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ORIGINAL PAPER

Electronic Medical Records (EMR) and Nurses in Turkish Hospitals

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Abstract Electronic medical records (EMR) are generally used by nurses in hospitals. However, studies investigating views on and evaluations of EMR by nurses are limited in Turkey and in other countries around the world. In this study, nurses' views on EMR systems were investigated in terms of "Nursing care management", "Order entry", "Information Management", "Information quality", "Service quality", "Impact of EMR system on clinical care". The purpose of this study was to investigate the views/perceptions on EMR used by nurses working at hospital clinics in Turkey. The research questions were: (a) What are nurses' perceptions on EMR? (b) Were there relationships among nurses' perceptions on EMR? (c) Were there differences among nurses' perceptions on EMR according to hospitals in Turkey. This study is composed of field research conducted using questionnaires. To prepare the data-measuring instrument, the literature on EMR was reviewed. A Likert scale type was used in this questionnaire. The study was planned and conducted on nurses working at inpatient care units at four Turkish hospitals. At the end of this study, the questionnaire had been conducted on 517 nurses. Total response rate is 66.70 %. We found that the Information quality of EMR, impact of EMR system on clinical care and service quality were high level. Information quality has the highest mean score. EMR system is an important system for nurses' hospital has the highest mean score in this study. Nurses feel about impact of EMR system on clinical care that generally 'EMR system's usefulness', 'improving quality of information due to EMR system', 'improving quality of nurses' work', 'improving quality of information due to EMR system'. All of the six subscales of EMR were positively correlated with each other. This study revealed that there are significant differences among the mean scores for six

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subscales according to the ownership of hospitals. EMR systems were not well integrated into their workflow. In addition, half of all respondents had not been trained in using EMR systems. This study will added to evaluation views and assessments of nurses about EMR literature. The results will assist in determining "Information quality", "Service quality", of EMR, and "Impact of EMR system on clinical for nurses in Turkish health system". This survey suggests that nurses favor the use of an EMR and suggests opportunities for EMR enhancement.

Keywords Medical information systems · Information technology · Medical information records · Health informatics · Hospital information management

Introduction

The recent focus on health care quality improvement and cost containment has led some policymakers and practitioners to advocate the adoption of health information technology. One such technology is the electronic medical record (EMR) (Kazley and Ozcan 2007). The development of medical sciences has proved that information sciences, computer technology and communication technology have a great impact on the healthcare industry. In many hospitals, computers are in regular use by every layer of the administrative and clinical departments (Shortliffe and Cimino 2006). EMR is the most frequently used system because it's the core of the hospital information system, clinical information management and medical informatics (Jha et al. 2009, 2010; Li et al. 2012). Clinicians, health and information administrators, policy makers, payers, and researchers have reported upon and debated the potential impact (quality, patient safety, efficiency, patient satisfaction, performance etc.) of EMR use on the health care systems (Kazley et al. 2011).

EMR is a computerized record of clinical, demographic and management information. EMR systems are an enabling technology that allows physicians to utilize quality improvement processes in the practice of medicine. EMRs are an encompassing and complete process (Howard 2009; Barnette 2009). Other terms used to describe EMR include hospital information system, computerized system, and computerized physician order entry system. The EMR is defined as a new technology in the health and hospital information field where clinical, demographic, and management information is entered in a computerized record. The health care industry has learned from other industries that computers facilitate the speed of communication, accuracy of information, capacity for information storage, data retrieval, and date revision. Leaders in the health care industry are developing computerized clinical record systems to manage the huge volume of clinical, administrative, and regulatory information in contemporary health care. These systems are also viewed as a way of reducing the rate of medical error, complying with regulatory audits, and improving quality (Farsi and West 2006).

There are many examples within the literature of organizational experiences with implementation of various types of EMR, clinical information system, or other related healthcare technology (Wolf et al. 2006). Organizations that implement EMR expect to realize benefits such as reduced errors and enhanced patient safety from EMR. Wolf identified four guiding principles for implementation of EMR: improved quality of care, physician, nurse and clinical champions, sound technology decision processes, and communication (Wolf et al. 2006).

The EMR system is the most frequently used system in hospital, and it matches the medical process best. If the EMR can cover the whole treatment, patient care and obtain all

the information needed, it can manage the medical process automatically and provide materials for the hospital managers, nurses and doctors to analyze and make clinical and administrative decisions. In this way EMR can help doctors, nurses and hospital managers to manage the whole medical process and improve the quality of medical services by analyzing the results (Li et al. 2012).

In Turkey, as the basic level of fundamental rights and freedoms, ensuring right of life and maintaining physical and mental healthy life by Government to an individual is under our Constitution. In order to fulfill this duty by Government properly, it is required that necessary arrangements shall be done to provide health care services more effectively and to allow citizens to benefit from health services in the maximum way by improving access to health care services. The Ministry of Health providing a service in accordance with the scope of this constitutional right, has carried out health transformation program (HTP) so as to provide (human) patient-centered health care services since 2003 (Akdağ 2008).

HTP is searching for a solution to overall concerns and structural unqualifications such as public health insurance, accession to health care services and the service quality, improving information management, and hospital information systems of Turkish health system (Akdağ 2008; Turkish Ministry of Health 2010). A information management priority for Turkey has been the creation and establishment of the major health information systems of the Ministry of Health, Turkey, namely, the Saglik-Net (Turkish for "Health-Net"), the National Health Information System (NHIS), the Family Medicine Information System (FMIS), the Centralized Hospital Appointment System (CHAS) and the Core Resources Management System (CRMS), clinical decision support systems, electronical medical and patient records systems (Doğaç et al. 2010).

Nurse perceptions about EMR were examined in multiple studies. Some common themes identified are concerns about impact on nurse workflow and impact on patient outcomes, patient safety, satisfaction, efficiency. Kossman and Scheidenhelm (2008) studied the impact of EMR on nurse job performance and patient outcomes. The authors conducted a descriptive qualitative study using the nursing role effectiveness framework. The study included 46 subjects from a convenience sample of nurses at two affiliated sites using the same EMR system for at least six months. The themes that emerged from this study demonstrated that EMR has effects on nurses' role. Some effects are perceived as positive (increased access to information, increased efficiency and improved organization) while others were considered to have a negative (slowing nurses down, decreased time with patients, limited critical thinking, and limited communication) effect on nurses' role. Nurse perceptions of EMR also consider the impact of EMR on the quantity of time spent with patients and influence nurse attitudes regarding service quality (Wakefield et al. 2007).

The most recent studies on EMR in hospitals have focused on physician perceptions in the primary care arena (Hippisley-Cox et al. 2003; Karsh et al. 2004). EMR systems continue to grow in popularity within the health care industry. It was necessary to determine, investigate and analyze the impact on the practice of the registered nurse in hospitals and nurses' perceptions on EMR systems (Baron et al. 2005).

The literature suggested future research was required on EMR on other health care professionals (especially nurses). Nurses' views on and perceptions about the use, quality and user satisfaction, impact on clinical care, service quality, Information quality of EMR have not been as widely as investigated. The evaluation of EMR systems from the user viewpoint, and especially that of nurses, has received little attention. Moreover, nurses' views and evaluations of EMR in the Turkish hospital sector have not been widely investigated and analyzed. Therefore, we think that this study will be original for the

Turkish health care system and hospital information management. This study is the first study on the nurses' perceptions of "Nursing care management", "Order entry", "Information Management", "Information quality", "Service quality" of EMR, and "Impact of EMR system on clinical care" in Turkish hospitals. Further research exploring the specific aspects of EMR systems that contribute to user satisfaction is necessary to aid successful future development and implementation of effective computerized record systems. The results will assist in determining "Information quality", "Service quality", of EMR, and "Impact of EMR system on clinical for nurses in Turkish health system". This research focused on the registered nurses' perceptions of the specific aspects of the EMR that enhanced the patient care delivery by the nurse in four Turkish hospitals. The research questions were listed below:

- Research Question (RQ) 1. What are the nurses' perceptions on EMR?
- Research Question (RQ) 2. Were there relationships among nurses' perceptions on EMR?
- Research Question (RQ) 3. Were there differences among nurses' perceptions on EMR according to hospitals in Turkey?

Following sections will explain literature review, method, results and discussion.

Literature Review

EMRs were an integral component in the transformation of the health care industry (Chaudhry et al. 2006; Lee 2007). EMR systems are starting to be used in hospitals throughout the world (Fung et al. 2004; Likourezos et al. 2004). Electronic patient records (EPRs) are expected to have a great impact on healthcare practice in the years to come (Goorman and Berg 2000). EMR systems are used commonly as a useful means of improving the efficiency and quality of health care. EMRs have significant potential to improve patient safety, patient satisfaction, organizational efficiency and information security as well as to reduce medical care costs, (Mekhijian et al. 2002; Fung et al. 2004; Walsh 2004; Pizzi et al. 2005), thereby potentially improving health outcomes for patients (Pizzi et al. 2005). Although EMRs have been implemented in many hospitals and healthcare providers benefit from their effective and efficient data processing, their evaluation has received little attention from nurse users who provide 24-h patient care (Otieno et al. 2007). According to an influential report by the US Institute of Medicine, electronic patient records (EPR) are "an essential technology for health care today and in the future" because EPRs will lead to a higher quality of health care, increase the scientific basis of medicine and nursing, and reduce health care costs (Kazley et al. 2011; Li et al. 2012; William and Boren 2008). An immediate benefit of the use of EMRs, these authors argue, is the increased accessibility of the patient record. Healthcare providers who want information are no longer limited by the boundaries of wards and time because the record is always available from different places. Moreover, an EPR is more structured and more readable than a paper record, which facilitates information retrieval (Goorman and Berg 2000).

Since the advent of EMR systems, the adoption of this technology continues to progress rapidly within the healthcare industry. This new technology reshapes healthcare at all levels of the industry, especially nursing (Bates 2002). Since this technology first became popular, nursing professionals have used computer systems in patient care (Lee 2000; Lee et al. 2005). Both medical secretaries and nurses are important users of hospital

information systems, utilizing both the EMR and the administrative part of the system. The medical secretaries work as transcriptionists, receptionists and coordinators of patient logistics and communication, and the nurses have their own documentation and administrative routines. The elimination of paper-based medical records is a radical change in the work routines of those who work in the hospital organization (Laerum et al. 2001).

EMR are intended to support medical and nursing staff in their daily work, patient care by means of electronic data processing (Burkle et al. 2001; Likourezos et al. 2004). In general, nurses seem to share these positive expectations about EMR (Goossen 1996). The majority of nurses believe that the EMR will make their work easier (Ngin et al. 1993). Similarly, nurses hope that the use of computerized technology (such as EMR systems) will help improve their professional status (Axford and Carter 1996). More specifically, it is felt that computerization might help nurses make the high level of their skill and the complexity of their activities more visible, allowing them to attain a level of systematization of nursing knowledge (Goorman and Berg 2000).

Nurse perceptions about EMR were examined in multiple studies. Some common themes identified are concerns about impact on nurse workflow and impact on patient outcomes. Kossman and Scheidenhelm (2008) studied the impact of EMR on nurse job performance and patient outcomes. The authors conducted a descriptive qualitative study using the nursing role effectiveness framework. The positive effects of EMR included: increased access to information, increased efficiency, and improved organization (Kossman and Scheidenhelm 2008). The effects of EMR reported as hindering nurses' role included slowing nurses down, decreased time with patients, limited critical thinking, and limited communication. The limited critical thinking was attributed to check box charting, while limited communication was due to members of the care team not reading entries in the EMR written by other disciplines. (Kossman and Scheidenhelm 2008; Howard 2009).

Nursing, as a profession, offers an important link in the chain of patient care and health services because nurses are often identified as both coordinators and providers of patient care and health services (Van Bemmel and Musen 1997). Nurses attend to the whole patient, including psychosocial, somatic and spiritual needs. They are the largest proportion of healthcare professionals and interact most with EMR systems due to the nature of their work. They make nursing diagnoses (Lee et al. 2002), check physician orders (Roemer et al. 2005), write nursing care plans (Lee 2004), record vital signs, and sometimes transcribe physician orders (Aronsky and Haug 2000).

The review of the literature reflects an increase in numbers of healthcare organizations especially hospitals that have implemented or soon will be implementing EMR and other electronical information applications (Kossman and Scheidenhelm 2008; Wakefield et al. 2007). Information and lessons learned from those organizations/hospitals that have completed EMR implementation should be utilized to influence the implementation at future sites. Positive nurse perceptions about EMR will influence speed and ease of acceptance and utilization of EMR. The degree of nurse self-efficacy with EMR or other healthcare technology will have a significant impact on the success of EMR implementation in health systems (Dillon et al. 2003).

Method

This study was a nonexperimental, quantitative and descriptive study based on a questionnaire conducted and planned in four hospitals in the Turkish health system.

Data Collection

This study was a nonexperimental study conducted and planned in four hospitals in the Turkish health system. The study was planned and conducted on nurses working at inpatient care units at one public university hospital, one Turkish Ministry of Health hospital and one private hospital in Kocaeli, one public university hospital in Ankara. The EMR systems in these hospitals include access to all internally generated notes, reports, lab values, and scanned documents. All outside documents and letters are scanned and added to the EMR. An electronic messaging system is also incorporated into the EMR. Workstations were installed in all exam rooms, nursing stations, and offices. The EMR systems in all four hospitals have similar modules (notes, reports, lab values, and scanned documents, statistics etc.) in general. However, the university hospitals have a more advanced EMR system than the public and private hospitals.

A sampling technique was not used because we intended to conduct the questionnaire among all 517 nurses who work in inpatient care units at the four hospitals. The questionnaire was given to supervisor nurses in the departments (clinics) to distribute to the nurses in their departments. At end of this study, the questionnaires had been conducted between May and June 2010 in Kocaeli and Ankara.

The response rate was calculated to be 66.70 %. 517 survey forms were evaluated. Table 1 displays the number of nurses working at clinics in each hospital and the response rates for each hospital.

Instrument/Questionnaire

Self-administered questionnaires can provide great insight into understanding the use, quality and user satisfaction associated with EMR (Otieno et al. 2007). Based on a thorough review of the literature investigating the use, quality and user satisfaction of EMR, a 40-item questionnaire was developed to measure three constructs (system quality, usage and user satisfaction) grouped into three main sections: extent of usage of EMR, quality of EMR and user satisfaction. The studies of Laerum et al. (2001), Fung et al. (2004), Laerum and Faxvaag (2004), Likourezos et al. (2004), Pizzi et al. (2005), Farsi and West (2006), Joos et al. (2006), Otieno et al. (2007), Kossman and Scheidenhelm (2008), Barnette (2009), and Howard (2009) were particularly useful in formulating the initial items depicting the use of, quality of and user satisfaction with EMR. A Likert scale type was used in this questionnaire. Responses for "Nursing care management", "Order entry", "Information Management" were assigned a value of 1–5 ('never/almost never/not at all' to 'always/almost always') for each item. Responses for "Information quality", "Service

Table 1 Response rates by the hospitals

Hospitals	Number of nurses in clinics	Response number	Response rate (%)
University Hospital in Koaceli	160	96	60.00
The Ministry of Health Hospital in Kocaeli	105	68	64.76
Private Hospital in Kocaeli	60	36	60.00
University Hospital in Ankara	450	317	70.44
Total	775	517	66.70

quality", "Impact of EMR system on clinical care" were assigned a value of 1–5 ('not at all', to 'very great') for each item. All survey items and subscales for EMR was showed in Table 4.

A pilot study was done for 50 nurses from different departments to minimize bias and to standardize the survey questionnaire. The reliability statistics of the survey showed a high rate of Cronbach's alpha (93.5 %) for all 40 questions. Moreover, Cronbach's alphas for the subscales of EMR system are higher than .88. All survey items and subscales of EMR system have high reliability scores.

Data Analysis

Responses from the completed questionnaires were entered into a computer. Data were analyzed using the Statistical Package for Social Sciences (SPSS 15.0). Negatively worded items in the questionnaire were reverse scored so that higher values indicated more positive scales. Negatively worded items were "How often is the system subject to frequent system problems and crashes?", "Does the lack of staff computer skills impede the use of the EMR system?", and "Are enough workstations available for use by nurses?" The means for items and subscales of questionnaire were computed. The questionnaire items were summarized by the use of descriptive statistics, using valid percentages for all interval scale variables and using the arithmetic mean as a central tendency measure. Descriptive statistics were used for analyzing Research Question 1, Spearman correlation test was used for analyzing Research Question 2, and Kruskal–Wallis (a non-parametric test) test was used for analyzing Research Question 3. Also, Cronbach Alpha test was used for analyzing reliability of questionnaire. A probability value of less than .05 was considered significant.

Results

Table 2 shows some characteristics of nurses in terms of hospitals, education level, age, and length of tenure.

All respondents were female, 148 (72 %) were aged between 24 and 42 years old, and 51.8 % of nurses held bachelor's degrees; The majority of participants (79.88 % of 517

Table 2 Some characteristics of nurses ($n = 517$)

Characteristics	Frequency	Percentage (%)
Hospitals		
University Hospitals	413	79.88
The Ministry of Health Hospital	68	13.15
Private Hospital	36	6.97
Education status		
High school	249	48.16
Bachelor and higher	268	51.84
	Mean	Standard deviation
Length of tenure	5.34	4.62
Age	29.56	5.82

nurses) were from the public university hospital, 68 were from the public general hospital, and 36 were from the private hospital. This group had a median of 8 years in practice and a median of 4 years at their current hospitals at the time of the study. Mean age is 29.56.

Table 3 depicts descriptive statistical values for EMR according to Nursing care management, Order entry, Impact of EMR system on clinical care, Information quality, Service quality, and Information Management. The means for Information quality, Service quality, Impact of EMR system on clinical care are high level. Information quality has the highest mean score (3.61).

Table 4, for Research Question 1, depicts descriptive statistical values for all survey items of EMR system. Generally nurses have positively assesements on items for impact of EMR system on clinical care, services quality, Information quality, Information Management and Nursing care management. However nurses sometimes have negatively assessments about order entry in EMR system. Because the mean scores for items of order entry are lower than other mean scores for items of subscales of EMR system's subscales. EMR system is an important system for nurses' hospital has the highest mean score (4.21) in this study. Nurses in this study feel about impact of EMR system on clinical care that generally 'EMR system's usefulness', 'improving quality of information due to EMR system', 'improving quality of nurses' work', 'improving quality of information due to EMR system'.

Nurses were somewhat less positive towards the EMR systems in terms of the quality of information than on their impact on clinical care and patient safety, their performance, and the quality of their work.

Table 5, for Research Question 2, presents the results of the Spearman's correlation analysis for relationships among Nursing care management, Order entry, Information Management, Information quality, service quality, and impact of EMR system scores. Significant correlations were found among these subscales. The correlation analysis revealed the highest significant correlation between Nursing care management and Order entry scores ($r = .781$; $p < .01$). All of the six subscales were positively correlated ($p < .01$) with each other. Impact of EMR system on clinical care has the strongest intercorrelation with information quality ($r = .489$; $p < .01$).

Table 6, for Research Question 3, shows levels of "Nursing care management", "Order entry", "Information Management", "Information quality", "Service quality", "Impact of EMR system on clinical care" according to the hospitals where this study was conducted. We found that mean scores for "Nursing care management", "Order entry", "Information Management", "Information quality", "Service quality", "Impact of EMR system on clinical care" diffiriate significantly in terms of the hospitals where this study was planned. Generally mean scores for University Hospital in Ankara are higher than than the other hospital's mean scores.

Table 3 Descriptive statistics for subscales of the EMR system

Dimensions of EMR	Mean	Standard deviation	Range	Minimum	Maximum
Nursing care management	2.92	1.41	4.00	1.00	5.00
Order entry	3.12	1.19	4.00	1.00	5.00
Information management	3.26	1.11	4.00	1.00	5.00
Information quality	3.61	.82	4.00	1.00	5.00
Service quality	3.49	.79	4.00	1.00	5.00
Impact of EMR system on clinical care	3.53	.52	3.25	1.75	5.00

Table 4 Descriptive statistics for all survey items of the EMR system

Items of the EMR system	Mean	Standard deviation
Nursing care management		
Reviewing the patients problems	2.81	1.55
Entering daily nursing care notes	3.08	1.66
Capturing patient observations at the bedside	3.09	1.62
Writing nursing care plans	3.41	1.59
Writing nurse care worksheets (Kardex)	3.09	1.57
Collecting patients info for discharge reports	3.24	1.36
Documenting physical assessment of patients	3.36	1.38
Frequency of use of order entry		
Obtaining information on investigation or treatment procedures	2.98	1.59
Obtaining the results from new tests or investigations	2.90	1.65
Answering questions concerning general medical knowledge (concerning treatment, symptoms, complications, etc.)	2.95	1.51
Obtaining results of tests and investigations	3.07	1.69
Checking drug information (such as allergy and interactions)	3.11	1.69
Information management		
Seeking out specific information from patient records	2.81	1.55
Produce data reviews for specific patient groups, e.g. complication rate, diagnoses, etc	3.40	1.41
Giving written individual information to patients, e.g. about medications, disease status	3.24	1.40
Information quality		
Degree of EMR system'providing the precise information you need	3.57	1.08
Degree of EMR system's meeting your information needs	3.62	1.08
Degree of EMR systems's provideing reports that seem to be just exactly what you need	3.75	1.05
Degree of EMR system's providing sufficient information	3.51	1.13
Degree of EMR system's accuracy	3.60	1.11
Degree of satisfaction with the accuracy of EMR system	3.73	1.02
Degree of thinking the output is presented in a useful format	3.69	1.05
Degree of information clearance	3.54	1.05
Degree of EMR system's user-friendship	3.53	.99
Degree of getting the information you need in time	3.80	.97
Degree of EMR system's provide up-to-date information	3.50	1.14
Service quality		
Degree of counting on the system to be up and available	3.42	1.17
Degree of EMR system's problems and crashes	3.27	1.17
Impact of EMR system on clinical care		
Degree of feeling EMR system's usefulness	3.73	1.22
Degree of improving nurses' performance due to EMR system	3.37	1.20
Degree of improving quality of nurses' work	3.66	1.01
Degree of feeling EMR is worth the time and effort required to use it	3.66	1.07

Table 4 continued

Items of the EMR system	Mean	Standard deviation
Degree of feeling improving quality of information due to EMR system	3.65	1.02
Degree of feeling EMR system has been successful in your hospital	3.89	.91
Degree of feeling EMR system is an important system for your hospital	4.21	.78
Degree of training in using EMR systems	3.21	1.27
Degree of computer Workstation's deranging your workflow	3.17	1.24
Degree of impeding of the lack of staff computer skills the use of EMR system	3.18	1.21
Degree of workstations' availability for use by nurses	3.16	1.09
Degree of well integrating computerized documentation into the workflow	3.50	1.10

Table 5 The correlations between subscales for the EMR system

Dimensions of EMR		Nursing care management	Order entry	Information management	Information quality	Service quality	Impact of EMR system on clinical care
Nursing care management	*r*	1.000					
	p	–					
Order entry	*r*	.781**	1.000				
	p	<.0001	–				
Information management	*r*	.593**	.700**	1.000			
	p	<.0001	<.000q	–			
Information quality	*r*	.529**	.584**	.595**	1.000		
	p	<.0001	<.0001	<.0001	–		
Service quality	*r*	.281**	.306**	.409**	.483**	1.000	
	p	<.0001	<.0001	<.0001	<.0001	–	
Impact of EMR system on clinical care	*r*	.313**	.359**	.387**	.489**	.459**	1.000
	p	<.0001	<.0001	<.0001	<.0001	<.0001	–

** Correlation is significant at the .01 level (2-tailed)

Discussion

This research focused on the registered nurses' perceptions of the specific aspects of the EMR that enhanced the patient care delivery by the nurse in four Turkish hospitals. The results of this research can measure Nursing care management, Order entry, Information Management, Information quality, Service quality, Impact of EMR system on clinical from the viewpoints of nurses in four hospitals in the Turkish hospital industry. At the end of this study, we found that the average score for Nursing care management was 2.92, for Order entry was 3.12, for Information Management was 3.26, for information quality was 3.61, for service quality was 3.49, and for impact of EMR system on clinical care was 3.53. There are significant relationships among the subscales of EMR systems. Nurses'

Table 6 Dimensions of EMR systems according to hospital ownership status

Dimensions of EMR	Hospitals	*n*	Mean	Standard deviation	Chi-square	*p*
Nursing care management	Ministry of Health Hospital in Koaceli	68	1.56	.70	294.617	<.0001*
	University Hospital in Kocaeli	96	1.36	.75		
	Private Hospital in Kocaeli	36	1.80	1.12		
	University Hospital in Ankara	317	3.80	.90		
Order entry	Ministry of Health Hospital in Koaceli	68	2.10	.95	180.533	<.0001*
	University Hospital in Kocaeli	96	2.22	.91		
	Private Hospital in Kocaeli	36	2.54	.87		
	University Hospital in Ankara	317	3.68	.98		
Information management	Ministry of Health Hospital in Koaceli	68	3.05	.91	59.480	<.0001*
	University Hospital in Kocaeli	96	2.64	1.04		
	Private Hospital in Kocaeli	36	2.96	.84		
	University Hospital in Ankara	317	3.53	1.10		
Information quality	Ministry of Health Hospital in Koaceli	68	3.25	.86	98.401	<.0001*
	University Hospital in Kocaeli	96	3.03	.87		
	Private Hospital in Kocaeli	36	3.43	.62		
	University Hospital in Ankara	317	3.88	.68		
Service quality	Ministry of Health Hospital in Koaceli	68	3.78	.89	37.035	<.0001*
	University Hospital in Kocaeli	96	3.05	1.01		
	Private Hospital in Kocaeli	36	3.30	.76		
	University Hospital in Ankara	317	3.59	.62		
Impact of EMR system on clinical care	Ministry of Health Hospital in Koaceli	68	3.52	.45	18.388	<.0001*
	University Hospital in Kocaeli	96	3.34	.54		
	Private Hospital in Kocaeli	36	3.47	.40		
	University Hospital in Ankara	317	3.59	.53		

* Significant difference

assessments and perceptions about the six subscales (Nursing care management, Order entry, Information Management, Information quality, service quality, and impact of EMR system on clinical care) significantly variate according to hospitals in Turkey.

Overall, we found that nurses positively perceive the EMR as helpful in their daily work in their hospitals. Nurses reported that entering, accessing, and reading data is easy with the EMR and that the EMR will likely eliminate a lot of paperwork and improve their ability to monitor patient progress and decrease their workload. The nurses also feel that they are currently able to finish work much faster as compared to the previous paper and pen system in their hospitals.

Our survey covered only nurses' views on the use, quality and user satisfaction with EMR systems, but other healthcare workers (especially doctors) also use the EMR systems. The major limitation to this study is that it consists of findings from four hospitals in Turkey, with a low nurse response rate, and at one particular point in time. Thus, the results

could be quite biased in reflecting the opinion of these very few respondents (Cook and Campbell 1979). Our study results cannot be generalized to all nurses in the Turkish hospital sector. Self-reporting carries a risk of misinterpretation and bias, even when "value-neutral" behavior is investigated. The study was conducted as a retrospective descriptive study, which may have limited the accuracy of some survey responses. The other limitation is that the three hospitals at which the study was planned and conducted do not have identical EMR systems; rather, the university hospital has a more advanced EMR system than do the public and private hospitals.

The results of this study indicated that nurses perceived that the EMR impacted nurse workflow and performance in multiple ways. Nurses perceived that overall, the EMR made their nursing job easier, improved their ability to make important patient care decisions, allowed them to have improved access to patient information, and allowed them to spend less time communicating with other members of the patient care team. Kossman and Scheidenhelm (2008) reported similar findings in terms of nurses' perceptions of EMR in nursing work. The study results indicated that nurses thought that EMR had a significant impact on patient safety, performance, productivity, quality and communication. Nurses perceived that the EMR enhanced their ability to practice in a way that increased patient safety. Nurses also perceived that patient safety related to medication administration was enhanced by the implementation of the EMR. These results are consistent with literature related to perceptions on EMR (Denny et al. 2005; Dillon et al. 2003; Wolf et al. 2006; Lee 2007; Howard 2009).

There are a number of studies relevant to our research and the results of our study. The studies consistent with our results are summarized below. These results of our study are consistent with previous studies examining the attitude of nurses towards the use, quality, effectiveness (Chaudhry et al. 2006), user satisfaction, and improved work performance (Likourezos et al. 2004) as a result of computerization and EMR in health care (Kirshbaum 2004; Likourezos et al. 2004; Otieno and Hosoi 2005; Farsi and West 2006; Joos et al. 2006). A large majority of the nurses in the Howards' study ($n = 221$, 89.5 %) perceived that the EMR increased patient safety with medication administration. The majority of the nurses ($n = 185$, 75.5 %) perceived that the EMR improved the quality of patient information in the patient record. Nearly all nurses in the study ($n = 238$, 97.1 %) perceived that the EMR improved the legibility of patient information. The majority ($n = 160$, 64.8 %) also agreed that the EMR increased patient safety via improved communication among members of the patient care team (Howard 2009).

Darr et al. (2003) showed that the nurses identified use of the EMR as good for quality of care and administration of patient care. Sitting et al. (1999) revealed that overall satisfaction was moderately correlated with screen design and layout but not with the system response time. Laerum et al. (2001) compared the use of three EMR systems by doctors in Norwegian hospitals for general tasks. The user satisfaction scale consisted of five factors: content, accuracy, format, ease of use and timeliness. The results revealed a low level of use of all three EMR systems by physicians because of a lack of available computers and insufficient computer literacy. A study conducted by Miller and Sim (2004) identified barriers to physician use of EMR that included high financial cost, slow and uncertain financial payoffs, and high initial time costs. Underlying barriers included difficulties with technology, support, electronic data exchange, financial incentives, and physician attitudes. Finally, a study was done by Q. Ayyad (2002) regarding nursing satisfaction with computerized nursing records in a hospital. The study examined staff nurses with at least three years of experience. The results revealed that staff nurses were satisfied with the computer

system (including the EMR), had received adequate training and found that the system improved productivity in the patient care setting.

Based on our results, the following recommendations are made for further research. First, assuming that time saved in charting could be applied to patient care, patient outcome variables such as length of stay or patient satisfaction could be considered as dependent variables. In addition, as one of the purposes of using the EMR systems is to give clinicians and nurses immediate data for decision-making, variables related to critical thinking or problem-solving ability deserve further study. Lastly, factors related to organizational culture, such as learning environment and peer/managerial support, could affect nurses' and doctors' adoption of computer use and EMR use. In the future, the views of doctors, nurses and other health personnel on the use, quality, effectiveness, and user satisfaction of EMR systems in the Turkish health sector may be investigated by health managers and health management academicians. Further work needs to be done with various EMR systems and various personnel in multiple settings.

In deciding what EMR systems to develop and deploy for nurses and doctors in developing countries, promising ideas are not enough; these ideas need to be validated in the field (Fraser et al. 2005). It is important to look closely at EMR systems that have been successfully deployed in challenging environments, as well as any available evaluation data. Specific outcomes should be measured, such as time to change patient management in response to new laboratory results and better monitoring of patient compliance (Rotich et al. 2003). There is some evidence of benefit to patient care from access to communication, including the use of telemedicine consultations to improve diagnostic accuracy and reduce unnecessary patient transfers (O'Mahony et al. 2002; Stormo et al. 2004). Improvements in drug supply management using medication data from EMR systems could offer the most measurable cost benefits at present; a well-managed drug supply also improves the availability and quality of patient care (O'Mahony et al. 2002; Stormo et al. 2004).

This study has helped identify several opportunities for hospital leadership and human resources (especially nursing human resources) management and clinical information management. The data generated by this survey identify important implications for medical managers, nurses and people who work in the university and private hospitals and Ministry of Health in Turkey in terms of the introduction and implementation of other technical or administrative innovations in EMR. We suggest that EMR systems in Turkish hospitals should be standardized.

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Appendix 1

An example questionnaire form

Items of the EMR system	1	2	3	4	5
To what extent do you use the EMR system for each of the following tasks?					
Nursing care management	1				5
	Never/almost never/not at all				Always/ almost always
1. Reviewing the patients problems					

Appendix continued

Items of the EMR system	1	2	3	4	5	
2. Entering daily nursing care notes						
3. Capturing patient observations at the bedside						
4. Writing nursing care plans						
5. Writing nurse care worksheets (Kardex)						
6. Collecting patients info for discharge reports						
7. Documenting physical assessment of patients						
Frequency of use of order entry						
8. Obtaining information on investigation or treatment procedures						
9. Obtaining the results from new tests or investigations						
10. Answering questions concerning general medical knowledge (concerning treatment, symptoms, complications, etc.)						
11. Obtaining results of tests and investigations						
12. Checking drug information (such as allergy and interactions)						
Information management						
13. Seeking out specific information from patient records						
14. Produce data reviews for specific patient groups, e.g. complication rate, diagnoses, etc						
15. Giving written individual information to patients, e.g. about medications, disease status						
In your hospital, to what extent						
Information quality	1					5
	Not at all					Very great
16. Degree of EMR system'providing the precise information you need						
17. Degree of EMR system's meeting your information needs						
18. Degree of EMR systems's provideing reports that seem to be just exactly what you need						
19. Degree of EMR system's providing sufficient information						
20. Degree of EMR system's accuracy						
21. Degree of satisfaction with the accuracy of EMR system						
22. Degree of thinking the output is presented in a useful format						
23. Degree of information clearance						
24. Degree of EMR system's user-friendship						
25. Degree of getting the information you need in time						
26. Degree of EMR system's provide up-to-date information						
Service quality						
27. Degree of counting on the system to be up and available						
28. Degree of EMR system's problems and crashes						
Impact of EMR system on clinical care						
29. Degree of feeling EMR system's usefulness						
30. Degree of improving nurses' performance due to EMR system						
31. Degree of improving quality of nurses' work						

Appendix continued

Items of the EMR system	1	2	3	4	5
32. Degree of feeling EMR is worth the time and effort required to use it					
33. Degree of feeling improving quality of information due to EMR system					
34. Degree of feeling EMR system has been successful in your hospital					
35. Degree of feeling EMR system is an important system for your hospital					
36. Degree of training in using EMR systems					
37. Degree of computer workstation's deranging your workflow					
38. Degree of impeding of the lack of staff computer skills the use of EMR system					
39. Degree of workstations' availability for use by nurses					
40. Degree of well integrating computerized documentation into the workflow					

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