Professional practice and innovation:

Users' attitudes to an electronic medical record system and its correlates: a multivariate analysis

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Abstract

Implementation of an electronic medical record (EMR) system increases efficiency of health services, quality of care and patient satisfaction. Successful implementation depends on many factors, one of which is how users respond to the new system. We studied medical receptionists' appraisal of the newly implemented EMR system in primary healthcare centres in Kuwait. Four hundred receptionists were selected randomly from different healthcare centres and asked to complete a user interaction satisfaction questionnaire relating to their experience of the new system. The response rate was 80.5%. A large majority of the respondents considered the system to be flexible (83%), easy (89%), and satisfying (81%). However, more than one third of the respondents (36%) found the system inadequate. Bivariate and multivariate analyses found age, typing ability, ease of data entry and computer error as significant correlates with overall user response. These findings relating to users' reactions to various aspects of the EMR should assist policymakers to recognise the causes of dissatisfaction with the EMR among medical receptionists at health centre clinics that may adversely affect its successful implementation and regular use, as well as the quality of care provided by the clinics. In addition, the findings provide information to assist the development of guidelines for future implementation of the EMR system at the secondary healthcare level.

Keywords (MeSH):

Medical Records, Computerised; Electronic Medical Record; Evaluation; Medical Receptionists; Kuwait; Multivariate Analysis.

Enhancing service efficiency and quality has always been one of the most important factors in heightening competitiveness in the healthcare service industry (Gillies et al. 2006; Gold, Glynn & Mueser 2006). With the increase in the demand for high quality medical services, the need for an innovative Hospital Information System (HIS) has become essential (Yoo et al. 2008). HIS and electronic medical records (EMR) are considered prerequisites for the efficient delivery of high quality care and instrumental to the decrease in medical errors in healthcare delivery (Wang et al. 2003; Lium, Tjora & Faxvaag 2008). It is widely acknowledged that the EMR has the potential to become the core electronic information and communication system in the healthcare sector (Ball 2003; Haux 2006; Chang & Chang 2008). The EMR eliminates the need for hand-written records, hence reducing time spent on record-keeping by doctors and other healthcare staff, which in turn results in reduced patient waiting time (Cimino et al. 2002). In addition, tracking time on historically-related records is also reduced simply by accessing the computerised medical records through the integrated computerised central system (Sharda et al. 2006). EMRs may also increase both patient satisfaction and financial savings (Sittig, Kuperman & Fiskio 1999).

With the assumption that that EMR system can improve both the quality and effectiveness of the healthcare delivery, many healthcare provider organisations in developed countries have invested in the development and deployment of such systems (Lium et al. 2006). However, in many developing countries the EMR system

is not widely disseminated or implemented. Published literature shows low adoption and high failure rate of successful EMR implementations (Southon, Sauer & Dampney 1999; Benson 2002; Ball 2003; Littlejohns, Wyaat & Garvican 2003; Ash et al. 2004). Van der Meijden et al. (2003) identified user resistance as one of the primary factors for unsuccessful EMR implementation. Despite their potential advantages, implementation of EMR systems may be resisted if users are not satisfied with the system (Van der Meijden et al. 2003). Although there is evidence of immediate benefit (Berg et al. 1998) and the improvements in time efficiency (Poissant et al. 2005), other factors, such as deficiencies in users' computer skills (Dansky et al. 1999; Van der Meijden et al 2001; Ammenwerth et al. 2003) and the implementation process (Southon et al. 1999; Aarts, Doorewaard & Berg 2004; Berg 1999), also had a negative impact on successful EMR implementation.

Previous published work has identified many factors that may influence EMR user satisfaction and ultimately help its successful implementation. These are system error, response time, logical and efficient flow of tasks, ability to complete desired tasks, ease of correcting mistakes and data entry, effects on individuals' time, prior computer experience and training on the system (Dansky et al. 1999; Aaronson et al. 2001; Murrf & Kannry 2001; Loomis et al. 2002; Likourezos et al. 2004). Van Der Meijden et al. (2003) also suggested that perceived impact on the quality of patient care may be an important factor in users' satisfaction with an EMR, especially when the system is perceived as negative.

Background

Kuwait is a small oil-rich Arab-Muslim country of 3.2 million people, only 33% of whom are Kuwaiti nationals. Non-Kuwaitis are from over 100 countries; 28.7% are Arabs and the rest (33.3%) are from various other Asian countries (PACI 2007). The healthcare delivery system in Kuwait has developed rapidly. The Ministry of Health of the government of Kuwait provides about 90% of the healthcare service through the usual three-tier healthcare delivery system, comprising primary, secondary and tertiary levels.

As stated in 1999-2003, one of the objectives of the Ministry of Health in Kuwait is to establish an EMR system in all primary healthcare centres, under the Ministry's computerisation program. The Ministry aims to improve the quality of healthcare by establishing a modern information technology system in all related processes and extending the system to various levels of healthcare (Ministry of Health 2004). It believes this will improve health professionals' performance, and hence the quality of patient care; it is also consistent with the Kuwait government's overall plan to have an 'electronic government'. At present, EMR has been implemented in all primary healthcare centres.

Evaluation of user interaction and satisfaction with the EMR will provide important information that will allow the user to have a greater voice in design and delivery of healthcare services at the level of primary healthcare. Findings from the primary healthcare centres' experience will help policy makers to plan future implementation of HIS at the secondary and tertiary care levels. This study was aimed at identifying receptionist's reaction to the newly implemented EMR systems at primary healthcare centres in Kuwait and its correlates.

Method

Participants

At the time this research took place there were 877 medical receptionists in total who were using computerised systems in 78 health centres in the five health regions of Kuwait. During the first stage, 44 of these 78 centres were selected, covering more than 50% of patient population. A sample of 400 receptionists was randomly selected for the interview; they returned 332 completed questionnaires, a response rate of 80.5 %. The data collection period spanned November to December 2005.

Instrument

A structured questionnaire was prepared to measure the user reaction regarding the computerised system at the health centres. A user interaction satisfaction questionnaire (QUIS) developed by the researchers from the Human Computer Interaction Laboratory at the University

of Maryland was adopted with minor modification (e.g. to some of the wording) for the current study. It was a standardised, general user evaluation instrument for interactive computer systems. Psychological test construction method was used to develop this questionnaire to ensure reliability and construct and empirical validity. The short form of the QUIS was divided into five sections of four to six questions each. The sections were designed to assess: (a) overall user reactions; (b) screen design and layout; (c) terms and system information; (d) learning; and (e) system capabilities. In order to ensure its validity, the questionnaire was translated into Arabic and back-translated by two Faculty members who were fluent in both English and Arabic. The Arabic version of the questionnaire was used, since most of the receptionists were only Arabic speaking. Necessary permission was obtained from the Ministry of Health before conducting the survey. Respondents were informed that participation in this survey was voluntary.

Independent variables

Some questions related to background characteristics (e.g. age, gender, education, nationality and duty shift) and computer literacy-related questions (previous computer experience, possession of computer at home and office, daily computer use frequency, typing ability, ease of data input and computer error frequency) were also included.

Outcome variable

Six questions (*yes*=1 or *no*=0) about overall user reaction regarding EMR were asked. Respondents were asked whether they found their system to be: (a) *rigid*; (b) *adequate*; (c) *difficult*; (d) *dull*; (e) *frustrating*; or (f) *very bad*. Overall user reactions scores were computed by adding responses to all six questions. The minimum value for computed overall user reactions score is 0 (no negative reaction) and the maximum 6 (maximum negative answer). For bivariate analysis, overall user reaction score were re-categorized as 0, 1, 2 and 3 (3 or more negative answers). For Poisson regression, this is used as a count variable.

Data analysis

Data were analysed using SPSS. Descriptive statistics (frequency distribution and bivariate table) were used to present the data. A chi-square test was used to determine the significance of the relationship between two categorical variables. In addition, Poisson regression was used to identify independent correlates which influence user reaction to the EMR system.

Results

Overall user reactions regarding the various aspects of the EMR system are presented in Table 1. Distribution of the background characteristics by overall user reactions are presented in Table 2.

Among the respondents, 23% were aged 25 years or less, 43% between 26 to 35 years, and 34% were 36 years or over. The relationship of age with overall user reaction was found to be significant: 62% of respondents were female and 38% male. Regarding education, 28% completed intermediate schooling (5th to 8th grade), followed by 31% secondary education (to 12th grade), and 41% college or higher degree. A

Table 1: Overall user reaction regarding the various aspects of EMR system

CHARACTERISTICS	TOTAL	
	N	%
Is the system rigid?		
Rigid	57	17.2
Flexible	275	82.8
Is the system adequate?		
Inadequate	126	38.0
Adequate	206	62.0
Is the system difficult?		
Difficult	37	11.1
Easy	295	88.9
Is the system dull?		
Dull	167	50.3
Stimulating	165	49.7
Is the system frustrating?		
Frustrating	63	19.0
Satisfying	269	81.0
Is the system terrible?		
Very bad	121	36.4
Wonderful	211	63.6

NOTE: *N* may not be added to the total sample size due to missing values.

Table 2: Distribution of Background characteristics of the respondents by overall user reaction

CHARACTERISTICS	OVERALL USER REACTION SCORE (%)				TOTAL	
	0	1	2	3+	*N*	%
Age (in years) *						
≤ 25	15.5	24.8	21.1	15.5	76	22.9
26-35	39.7	43.6	35.5	39.7	144	43.4
≥ 36	44.8	31.6	43.4	44.8	112	33.7
Gender						
Male	48.3	29.1	42.1	39.5	126	38.0
Female	51.7	70.9	57.9	60.5	206	62.0
Education						
Intermediate	36.2	29.1	26.3	23.5	94	28.3
Secondary	32.8	28.2	31.6	34.6	104	31.3
College or above	31.0	42.7	42.1	42.0	134	40.4
Nationality						
Kuwaiti	94.8	99.1	98.7	97.5	325	97.9
Non-Kuwaiti	5.2	.9	1.3	2.5	7	2.1
Duty shift						
Morning	94.8	99.1	98.7	97.5	228	68.7
Evening	5.2	.9	1.3	2.5	104	31.3

NOTES: * Significant at 5% level.

N may not be added to the total sample size due to missing values.

Table 3: Distribution of computer related experience of the respondents by overall user reaction

CHARACTERISTICS	OVERALL USER REACTION SCORE (%)				TOTAL	
	0	1	2	3+	*N*	%
Previous PC experience						
Yes	63.8	67.5	73.7	65.4	225	67.8
No	36.2	32.5	26.3	34.6	107	32.2
Computer at home						
Yes	65.5	68.4	77.6	70.4	234	70.5
No	34.5	31.6	22.4	29.6	98	29.5
Computer at work						
Yes	87.9	86.3	85.5	80.2	282	84.9
No	12.1	13.7	14.5	19.8	50	15.1
Daily PC use frequency						
No use	5.2	14.5	11.8	16.0	42	12.7
Moderate	41.4	41.0	52.6	34.6	140	42.2
Many times	53.4	44.4	35.5	49.4	150	45.2
Typing ability **						
Bad	13.8	5.1	9.2	23.5	40	12.0
Moderate	46.6	33.3	36.8	43.2	129	38.9
Good	39.7	61.5	53.9	33.3	163	49.1
Ease of data input **						
Easy	98.3	94.0	93.4	76.5	300	90.4
Difficult	1.7	6.0	6.6	23.5	32	9.6
Computer error frequency **						
Seldom	44.8	57.3	48.7	34.6	158	47.6
Sometimes	44.8	37.6	51.3	63.0	160	48.2
Always	10.3	5.1		2.5	14	4.2
Can access medical information from the electronic record *						
Yes	27.6	29.1	15.8	12.3	72	21.7
No	72.4	70.9	84.2	87.7	260	78.3

NOTES: ** Significant at 1% level; * Significant at 5% level.

N may not be added to the total sample size due to missing values.

majority of the respondents (98%) were Kuwaiti. Approximately 68% of the respondents were from the morning shift of work duty while the remaining 32% were from the evening shift.

Table 3 presents the data on computer-related experience of the respondents by overall user reactions. Of all respondents, 71% had a computer at home and 68% had previous computer experience. A majority of the respondents (85%) had a computer at work. Regarding typing ability, 49% reported as good, 39% moderate and 13% bad and the relationship between the typing experience and overall user reaction regarding EMR was significant. Of responses related to the ease of data entry, 90% reported it as easy and remaining 10% found it difficult. Forty-eight percent of respondents mentioned rare computer error, followed by, 48% sometimes and 4% always.

Multivariate analysis

Logistic regression was employed to determine which characteristics independently correlated with overall user reaction. For the multivariate analysis, all variables from Tables 2 and 3 were included in the logistic regression model (Table 4). The dependent variable was counted as mentioned in the Method section. Two variables, ease of data input and computer error frequency, emerged as significant correlates with overall user reaction. Overall negative reaction was significantly lower for those who felt data entry was easy. Similarly, respondents who reported seldom/sometimes computer error showed significantly lower negative reaction regarding EMR.

Table 4: Results of Poission Regression Analysis (dependent variable = overall user reaction)

VARIABLES	COEFFICIENTS	*p*-VALUE
Age (in years)	-0.010	0.128
Gender (Male=1, Female=0)	0.051	0.711
Education		
Intermediate (Reference category)	-	-
Secondary	0.078	0.493
College or above	0.079	0.497
Nationality (Kuwaiti=1, Others=0)	0.170	0.623
Duty shift (Morning=1, Evening=0)	-0.221	0.118
Previous PC experience (Yes=1, No=0)	-0.040	0.699
PC at home (Yes=1, No=0)	0.116	0.262
PC at work (Yes=1, No=0)	-0.173	0.129
Daily PC use (Yes=1, No=0)	0.023	0.789
Typing ability		
Bad (Reference category)	-	-
Moderate	-0.169	0.206
Good	-0.219	0.118
Ease of data input (Yes=1, No=0)	-0.630	0.000
Computer error frequency		
(Seldom/sometimes=0, always=1)	0.631	0.028
Constant	0.020	1.672
Model Chi-square	55.758	0.000

Discussion

This study investigated the overall user reaction and its correlates concerning the newly implemented EMR at primary healthcare centres in Kuwait. A majority of the respondents found the system *flexible* (83%), *easy* (89%) and *satisfying* (81%). However, more than one-third of the respondents reported that the system was *inadequate* (38%), and *very bad* (36%). Furthermore, a half of the respondents perceived the system to be *dull*. According to published literature, increased positive outlook on these aspects of EMR assists its increased use and successful implementation (Laerum, Karlsen & Faxvaag 2004; Lium et al. 2006; Lium et al. 2008). The medical receptionists' tasks are usually limited in scope, and have a narrower and more defined range of the type of information needed compared with those for nurses and physicians. Hence, their tasks could be incorporated in the EMR system in a simpler way, leading to a more favourable user reaction, and ultimately leading to its successful implementation.

In our study, bivariate analysis showed that age had a significant positive relationship with the overall user reaction. This might be because older people are reluctant to accept new technology, particularly computer systems, as has been observed in previous studies (Marasovic et al. 1997; Simpson & Kenrick 1997; Alquraini et al. 2007).

Respondents with moderate to good typing ability reported significantly fewer negative views on EMR. A similar significant trend was shown for ease of data entry and computer error frequency with respect to overall user reaction. A negative response to these variables suggests diminished user satisfaction and influence on EMR implementation. Published reports show a mixed picture regarding these relationships (Murff & Kannry 2001; Loomis et al. 2002; Likourezos et al. 2004;

Laerum, Karlsen & Faxvaag 2004; Otieno et al. 2008; Lium et al. 2008). In the present study, for example, the significance of the impact of typing ability did not remain so in multivariate analysis. Although we found several significant associations in bivariate analysis, the association between two variables does not necessarily imply a significant causal relationship between them. Therefore, a multivariate approach was applied to determine which factors best explain and predict overall user reactions.

In this study, multivariate Poisson regression identified the ease of data input and computer error frequency as significant correlates of overall user reactions. As medical record receptionists enter basic Master Patients Index (MPI) data and other administrative data, the entry screen should be simple and easy to use. Laerum, Karlsen and Faxvaag (2004) argued that the EMR should be developed in such a way that medical receptionists can perform their tasks easily. This will improve receptionists' approach to EMR and will ultimately help in successful implementation of the system.

Computer error can occur for several reasons, namely hardware failure, network failure and any problem with EMR. Any breakdown of the EMR system has to await the arrival of the specialist technicians and during that time the user reverts to the paper-based system. This generates frustration and disappointment with EMR. Haux (2006) reported that the combined use of both EMR and paper-based systems will reduce the chance of successful implementation of EMR.

Proper training of EMR users will increase their computer skill and confidence with the use of the system. This will also help them to solve some simple computer and software-related problems. Ultimately, this is likely to enhance users' positive reactions towards EMRs. Lium et al. (2006) suggested that factors such as computer skills, training, and a well-functioning system are necessary but not adequate for success.

Limitations of the study

The present study included receptionists from government primary healthcare centres only, which limits the generalisability of findings to secondary and tertiary care facilities. In addition, the survey instrument could have been broadened to encompass some other specific areas of user satisfaction with the EMR system.

Conclusion

This study showed that medical receptionists' satisfaction with EMR depends on ease of data input and reduced computer error frequency. Therefore, it is recommended that concerned decision makers ensure that technical help is available promptly, when required. This study provides a set of baseline data and some pointers to conducting future studies with larger samples from different sectors of healthcare. The findings should also help policymakers to recognise the causes of dissatisfaction with the EMR system among medical record receptionists that adversely affect its successful implementation, regular use, and quality of care at the clinics.

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