, values and relevant practical context. To judge the studies, we used Critical Appraisal Skill Programme (CASP) tools, which were developed by Sir Muir Gray (1997), for the critical appraisal of the qualitative and quantitative data. By using the checklists of the CASP tools, we identified the ‘focused’ area of review (including population, intervention and outcome), data sources, data

analysis, study design, research outcome, research validity and application site, appropriate of the methodology and the relationship between researcher and participants. During the quality assessment, the first reviewer (M.A) has justified the extracted papers by the quality of studies as ‘yes’ which meet fully the quality assessment questionnaires and ‘no’ which does not meet the assessment criteria questionnaires and ‘unclear’ which seems to not clear enough about the quality questions regarding data settings, collection, ethical consideration etc. Based on the quality assessment rating the studies have found high, moderate and low quality but we were not excluded the papers which were low in grade.

III. RESULTS

A. Search Outcomes

After completing data extraction techniques for the 13 selected articles, the author found seven articles (No. 4,6,8,9,10,11 and 12) (Table I) have used quantitative approach, five articles (No. 2,3,5,7 and 13) used qualitative approach and one article (No.1) has used observational investigation for conceptual mapping. Majority of the quantitative research of EHR adoption were cross-sectional studies because the researchers were surveyed in different hospitals, small-big ambulatory care settings among the different participants such as physicians, registered nurses, assistant nurses and other specialists in different departments. On the other side, qualitative research papers were focusing on researchers’ experience through systematic and interactive approaches of conducting their research. In the following sections, the outcomes of different qualitative and quantitative studies were analysed through quality appraisal techniques and their papers validity was judged through frameworks to meet research objectives.

B. Quality Appraisal for Quantitative Research

Five of the studies (4,6,8,9 and 12) (table I) focused on clear issues of EHR related initiatives which are described logically. Narcisse *et al.*, (2013) studied the ‘Meaningful Use’ of EHR among Advance Practise Nurses (APN) between adopters and non-adopters. Many of their responses related to age categories, practice settings and practice sizes. The researchers also used the theoretical framework of Roger’s (1983) Diffusion of Innovation model to examine technology adoption. Though the researchers have described the various issues of EHR system’s advantages and disadvantages for complete adoption, their research was based on non-probabilistic sampling which is limited in generalisation (not focused in particular area).

C. Critical Appraisal for Qualitative Studies

Green *et al.*’s (2015) paper mainly focused on low resourced primary care settings for the sustainable use of health information technology. Their research suggested

that efficient change management activities, technical supports, vendor relationships and social challenges were the key factors to attain the ‘Meaningful Use’ incentives. They also suggested that technical and management expertise in low resourced practices could achieve the three stages of ‘Meaningful Use’ by overcoming all EHR barriers. McAlearney *et al.*, (2015) conducted open ended interviews

and they also used Kotter’s (1996) eight steps change management frameworks and Kubler-Ross’s (2005) five stages grief model to analyse the change for technology adoption in the health care setting. By combining those frameworks, they analysed ten important strategies whose ideas mainly came from the results of experts’ interviews and suggestions.

TABLE I EXTRACTED ARTICLES BY SYSTEMATIC EXTRACTION PROCESS

Ref. No.	Author	Year	Location	Study design	Sample size	Purpose of the study
1.	W.Martin	2014	Chicago, U.S.A	Conceptual mapping by observational investigation	60 patients	The purpose of this study was to describe the overall health information situation in care setting and apply Kotter’s change management model to implement EHR in a small physician practise of outpatient settings.
2.	A.S.McAlearney, J.L. Hefner, C.J. Sleck and T.R.Huerta	2015	U.S.A	Qualitative	Data collected from 47 physicians and 35 administrative staffs from six US hospitals	To improve understanding of facilitators of EHR system implementation, paying particular attention to opportunities to maximise physician adoption and effective development.
3.	A.S.McAlearney, J.L. Hefner, M. Rizer and T.R.Huerta.	2014	U.S.A	Qualitative	45 interviews held with six focus group among 37 physicians in 6 health care	To study comprehensively and synthesise best practices for EHR systems implementation in healthcare organisations by highlighting applicable management theories and successful strategies.
4.	M.R Narcisse, T.A.Kippenbrock, E.Odell and B.Buron	2013	U.S.A	Quantitative (Non-experimental)	Survey among 6,986 advance practise nurses of the four US hospitals and among them 526 nurses participated	An effort to better understand the use of EHR by APNs and relies upon Roger’s theory of diffusion of innovations as a theoretical framework to apprehend APNs’ use or non-use of EHR as an innovation in the health care systems.
5.	E.Davidson and D.Heslinga	2007	Hawaii, U.S.A	Qualitative	Interviewed 26 physicians from 26 sites	To investigate the barriers to adoption and assimilation of EHRs in small physician practise.
6.	C.M. DesRoches, E.G. Campbell, S.R.Rao and K.Donelan	2008	U.S.A	Quantitative	Surveys conducted among 2,758 physicians in association with AMA (American Medical Association)	To assess physicians’ adoption of outpatients EHR sytems, their satiosfaction with such systems, the perceived effect of systems on the quality of care and the perceived barriers of adoption.
7.	L.A.Green, G.Potworoski, A. Day and May R.Gentile,	2015	Michigan, U.S.A	Qualitative	70-90 minutes semi-structured interviews among 6 MCIETA specialists	To identify the potential barriers to maintain meaningful use of EHRs in priority primary care practices using a qualitative observational study.
8.	E.W. Jamoon, V.Patel, M.F.Furukawa and J.King.	2014	U.S.A	Quantitative	National Ambulatory Medical Care survey report, 2011. Sample size 10,302 physicians	EHRs on clinical care, practise proficiency and operation; barriers of EHRs adoption and the influence of major policy initiatives that seek to increase the EHRs adoption.

9.	A.K. Jha, C.M.DesRoches, P.D. Kralovec and M.S.Joshi	2009	U.S.A	Quantitative	Conducting surveys collaboration with AHA.	The purpose of this research was to examine the relationship of adoption of EHRs to specific hospital characteristics and factors which were reported to be barriers of facilitators of adoption.
10.	N.M. Lorenzi, A. Kouroubali, D.E. Detmer and M. Bloomrosen	2009	California, U.S.A	Quantitative	Surveyed among 2,758 physicians	The purpose of this study was to outline the benefits and barriers to EHRs use in ambulatory practice settings and provided 'field guideline' to facilitate successful EHR adoption.
11.	L.S.Yontz, J.L. Zinn and E.J.Schumacher	2015	South-Eastern Side U.S.A	Quantitative	Surveyed among 396 nurses from operating department and post Anesthesia department	The purpose of this research paper was to identify prospective nurses' attitudes towards the use of EHR systems.
12.	L.Erika, Abramson, S. McGinnis, J. Moore and R.Kaushal,	2013	New York State Nursing homes, U.S.A	Quantitative	Surveyed 632 nursing homes and among them 375 responded	To determine the rates of EHRs adoption and health information exchange (HIE) among NewYork State nursing homes.
13.	R.H.Miller and I. Sim	2004	U.S.A	Qualitative	Interviewed 90 physicians in primary care	To overcome barriers including providing work/practice support systems, improving electronic clinical data exchange and providing financial rewards for quality improvement.

1. Lack of Willingness

Physicians were highly concerned to use the EHR systems based on their psychological points such as personal issues, knowledge and perceptions. They have often found the lack of belief on the new systems. In Narcisse *et al.*'s (2013) study, 38.4% of APN's were not interested to use the technology because they thought that to work on the computers and electronic pads were more complicated than using paper based documentation. Due to the lack of willingness, they were continuously blaming the system for their slow work progress. McAlearney *et al.*, (2015) studies also cited that the physicians often clung to the past practice because they did not want to lose the sense of practice and comfort with the way they did things by practicing in the new systems. One of administrative reported that "They're really trying to do their old work in an EHR, as opposed to innovating, using that new functionality to innovate and change the way they practice."

2. Lack of Financial Incentives and Legal Bindings

Following DesRoches *et al.*'s (2008) study, 66% of respondents were addressed the initial capital cost as a main barrier of EHR adoption and they also added that it might be taken several years to see their return of investment. Miller and Sim's (2004) addressed the same issues regarding financial incentives and they added that the upfront cost ranges were \$16,000 to \$36,000 per physicians with \$10,000 annual maintenance costs. Their study also addressed that the physicians spent more time to use EMR

which resulted longer work days (time costs) and fewer patients seen (revenue decreases). One of the most important aspects regarding financial incentives, they pointed out that in the solo/small group practice failed to gain the financial rewards for quality improvement and for public reporting of multiple measures of quality performance due to their slower gain to access in the EMR system.

3. Lack of Technical Skills among Physicians

In Green *et al.*'s (2015) study, the experts (M-CEITA) identified that some technical issues related to the system such as data entry error or data extraction, complexity, inflexibility of the system, customization limitation and data exchange problems were the main barriers for EHR adoption. Yontz *et al.*'s (2015) surveyed 396 nurses from various departments and identified that the number of respondents complained about system problems with slow speed, programmes freezing or not working correctly. In this regard, some nurses commented that 'I fell in slow, slow log in and system freezing up while I am using it' (Yontz *et al.*, 2015, pp. 30). In Narcisse *et al.*'s (2013) study, 38.4% of APN's were not interested to use the technology because they thought that to work on the computers and electronic pads were more complicated than using paper based documentation.

4. Time Constrains

Most of the past research identified that the introduction of EHR systems slower the workflows and always required the

additional time to select, implement and adapt to the new systems. McAlearney *et al's* (2014) study investigated that physicians spent more time of entering data from the prior chart which slowed down everything and for this they needed to spend round a year for getting ready to implement the systems to smooth their work load. Miller and Sim's (2004) study reported that physicians spent more time per patient from the period of months or even a year after EHR implementation. Their study was underlaying three important issues for that time constrains: difficulties with technology, complementary change and support and electronic data exchange.

5. Lack of Physicians' Involvement and Organisation Characteristics

Physicians collaboration is considered both psychological and organisational hierarchical issues among the physicians in practise. In McAlearney *et al's* (2014) study, respondents argued that they were not informed properly from the higher authority about their new workflow structure and also they did not receive any demo about what the system looked like and how it worked. On the other side, Narcisse *et al's* (2013) study found out that Advance Practise Nurses (APN) used the EHR system and they were not interested to collaborate with junior practise nurses for getting more financial incentives. The study also found out that the higher proportion of EHR users were age categories (35-55 years old) and got 30% more financial incentives comparing to juniors. Erica *et al's* (2013) study identified the most important issues of communication which was lack of interoperability where 30% of respondents mentioned that they did not receive the meaningful data from the other physicians to make a decision.

IV. DISCUSSION

In this research, we have explained the themes of major organisational barrier related issues for the adoption of EHR system. The literature of the extracted articles have provided the crucial issues of organisational barriers and suggested some change management issues to overcome of those barriers. Some change management issues are categorise in the following categories:

A. Readiness for Change

Readiness for change is the essential component to adopting the new technology like EHR systems. Readiness aims to evaluate the preparedness of the each components of the organisation and also helps to improve the correct decision making ability. Both Lorenzi *et al.*, (2009) and McAlearney *et al.*'s (2015) study cited that the organizations were varied in size, culture, capacity (resource and finance), knowledge of information system and staffing. As a result, the readiness for change to adopt the new technology required a clear vision for this change. In accordance with their findings, they have also cited that the vision for technology adoption was related to improved clinical and

medical records for decision making, better quality patient care and rapid access to patient information to gain more financial benefits.

B. Employ Potential Leader or Champion

To adopt the EHR systems comprehensively, potential change managers or leaders need to employ or elect to investigate potential problem issues, and implement strategic planning, quality improvement and care management activities. By executing these activities, they can increase their management focus, potential process development and planning issues. A comprehensive training plan for the project managers and IT staff (service providers) can potentially reduce data errors and increase the care of quality. For the technical readiness, they need to keep good relations with the vendors, choose the right suppliers according to their demand and also emphasise the need for proper training for staff. This training is not only related to hardware and software use but also the maintenance related training need to be ensured.

C. Performance Incentives and Collaboration

Miller and Sim (2004) cited that financial payback of practices for achieving quality improvement of IT use could motivate the employees to adopt the new systems. In this case, small but growing number of purchasers, health plans, quality based reimbursements, performance report and feedback sheets were required to establish in the organisation. Here, the leaders or policy makers should be taken some initiatives or research to design the performance incentive programme. The collaboration at all levels despite hierarchy need to maintain like matrix structure organisation. In this case proper workflow structure or chain need to redesign when new system implemented.

D. Focus on Potential Problem Areas

Organisation members need to have good focus to identify potential problem areas and staff requirements. Some of the studies identified that the hierarchy in the organisation had interrupted the workflow, such as the head nurse or senior physicians restricting staff from getting direct access to patient information because of their position. In this case, to create the proper workflow structure for the smooth use of EHR systems, this discussion would recommend that this type of barrier needs to be minimised.

E. Focus on Data Security and Privacy

With this minimisation of hierarchy, the leaders also need to ensure the data privacy and secure data handling by using high level security protocols. Moreover, according to the HIE regulation, patient information security is one of the most significant issues and physicians need to be careful when correcting/editing patient information, data exchange and data extraction.

F. Limitations

This research project is limited in various perspectives. Firstly, it is only focused on one geographical region (U.S.A) and all the related searches are limited to this region's published articles. Secondly, the synthesizing data from different databases led to difficulties when extracted through screening process. Moreover, the elimination of non-English journals meant some very useful research articles for EHR systems could not be included. Thirdly, none of the papers have addressed the comprehensive adoption guideline by overcoming every type of barrier related issues. Some of the papers' quantitative data were collected from national survey results. Though those data were collected in certain time periods from the large settings, the researchers have not mentioned the validity of data. The research outcomes are generic and focused on the general issues of the EHR adoption rather than its use in any specific hospital or care setting.

V. CONCLUSION

The comprehensive discussion of the existing literature addressed important barrier related issues when adopting the EHR technologies but almost all the articles failed to provide clear views or guidelines on how to implement the comprehensive use of the EHR systems. Moreover, the existing literature ideas are quite diffuse (data collection and discussion over large areas/population and not concentrated ideas) except for some of the studies such as Green *et al.*, (2015), DesRoaches *et al.*, (2008), Miller and Sim (2004) and Lorenzi *et al.*, (2009). In the above four studies, the researchers focused on the very specific issues of EHR and gave guidance on overcoming the barriers for the successful adoption of the EHR systems. Apart from those studies, other articles revealed barriers but no clear ideas to overcome of those issues. However, the systematic search for this project was helpful getting the basic knowledge for EHR adoption. Almost all the articles addressed more or less the change management activities which were the key components for the technology acceptance by overcoming barriers. Recognizing and realizing all the facilitates at the organisational and operational levels should increase the likelihood of adopting the EHR systems successfully.

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