Healthcare Professionals use Electronic Medical Records System (EMRs) in Jordan Hospitals

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Summary
Many hospitals have implemented Electronic Medical Record (EMR) although its effectiveness to improve healthcare is still in quest. EMR is use for patient registering, error reduction, administrative cost savings, increased productivity, and improved patient satisfaction, yet widespread adoption has been slow However, many barriers to the successful implementation of EMR systems continue to limit the uptake, including the lack of organizations culture, lack of incentives to the users and lack of vender support .Currently exists in terms of where users are and where they need to be in order to implement an EMR system. The promise of electronic medical records is great, but much careful planning is needed before the benefits can be reaped. This paper addresses post-implementation usage behavior of Electronic Medic Records system among healthcare professional in healthcare organization by applying the Technology Acceptance Model (TAM). EMR- TAM instrument was developed for this research and assessed with principal component analysis. The hypotheses were developed and tested using hierarchical multiple regressions.

Key words:
EMR, TAM, Healthcare Information System (HIS).

1. Introduction

The benefits of using electronic medical records (EMRs) have been well documented; however, a number of implementation barriers have impeded their widespread use. reports call for the use of electronic health records to make healthcare information available at the point of patient care, as well as to save lives. Technological foundation that collaboration in healthcare rests is Electronic Medical Records (EMR) technology.via channeling patient information through EMR systems, physicians can pool department, organizational, and institutional resources to restore patient health. Yet, despite the tremendous functionality that EMR systems provide for end-users, potential for implementation failure exists without understanding the educational implications of EMR software in the clinical setting. Essentially, EMR technology will only act as a conduit for innovation and creativity within the healthcare institution, provided professional's healthcare is equipped with the necessary technical and communication skills to work within a collaborative environment.

Researchers in medical informatics have developed new methods and techniques to improve health care, biomedical research, and education through information technology [1]. It is expected that MI would be able to provide a plausible solution for the hospitals' profiling system to reduce the congestion information retrieval of the patients' history and related information. EMR is one type of healthcare information system (HIS) or medical informatics like electronic health record (EHR) and computerized physician order entries (CPOE) that has recently been introduced to help improve healthcare by activating the communication among the users, to ease the patients' data retrieval, to reduce medical errors, and to provide medical diction support, but still have many challenges facing of implementation the EMRs in hospitals.

This paper is organized as follows: Section 1 presents the introduction of the paper, while section 2 discusses the electronic medical record in detail. while section 3 describe overview of healthcare in Jordan. Also in section 4 describe implementation of EMRs including how EMRs working with users. While section 5 shows sample that using in this study. Section 6 shows hypotheses were developed based on TAM of factors that have affecting for EMRs in Jordan. Section 7 shows discussion of results, final, section 8 concludes the paper and presents the future work.

2. Electronic Medical Record

EMR is referred to as managing patient medical records electronically from a variety of sources. It deals with patient treatment, diagnosis, laboratory test, imaging, history, prescription and allergies that can be accessed from various sites within the organization with the protection of security and patient privacy [2-4].Furthermore,the EMR is an application environment which consists of the clinical data repository, clinical decision support, controlled medical vocabulary, order entry, computerized provider order entry, pharmacy, and

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clinical documentation processes. This environment enhances the patients' electronic medical record in inpatient and outpatient processes, which are manipulated by healthcare users to document, supervise, and administer health care treatment within a care delivery organization (CDO). The data in the EMR is the official record of the patients' health treatment during their stay at the CDO [5, 6].

The EMR is often seen as an "alphabet soup" because it has been attributed by many diversified names and titles, for example, some of these attributed names are 'clinical data repository' (CDR) and electronic patient record. However, the issue is not the names or titles but rather, the problem concerns about defining the criteria to what the names would entail, or simply the definition by itself. EMR has not covered all areas of applications in healthcare, that is, there is no standard EMR application, and any EMR application has to consideration an order transmission system and organized reference system that include all the application domains [7]. In next section will discuss by overview of healthcare in Jordan.

3. Overview of Healthcare in Jordan

All hospitals in Jordan registered under the Ministry of Health (MoH) can be categorized under the following entities: government hospitals, ministry of defense, universities and private sector. The total number of hospitals in Jordan—without medical centers—is 104, serving health care to about 5.700,000 million people in the Kingdom. The number of hospitals, which has actually implemented EMR system, is around 15, either full or partial implementation. Five hospitals have full implementation; ten have partial implementation. Most hospitals facilities are totally dependent either on manual paper work or on very basic software tools to do their day-to-day tasks such as patient admissions [8]. In Jordan, political will and commitment to improve health exist at the highest level. Based on the political commitment to improve health, a paper on the health sector, developed by a special committee, was discussed during a high level meeting held in Aqaba in October 2002. The paper proposed a long term vision for Jordan to become a centre of excellence for the provision of health care in the Region [9].

This vision can be achieved through protecting health of all citizens and promoting social security and justice by providing efficient health care; restructuring the health sector; upgrading the standards of health care and strengthening quality control; considering health as an economic value and as a stimulant of the national economy; and efficient management of health care [9].

Section 4 will discuss the advantages of EMRs implementation that are already complete in different countries healthcare sectors and how these implementation have improved the quality of clinical performance.

4. Implementation of EMRs

Workflows of EMR have no fixed criterion (standards), as different organizations have different understanding of EMRs. Since, there are multiple interpretations of what exactly EMR is, and what the EMR requirements are, therefore, organizations are unable to identify their current and future needs from it [10].

4.1 How EMRs work with the users

Figure 1 shows the workflow of EMR and how the users can capture, store, process, communication, and security of data for each patient.

EMR helps administrative staffs to access and retrieve information, and by activating communication with each others, users and medical researchers. EMR can be used in human resource departments, and in obtaining the patient billing information. Therefore, the users (hospital administrative staffs) can retrieve the information that is needed at anytime and anywhere. EMR also enable the patients to access their data by themselves. The workflow of EMR shown in Figure 1 are based on the main functions of EMR discussed by researches [10-14].

These functions are:

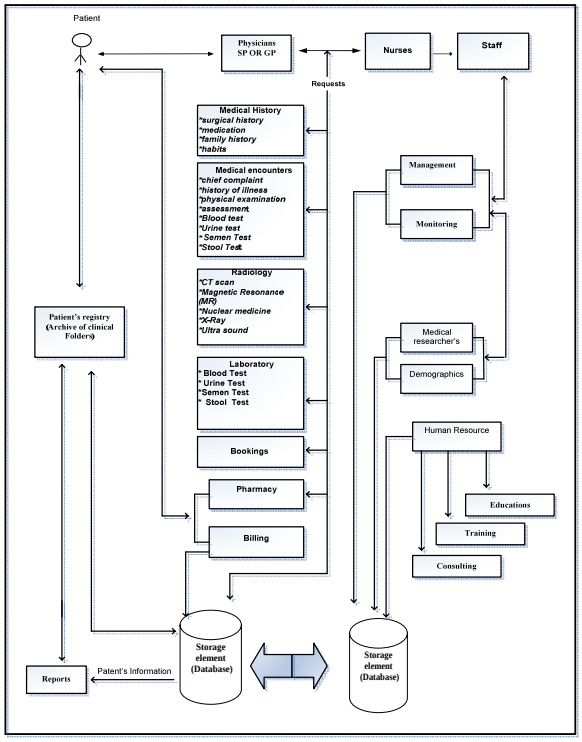

Figure 1 Workflow of an EMR System

Medical history: describe in detail or longitudinal record of what happened to the patient since birth or visit to the physicians. It show chronic diseases, major and minor illnesses, as well as growth details and patient history to the over the years. Medical history also includes surgical history, medications, medical allergies and medications.

Medical encounter: This includes complaint, history of the present illness, assessment, plan (diagnosis, treatment), and progress notes. Within the medical record, individual medical encounters are marked by discrete summations of a patient's medical history by physicians, nurses, practitioners, or physician assistants and can take several forms such as:

Radiology: This allows physicians or other users make booking and get results of CT scan, magnetic resonance (MR), nuclear medicine, X-Ray and ultra sound easily and fast.

Laboratories: Allows users to make booking during interviews with patients and get result which include blood test, urine test, semen test and stool test.

Booking in the wards: Allows physicians to make booking for patients in the wards if there is an emergency case.

Billing information: Via EMR, care users can access to the billing information of the patients, and conduct instant bill calculation for paying cases.

Pharmacy: EMR is able to offer the electronic medical prescription which is easier than paper medical prescription. Thus, it is able to reduce the medical errors.

Demographics: Include patient information that it is not medical information in particular. This information will include the location of patients, identifying numbers, addresses, and contact numbers. And contain information about race and religion as well as workplace and type of occupational information. It may also contain information regarding the patient's health insurance. Through the implementation of EMR, users can access these functions that enable them to perform their job function efficiently.

4.2 Examples of EMRs in healthcare organizations

According to Wald (2004), a Longitudinal Medical Record (LMR) which is an ambulatory-care used by providers including physicians and other clinical employees in the outpatient setting for documentation of medical care, comprised: patient problems, procedures, medications, allergies, health maintenance topics, and encounter notes, write prescriptions [11].

In Wald's study, there were 1000 patients enrolled in Patient Gateway in the first 12 months and this increased to 1000 patients per month in the second year driven by practice marketing efforts and the addition of one new practice site per month. Practices adopting Patient Gateway differed in both the actual system usage by patients, and in their expectations of how it would be used [11].The information contained in the medical record allows health care providers to provide continuity of care to individual patients. Patient Gateway (PG) allows activating the communication between patients and physicians, exchange massage between physicians and staff.

Another, system describes how patients with heart failure using natural language contained in EMR were proposed. There are two validated methods of identifying Heart Failure (HF) through the EMR, which offers transcription of clinical notes within 24 hours or less of the encounter. The first method was Natural Language Processing (NLP) of the EMR text. The second method was predictive modeling based on machine learning, using the text of clinical reports. Natural language processing was compared with both manual record review and billing records and predictive modeling was compared with manual record review [15].

In the implementation of EMRs in Reinickendorf's Hospital in Berlin for the urology ward, the system provided the physician with a consistently patient-oriented view of the data, in the form of an electronic patient file with a complete chronological illness and treatment history [10]. The emphasis is on structural requirements and diagnostic reports that can be viewed on a portable computer right at the patient's bedside. For this purpose, the "notebook on wheels" that has a wireless signal connection to the hospital's computer network is used. In this system, there are no commutations and between physician and patient or communication between as well different electronic medical records systems between the departments.

On the other hand, the patients access to their records using Electronic Medical Records System (PAERS) which is a self-contained system. That allow patients to access and navigate around their GP electronic medical record autonomously, PAERS provides them with the information that they need to understand the medical terminologist in the system. This system had been designed and developed by clinicians and patients [13]. The PAERS Kiosk is easily accessible by all patients using: touch screen or mouse interface and conation information such as Consultations which include date, practitioner seen, reason for visit, history, examination, and outcome are investigations.

The patients can, via this kind of Web-based system, get services anytime and anywhere automatically. The patients can interact with health reminders; they can review electronic chart information maintained, as well as enter additional clinical information, and prepare information summaries before an office visit. Creating shared information resources to support a collaborative care model required analysis of the business, architectural, and workflow requirements of the patient-controlled clinical portal and the physician-controlled electronic medical record systems.

Tata Main Hospital (commonly known as TMH) at Jamshedpur caters its services to the employees (around 60,000) of Tata Steel, their families, and dependents. Patient care management in Tata Steel has fully utilized the power of computers in medicare, whereby network of integrated systems maintaining patient database for the hospital services in the areas of pathology, radiology, medical research, in-patient admissions and billing, medical stores and pharmacy are operational [16].

The system has some of the functionality as: admissions, discharges and transfers. The system is able to cater for the in-patient admissions and discharges or transfers from various wards, cabins and ICU. It also deals with registration of casualty observation patients, birth and death records maintenance, on-line and web based enquiry facility, daily bed availability and monthly management information system (MIS), and statistical reports [16]. The next section will discuss of method including the sample of respondents for

5. The Sample of Respondents

For the purposes of this research, the targeted respondents are chosen from physicians, nurses, pharmacists, lab technicians, medical records staff and administrative staff at different hospitals from different areas in Jordan with different rates by 7 hospitals some following government hospitals and private sector hospitals. As a result of these efforts, out of 700 questionnaires distributed personally by hand to the respondents in hospitals, 500 respondents responded and returned the questionnaires making a response rate of 82.72%. Out of these, 95 questionnaires are discarded from analysis because they are not completely filled. Eventually, 405 questionnaires are used for further analysis, making a valid response rate of 58%.

The next section will discuss of hypotheses based on TAM.

6. Hypotheses Based on TAM

TAM provides a hypothesis whereby perceived usefulness and perceived ease of use are basic determinants of user acceptance. The former is depicts the level of the individual's belief in the new information system's contribution in enhancing job performance while the latter is the level of the individual's belief in the system's user-friendliness. Additionally, TAM suggests that external variables indirectly depict an individual's attitude toward technology acceptance through its affect on perceived usefulness and perceived ease of use (Davis et al., 1989). These external variables many relate to individual user attributes, job tasks, system development and implementation process, system design characteristics or adequate training and user support. Other factors also include political influences which relate to the organizational environment and may also influence an individual's attitudes toward perceived usefulness as well as ease of use (Fishbein & Ajzen, 1975). Several prior TAM research studies determine external variables having statistically significant impact on healthcare systems which are presented below in hypotheses.

H1: There will be a significant positive relationship between users Involvement and perceived usefulness**.**
H2: There will be a significant positive relationship between users-patient relationship and perceived usefulness.
H3: There will be a significant positive relationship between user-autonomy and perceived usefulness.
H4: There will be a significant positive relationship between resident background and perceived Ease of use
H5: There will be a significant positive relationship between limited access and perceived Usefulness.

Next section wills desiccation of Discussion of Results for these hypotheses.

7. Discussion of Results

This section discusses the identification and the comparison of the independent variables' strength of predicting the dependent variable. It attempts to distinguish those variables that are able to predict the dependent variable with the Beta value. This is where the interest of the present research lies. In Table 1 all variables having a significant effect upon perceived usefulness in the model is listed with user patient relationship heading the list out of all the independent variables ($\beta = .534$). As for the other variables, the degree of their significant and positive effect on usefulness of EMRs is arranged in descending order as follows: user involvement, user patient relationship and user autonomy was insignificant. Also hypothesis 4 and 5 were including as their constructs dropped during the factor analysis process. In next table shows the results in below.

Hypotheses	B	T-value	Significa nt-ant	Result
H1	.427	9.235	.000	Supporting
H2	.455	12.375	.000	Supporting
H3	.029	.901	.000	Supporting
H4	-	-	-	Dropped
H5	-	-	-	Dropped

Table 1: Results of Hypotheses

Dependent Variable: Perceived Usefulness (F =842.727, P < = .000, R = .929, R2 = .863, Adjusted R^2 = .862)

H1: The result in Table 1 shows a positive and significant relationship between user involvement and perceived ease of use (t =9.235, p >.05). The result suggests that for each unit increase in the user involvement, there is an expected increase of .427 in the perceived ease of use in the model. Therefore, hypothesis 1 is supported.

According to some researchers Lorenzi et al (1997) and Lorenzi & Riley (2000), user involvement in the selection of a suitable system and its implementation can encourage user ownership development. In the present study, respondents brought up the importance of users' leadership in the EMR selection as well as the implementation process. The present research is conducted in a health system whereby the department of information system took part in the study. These professionals are answerable to the top management for the clinical affairs and each and every one of them is a respected physician. In addition, some of the respondents are healthcare professionals who are heads of the clinical information systems that leads the committee that overlooks the information systems used in the entire healthcare system. The said committee comprises of active and well known individuals and majority of them are physicians. This very fact exhibits the power and hands-on characteristic of leadership in this particular health care system. This notion is further supported by the displayed strong relationship between user's involvement and management support.

The results of the analysis as displayed in table 1 reveal a positive significant relationship between user involvement and perceived usefulness, a result that is parallel with Morton's (2008). Results also show that users should participate in selecting product because they are more knowledgeable of the clinical workflow and it is imperative that the system is tallies with the clinicians' practice techniques. Respondents show some concern with the computerized documentation and an all encompassing disinclination towards the use of rigid data entry templates. It is assumed that the respondents or the users in the present study are already convinced of the EMR's advantages; therefore, they displayed an expectation regarding user leadership in the selection of a user-friendly system. This obvious direct relationship shows that healthcare professionals' attitudes are influenced by their perceptions regarding involvement and disregarding the kind of system selected. This in turn, reveals a great sense of trust in the ability of the user leadership to choose the required suitable system that satisfies the requirements of the staff. The respondents reveal their desire for professionals to carry out the training classes since they possess a clear picture of the clinical workflow; a notion supported by the relationship between the user's involvement and the adequate training scales.

H2: In Table 1 shows a positive and significant relationship between user patient relationship and perceived usefulness (t =12.375, p >.05). The result suggests that for each unit increase in the user patient relationship, there is an expected increase of .455 in the perceived usefulness in the model. Therefore, hypothesis 2 is supported.

EMR implementation includes significant costs for first installation expenses. Therefore, when healthcare institutions decide to implement EMR systems, they have to appropriate a portion of the capital to information systems infrastructure, making it a challenge to build a state of the art system. Not all organizations can afford to do so at the onset of business as this might entail an investment of a significant kind that would represent as a heavy financial burden on the owner of the company. Some firms are hesitant to take the plunge due to the uncertainty of the amount of benefits that will accrue over the years. In the present study, the relationship between cost and ease of use is shown to be significant as displayed in table 1. In other words, health care professionals in Jordan are inclined to believe that cost of a complete HER implementation is higher than the benefits it will later provide. This result is consistent with previous studies [17-19]. It is logical to say, that based on this notion, it is not surprising that healthcare professionals list cost as the most significant barrier to complete EMR implementation. Majority of the respondents who use EMRs in Jordanian hospitals, believe that as a result of the time consuming factor of EMRs, they have to work longer, and they don't have enough time for patients during the implementation and the initial period. Thus, the three underlying main barriers to EMR implementation are challenges faced with new technology, training and support of organization leadership, and increased time and costs.

H3: Also, Table 1 shows that there is an insignificant relationship between user autonomy and perceived ease of use (t = .901, p >.05). Therefore, hypothesis 3 is rejected.

This survey item received very little qualitative results implying user's very little concern for it in this healthcare system. The results showed a highly insignificant relationship between user autonomy and perceived usefulness as exhibited in Table 1 another result consistent with Morton's (2008) study of UMHC system.

In addition, a strong negative direct relationship is established between autonomy and attitude towards EMR use; a relationship that was not hypothesized by the researcher. However, perceptions of autonomy display a significant influence on attitudes and using. The results are contrary to Aldosari (2003) who achieved mixed results. The author noticed a strong negative relation between autonomy and attitude but he also noticed a significant relation between autonomy and perceived ease of use and perceived usefulness.

Some other previous studies have validated the current results regarding the relationship between autonomy and attitude [20-22]. Gadd and Penrod takes the validation further by expounding that perceptions of the system's impact on physician autonomy happened to be one of the major concerns physicians had about EMR use before and after post implementation. These perceptions co-varied with the perceptions of doctor-patient relationship, claimed by Gadd and Penrod (2000).

The data collected in the present study, imply that healthcare professionals keep practicing their dominance and autonomy as they are comparatively small and pretty much autonomous with no governing body looking over their practices. A promising result suggests that oversight of colleagues is minute and practically non-existent. The question does not revolve around the provision but the documentation of care. As such, only a little oversight was exhibited by the work of nurse practitioners, physician assistants and other healthcare professionals. The level of oversight differed from one individual to another, mostly based on documentation and was corrected by the physician responsible and sometimes healthcare professionals signed off on the documentation only as a legal formality without going through it first. Nevertheless, there are no cases where the provider had to correct a colleague's formal oversight.

Furthermore, healthcare professionals work in autonomous techniques although they like to believe that they are practicing a standardized way when operating EMR. Providers however, find no problem with their individualized ways and consider it as a mere 'different styles' of operating.

8. Conclusion and Future work

Future studies can look into the comparison for example between the use of templates in the light of data entry formats like narrative documentation, digital dictation or data capture through handheld devices. The results of these studies can be made of by EMR vendors and healthcare systems that normally deal with issues of data entry. The researcher is of the opinion that a measure of pre-implementation is a gateway to assessing system readiness for EMR adoption. However, constant and continuous evaluation would be required to find out EMR's affect on users and its influence on patient care.

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