A Duel between Clinical Decision Support System and Healthcare Professionals: A Study in Malaysia

Pouyan Esmaeilzadeh(Corresponding author), Murali Sambasivan, Naresh Kumar & Hossein Nezakati
Graduate School of Management, Universiti Putra Malaysia (UPM)
43400 UPM Serdang, Selangor, Malaysia
E-mail: pouyanes@yahoo.com

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Abstract

As clinical IT can improve the productivity and performance (at different levels) of hospitals, researchers have tried to find out factors affecting the successful adoption of technological advancement (especially, progression in information technology) among healthcare professionals. One of the most important determinants influencing the success of clinical decision support system (CDS) adoption is that to what degree the system is accepted by healthcare professionals. Hospitals invest in CDS systems with the hope of cutting medication errors and increasing the quality of products or services. But if users are not likely to accept the systems, hospitals can not benefit significantly from the systems. On the other hand, if users accept CDS system they become more willing to make use of the systems in their practice patterns. The usage of CDS can be a sign of the system success in hospitals. Therefore, the purpose of this study is to investigate the reasons that motivate healthcare professionals to use CDS in hospitals. In this study, a series of interviews has been conducted among 21 healthcare professionals in Malaysia. The content analysis has been used to analyze the interviews in this context. The results reflect the importance of perceived threat to professional autonomy, level of interactivity with CDS, level of involvement in decision making, computer self efficacy and subjective norms in predicting healthcare professionals' intention to use CDS system in Malaysia. Based on the qualitative study, a conceptual mode has been proposed for an empirical study in future research.

Keywords: Clinical IT, CDS, Interview, Content analysis, Perceived threat to professional autonomy, Level of involvement in decision making, Level of interactivity with CDS, Computer self efficacy, Subjective norms

1. Introduction

The use of different forms of IT has increased in healthcare profession recently. With reference to Walter and Lopez (2008), two types of IT are available in medical care environment. The first one is Electronic Medical Records (EMR) systems which are computer systems that allow users to create, store, and retrieve patient charts on a computer. The second one is Clinical Decision Support (CDS) system that is classified as a decision support system. A CDS System is regarded as an application of Decision Support System (DSS), which takes patient data as input and generates decision- specific advice (Chang et al., 2007). These systems are referred to as knowledge-based systems that use patient data and series of reasoning techniques to generate diagnostic and treatment options and care planning. Typically, clinical IT is designed to enhance decision-making in health care environment and in this research, the emphasis is on CDS systems.

CDS can change the practice patterns of healthcare professionals to improve the quality of health care delivery. When a new CDS system is introduced to a hospital, healthcare professionals play an important role in the adoption and implementation process. So, healthcare professionals need to use emerging CDS to reap the benefits of new systems otherwise the technology will remain underutilized. In other words, healthcare professional's acceptance is reported as an important need to the success of the clinical systems (Payton, 2000; Kijsanayotin et al., 2009).

The underutilization of CDS emerges as a new challenge for the healthcare industry. According to Mathieson, (1991) and Chang et al. (2007), although a technology carries potentially technical merits, it cannot be effective if it is not used. Thus, there is a vital need to solve concerns regarding healthcare professionals' IT adoption. Despite large volume of studies in technology acceptance research, very little work has been done in the health care context (Aggelidis and Chatzoglou, 2009). This is a sign of a significant gap in this area. Also, based on the studies conducted in health sector, it is shown that healthcare professionals have not fully adopted the IT systems such as CDS (Walter and Lopez, 2008;

Tung et al., 2008; Yi et al, 2006; Chismar and Wiley-Patton, 2003; Dearne, 2003; Murray, 2002; Wenn et al., 2002, Western 2001). Also, despite the different potential applications of CDS to improve healthcare decision making, it should be noted that healthcare professionals are more concerned and sensitive to changes brought by CDS than EMR. Showing resistance by physicians becomes critical when it comes to the implementation of CDS in clinical practice (Ridderikhoff and Van Herk, 2000).

There is enough evidence to state that healthcare professionals are different from other IT users in terms of accepting technology and may respond differently to clinical IT (Paul and McDaniel, 2004; Schaper and Pervan, 2004). Their different IT adoption behavior is attributed to their professional characteristics such as specialized training, professional autonomy and professional work context. Healthcare professionals are highly sensitive to changes in their work setting especially, they are more concerned about the kind of changes that are perceived as a threat to their professional autonomy (Dowswell et al., 2001; Goldman, 1974; Harrington, 1975; Hayward et al., 1997). On the other hand, different features of CDS such as level of knowledge sharing and nature of instructions and guidelines given by those systems can affect healthcare professional's CDS acceptance.

The gap of this study is related to few studies on special characteristics of healthcare professionals and different features of clinical information systems (especially CDS) in the field of healthcare professional adoption (Walter and Lopez, 2008). Furthermore, according to Moon and Kim (2001), besides the important constructs embedded in technology adoption models, additional exploratory factors are needed to better account for the variance of accepting new technology such as the specific technology context.

According to Malaysia' Ministry Of Health strategic plan for 2006-2010, one of the most important strategic programs to improve healthcare delivery system is adopting appropriate technology for the prevention, diagnosis and management of diseases (such as CDS systems). Therefore, one of the research and technical support programs is to conduct research to support MOH to adopt new technology (CDS in particular) in hospitals. Thus, there is a strong current need to integrate fundamental factors influencing healthcare professionals' CDS adoption behavior to get a better understanding in healthcare context. In line with the problem statement, the purpose of this study is to investigate the degree to which clinical IT systems has been accepted and used in Malaysian hospitals.

2. Methodology

In this research a qualitative study was conducted to obtain a better and deeper understanding on healthcare professionals' IT adoption behavior in Malaysia. The qualitative study was performed based on 21 semi-structured interviews with specialty doctors in different fields to reflect the full scope of the issue under study. The 21 doctors belonged to different specialties, backgrounds and organizational levels in the hospitals. The doctors were selected from different departments and they were two general practitioners, two internists, two pediatrics, two radiologists, three geriatrics, two gynecologists, two pathologists, four surgeons, two anesthesiologists. The interviews started with a few specific questions related to IT adoption in the healthcare sector and its characteristics. Then, further questions followed the interviewees' thoughts and ideas. The reference group was selected in light of their experience, occupational status, familiarity with the purpose of this study as well as a referral network in different specialties. Thus, elite or expert interviewing was conducted to get deep information from well-informed healthcare professionals working in hospitals. These interviews were conducted individually through the period of July to October 2011 in Kuala Lumpur and Selangor. Kuala Lumpur was chosen because it is the capital of Malaysia and a large portion of specialists work there; also the healthcare professionals of Kuala Lumpur as well as Selangor were more reachable for the researcher. The targeted healthcare professionals worked both in the public and private sectors. The respondents of the study belonged to Hospital Putrajaya, Hospital Serdang, Hospital Kuala Lumpor, Pantai hospital Cheras, UPM medical center, UKM hospital, Ampang Puteri and Sunway medical center. In order to consider the ethical issues, the name of physicians participated in the study is not disclosed. The respondents have already used or have been familiar with the function of EMR and they have not applied CDS but they have been familiar with the features, properties and applications of CDS.

Since hidden meanings were sought, some objective techniques were used within the interview structures as follows (Cooper et al., 2008). Some examples are provided in the appendix as well.

-Free association: interviewees were asked to state the words that came to their mind when the issues under study were mentioned. For instance, healthcare professionals were asked to declare "what they think of the CDS system, professional autonomy, the subordinate group, computer self-efficacy" and so on.

-Sentence completion: participants were asked to complete a sentence. For instance, "complete this sentence: healthcare professionals who are supposed to use the CDS system feel …" or "complete this sentence: knowledge

sharing with the subordinate in a hospital setting …" or "complete this sentence: if I am given greater level of involvement in decision making in hospital ..."

-Empty balloons: interviewees were asked to write the dialog for a cartoonlike picture occurring in the hospital. For instance, they were supposed to write the dialog for a discussion between two physicians (from their own specialty) regarding the development of a new CDS system in their hospitals. Or, they were asked to write the dialog for a chat between two physicians (from their own specialty) about sharing knowledge in their hospitals. Demographic data of the participants are shown in table 1 to table 4.

3. Analysis and Results

The written records of interviews were analyzed using content analysis. According to Cooper et al. (2008), content analysis corresponds to a systematic process of coding and drawing inferences from written or verbal texts. This analytical process provides a qualitative picture of the respondents' concerns, ideas, attitudes, mindsets, and feelings. According to this process, common phrasing and words, context and patterns of expression are assessed to induct the significant points.

To do the content analysis, the answers were coded based on categorization of the data set. In a systematic process, four types of data units are the basis for coding written answers into categories. These four types were syntactical, referential, propositional and thematic (Cooper et al., 2008). The coding process involves recognizing important ideas and encodes them prior to a process of interpretation (Boyatzis, 1998). The data were summarized to identify initials themes and patterns.

The similar themes and patterns were combined to make categories. Each category, which was set up to be appropriate to the research problem and objectives, exhaustively reflects one construct and the categories were mutually exclusive. This process shows how analysis of the raw data from interview transcripts results in the identification of overarching themes that captured the constructs embedded in the research model of the study (Fereday and Muir-Cocharne, 2006). By interpreting the data, the meaning and significance is attached to the raw data. According to Taylor-Powell and Renner (2003), interpretation starts with developing a list of important findings discovered as a result of data categorization. The key points and information extracted from the interviews are summarized in this section.

- The reference group believes that there is a hierarchy in hospitals based on the possession of medical knowledge. So, healthcare professionals are put at the top and then physician assistants, para-professionals and non-professionals are located. For instance, one of the surgeons said: "medical knowledge is physicians' weapon in a hospital setting". Figure 1 shows this hierarchy in hospitals.

-The reference group states that healthcare professionals are the best personnel regarding consultation with patients and treatment in special fields. Also, nurses are the best workers regarding care-giving to patients and medical assistants as well as physician assistants are the best groups to carry out what they are ordered by healthcare professionals. Finally, management is involved in managing the activities and costs incurred in hospitals and also share information about hospitals' activities and financial affairs in the organization. Therefore, work activities are divided into these occupational groups and each group has its own standards. For instance, one of the internists stated: "the organizational working standards of each group depend on the types of functions performed by them, the more challenging the duties the more difficult the standards".

-The reference group is asked to state their options about clinical IT. They believe that healthcare professionals should be given professional autonomy to do the health care practices. They believe that all clinical IT systems in different forms are effective and useful to the extent that their professional autonomy is not invalidated. As one of the surgeons said: "professional autonomy should not be lost because of a new clinical IT system".

-The reference group mentions that healthcare professionals do not like to be ordered by any computerized system on what to do. They argue that the guidelines of IT systems limit healthcare professionals' autonomy and might result in rejecting new clinical IT systems. The interviewees declare that they defend their autonomous practice in hospitals and they would rarely care the suggestions of new clinical IT if they erode their status. As one of the interviewees stated: "if the CDS destroys our professional autonomy in the hospital no one will consider the functions of the system".

-The reference group is concerned about erosion of their status in hospitals due to the functions of CDS. They state that if healthcare professionals use a system that tells them what to do; others (such as para-professionals, physician assistants and junior professionals) might think that healthcare professionals are no longer needed. As one of the gynecologists stated: "the status of being professional in a hospital might become insignificant by a decision support system".

-Healthcare professionals argue that pushing a key to deliver some diagnostic options without any interference and interaction of healthcare professionals is of no value to them. They emphasize that healthcare professionals never accept to be an operator of clinical IT. Also, the interesting point is that the interviewees state the interaction level with the CDS should be acceptable enough to show the competence of healthcare professionals in professional interaction with CDS. In this regard, they are concerned about the required skills to work with the CDS. Also, they believe that more interactivity with the CDS results in more trust they can put in care options suggested by the CDS. As one of the radiologists mentioned: "using a CDS should not seem that everything is going to be done by the system and the professionals are simple operators of the system".

-The role of computer self- efficacy on use of CDS has been mentioned by the reference group. They believe that if they become aware of the function and application of the CDS system, they could better understand the instructions of the system. Some of the interviewees refer computer self- efficacy to "an armor in the interaction with the new technology" in a hospital setting. They believe that "with a stronger armor" they could be safe with no threats in the interaction with the CDS system.

-The interviewees put emphasis on being involved in planning and implementation of new technology such as the CDS system in hospitals. They believe that being involved in decision making makes them more likely to use the system which has been implemented by them. They stated that "delegating managerial duties related to planning a new technology to healthcare professionals makes them more intended to use the system". The reference group mentioned that when they are aware of the planning and implementation process of the CDS system from the beginning, they are more prone to use the system in their practice pattern.

-The reference group believes that "the relationship between healthcare professionals and other occupational groups such as para-professionals, physician assistants and junior professionals in hospital is very formal". The interviewees reflect that healthcare professionals instruct assistants, nurses and junior (inexperienced professionals) about the way they should act. In return, assistants and nurses give them feedbacks about the results and symptoms of the patient's disease. They emphasize that healthcare professionals should decide and other occupational groups should carry out the demands.

-The reference group states that healthcare professionals give more value to knowledge sharing and interaction with other professionals rather than nurses and assistants and also they rarely observe other professionals knowledge sharing with other occupational groups. They indicate that effect of important others (other healthcare professionals and hospital managers) can play an important role in a professional context of healthcare to whether decide using new CDS. As one of the pediatrics stated: "a majority of knowledge sharing, idea transfer and affection usually happen among physicians with important others in a hospital setting".

-The interesting point is that whenever health care professionals want to talk about sharing ideas with other occupational groups, they use "order" or "command" and they hardly say "sharing". One reason is inferred to lacking a sense of collaboration with others and relying more on independent decision making. As one of the surgeons stated: "we share our ideas with the subordinate group in a form of a training command".

-The interviewees declare that other occupational groups can help them to obtain information about patients. They state "the possibility for healthcare professionals to share their medical knowledge with other occupational groups" that work with them in a team (such as physician's assistants, nurses and junior professionals) to help them do their tasks and improve team performance. But their priority is to share ideas with other professionals in the same level. As one of the gynecologists stated: "the status of being professional in a hospital might become insignificant by a decision support system".

-The reference group states that healthcare professionals with different level of experience are generally not likely to share their knowledge with junior professionals. Also they indicate that "especially senior healthcare professionals (age + experience + qualification) hardly share their knowledge with juniors (inexperience) and new comers". The main reason is their seniority status in hospital and fear of losing this status obtained over the years of practice.

-At the end, the reference group argues that when "any type of IT system or medical equipment is required for hospitals, the Malaysia Ministry of Health is responsible to give the directions to the management of hospitals". The other way for introducing new IT systems is that the IT systems are suggested by healthcare professionals to the management of hospitals and the managers request them from MOH to obtain approval.

4. Conclusion

The results of the qualitative study conducted in this research support the concern of CDS adoption in Malaysian context. The findings confirm that healthcare professionals in Malaysia are more likely to protect their professional

autonomy and work patterns rather than using new CDS systems. Besides, they are worried about the features and function of CDS especially when these features are threatening to their autonomous practice. The results stress the importance of perceived threat to professional autonomy in CDS adoption in Malaysia. Thus, if CDS system is perceived as threatening to healthcare professionals' professional autonomy, they become less likely to accept and use the system.

This study also states the important role of physicians' involvement in decision making about CDS planning as well as implementation in shaping physicians' intention to use CDS systems in a Malaysian hospital context. This finding indicates that if healthcare professionals are granted high level of involvement in different steps of employing new CDS, they become more likely to use the system respectively. The results of the interview state that healthcare professionals' subjective norms in a hospital setting are positively related to their intention to use new CDS. This finding indicates that social pressure perceived from "important others" in a hospital setting can improve healthcare professionals' intention to use new CDS.

We explore the influential effects of computer self-efficacy on physicians CDS adoption in Malaysia. Literature in IT acceptance indicates the important role of computer literacy in accepting new technology in the healthcare context (Pain et al., 2003). There is no guarantee that health care professionals who have control over the medical knowledge necessarily have capability to use a computerized system (Gagnon et al., 2003). Therefore, not only computer self-efficacy does not erode the central characteristic of healthcare professional which is professional autonomy but also it supports their autonomous practice to interact with the system more confidently. This finding states that for healthcare professionals with low computer self-efficacy, it is difficult to deal with the instructions and features of a new CDS system and they feel more threatened by the system. On the other hand, healthcare professionals with high capability to use a CDS system can better understand the rules and care planning provided by the system and they perceive less threat from the system.

The findings show that healthcare professional interaction with CDS can improve their intention to use the system. The effect of healthcare professionals' interactivity on intention to use the CDS system indicates that having high level of interactivity with the CDS in a hospital could motivate healthcare professionals to use the system. This study recommends high level of physicians' interactivity with CDS system. Interactivity is characterized by increased control over the relationship between user and system. Higher level of interactivity leads to a higher level of involvement with the system and increase the control over each step of the patient care process (Bucy, 2004). Also, the high level of interactivity encourages the users to spend more time experiencing with the system.

Based on the finding achieved from the interviews, this study proposes the results in the form of a conceptual framework. This framework can be tested quantitatively in Malaysian context for future studies. Figure 2 depicts this framework as the result of our qualitative study.

The results of this study definitely have roots in the organizational culture, special organizational structure in the healthcare sector and power difference in Malaysian hospitals. This study adds to the body of knowledge on IT adoption models and sheds new insights into technology acceptance models amongst healthcare professionals by predicting factors affecting healthcare professional's intention to accept the CDS system. Moreover, with this understanding, managers and practitioners are in a better position not only to identify the source of resistance toward the new CDS but also to devise strategies to improve the overall acceptance of the system among healthcare professionals in a hospital setting.

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Table 1. Age of participants

	Age	Frequency	Percent
Valid	30-40	4	19.0
	41-50	11	52.4
	51-60	5	23.8
	over 60	1	4.8
	Total	21	100.0

Table 2. Work experience of participants

	Work experience	Frequency	Percent
Valid	1-10	3	14.3
	11-20	14	66.7
	21-30	4	19.0
	Total	21	100.0

Table 3. Specialty distribution of participants

	Specialty	Frequency	Percent
Valid	general practitioners	2	9.5
	internists	2	9.5
	pediatrics	2	9.5
	radiologists	2	9.5
	geriatrics	3	14.3
	pathologists	2	9.5
	gynecologists	2	9.5
	surgeons	4	19.0
	anesthesiologists	2	9.5
	Total	21	100.0

Table 4. Gender distribution of participants

Gender		Frequency	Percent
Valid	Male	13	61.9
	Female	8	38.1
	Total	21	100.0

Figure 1. The hierarchy in healthcare organizations based on level of medical knowledge

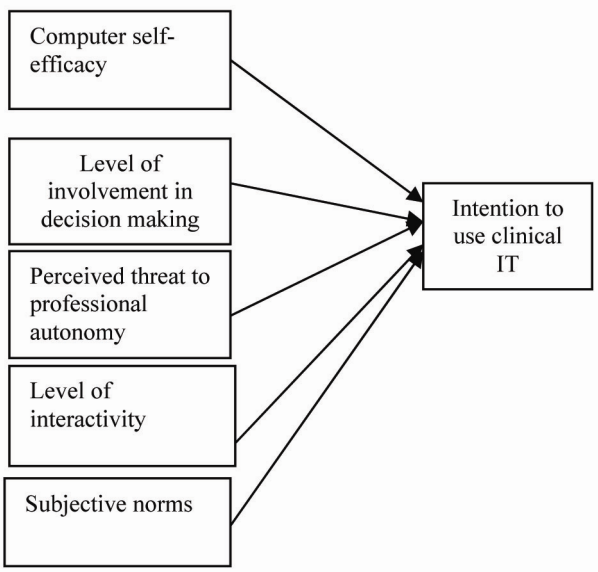

Figure 2. Proposed conceptual framework