

## Challenges in Managing Knowledge through Medical Record Management: A Case Study of an Australian Hospital

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### Abstract

*The healthcare industry produces a huge amount of data and information. The growing of number of patients, diseases, medical research areas as well as the rapid changes in the healthcare environment result in demands for better provision of quality healthcare information. Healthcare organisations use various information systems to support the management of knowledge and one example of such system is Medical Records System (MRS). In this paper we look at the extent doctors and medical practitioners use MRS to manage their knowledge and the challenges they face in doing so. Through an exploratory case study of a large Australian metropolitan hospital, a set of key factors was identified that may influence and inhibit knowledge management (KM) processes in health practices. These factors were then mapped onto the functionality of MRS providing a better understanding of the role of patients' medical records as part of a comprehensive KM system.*

### Keywords

Health informatics, knowledge management, medical records, records management system, case study

### INTRODUCTION

It is widely known that the quantities of data and information generated increase every day, especially in the healthcare sector. The population growth, the increasing number of patients and, the emergence of new diseases and symptoms require healthcare organisations to capture and manage enormous amounts of data and information (Desouza, 2005). Medical knowledge is estimated to increase fourfold during the lifetime of healthcare professionals, which places pressure on the health industry to improve and develop their services. In the current healthcare environment patients are not only being managed or provided care for a certain period of time, it needs to be ensured they will stay in a good state of health throughout their lifetime and they expect effective and efficient treatment and services from healthcare services providers (Wickramasinghe, Sharma, & Gupta, 2005). Therefore, the increasing healthcare problems and complaints about healthcare quality demand that healthcare practitioners maintain up-to-date medical knowledge.

Although many healthcare organisations are increasingly realising how important it is for them to capture and manage data and information, currently this data, information and knowledge is inadequately managed (Abidi, 2001) when compared with other industries?. Undoubtedly, such limitations can affect healthcare practices and processes as well as healthcare quality. As a component of management, knowledge management (KM) seems to be attractive to many healthcare organisations (Dwivedi, Bali & Naguib, 2007). However, the management of knowledge in the healthcare industry is not easy and depends on a number of factors within the organisation. Therefore, it is still challenging for a number of healthcare organisations to achieve their goals and purposes by using a KM concept.

KM is a multidisciplinary concept that involves business, economics and information management (Becerra-Fernandez, Gonzalez, & Sabherwal, 2004). Regardless, whichever perspective KM is rooted in, it involves four basic processes, namely: creation, storing or retrieving, transfer, and application of knowledge (Alavi & Leidner, 2001). In general business settings, organisations can use KM as an approach to leverage and disseminate their collective knowledge to provide better quality decision-making and achieve business goals and objectives (Becerra-Fernandez et al, 2004). For healthcare organisations, Myllärniemi et al. (2012) assert that healthcare enterprises are considered to be knowledge-intensive due to the massive amount of data, information and knowledge generated and managed. It is important for this type of organisation to invest in knowledge. Therefore, KM is one of the most

significant tools used to exploit information and knowledge resources to improve healthcare quality and enhance the effectiveness and efficiency of healthcare practices and processes.

Healthcare organisations have increasingly acknowledged the value of knowledge and the benefits of adopting KM methods to achieve their purposes such as improving care quality, effectiveness and efficiency of practices. (Dwivedi et al., 2007). Healthcare sectors utilise various information systems and technology to support the management of their organisational knowledge. One such system is used in Medical Records Systems (MRS) and typically, MRS refer to either paper-based or electronic systems or the combination of these two, that used to organise, collect, store and access medical records about patients (Huffman, 1990; Edmund et al., 2009). From within the healthcare domain such systems are also known as Electronic Medical Record (EMR) or Electronic Health Record (EHR) systems; or occasionally also as Clinical Information Systems (CIS) (Edmund et al, 2009).

### **Research Problem and Question**

Good practice of records management is a key to improving healthcare processes and services in an organisation. These benefits can be brought by reducing time for retrieval of information, improving accessibility and providing comprehensive patient information to support clinical practices (Wong & Bradley, 2009). Therefore, MRS are used to manage information and knowledge about patients and can enable KM in the healthcare industry. This research attempts to identify and examine the factors that influence use of MRS to support KM processes within the hospital by answering the following main question:

*What are challenges for KM processes imposed by the limitations of MRS?*

In order to answer the main research question, the research needs to address three sub-questions:

- *What are the limitations of MRS, including both paper-based and electronic medical records, for KM as defined in the literature?*
- *What is the relevance of those limitations in the real world setting?*
- *What are the implications of those limitations on KM processes in healthcare settings?*

## **KNOWLEDGE MANAGEMENT IN HOSPITALS**

KM is an attractive proposition for many healthcare enterprises to manage their knowledge resources in order to achieve their primary goals such as improving the quality of care and decreasing costs. In this section we explain what we mean by KM processes to make sure our discussion and findings are understood within the definitions adopted in this study. We then contextualise these concepts in the hospital context and link them to patients' records as one mechanism for knowledge transfer in a hospital.

The research on KM is extensive and many perspectives have been applied to discuss KM and its processes. Thus, many frameworks have been developed to study the processes of KM. According to the framework developed by Alavi and Leidner (2001) and further extended by Alavi & Tiwana (2003), KM is largely concerned with the four basic processes of creation, storing/retrieving, transferring, and applying knowledge.

*The Knowledge creation* process refers to the development of new knowledge in organisations through collaborative interaction at individual, group and organisational levels. New knowledge can be acquired through social activities, or the combination or synthesis of information (Alavi & Leidner, 2001), for example, training to use a computerised system to enter data and other development programs that motivate employees to discuss ideas with one another, and the analysis of data/information that provide a better understanding of things.

*The Knowledge storing/retrieving* process can be thought of as developing organisational memory when new knowledge has been created. It is important for organisations to capture and store that knowledge. In order to accomplish these processes, the organisation is required to find a means to retrieve or access that content (Alavi & Tiwana, 2003). Organisational memory can be classified into internal and external. Internal memory refers to the knowledge that resides within individuals such as skills and organisational cultures, whereas, external memories consist of knowledge that is represented in explicated forms such as written documents, information stored in databases, computer files or digital records (Alavi & Leidner, 2001; Alavi & Tiwana, 2003).

*The Knowledge transfer/dissemination* process is the concept of transferring knowledge throughout the organisation, from one place to where it is needed and can be applied (Alavi & Leidner, 2001). This process can be challenging due to the fact that in the real world setting, the organisation may not be able to pinpoint the appropriate knowledge and location for that knowledge to be received. Knowledge transfer also refers to the utilisation of communication support systems to serve as the enabling technology to transfer knowledge from individuals to individuals and from individuals to knowledge repositories, such as downloading reports from document repositories and developing a report in the repositories (Alavi & Tiwana, 2003).

*The Knowledge application* process can be defined as individuals or groups in organisations who use knowledge for decision-making and problem solving. Individuals can use knowledge to make a decision by integrating rules and organisational standards. Alternatively, specified knowledge also can be utilised without acquiring or learning that knowledge (Becerra-Fernandez et al., 2004).

Together these processes represent the complete cycle of systematic knowledge management (Becerra-Fernandez et al., 2004) from generating and capturing knowledge to making it available for application and better decision-making. KM can help map and protect intellectual assets within a healthcare organisation through knowledge processes (Wickramasinghe et al., 2005). For instance, by computerising records and information KM techniques allow healthcare professionals access to best practice, enabling them to make a conclusion by interpreting and understanding patients' data which then leads to better diagnosis and treatment (El Morr & Subercaze, 2010; Hirakis & Karakounos, 2008). In addition to improving the effectiveness of treatment, KM also allows healthcare practitioners to pull out the documented evidence of treatments which are generated in the paradigm of "evidence-based medicine" and assist them to evaluate the best care for patients (De Brún, 2007). In the next section of the paper we map MRS functionality to the above identified processes and analyse the possibilities of using the knowledge captured in MRS in clinical practice based on the data collected in the large hospital.

## **MRS GENERIC PROBLEMS AND THEIR EFFECTS ON KM PROCESSES**

A medical record is a set of information and data that is documented as the health information and medical care information of a patient. This information serves as media in the communication among treatment teams or healthcare professionals (Wong & Bradley, 2009). The management of medical records is mainly concerned with organising, controlling, collecting, storing and accessing records (Huffman, 1990). However, the management of medical records is complicated and the hospital needs to handle many management issues such as privacy, security and data quality (Al Farsi & West Jr, 2006).

MRS can refer to either paper-based or electronic medical record (EMR) systems. In record management, the requirements for managing medical records in paper or electronic forms are similar, in that it refers to the maintenance of a document as a file (Edmund et al., 2009). In comparison to electronic medical records systems, paper-based record management systems (PMRS) can be seen as a traditional approach in managing records, but in many settings, the two systems are still used in parallel to perform different tasks (Stausberg, Koch, Ingenerf, & Betzler, 2003). EMR systems become enabling technology to enhance the ability of physicians and other healthcare professionals to improve their medical record management practices that are impossible in PMRS (Al Farsi & West Jr, 2006). EMR management systems capture and organise paper-records which are digitised by using scanners. The scanned documents are then entered into EMRS with additional meta-data information attached to computerised order entries (Edmund et al., 2009).

The reasons for the transformation of paper-records are to overcome the problems that exist in paper-based MRM systems and to ease the management processes in the hospital (Li, Zhang, Chu, Suzuki, & Araki, 2012). EMR systems can improve the process in the hospital by facilitating the process of access, retrieval, capture, storage, transfer and communication between physicians and departments (Beaver, 2003; Li et al., 2012; Makino, 2003). By supporting those key processes, EMR systems can provide benefits such as increasing efficiency in medical information management, improving patients' care and data quality, reducing medical errors, enhancing the speed of communication between healthcare professionals, more readability, availability and accessibility of information (Ayatollahi et al., 2009; Erstad, 2003).

Even though the EMR management approach helps eliminate and reduce some of the problems of PMRS, there are still some existing and new challenges in EMR systems. Surprisingly, a number of the challenges and difficulties involved in this system appear to be more than the challenges found in paper-based systems. Based on some of the outcomes in the literature, the table below displays some challenges and problems involved in EMR systems (Al Farsi & West Jr, 2006; Ayatollahi et al., 2009; Bouamrane, Mair, & Tao, 2012; Nicolini et al., 2008; Stroetmann & Aisenbrey, 2011). The table below presents a comparison of the problems reported in the literature on MRS (both paper-based and electronic) and their implications on KM processes.

## **RESEARCH METHOD AND DESIGN**

This study followed exploratory single case study method based on a qualitative research strategy (Darke & Shanks, 2002). The research project was developed through five phases. Firstly, the literature was reviewed to examine the background of MRS in a healthcare setting. After the research problem and questions were refined in phase two, further analysis of KM literature was conducted to identify the relationship and impact of the MRS on KM processes.

Table 1: Summary of MRS' challenges and implications for KM processes

<div style="text-align: center;"><b>MRS</b></div> <div style="text-align: left;"><i>KM processes</i></div>	<b>Paper-based MRS</b>	<b>Electronic MRS</b>	<b>Implication for KM</b>
<b>Creation</b>	<ul style="list-style-type: none"> <li>• Wrong ordered notes in the forms</li> <li>• Incomplete forms filled by physicians and patients</li> <li>• Decreasing the interaction with patients</li> </ul>	<ul style="list-style-type: none"> <li>• Poor quality of data entry</li> <li>• Relevant information and possibly available data was not collected</li> </ul>	<ul style="list-style-type: none"> <li>• Incompleteness and inaccuracy results in misinterpretation of information and therefore blocks the creation of new knowledge</li> </ul>
<b>Storage/retrieval</b>	<ul style="list-style-type: none"> <li>• Redundancy of records leading to a large volume of papers</li> <li>• No alternative sorting, grouping, or linking mechanisms between documents</li> <li>• Missing pages as pages fall out or are misfiled</li> <li>• Time-consuming to search for information, especially when there is a large amount of medical notes</li> <li>• Wasting time searching for missing records</li> </ul>	<ul style="list-style-type: none"> <li>• Inability to retrieve data due to inadequate storage facilities</li> <li>• Flaws in data structure</li> <li>• Concern for privacy, confidentiality, and security for computerised information</li> </ul>	<ul style="list-style-type: none"> <li>• Increasing time to capture, summarise and access knowledge</li> <li>• Difficulty in accessing knowledge as it is held in different locations</li> <li>• More time-consuming for users to find what they need and where to find it</li> <li>• The concern of information being accessed or destroyed by unauthorised users</li> </ul>
<b>Transfer/dissemination</b>	<ul style="list-style-type: none"> <li>• Illegibility of handwriting</li> <li>• Wrong ordered notes in the forms</li> <li>• Incomplete forms filled by physicians and patients</li> </ul>	<ul style="list-style-type: none"> <li>• The failure to transfer adequate information to relevant staff</li> <li>• Flaws in data structure</li> <li>• Query and the failure to transfer adequate information to relevant staff</li> </ul>	<ul style="list-style-type: none"> <li>• Difficulties in selecting appropriate information to be transmitted</li> <li>• Increasing time to internalise knowledge due to poor data quality(e.g. incompleteness and inaccuracy)</li> <li>• Incompatibility and inconsistency of document structure requires more time for reconstructing, extracting and storing knowledge</li> <li>• Sensitive information being exposed and accessed by unauthorised users during transmission</li> </ul>
<b>Application</b>	<ul style="list-style-type: none"> <li>• Wrong ordered notes in the forms</li> <li>• Incomplete forms filled in by physicians and patients</li> </ul>	<ul style="list-style-type: none"> <li>• Poor quality of data entry</li> <li>• Relevant information and possibly available data was not collected</li> </ul>	<ul style="list-style-type: none"> <li>• Incompleteness and inaccuracy of information impede healthcare professionals/practitioners to effectively apply their knowledge for decision-making and problems solving</li> </ul>

The outcome of this analysis allowed hypothesizing the implications of the use of MRS's on KM processes (Phase three). The next phase (Phase four) involved conducting a data collection in a large Melbourne hospital (Hospital X). This phase followed inductive qualitative research logic (Creswell, 2009) when data derived from the literature

was mapped onto the thematically analysed qualitative data from the face-to-face interviews. Ten participants took part in this study. Despite of the small sample, it was quite representative of the current hospital practice with the participants bringing experience of up to 25 years of working in the field (see Table 2 for the details of the interviewees profiles). Each interview took approximately 30 to 45 minutes, depending on the responses and demonstration given by the participants.

The interview instrument was designed to reflect the concepts derived from the literature review. Apart of demographical data and probes about the role of the interviewee in managing medical knowledge, the questions were grouped into three sections; first focussed on medical records management practices and systems; second related to the relationship between MRS and KM processes, with the last one specifically asking about the challenges which are experienced when trying to derive knowledge from MRS and importance of these records as a mechanism for organisational KM. The thematic analysis of qualitative data was performed using NVivo system. The findings were interpreted at individual and organisational levels. The study was following positivistic paradigm and validity and reliability of the results were tested by triangulating the data from multiple participants holding the same position and detailed semantic coding of the data (Creswell, 2009).

In this paper we report the results of the data analysis and conceptualisation of these as an extension of the original model which was built from the literature review.

Table 2: Interviewees' Profiles

<b>Job Duty</b>	<b>Total</b>	<b>Responsibility</b>	<b>Work Experience</b>	<b>Group of Interaction</b>
<i>Directors</i>	3	Manage of information, work processes and staff	10-25 years	IT teams, managerial teams, nurses, doctors, other staff
<i>Data/ IT manager(s)</i>	3	Manage and analyse of information and data	1-15 years	Data clerks, other managers, nurses
<i>Clinicians/ directors as head doctors</i>	4	Provide care to patients	2- 25 years	Patients, patients' families, nurses
<i>Clinical coordinators</i>	2	Document and surveillance reporting	7-20 years	Other documenting staff, nurse managers, directors

## ANALYSIS AND RESULTS:

The participants identified the most unresolved problems with their current MRS. They elaborated on how those issues can affect their task performance and how those affect their work practices and KM practices. This result was derived from data analysis through counting the number of participants (out of 10) who mentioned the proposed factors during the interview.

The findings show that the limitations of MRS highlighted in the literature review remain present in the Hospital X. Also, to compare with the proposed model, the findings highlighted that data access or retrieval issues also affect knowledge application processes; this observation was not clear from the literature review.

Additionally, we discovered further information on the factors that affect KM processes which was not mentioned in the literature.

The final model is represented in Figure 1. As Figure 1 indicates that all the parameters found in the literature were present as the factors that influence KM processes in the case study. The new parameter in knowledge application (data access) and its element (timeliness) were identified by the interviewees in addition. Below we discuss the details of the effects of each MRS parameter on KM process and provide some illustrative statements from our participants.

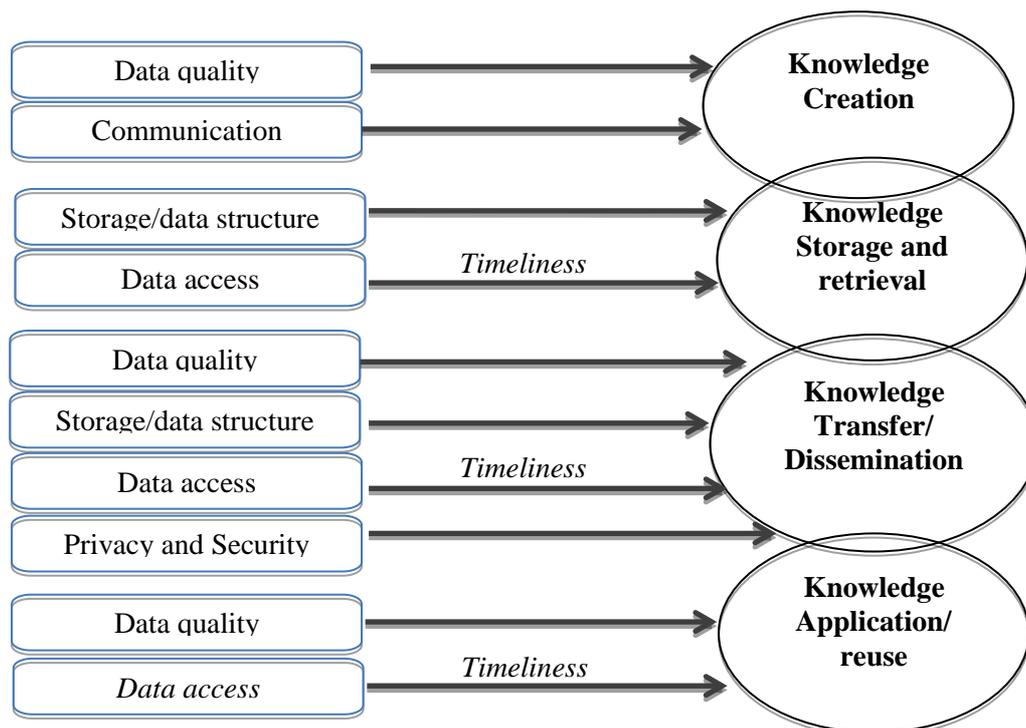


Figure 1: Mapping of MRS's Challenges to KM processes

### **Knowledge Creation**

**Data quality:** from the findings, many problems that are related to this factor are still a dominant issue in healthcare and KM practices. The findings confirm all of the data quality problems that have been discussed in the literature review. In the real world setting, the incompleteness and inaccuracy of information still exists and remains as the barrier for knowledge creation processes. Specifically, most doctors and clinicians often suffer from reading illegible handwriting, and the use of acronyms in the medical records that takes time to interpret and analyse. Therefore, this imposes difficulties to understand and make sense of information as well as to generate knowledge about the patients and medical treatments.

*“You can’t read the writing, or you don’t understand different acronyms that people use, this is very broad topic it is difficult to kinda explain everything” (Doctor 7)*

*“Quite often that information is not enough but that’s because what happens to that patient when we look at the record doesn’t cover ..... Then we just can’t get that information, if it is not there, we can’t get and that is just bad luck then you have to accept that there will be information missing from time to time and the data will be incomplete” (Manager 5)*

**Communication:** it has been noted earlier that knowledge can be generated through personal interaction and communication with patients. However, the findings are not only limited to the interaction with patients, but also embrace the exchange of knowledge about clinical care among health practitioners themselves. Medical records can facilitate communication in health practices. If the patients are too sick to provide details of their symptoms, medical records are the place where the doctors will find and generate knowledge about that patient. Therefore, to avoid a cumbersome conversation with ill patients, it is tempting to see how much they will rely on MRS and medical records to understand patients’ problems and reduce personal interaction time with patients. In addition, between healthcare practitioners, medical records and MRS becomes the medium that communicates medical information regarding patients among them. However, it appears that they still prefer personal discussions to exchange knowledge and experience than only reading incomplete and illegible medical records.

*“I think verbal communication is still preferable when you’re dealing with complex decisions, you still need to talk to someone, people need to sit down together and often consult what the best course of action would be, so that’s not gonna change” (Doctor 6)*

### **Knowledge Storage/Retrieval**

**Storage/data structure:** the insufficiency of infrastructure of IS to be installed and used across the organisation results in the lack of integration of the information systems and databases. The same patient’s information is stored in different databases and locations. This can lead to duplication of information or insufficient collection of

information for a particular patient, which increases time to capture knowledge, aggregate and access information and knowledge.

*“We have problems sometimes, if the person has been allocated with more than one medical records number ..., but when that happens they have certain amount of information under that number and other certain amount of information under that number. Unless you know that you got information under two numbers or more than one number, you can miss the information that you need” (Manager 5)*

**Data retrieval or data access:** based on storage problems, accessing information from different locations and repository is more time consuming. In particular, the amount of records is increased and distributed unequally in different places. MRS could contain important and useful knowledge for healthcare practice. Therefore, the ability to be able to retrieve knowledge from the system is the most significant factor assisting individuals and organisations to perform KM processes.

*“For example, only one person can access at a time, so two people need to write into it, the knowledge, into the medical records .... Also you can't find the information, sometimes, you can't find the history if it's the paper-based, so you can't put information into it” (Doctor 6)*

### **Knowledge Transfer/Dissemination**

**Data quality:** the effect of this limitation of MRS is similar to the affect that has on the knowledge creation process. To transfer and deliver knowledge on any level requires good quality data and information to allow effective learning of new knowledge and experience.

*“There's a lots of problems with paper records you know illegibility of writing....sometimes you don't even know who to ask so you just take in the context and try to read around it”(Doctor 7)*

**Storage/data structure:** within an organisation, patients' and medical information could be stored in different databases and systems. It is likely that they also have different ways to present information. As a result, the transfer or exchange of information through the use of different forms and different ways of presenting knowledge, especially in paper records, can be difficult. This may be because receivers find it more difficult to understand and find the relationship between that information.

*“...In creating new form... we have a system that for a document to go into the medical record and it needs to be approved. ... for units and wards to create non-approved documentation... so that is an ongoing problem, people are just generating their own sort of documents” (Clinical Coordinator 1)*

*“Yeah when you are using paper-based records it is almost impossible to exchange information, in fact it is, the minute you go you switch to electronic means, recording data, is very easy to link the data to share the data” (Doctor 6)*

**Data access:** this parameter provides the same impact on the difficulty to retrieve, especially, to internalise knowledge through longer times searching and retrieving aggregate knowledge from the system.

*“I meant partly the time, it might take them to extract the information and get reports, so the data is in there, but there is no use for them if it takes 5 minutes to run the report that covers a month, they will walk away. They can't wait that long, so it is a system performance issue” (Director 3)*

**Privacy and security:** surprisingly, based on the findings this issue appears not to be a top concern for Hospital X that uses the EMRS. This may be because healthcare organisations acknowledge that privacy and security is their first and core responsibility. Therefore, they know that they need to ensure that their electronic system can embrace this concern. The common approach to protect privacy and security of the system is using password protection and log in function. Through this, information is protected from unauthorised users. Furthermore, in exchanging information between departments or external agencies, such as a government agency or research institutions, the information is transferred and shared through secured file transfer protocol and emailing system.

However, a scenario of unsecured behaviours can be envisaged that may affect this issue.

*“.....in terms of security, people don't log out their systems, so that anyone can just walk up to the computer and look up the records, but that's the same with the papers you just open the records, you can pretend to be a doctor” (Doctor 7)*

### **Knowledge Application**

**Data quality:** this issue is still a main factor affecting the quality of decision making and care services to patients. The inaccuracy and incompleteness of information in both paper-based records and electronic records appears to be inevitable in a busy and fast moving place like hospitals. Although the information is available in the medical records, these limitations may not allow them to realise the full potential to perform their tasks.

*“If you can't find the information sometimes you have to make decision on how sick the patient is with incomplete information, that's part of the job, ... like you will never ever have complete information but, say ...*

*there has been information documented previously in medical records and you can't find the medical records, you just kinda use your best judgement, the knowledge that you have...at the time" (Doctor 7)*

**Data access:** this limitation of MRS is another factor that has been added as the final model of KM challenges. Apart from the quality of data stored in the medical records, data access can influence the ability to apply knowledge in healthcare practices. Regardless of how much knowledge is contained in MRS, it is crucial that healthcare workers and organisations can search and access what they need. By considering how busy a hospital staff can be, timely access to information and knowledge is critical to assist the healthcare practitioners in decision-making and providing efficient services to patients.

*"... the hospital is extremely busy place, everyone is under pressure, everyone is working hard, ... if you don't have decent medical records system or (an) advanced one it wastes lot of time" (Doctor 6)*

*"Guess sometimes we can't do projects because we can't actually get access to the data, in the timely manner, so if we can't get the data we need so, we got an outbreak of something we can't get the who was in what bed when, we have to do it manually so a lot of work that slices things up" (Manager 1)*

*"I think the timeliness too, they can get the data but not always as timely as they like, ... So if I am a head doctor in charge of my ward ... I might have 50 patients and in order to access the information of patients I have to go into individual patients one by one and find out the stuff about them. Whereas, I might be interested in the bigger picture of my 50 patients but the system does not easily allow that" (Director 3)*

It can be seen that the findings have resulted in a refined model, in which there are two major changes in the model. First, timeliness of access becomes an important element that contributes to data access/retrieval. Second, apart from data quality, data access is found to be another factor that can affect the efficiency and effectiveness of the knowledge application process as well. In addition, the discussion of the findings and examples provided from the interviews highlight that data access and data quality are the most important problems of MRS and affect most KM processes. Finally, in relation to the impact of KM challenges on the knowledge process life cycle, domino effects within the lifecycle could be observed from the finding, in which any challenge that influences on KM process can also affect the performance of the other processes.

### **Transformation from Paper-based to Electronic systems**

Many organisations that realised the benefits and advantages of having EMRS also use paper-records in their healthcare practices. While there are advantages of paper-based records (i.e. flexibility and convenience), this study also found another two main challenges to implement full electronic records systems, these are funds/infrastructure and change management.

#### *Funds and infrastructure*

The transformation from a paper-based system to electronic system is a huge and complicated task, particularly for organisations that come from traditional paper-based records. The complexity of transforming paper to electronic requires a huge investment. Funding is the first and basic input to allow this transformation to occur. Other investments that also relied on funding include the investment in technology, infrastructure, human resources, staff, project managers, business analysis, and undoubtedly time.

*"To implement electronic records is the hugely complex task and there has to be political good will to do that, it's incredibly difficult thing to do and in Australia to my knowledge, there is no single hospital that uses true full electronic records,..., it is beyond the capability of any hospital to use, at this point in time without government backing, without political good will and without materials or resources to do the job" (Manager 5)*

*"One of the reasons why we still use papers, is when the patient come in we don't have enough terminals, we don't have the infrastructure really that allows us to just type notes directly into the computer system ... So we still use pieces of paper" (Doctor 6)*

#### *Change management*

Change management is a success factor for most IT projects that involve the implementation of new systems or the improvement of existing systems by adding new functions or features into the system. In some healthcare organisations, the traditional MRS may heavily rely on paper-records. The implementation of electronic systems and utilisation of electronic records can introduce cultural change. The findings of this research demonstrate that resistance of users is the common issue for many large hospitals, especially hospitals that have a long history of the paper-based record system. Many healthcare workers, including the clinicians and maybe nurses seem to prefer a paper-based records system rather than electronic system. Some users are not technically savvy and navigating paper records tends to be faster and more convenient for some staff and healthcare workers.

*"There is a little bit of the cultural stuff, so even in the normal wards, staff who would prefer to do on paper..., there's a little bit of accessibility issues, ..., I can have it with me all the time" (Director 3)*

*“I use paper records because it’s more convenient for me to hand write rather than type into the computer because I’m not that fast of a typer” (Doctor 10)*

### **Potential Improvements for IT Design for Medical Record Management**

Another finding from the case study is about how the current technology and tools used in the organisations should be improved. Since all the participants are the users of the system, the research asked them to identify what would be their suggestion to improve the system and their working approaches, based on the belief that it would help them to deliver better KM outcomes.

Most of the participants who need to interact with medical records every day see that electronic records can provide an instant input and access to information. Therefore, having more infrastructure and computer access can help them to find information and the knowledge they need wherever they are.

*“When the patient comes in we don’t have enough terminals, we don’t have the infrastructure really that allows us to just type notes directly into the computer system because, that, what means that we need to have computer terminals, or computer screen for every patient and we don’t have enough, we don’t have infrastructure for that”(Doctor 6)*

Apart from having enough computer access, the usability of the system is another request from the users. Clinical information systems should not require too much effort to use. The ease of use is important for them to provide better efficiency in task performance and avoid any frustration of users.

*“Often if you do electronic documentation, it might not be to find for other people based on the current system that we’re using, so it’s obviously um....program or tools specific if you have a tool or program that is not user-friendly” (Doctor 7)*

More integration between different databases and systems is another issue that needs to be solved. The lack of integration between different systems can introduce storage and data integrity issues, because the system allows the medical records to be accessed from different locations which can cause information duplication. From the discussion of KM challenges in the earlier section (Section 4.4.2), it can be seen that it is difficult and time consuming to access records or the information in different locations.

*“Within the department there is a number of individual specialists, that look at the same patient, all specialists practice as individuals, they set up as individual and there are multiple, I don’t know how, 8, 10 multiple records keeping system in that outpatients department that [are] not speaking to each other because those patients attending to those specialists as individuals and I don’t believe that is a healthy situation” (Manager 5)*

## **CONCLUSION**

Well-organised medical records is key to help reducing retrieval time of information, improving its accessibility, and providing comprehensive information of patients to support clinical practices (Wong & Bradley, 2009). The research provided an insight into the role of medical records’ in managing knowledge within a healthcare environment, by examining factors that affect KM processes. Through this examination, the study proposed a model, which detailed parameters that support or inhibit hospital KM practices. The findings showed that the MRS limitations, such as data quality and difficulties in information retrieval, are still significant factors in the management of healthcare knowledge. Additionally, the findings also indicated that a user-friendly system interface and timely access to information are important in order to improve healthcare practices and provide more effective and efficient KM outcomes.

This study created a better understanding of the role of medical records and electronic medical records systems in hospital KM practices. Despite its limitations and exploratory nature, the findings clearly highlighted potential gaps within hospital’s current medical records management practices, and their implications for knowledge assets management. The additional findings regarding the role of technology can contribute to improving future design of tools and EMRS within the organisations. Particularly, it can be quite beneficial for healthcare enterprise to integrate their current or new electronic information system and technology to manage their records management systems, as well as enabling more effective management of knowledge resources. However, more empirical research is required to confirm these results for generalizability purposes.

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