ZKÜ Sosyal Bilimler Dergisi, Cilt 6, Sayı 12, 2010, ss. 37–65
ZKU Journal of Social Sciences, Volume 6, Number 12, 2010, pp. 37-65

EVALUATION OF AN ELECTRONIC MEDICAL RECORD SYSTEM: ZONGULDAK KARAELMAS UNIVERSITY HOSPITAL SURVEY*

Doç.Dr. Erkan ERDİL
Ortadoğu Teknik Üniversitesi
İktisadi ve İdari Bilimler Fakültesi
erdil@metu.edu.tr

Prof.Dr. Suat Hayri UĞURBAŞ
Zonguldak Karaelmas Üniversitesi
Tıp Fakültesi
shugurbas@yahoo.com

Doç.Dr. Ali Sait ALBAYRAK
Zonguldak Karaelmas Üniversitesi
İktisadi ve İdari Bilimler Fakültesi
asalbayrak@gmail.com.tr

ABSTRACT

This study investigated the electronic medical record system (EMR) of Zonguldak Karaelmas University Hospital which is in use for the last six years. The recommendations for the development of EMR and more efficient use of the system are principle goal of this study. The purposes of this study include promoting the implementation of EMR by introducing the advantages and disadvantages from the user's point of view.

While the successful applications of EMR systems are evident in western word, the implementation of EMR to a hospital information system is a new topic in Turkey. Some applications are mainly in the form of converting the paper-based medical record systems to the fully automated electronic record systems. Our study is a pioneering attempt to analyze the users' opinion for a fully integrated EMR system in a Turkish academic hospital. The suggestions such as restricting the access, improving the hardware, integrating to the internet are made for the improvement of the system in future.

***Keywords**: Electronic Medical Record, Hospital Information System, ZKU.*

BİR ELEKTRONİK TIBBİ KAYIT SİSTEMİ DEĞERLENDİRMESİ: ZONGULDAK KARAELMAS ÜNİVERSİTESİ HASTANESİ ANKETİ

ÖZET

Bu çalışma Zonguldak Karaelmas Üniversitesi Hastanesinde altı yıldır kullanılmakta olan elektronik tıbbi kayıt sistemini incelemektedir. Bu çalışmanın temel amacı, elektronik tıbbi kayıt sisteminin geliştirilmesi ve daha verimli kullanımı için önerilerde bulunmaktır. Kullanıcı görüşüne göre avantaj ve dezavantajlarını ortaya koyarak elektronik tıbbi kayıt sisteminin yaygınlaştırılmasını desteklemek bu çalışmanın amaçları arasında yer almaktadır.

Batı dünyasında başarılı elektronik tıbbi kayıt sistemi uygulamaları yerleşmekteyken elektronik tıbbi kayıtların bir hastane enformasyon sistemine uyarlanması Türkiye için yeni bir konudur. Uygulamalar genel olarak kâğıt kayıt sistemlerinin tam elektronik tıbbi kayıt sistemlerine dönüştürülmesi olmaktadır. Bu araştırma akademik bir hastanede tam otomatik bir elektronik kayıt sistemi için kullanıcıların görüşlerini inceleyen öncü bir çalışmadır. Sistemin gelecekte daha da iyileştirilmesi için erişimin kısıtlanması, donanımın güçlendirilmesi, internete açılım sağlanması gibi öneriler ortaya konulmaktadır.

***Anahtar Kelimeler**: Elektronik Tıbbi Kayıt, Hastane Bilgi Sistemi, ZKÜ.*

---

* Bu çalışma, 2006 yılında Erkan Erdil'in danışmanlığında Suat Hayri Uğurbaş tarafından hazırlanan ve ODTÜ Sosyal Bilimler Enstitüsü'nce Kabul Edilen "*Evaluation of An Electronic Medical Record System: Zonguldak Karaelmas University Hospital Survey*" adlı yüksek lisans tezinden üretilmiştir. Çalışmada, özellikle araştırma verilerinin düzenlenmesi, çözümlenmesi ve yorumlanması konularında Ali Sait Albayrak'ın önemli katkıları olmuştur.

1. INTRODUCTION

Our society is increasingly influenced by modern information and communication technology (ICT). Health care is also influenced from this technology. Hospital information systems (HIS) are in use for the last 25 years now. Hospital information systems process data, information and knowledge in health care environments.

The introduction of information technology to the health care began with administrative process. Medical applications were involved in the system by means of electronic medical records. Without having appropriate access to relevant data, it is impossible to make reliable decisions including diagnosis and treatment of patients. Approximately, 10% of the gross domestic products of nations are devoted to health care and approximately 5% to information and communication technology (Haux, 2006). There is a tendency to increase investments in health and in ICT, particularly in developed countries. Progress in the field of health information systems is directly correlated with increased quality and efficiency of care. HIS contributes to a high quality and efficient patient care.

There has been a tremendous shift from paper-based processing and storage to computer based processing and storage through the last decades (Haux et al., 2002). This shift had advantages such as higher functionality and better opportunities in using patient data and medical knowledge. It had also disadvantages such as technological complexity.

It is clear that, electronic medical record (EMR) systems have already become the preferred choice of new hospitals. Three major goals requiring this achievement have been identified by Haux et al (2002): patient-centered recording and use of medical data for cooperative care, process-integrated decision support through current medical knowledge, and comprehensive use of patient data for research and health care reporting.

However, we are still in a phase of transition from paper to electronic records. The broad attention to electronic medical records has resulted in the analysis of successful systems and the factors contributing their effectiveness (McDonald et al., 1999). The HIS were intended to support health care professionals, mainly physicians, nurses and administrative staff. Some studies have assessed physician and nurse satisfaction with an EMR (Likourezos et al, 2004).

2. OBJECTIVES AND METHOD

This study is designed to evaluate the use of Electronic medical record (EMR) system in Zonguldak Karaelmas University Hospital and to investigate the advantages and disadvantages of an EMR system in comparison with paper medical records based on the user's opinion. The recommendations for the development of EMR and more efficient use of the system are principle goals of this study.

The purposes of this study include promoting the implantation of EMRs by introducing the advantages and disadvantages from the user's point of view. The main source of information used in this analysis is gathered from a questionnaire. Not only

the physicians who are the main users of the system, but also the other hospital staff including nurses, clinicians, administrative clerks and technicians were included in this survey.

Zonguldak Karaelmas University Hospital Information System is a comprehensive, fully integrated electronic medical record system. It contains more than 130.000 separately coded patient charts. It can display the records for any of these patients from the computer terminals throughout the hospital by means of a security code required for each user identified to the system. There are approximately 450 entries to the system every day. 302 doctors (119 academicians and 183 resident doctors), 164 nurses, 82 technicians, 63 administrative clerks enter the system. It carries all of the medical and administrative data collected since October 2000, when the hospital started to accept patients. It meets IOM (Institute of Medicine, 1999) ideal of pure source data entry at all sites.

The records in all of these files are physically sorted by patient ID, observation ID, date and time. Recently it included ICD 10 codes for the diagnosis part as a requirement for the social security organization's payment rules in Turkey.

In the present web structure only the system administrator has access to the system. The risks of virus transmission to the system are avoided by an antivirus system. There are 2 servers with same qualifications. There is two 60 GBx10 ultra SCSI discs raid-5 working as mirror. In case of a technical error, switching to the second server is possible in 3 minutes. Back-up procedure is done as three times a day (8.00 am, 12.00 pm and 12.00 am) to the second server.

The system operates on 30-40 MB load daily. The configurations of main servers consist of four processors in speed of 1 GHz with 4 GB RAM and 60 GB hard disc.

The users' workstations work on a network of personal computers with a minimum speed of Pentium III Celeron 1.7 processor and hard discs with a capacity of minimum 20 GB and128 megabit RAM.

Communication from the central system is via 10 megabit Ethernet links to the user terminals. The fiber optic cables are used between the blocks of the building.

The Software for Zonguldak Karaelmas University Hospital EMR system is MS Windows 2000 and MS SQL Server 2000. The MS Windows 2000 Professional program is the software for the end-user terminals.

The questionnaire consisted of 29 items and was developed from a task-oriented questionnaire from a previous study (Laerum and Faxvaag, 2004). The general clinical tasks in the questionnaire items had been tested by physicians and found to be relevant and comprehensible.

English and Turkish versions of the questionnaire which was applied to the participants of the survey were given in Table 1-a and Table 1-b respectively. The questionnaire was divided into seven sections. The first section (A) includes check boxes for the position of responder in the hospital. The second section (B) includes 12 questions for the clinical tasks. The responder is asked for the frequency of EMR use

for them. The third section (C) includes 12 questions for the same clinical tasks in the second section. This time, the responders were asked to reply for the ease of performing each task when using EMR. The forth section (D) includes 4 questions about the satisfaction of users with the EMR. These questions review the content, format, ease of use and accuracy of the system. The fifth section (E) includes 5 questions for evaluating the advantages of EMR and fifth section includes 5 questions for evaluating the disadvantages of EMR. The sixth section (F) includes 2 questions about the time period spent for EMR use during daily activities. Lastly, the seventh section (G) includes 1 question for the general assessment of the EMR system. There are blank areas for additional comments in fourth and fifth section. At the end of survey, there is another blank area for overall view of EMR and survey itself.

The responses were divided in a Likert scale: strongly agree, agree, no idea, disagree, and strongly disagree (Babbie, 1990).

The questionnaire items were summarized by the use of descriptive statistics, using valid percentages for all interval scale variables and using arithmetic mean, mode or median as a central tendency measure. Comparisons were made between physicians (academicians and residents), nurses, technicians and administrative staff. Data analysis was performed with version 13 of the SPSS statistical program.

3. RESULTS

One hundred twenty six survey forms were evaluated. There were 27 academicians (having titles of associate professor, assistant professor), 22 resident doctors 33 nurses, 13 technicians and 27 administrative clerks (civil servants) who were participated to the survey.

Simple random sampling method is used for the survey. The participants included 21% (25/119) of the academicians, 12.7% (23/183) of the resident doctors, 20.1% (33/164) of the nurses, 15.7% (13/82) of the technicians and 41.2% (26/63) of the administrative clerks.

In this cross-sectional survey, we assessed the use and satisfaction of electronic medical record system among the users of Zonguldak Karaelmas University Hospital. Approximately twenty percent of the eligible users were included in the study.

The questionnaire used in this study was based on the previous work for the development of a task oriented questionnaire by Laerum and Faxvaag (2004). The authors suggested that the questionnaire may provide valid and reliable information about how an implanted EMR system was utilized on an overall level in clinical practice, and how well the system supports clinical tasks.

Four problems arose from the interviews with the participants of their survey. The first problem was the respondent's confusion for replying the tasks in which no functionality was offered. To eliminate this problem we preferred to include the items with clear functional tasks. The second problem was distinguishing EMR from the use of other software for clinical work. The authors suggested that just considering EMR use was easier for the respondent. Our questions were organized to evaluate EMR only. As a third problem, questions about tasks which were not completely supported by the

EMR system were found hard to answer. In our survey, all questions were related to the tasks that were completely supported by EMR. Lastly, distinguishing other employee's use of the system from one's own appeared as a problem in two tasks. These are entering daily notes (C02) and consultations from other departments (C07). Since the doctors enter the daily notes and request consultations themselves rather than with the help of a "transcriptionist" (Laerum & Faxvaag, 2004) these tasks did not cause a problem in our survey.

The reliability of the survey is measured with Cronbach's Alpha statistics. Cronbach's Alpha has several interpretations. It can be viewed as the correlation between this test or scale and all other possible tests or scales containing the same number of items which could be constructed from a hypothetical universe of items that measure the characteristic of interest. Cronbach's Alpha tells us how much correlation we expect between our scale and all other possible 41 item scales measuring the EMR system (Norusis, 1998). Note that the value of Cronbach's Alpha statistics, 92.2%, is large, indicating that our scale is quite reliable.

The coefficient of skewness for a variable less than 2 and coefficient of kurtosis for a variable less than 7 in absolute values show that variables are distributed normally (Fabrigar et al, 1999). According to skewness coefficient, all items except E01, E02, and E03 are symmetrically distributed in our survey. Other than E01, all items were distributed normally based on kurtosis coefficients.

In a frequency distribution of quantitative variables, if the frequency of a particular value has a relatively higher ratio compared to other values, mode can be used as appropriate measure of central tendency (Yamak and Köseoğlu, 2006).

The questions for use of medical record system are located in part B of the questionnaire (Table 1). The answers for the use of 12 tasks are evaluated in this section.

The answer to "review of problems" task (B01) is given as "in most of the occasions" and "always" by 81.3% of all the users (Table 2). The cross comparison of the answers showed that this task is mainly used by doctors (residents -academic staff) and nurses (Figure 1).

The answer to enter daily notes task (B02) is given as "in most of the occasions" and "always" by 64.9 % of the users (Table 2). The cross comparison of the answers (Figure 1C) showed that this task is mainly used by doctors (academic staff -residents) and nurses.

The answer to order laboratory tests (B03) is given as "always" by 42.9 % of the users (Table 2). The cross comparison of the answers (Figure 1) showed that this task is mainly used by doctors (academic staff -residents) and nurses. It is never or seldom used by 44.0 % of users (mainly civil servant, technician and nurses) (Figure 1).

The answer to obtain the results of laboratory tests (B04) is given as "always" by 61.10 % of the users (Table 2). The cross comparison of the answers (Figure 1) showed that this task is mainly used by doctors (academic staff -residents) and nurses

The answer to order radiological investigations (B05) is given as “always” and “most of the occasions” by 47 % of the users (Table 1). The cross comparison of the answers (Figure 1) showed that this task is mainly used by doctors (academic staff - residents). It is never or seldom used by 38.0 % of users.

The answer to obtain the results of radiological investigations (B06) is given as “always” and “most of the occasions” by 55.5 % of the users (Table 2). The cross comparison of the answers (Figure 1) showed that this task is mainly used by doctors (academic staff -residents) and nurses. It is never or seldom used by 41.3 % of users.

The answer to refer the patient to other departments (B07) is given as “always” and “most of the occasions” by 44.8 % of the users (Table 2). The cross comparison of the answers (Figure 1) showed that this task is mainly used by residents.

The answer to order treatments (B08) is given as “never” by 55.9 % of the users (Table 2). The cross comparison of the answers (Figure 1) showed that this task is mainly used by academic staff.

The answer to taking the treatment orders (B09) is given as “always” and “most of the occasions” by 51.4 % of the users (Table 2). The cross comparison of the answers (Figure 1) showed that this task is mainly used by nurses.

The answer to collect patient information (B10) is given as “always” and “most of the occasions” by 74.1 % of the users (Table 2). The cross comparison of the answers (Figure 1) showed that this task is mainly used by doctors (academic staff- residents) and nurses.

The answer to collect patient information for discharge reports (B11) is given as “always” and “most of the occasions” by 58.3 % of the users (Table 2). The cross comparison of the answers (Figure 1) showed that this task is mainly used by doctors (academic staff- residents).

The answer to register codes for diagnosis (B12) is given as “always” and “most of the occasions” by 52 % of the users (Table 2). The cross comparison of the answers (Figure 1) showed that this task is mainly used doctors (academic staff – residents).

The overall review of section B which consists of the questions for use of EMR in 12 clinical tasks is shown in Figure 1. According to the figure, all tasks have a high rate of acceptance (over 3) by the users accept tasks 5, 7 and 8. 8^{th} task (ordering treatment) is only used by doctors (academicians and residents). 7^{th} task (referring patients to other departments) and 5^{th} task (ordering a radiological investigation) are also used by doctors only.

Descriptive statistics showed that the mode of answers for the 12 tasks in section B (frequency of the EMR use) of the questionnaire were mostly 4 (frequently) and 5 (always) except the tasks 5, 7 and 8. Task 5 (to order radiological investigations), task 7 (consultation from other departments) and task 8 (giving the treatment orders) had a mode of 1 (never). These tasks are less frequently used by the system users in comparison with other tasks.

The questions about the ease of EMR use compared to paper record system are located in part C of the questionnaire (Table 1). The answers for 12 tasks (same as questioned in section B) are evaluated in this section.

Since these tasks are related with patient care, only the answers of doctors (both academic staff and resident doctors) and nurses are evaluated in this section. The answers given by the other groups are not taken into account.

The overall review of section C which consists of the questions for easy use of EMR in 12 clinical tasks compared to paper records is shown in Table 3 and Figure 2. According to the table all tasks are found to be "easy" and "very easy" by the majority of users. Task 8 (ordering treatments) is only used by doctors. Since the hospital is an academic facility, treatment orders are generally given by resident doctors. 95.5 % of the resident doctors found the task as "easy" and "very easy". Task 9 (taking the treatment orders) is only used by nurses. 96.4 % of the nurses found it "easy" and "very easy" (Table 3).

The median and mode for all questions of section C of questionnaire (ease of EMR use compared to paper records) were either 4 or 5. The answers for section C of the questionnaire were mostly 4 (frequently) and 5 (always). This implies that, the users found application of these tasks with EMR easier than with paper medical records (Table 3).

The questions about the satisfaction of users from the EMR system are located in part D of the questionnaire (Table 1). The answers to four questions are evaluated in this section.

The overall review of section D which consists of the questions for satisfaction with EMR use is shown in Table 4 and Figure 3. According to the figure first three questions have a high rate of acceptance (over 3.5) by the users. Fourth question (about the accuracy of the system) has a lower rate of acceptance. This may reflect dissatisfaction from the system accuracy. The computer may run slowly then expected.

The mode of answers to the questions of section D which is about the satisfaction of the users with EMR was 4 (frequently). This implies a general satisfaction of the users with the present EMR system.

Section E questions the advantages of EMR. An overview of section E is shown in Table 5 and Figure 4. The users were highly agreed with the advantages questioned. Slightly lower rate of last two items (ability to retrieve data for scientific research and restructuring for the necessities) may indicate that these items do not have priorities for all users of the system.

Section F questions the disadvantages of EMR (Table 1). The first question is whether the users are spending more time with EMR than with paper records. Table6 shows that 54.2 % of the users are disagree.

The second question of the section F is about the privacy of the patient information. 61.4 % of the users were agreed that the privacy of patient information was decreased with EMR (Table 6). This belief is more prominent in nurses groups (Figure 5).

The third question of the section F is about the safety of the records. 57.4 % of the users were agreed that it was difficult to maintain safety of records in EMR (Table 6). Interestingly, administrative clerks were more optimistic than other groups for the safety of records (Figure 5).

The fourth question of the section F is about the need for frequent adjustments in parallel with technologic developments. 59.8 % of the users were agreed that frequent adjustments in parallel with technologic developments were disadvantageous for EMR (Table 6).

The fifth question of the section F was about the possibility of breakdown or errors in computer system. 77.9 % of the users were agreed that possibility of breakdown or errors in computer system was disadvantageous for EMR (Table 6).

Section G questioned the period of time that was spent for using the system. The first question of section G was determining the time period to enter data for an individual task such as an examination, procedure, etc. 60.2 % of the users spent up to 25 % of time period for entering data for an individual task (Table 7).

The second question of section G was about the time period spent for using EMR in daily activities. 20.8 % of the users spent less than 10 % of daily working time. 32.7 % of the users spent 10-25 %. 24.6 % of the users spent 25- 50 % of their working time by using EMR and 21.8 of the users spent 50- 75 % of their working time by using EMR (Table 7).

Last section (H) of questionnaire was about overall rating of the EMR system in Zonguldak Karaelmas University Hospital. 65.1% of the users rated the system as good and perfect (Table 7). All groups had similar rates (Figure 6). The mode of answers for the overall evaluation of the system in section H was 4 (good). The users are generally satisfied with the system according to this result.

4. DISCUSSION

The EMR system of Zonguldak Karaelmas University Hospital is in use for six years. It is a fully automated hospital information system used by all health care personnel.

According to Schoeffel (2001) the paper record represents massive fragmentation of clinical information. The clinical tasks such as reviewing patient problems (C1), collecting patient information (C10) and collecting patient information for discharge reports are affected from the fragmentation of data.

The clerk registrars group has no consensus for disappearance of paper records. Their responds show a wide range of heterogeneity (Figure 4). The clerks are computer literates, but they do not take a specific education course to use the system. An education program may increase their efficiency of work with EMR.

Since they use the administrative part of records, the ability to see the patient data as a whole is not appreciated by them as well (Figure 4). To maintain the privacy and security of the records users were given access only to the part of the system that

they need to work on. This may explain the lower rate of response for this question in nurses and clerks group.

Denley and Smith (1999) described a large scale clinical information system in the secondary care sector. Access to individual patient records has been made the key to the system with this access being granted only when the member of staff's rights match a patient's current clinical contacts. Their approach seemed to be overly restrictive in secondary areas such as clinical audit according to O'Conor (1999). Because it may avoid sharing clinical information by reducing the amount of private information included. Sadan (2001) states that by giving individuals control over their medical data, both privacy protection and quality of information improvement.

The mode of answer to the first question of section F which is about the disadvantages of EMR was 5 (totally disagree). This question inquires whether the users are agreeing that they spend more time with EMR compared to the paper systems. It roots from the belief that entering the data to the computers were more difficult and time consuming than hand writing the paper records. The users were not agreeing that, using EMR took more time than using paper records. Since the younger generation of clinicians are increasingly more computer literate and more accepting of typing this response is not surprising (Rind & Safran, 1993). The structured data entry is often more time consuming than entering free text (Powsner et al, 1998). Since the free text is used in ZKU Hospital EMR system this may explain the positive view of users for EMR that is not time consuming compared to paper records in their opinion.

The mode of answer to the second question of section F which is about the disadvantages of EMR was 2 (partially agree). The users were partially agreed that the privacy of patient information was decreased. This finding implied the concerns about the privacy of patient records. The retrieval and access is much easier from electronic records than from hard copy records stored in the archives of care providing institutions (Etzioni, 1999). The Institute of Medicine also stressed on the systemic violation of privacy via authorized abuse. The authorized abuse meant the users' abuse of their access privileges. In ZKU hospital system users have full access to the records except psychiatric chart. Various users have access to the system such as laboratory technicians, pharmacist, secretaries etc. The authorized abuse might be possible in some occasions. For example someone who has access to the system can retrieve any information from a patient's medical chart. It is very difficult to avoid authorized abuse but the users' access to the system can be limited according to their position. They can be given permission only to the parts of the chart that they are using and making entries.

The users were partially agreed that it was difficult to maintain the security of records in EMR system. In an ideal EMR system, the user authorization should be specific. The patient information can be divided into fragments. Therefore, the patient data that the physician may access can be markedly different than patient data that the receptionist should access. The system administrator assigns the access levels.

The access logs to EMR are also problematic. It should be verified. HIPAA (Health Insurance Portability and Accountability Act) legislation (1996) requires that the clinic can provide patients with a list of who has seen their chart and which parts of their chart have been viewed (Mendoza, 2003). The current system of ZKU can not

verify the user who enters an individual patient's chart. Only the users who make a transaction such as ordering laboratory investigations, entering results can be identified by the system.

Poissant et al (2005) highlighted that a goal of decreased documentation time in an EHR project is not likely to be realized. But our survey showed that documentation time for clinical activities is reasonable. 54.3 % of the users were disagreed that using EMR was time consuming compared to paper records.

The twelve clinical tasks which are frequently used in EMR were asked for frequency and ease of use in different groups of hospital personnel. These twelve clinical tasks were mainly used by physicians and nurses. According to the survey, all tasks except "taking treatment orders" (B09) were most frequently used by physicians. The "ordering treatment" task is most frequently used by residents. This is obvious from the work model of the hospital. In every academic hospital, residents are trained to become specialists in various fields of work as main source of man power. The academic staff which consists of associate and assistant professors also see and treat the patients. But, the main purpose of their presence is to supervise and train the residents. Their comments and suggestions were given as treatment orders by residents. This also explains the less frequent use of ordering treatments task by academic staff in the survey.

"Taking treatment orders" (B09) task was most frequently used by nurses. The treatment orders were applied by nurses. It is easily used by the hospital staff both in giving the treatment orders and taking the orders according to the survey results.

Overall, we found that hospital staffs positively perceive the EMR as helpful in their daily work. They reported that entering, accessing, and reading data is easy with the EMR. Electronic medical records also eliminated a lot of paper work and improved the ability to monitor patient progress.

There are concerns about the security, privacy and confidentiality of medical records according to the survey. The openness of the EMR system to the all users without limitations might have been brought such concerns. The limited entry to the fragments of medical record which can be identified by the user's authorized identity could be a proper solution to the authorized abuse of the reports. The limited entry to the psychiatric chart of the patients in the current system is a good example of such a regulation. Currently, only the physicians from psychiatry department can enter the psychiatric charts of patients.

The possibility of breakdown or errors of the system is also a disadvantage. This is perceived as a very important drawback of the system especially by the clerk-registrars. Since the hospital has a paperless information system including administration and billing processes, all procedures require a working electronic network.

The accuracy of the system also had a lower rating from the users that may reflect a need for upgrading the computer hardware. Since the multiple entries during the busy hours of the daily activity slows the system down, a new hardware system with

cluster structure is implanted very recently. Restructuring of the system for the necessities is an advantage of EMR.

The ability to retrieve faster and reliable data for scientific research is possible with EMR. On the other hand, this needs a more structured data storage supported by statistical modules. The current EMR system has mostly a free text entry for patient charts which makes system easier to use. This is also appreciated by the users that, although proposed to be a disadvantage of EMR, EMR was not found to be time consuming according to the survey. The statistical module of the system is very limited. The statistical module and structured data entry of the current system should be developed.

The integration of the all information, ability for a safe future expansion of the system and a powerful statistical package are main requirements for effective decision support in hospital information systems (Lillehaug, 1998). The current system has a good integration of information. The analysis of health care data remains to be done.

The EMR provides the opportunity to improve quality of care in healthcare organizations. Paper-based record systems are no longer fulfilling the needs of clinicians, and related healthcare workers according to Koeller (2002). However, just as there are advantages and disadvantages with the paper medical record, there are also advantages and disadvantages with the EMR. There are several barriers and obstacles for the application of a successful EMR system.

Choosing the right EMR system for the hospital is important. This choice should meet the requirements of individual departments and clinics. The hardware and software components of the system should be planned accordingly at the beginning. This avoids the incompetence of previously chosen hardware with newly bought software.

Implementation of an EMR system to an already functioning paper -based hospital system is more difficult than starting with a new EMR system in a new hospital. There is a problem in integrating the old archives of patient reports to new EMR system.

To avoid the common mistakes done during an implementation process, user needs and expectations should be encountered in decision making. This also helps easier acceptance of changes by the users.

There is also a substantial learning curve for EMR system. It is useful if the users have some type of computer knowledge. Physicians are the primary users of EMR performing data entry such as orders, progress notes. They are familiar with the computers during their training. On the other hand, the clerks have different backgrounds of training mainly high school grade. A training course may be useful for them before they start to use the system.

The EMR system makes the daily activity of hospital staff easier. Disappearance of paper records are highly appreciated by them. This is practical for the storage and retrieval of data. It also helps to protect forests.

The scientific research benefits from a faster and reliable data source. Restructuring of an EMR system is possible for the necessities. Recent changes in Turkish Health Care System such as "payment based on the case" could be easily adapted to the present system.

Maintaining the privacy and security of the records are one of the obstacles in the present EMR system. Since all users have unlimited access to the charts accept psychiatric chart, the authorized abuse is possible in the present system. Entry to the patient charts can be restricted. For example, the access to the chart can only be possible during the patient's application for a medical examination.

Since the users are entering the data as free text rather than a structured text, computer literacy does not count much among the users. The users found the system less time consuming compared to paper-based reports. Switching to the use of structured text may help data storage and retrieval. The scientific research benefits more from the structured data. On the other hand, computer literacy becomes more important and the users should be educated for proper use.

The system applications are effected from the breakdown or errors of the system. The user's satisfaction is related closely to these technical obstacles. Experiencing these obstacles during the daily activities decreases the efficiency of system. The hospital system that is analyzed in our study has just upgraded the hardware component of the system. This change will probably increase the rate of satisfaction from the system.

Integration of imaging data is another problem for the present EMR system. Since it needs a higher storage capacity and might slow down the present system. The development of faster CPU systems with high capacity storage media will solve this problem in the future.

The aim of developing electronic medical records may be defined as to contribute a high quality, efficient health care for patients and for medical research. These systems enhance opportunities for global access to health services and medical knowledge. The hospital information system architectures and contents should be appropriately designed and strategically managed. We need evaluation studies to learn what is achieved and what could be done better.

The questionnaire described in this study applied to the users of ZKU hospital EMR system is relevant for EMR evaluation. The EMR system was rated highly by the users. Such information systems will ultimately be integrated to a health care network. Internet applications of current system should be developed. The expansion of EMR use will be possible in the future by combining the advantages of EMR with the users' appreciation of successful systems.

REFERENCES

Babbie, E. (1990), *Survey Research Methods*, 2nd ed., Wadsworth Inc, Belmont, CA.

Denley, I. and S. W. Smith (1999), "Privacy in Clinical Information Systems in Secondary Health Care," *British Medical Journal*, 318, 1328-1330.

Fabrigar, L. R., D. T. Wegener, R. C. MacCallum and Strahan E. J. (1999), "Evaluating the Use of Exploratory Factor Analysis in Psychological Research," *Psychological Methods*, 3, 272-299.

Haux, R. (2006), "Health Information Systems – Past, Present, Future," *Int J Med Inf*, 75, 268-281.

Laerum, H. and A. Faxvaag (2004), "Task-Oriented Evaluation of Electronic Medical Records Systems: Development and Validation of a Questionnaire for Physicians," *BMC Medical Informatics and Decision Making*, 4, 1-16.

Likourezos, A., D. B. Chalfin, D. G. Murphy, B. Sommer, K. Darcy and S. J. Davidson (2004), "Physician and Nurse Satisfaction with an Electronic Medical Record System," *The Journal of Emergency Medicine*, 27, 419-424.

Lillehaug, S. V. (1998), "Requirements for Integrating Effective Decision Support in Hospital Information Systems," *Journal of Courseware Engineering*, 1, 21-30.

McDonald C. J., J. M. Overhage, W. M. Tierney, P. R. Dexter, D. K. Martin, J. G. Suico, A. Zafar, G. Schadow, L. Blevins, T. Glazener, J. Meeks-Johnson, L. Lemmon, J. Warvel, B. Porterfield, J. Warvel, P. Cassidy, D., Lindbergh A. Belsito, M. Tucker, B. Williams and C. Wodniak (1999), "The Regenstrief Medical Record System: A Quarter Century Experience," *Int J Med Inf*., 54, 225-53.

Norisis, M. J. and SPSS Inc. (1999), *SPSS for Windows: Professional Statistics*, Rel.: 8.0.

O'Conor, R. (1999), "Commentary: Organizational and Cultural Aspects are Also Important," *British Medical Journal*, 318, 1331.

Sadan, B. (2001), "Patient Data Confidentiality and Patient Rights," *International Journal of Medical Informatics,* 62, 41-49.

Yamak R, Köseoğlu M. (2006), *Uygulamalı İstatistik ve Ekonometri*, 3. Baskı, Celepler Matbaacılık, Trabzon.

APPENDICES

Table 1-a: Questionnaire for Evaluation of Electronic Medical Record System in Zonguldak Karaelmas University Hospital (English questionnaire form)

In this questionnaire, we would like to know your use of and perception of electronic medical record system in your hospital.

(A) Your department (Please fill the appropriate blanks)

_____ Administrative (Patient record, reports, secretary act.)
_____ Clinic
_____ Laboratory
_____ Operating room

Your position

Civil servant [ ]
Technician [ ]
Nurse [ ]
Doctor [ ]
Academic staff [ ]
Other _____

(B) Use of medical record system: There are questions for how frequent you use the electronic medical record system in this section. Answers are arranged as column 1 to 5 in the row next to the question. You are asked to mark proper box accordingly.

No	Description of question [1= Never; 2= Seldom; 3= About half of the occasions; 4= Most of the Occasions; 5= Always]	1	2	3	4	5
B01	Review the patient problems					
B02	Enter daily notes					
B03	To order laboratory tests					
B04	To obtain the results of laboratory tests					
B05	To order radiological investigations					
B06	To obtain the results of radiological investigations					
B07	To refer the patient to other departments					
B08	Order treatments					
B09	Taking the treatments orders					
B10	Collect patient information					
B11	Collect patient information for discharge reports					
B12	Register codes for diagnosis					

(C) There are questions for the easy use of electronic medical record system compared to paper records in this section. Answers are arranged as column 1 to 5 in the row next to the question.

No	Description of question [1= More difficult; 2= Difficult; 3= No change; 4= Easy; 5= Very easy]	1	2	3	4	5
C01	Review the patient problems					
C02	Enter daily notes					
C03	To order laboratory tests					
C04	To obtain the results of laboratory tests					
C05	To order radiological investigations					
C06	To obtain the results of radiological investigations					
C07	To refer the patient to other departments					
C08	Order treatments					
C09	Taking the treatments orders					
B10	Collect patient information					
B11	Collect patient information for discharge reports					
B12	Register codes for diagnosis					

(D) In this section, your satisfaction with the electronic medical record system is asked.

No	Description of question (1=Never; 2=Seldom; 3=Half of the time; 4= Most of the time; 5= Always	1	2	3	4	5
D01	Do you think the system provide sufficient information for you?					
D02	Do you satisfied with the format of output from the system?					
D03	Is the system easy to use?					
D04	Are you satisfied with the application of the system?					

(E) What is the best about electronic medical record system for you?

No	Description of question (1=-Strongly disagree; 2=Slightly disagree; 3=No idea; 4=Slightly agree; 5=Strongly agree	1	2	3	4	5
E01	Easy access to the records					
E02	Disappearance of paper records					
E03	Ability to see and analyze the patient data as a whole					
E04	Ability to retrieve faster and reliable data for scientific research					
E05	Restructuring is possible for the necessities					

Your comments:

_____
_____
_____
_____.

(F) What is worst about electronic medical record system for you?

No	Description of question [1= Totally agree; 2= Partially agree; 3=No idea; 4= Partially disagree; 5= Totally disagree]	1	2	3	4	5
F01	To spend more time compared to the paper systems					
F02	Privacy of patient information is decreased					
F03	Difficult to maintain the safety of records					
F04	Need for frequent adjustments in parallel with technologic developments					
F05	Possibility of breakdown or errors in computer system					

Your comments:

_____
_____
_____
_____
_____.

(G) In this section, the period of time that you spend for using the system is asked.

No	Description of question (1= Les than10%; 2=10%-25%; 3=25%-50%; 4=50%-75%; 5=>75%	1	2	3	4	5
G01	What percent of your time (during an exam, procedure or recording ect.) do you spend for entering the clinical information or results of each patient?					
G02	What percent of your daily working time do you spent for using record system?					

(H) General opinion

No	Description of question [1= Very poor; 2= Poor; 3= Fair; 4= Good; 5= Perfect	1	2	3	4	5
H01	How would you rate the success of the electronic medical record system installed in your department?					

Comments (You can write down f you have any comments about the system or questionnaire in this section):

_____
_____
_____
_____
_____.

(*Thank you for your time and attendance*)

Table 1-b: Zonguldak Karaelmas Üniversitesi Hastanesindeki Elektronik Tıbbî Kayıt Sisteminin Değerlendirilmesi Anketi (Turkish questionnaire form)

Bu ankette hastanenizden elektronik tıbbî kayıt sistemi kullanıcısı olarak sistemin genel işleyişi hakkındaki değerlendirmeleriniz istenmektedir.

(A) Çalıştığınız Bölüm (Uygun Bölümü Belirtiniz)

_____ İdarî (Hasta Kayıt, Rapor, Sekreterlik vs.)

_____ Kliniği

_____ Lâboratuarı

_____ Ameliyathanesi

Göreviniz

Memur [ ]

Teknisyen [ ]

Hemşire [ ]

Araştırma Görevlisi [ ]

Öğretim Üyesi [ ]

Diğer _____

(B) Tıbbî Kayıt Sistemini Kullanım Sıklığı

No	Sorunun Tanımı [1= Hiç Kullanmam; 2= Nadiren; 3= Yaklaşık Yarısında; 4= Çoğunlukla; 5= Her Zaman]	1	2	3	4	5
B01	Hastanın problemlerinin gözden geçirilmesi					
B02	Günlük notların yazılması					
B03	Lâboratuar testlerinin istenmesi					
B04	Lâboratuar sonuçlarının elde edilmesi					
B05	Radyolojik inceleme istenmesi					
B06	Radyolojik inceleme sonuçlarının elde edilmesi					
B07	Diğer bölümlerden konsültasyon istemesi					
B08	Tedavi "order"larının verilmesi					
B09	Tedavi "order"larının alınması					
B10	Hasta bilgilerinin toplanması					
B11	Epikriz için hasta bilgilerinin toplanması					
B12	Teşhis kodlarının girilmesi					

(C) Elektronik Kayıt Sisteminin Kâğıt Kayıt Sistemine Göre Kullanım Kolaylığı

No	[1= Çok Zor; 2= Zor; 3= Fark Yok; 4= Kolay; 5= Çok Kolay]	1	2	3	4	5
C01	Hastanın problemlerinin gözden geçirilmesi					
C02	Günlük notların yazılması					
C03	Lâboratuar testlerinin istenmesi					
C04	Lâboratuar sonuçlarının elde edilmesi					
C05	Radyolojik inceleme istenmesi					
C06	Radyolojik inceleme sonuçlarının elde edilmesi					
C07	Diğer bölümlerden konsültasyon istemesi					
C08	Tedavi "order"larının verilmesi					
C09	Tedavi "order"larının alınması					
C10	Hasta bilgilerinin toplanması					
C11	Epikriz için hasta bilgilerinin toplanması					
C12	Teşhis kodlarının girilmesi					

(D) Elektronik Tıbbî Kayıt Sisteminin Hakkındaki Memnuniyetiniz.

No	[1= Hayır; 2= Bazen; 3=%50; 4= Sıklıkla; 5= Her Zaman]	1	2	3	4	5
D01	Sistemden yeterli bilgi edindiğinizi düşünüyor musunuz?					
D02	Sistemden alınan çıktıların içeriğinden memnun musunuz?					
D03	Sistem kullanımı kolay mı?					
D04	Sistemin işleyişinden memnun musunuz?					

(E) Elektronik Kayıt Sisteminin Sizce En İyi Özellikleri Nelerdir?

No	[1= Kesinlikle Katılmıyorum; 2= Kısmen Katılmıyorum; 3= Fikrim Yok; 4= Kısmen Katılıyorum; 5= Kesinlikle Katılıyorum]	1	2	3	4	5
E01	Kayıtlara kolay ulaşılabilmesi					
E02	Kâğıt evrakları ortadan kaldırması					
E03	Hastaya ait bilgileri toplu olarak görebilmek ve analiz edebilmek					
E04	Bilimsel araştırmalarda daha hızlı ve güvenilir bilgi edinme					
E05	Gereksinimlere göre yeniden yapılandırılabilmesi					

Yorumunuz:

_____
_____
_____
_____
_____.

(F) Elektronik Kayıt Sisteminin Sizce En Kötü Yönleri Nelerdir?

No	[1= Kesinlikle Katılıyorum; 2= Kısmen Katılıyorum;3= Fikrim Yok; 4= Kısmen Katılmıyorum; 5= Kesinlikle Katılmıyorum]	1	2	3	4	5
F01	Kâğıt sisteme göre daha fazla zaman harcamayı gerektiriyor					
F02	Hastaya ait bilgilerin mahremiyeti azalıyor					
F03	Kayıtların güvenliğini sağlamak daha zor					
F04	Teknolojik değişime paralel olarak sık değişiklik yapılması					
F05	Bilgisayar sisteminin çökmesi veya arıza olması					

Yorumunuz:

_____
_____
_____
_____
_____
_____
_____.

(G) Kayıt Sistemini Kullanım Süreniz Nedir?

No	[1=%10'dan az; 2=%10-%25; 3=%25-%5G0; 4=%50-%75; 5=%75'den çok]	1	2	3	4	5
G01	Klinik bilgileri veya sonuçları girmek her bir hasta başına yaptığınız işlem (muayene, tetkik, kayıt vs.) sürenizin % kaçını almaktadır?					
G02	Tıbbî kayıt sistemini kullanmak için harcadığınız zaman günlük mesainizin % kaçını almaktadır?					

(H) Elektronik Kayıt Sistemini Kullanım Memnuniyet Düzeyiniz Nedir?

No	[1= Çok Zayıf; 2= Yetersiz; 3= İdare Eder; 4= İyi; 5= Mükemmel	1	2	3	4	5
H01	Bölümünüzde kullandığınız elektronik tıbbî kayıt sistemini ne kadar başarılı buluyorsunuz?					

Yorumunuz:

_____
_____
_____
_____
_____
_____.

(*Zaman ayırıp katıldığınız için teşekkürler*)

Table 2: Use of Medical Record System (B01-B06)

			1 Civil servant		2 Technician		3 Nurse		4 Doctor		5 Academic staff		6 Other	
Clinical Task	Values	Total	Layer	Table	Layer	Table	Layer	Table	Layer	Table	Layer	Table	Layer	Table
Review the patient problems (B01)	1 Never	5,40%	33,3%	1,8%	14,3%	,9%							15,0%	2,7%
	2 Seldom	4,50%	33,3%	1,8%	14,3%	,9%			4,5%	,9%			5,0%	,9%
	3 About half of the occasions	8,90%	16,7%	,9%	14,3%	,9%	3,2%	,9%	9,1%	1,8%	18,5%	4,4%		
	4 Most of the occasions	25,60%					48,4%	13,3%	18,2%	3,5%	14,8%	3,5%	30,0%	5,3%
	5 Always	55,70%	16,7%	,9%	57,1%	3,5%	48,4%	13,3%	68,2%	13,3%	66,7%	15,9%	50,0%	8,8%
Enter daily notes (B02)	1 Never	16,70%	60,0%	2,8%	75,0%	2,8%	21,9%	6,5%			3,7%	,9%	22,2%	3,7%
	2 Seldom	15,70%			25,0%	,9%	12,5%	3,7%	4,5%	,9%	18,5%	4,6%	33,3%	5,6%
	3 About half of the occasions	2,70%					3,1%	,9%	4,5%	,9%			5,6%	,9%
	4 Most of the occasions	17,70%	40,0%	1,9%			21,9%	6,5%	22,7%	4,6%	11,1%	2,8%	11,1%	1,9%
	5 Always	47,20%					40,6%	12,0%	68,2%	13,9%	66,7%	16,7%	27,8%	4,6%
To order laboratory tests (B03)	1 Never	25,60%	60,0%	3,1%	60,0%	3,1%	43,5%	10,2%			3,7%	1,0%	44,4%	8,2%
	2 Seldom	18,40%	40,0%	2,0%			39,1%	9,2%			11,1%	3,1%	22,2%	4,1%
	3 About half of the occasions	4,00%					4,3%	1,0%	10,0%	2,0%			5,6%	1,0%
	4 Most of the occasions	9,20%			20,0%	1,0%			20,0%	4,1%			22,2%	4,1%
	5 Always	42,90%			20,0%	1,0%	13,0%	3,1%	70,0%	14,3%	85,2%	23,5%	5,6%	1,0%
To obtain the results of laboratory tests (B04)	1 Never	15,30%	20,0%	1,0%	28,6%	1,9%	7,7%	1,9%			7,7%	1,9%	45,0%	8,6%
	2 Seldom	13,50%	60,0%	2,9%	14,3%	1,0%	30,8%	7,6%	4,8%	1,0%			5,0%	1,0%
	3 About half of the occasions	1,90%							9,5%	1,9%				
	4 Most of the occasions	8,70%					11,5%	2,9%	14,3%	2,9%			15,0%	2,9%
	5 Always	61,10%	20,0%	1,0%	57,1%	3,8%	50,0%	12,4%	71,4%	14,3%	92,3%	22,9%	35,0%	6,7%
To order radiological investigations (B05)	1 Never	38,00%	60,0%	3,0%	100,0%	5,0%	78,3%	18,0%	4,5%	1,0%	7,7%	2,0%	47,4%	9,0%
	2 Seldom	11,00%	40,0%	2,0%			8,7%	2,0%	9,1%	2,0%	3,8%	1,0%	21,1%	4,0%
	3 About half of the occasions	4,00%					4,3%	1,0%	4,5%	1,0%	3,8%	1,0%	5,3%	1,0%
	4 Most of the occasions	15,00%					4,3%	1,0%	36,4%	8,0%	11,5%	3,0%	15,8%	3,0%
	5 Always	32,00%					4,3%	1,0%	45,5%	10,0%	73,1%	19,0%	10,5%	2,0%
To obtain the results of radiological investigations (B06)	1 Never	24,80%	20,0%	1,0%	100,0%	5,2%	39,1%	9,3%	5,0%	1,0%	7,7%	2,1%	33,3%	6,2%
	2 Seldom	16,50%	60,0%	3,1%			13,0%	3,1%	20,0%	4,1%	3,8%	1,0%	27,8%	5,2%
	3 About half of the occasions	3,10%							5,0%	1,0%	7,7%	2,1%		
	4 Most of the occasions	18,50%					17,4%	4,1%	30,0%	6,2%	15,4%	4,1%	22,2%	4,1%
	5 Always	37,00%	20,0%	1,0%			30,4%	7,2%	40,0%	8,2%	65,4%	17,5%	16,7%	3,1%

Table 2: Use of Medical Record System (B07-B12) (Continued)

Clinical Task	Values	Total	1 Civil servant		2 Technician		3 Nurse		4 Doctor		5 Academic		6 Other	
			Layer	Table	Layer	Table	Layer	Table	Layer	Table	Layer	Table	Layer	Table
To refer the patient to other departments (B07)	1 Never	40,80%	40,0%	2,0%	80,0%	4,1%	90,5%	19,4%	4,5%	1,0%	11,1%	3,1%	61,1%	11,2%
	2 Seldom	10,10%	40,0%	2,0%	20,0%	1,0%			22,7%	5,1%	3,7%	1,0%	5,6%	1,0%
	3 About half of the occasions	4,00%							9,1%	2,0%	3,7%	1,0%	5,6%	1,0%
	4 Most of the occasions	13,20%	20,0%	1,0%			9,5%	2,0%	13,6%	3,1%	7,4%	2,0%	27,8%	5,1%
	5 Always	31,60%							50,0%	11,2%	74,1%	20,4%		
Order treatments (B08)	1 Never	55,90%	100,0%	4,9%	83,3%	4,9%	83,3%	19,6%			37,0%	9,8%	94,4%	16,7%
	2 Seldom	3,90%									14,8%	3,9%		
	3 About half of the occasions	1,00%							4,5%	1,0%				
	4 Most of the occasions	4,90%					4,2%	1,0%	13,6%	2,9%	3,7%	1,0%		
	5 Always	34,30%			16,7%	1,0%	12,5%	2,9%	81,8%	17,6%	44,4%	11,8%	5,6%	1,0%
Taking the treatments orders (B09)	1 Never	42,90%	100,0%	4,8%	83,3%	4,8%			26,3%	4,8%	48,0%	11,4%	100,0%	17,1%
	2 Seldom	3,80%					6,3%	1,9%			8,0%	1,9%		
	3 About half of the occasions	1,90%							10,5%	1,9%				
	4 Most of the occasions	7,70%					15,6%	4,8%	15,8%	2,9%				
	5 Always	43,90%			16,7%	1,0%	78,1%	23,8%	47,4%	8,6%	44,0%	10,5%		
Collect patient information (B10)	1 Never	9,30%	40,0%	1,9%	33,3%	1,9%	3,3%	,9%			3,7%	,9%	21,1%	3,7%
	2 Seldom	12,10%	20,0%	,9%	33,3%	1,9%	3,3%	,9%	4,8%	,9%	7,4%	1,9%	31,6%	5,6%
	3 About half of the occasions	4,60%			16,7%	,9%	6,7%	1,9%	4,8%	,9%	3,7%	,9%		
	4 Most of the occasions	27,90%	20,0%	,9%			46,7%	13,0%	28,6%	5,6%	25,9%	6,5%	10,5%	1,9%
	5 Always	46,20%	20,0%	,9%	16,7%	,9%	40,0%	11,1%	61,9%	12,0%	59,3%	14,8%	36,8%	6,5%
Collect patient information for discharge reports (B11)	1 Never	28,60%	80,0%	3,8%	50,0%	2,9%	57,1%	15,2%			3,7%	1,0%	33,3%	5,7%
	2 Seldom	7,70%			16,7%	1,0%	7,1%	1,9%	9,5%	1,9%			16,7%	2,9%
	3 About half of the occasions	5,90%			16,7%	1,0%	3,6%	1,0%	4,8%	1,0%	7,4%	1,9%	5,6%	1,0%
	4 Most of the occasions	14,40%					17,9%	4,8%	23,8%	4,8%	11,1%	2,9%	11,1%	1,9%
	5 Always	43,90%	20,0%	1,0%	16,7%	1,0%	14,3%	3,8%	61,9%	12,4%	77,8%	20,0%	33,3%	5,7%
Register codes for diagnosis (B12)	1 Never	41,00%	60,0%	3,0%	57,1%	4,0%	81,8%	18,0%			11,1%	3,0%	76,5%	13,0%
	2 Seldom	6,00%	20,0%	1,0%			4,5%	1,0%	4,5%	1,0%	7,4%	2,0%	5,9%	1,0%
	3 About half of the occasions	1,00%							4,5%	1,0%				
	4 Most of the occasions	10,00%					9,1%	2,0%	9,1%	2,0%	14,8%	4,0%	11,8%	2,0%
	5 Always	42,00%	20,0%	1,0%	42,9%	3,0%	4,5%	1,0%	81,8%	18,0%	66,7%	18,0%	5,9%	1,0%

Table 3: The Easy Use of Electronic Medical Record System Compared To Paper Records (C01-C06)

			1 Civil servant		2 Technician		3 Nurse		4 Doctor		5 Academic		6 Other	
Clinical Task	Values	Total	Layer	Table	Layer	Table	Layer	Table	Layer	Table	Layer	Table	Layer	Table
Review the patient problems (C01)	1 More difficult	0,90%			16,7%	,9%								
	2 Difficult	7,20%					6,3%	1,8%	4,5%	,9%	15,4%	3,6%	4,8%	,9%
	3 No change	8,10%	25,0%	,9%			9,4%	2,7%	13,6%	2,7%	3,8%	,9%	4,8%	,9%
	4 Easy	47,70%	50,0%	1,8%	66,7%	3,6%	56,3%	16,2%	40,9%	8,1%	42,3%	9,9%	42,9%	8,1%
	5 Very easy	36,00%	25,0%	,9%	16,7%	,9%	28,1%	8,1%	40,9%	8,1%	38,5%	9,0%	47,6%	9,0%
Enter daily notes (C02)	1 More difficult	3,00%			20,0%	1,0%	8,0%	2,0%						
	2 Difficult	4,00%					4,0%	1,0%			8,0%	2,0%	5,9%	1,0%
	3 No change	17,30%	25,0%	1,0%			28,0%	7,1%	22,7%	5,1%	4,0%	1,0%	17,6%	3,1%
	4 Easy	44,90%	75,0%	3,1%	40,0%	2,0%	40,0%	10,2%	36,4%	8,2%	44,0%	11,2%	58,8%	10,2%
	5 Very easy	30,60%			40,0%	2,0%	20,0%	5,1%	40,9%	9,2%	44,0%	11,2%	17,6%	3,1%
To order laboratory tests (C03)	1 More difficult	3,60%	25,0%	1,2%	20,0%	1,2%			4,5%	1,2%				
	2 Difficult	8,40%	25,0%	1,2%			8,3%	1,2%	4,5%	1,2%	7,7%	2,4%	15,4%	2,4%
	3 No change	3,60%	25,0%	1,2%			8,3%	1,2%	4,5%	1,2%				
	4 Easy	34,10%	25,0%	1,2%	20,0%	1,2%	50,0%	7,3%	31,8%	8,5%	19,2%	6,1%	61,5%	9,8%
	5 Very easy	50,10%			60,0%	3,7%	33,3%	4,9%	54,5%	14,6%	73,1%	23,2%	23,1%	3,7%
To obtain the results of laboratory tests (C04)	1 More difficult	2,20%	25,0%	1,1%	16,7%	1,1%								
	2 Difficult	5,40%	25,0%	1,1%					4,5%	1,1%			21,4%	3,2%
	3 No change	3,20%					4,5%	1,1%	9,1%	2,1%				
	4 Easy	38,30%	50,0%	2,1%	50,0%	3,2%	40,9%	9,6%	40,9%	9,6%	23,1%	6,4%	50,0%	7,4%
	5 Very easy	51,10%			33,3%	2,1%	54,5%	12,8%	45,5%	10,6%	76,9%	21,3%	28,6%	4,3%
To order radiological investigations (C05)	1 More difficult	2,60%			25,0%	1,3%	9,1%	1,3%						
	2 Difficult	5,20%									4,0%	1,3%	25,0%	3,9%
	3 No change	6,50%					9,1%	1,3%	13,6%	3,9%			8,3%	1,3%
	4 Easy	40,30%	66,7%	2,6%	25,0%	1,3%	27,3%	3,9%	36,4%	10,4%	36,0%	11,7%	66,7%	10,4%
	5 Very easy	45,50%	33,3%	1,3%	50,0%	2,6%	54,5%	7,8%	50,0%	14,3%	60,0%	19,5%		
To obtain the results of radiological investigations (C06)	1 More difficult	3,30%			25,0%	1,1%	5,0%	1,1%	4,8%	1,1%				
	2 Difficult	4,50%	33,3%	1,1%									21,4%	3,4%
	3 No change	6,70%	33,3%	1,1%	25,0%	1,1%	5,0%	1,1%	9,5%	2,3%	4,0%	1,1%		
	4 Easy	36,60%			25,0%	1,1%	30,0%	6,9%	42,9%	10,3%	36,0%	10,3%	50,0%	8,0%
	5 Very easy	48,10%	33,3%	1,1%	25,0%	1,1%	60,0%	13,8%	42,9%	10,3%	60,0%	17,2%	28,6%	4,6%

Table 3: The Easy Use of Electronic Medical Record System Compared To Paper Records (C07-C12) (Continued)

			1 Civil servant		2 Technician		3 Nurse		4 Doctor		5 Academic		6 Other	
Clinical Task	Values	Total	Layer	Table	Layer	Table	Layer	Table	Layer	Table	Layer	Table	Layer	Table
To refer the patient to other departments (C07)	1 More difficult	2,60%			25,0%	1,3%	9,1%	1,3%						
	2 Difficult	3,80%	33,3%	1,3%									14,3%	2,5%
	3 No change	6,40%			25,0%	1,3%			13,6%	3,8%	4,0%	1,3%		
	4 Easy	43,00%	66,7%	2,5%	25,0%	1,3%	45,5%	6,3%	36,4%	10,1%	32,0%	10,1%	71,4%	12,7%
	5 Very easy	44,30%			25,0%	1,3%	45,5%	6,3%	50,0%	13,9%	64,0%	20,3%	14,3%	2,5%
Order treatments (C08)	1 More difficult	9,80%	100,0%	2,8%	25,0%	1,4%	10,0%	1,4%			4,3%	1,4%	20,0%	2,8%
	2 Difficult	4,20%			25,0%	1,4%	10,0%	1,4%			4,3%	1,4%		
	3 No change	7,00%							4,5%	1,4%	13,0%	4,2%	10,0%	1,4%
	4 Easy	38,00%			25,0%	1,4%	50,0%	7,0%	45,5%	14,1%	21,7%	7,0%	60,0%	8,5%
	5 Very easy	40,80%			25,0%	1,4%	30,0%	4,2%	50,0%	15,5%	56,5%	18,3%	10,0%	1,4%
Taking the treatments orders (C09)	1 More difficult	7,20%	100,0%	2,4%	25,0%	1,2%							30,0%	3,6%
	2 Difficult	2,40%			25,0%	1,2%	3,6%	1,2%						
	3 No change	7,20%							11,8%	2,4%	18,2%	4,8%		
	4 Easy	33,60%			25,0%	1,2%	32,1%	10,8%	41,2%	8,4%	22,7%	6,0%	60,0%	7,2%
	5 Very easy	49,40%			25,0%	1,2%	64,3%	21,7%	47,1%	9,6%	59,1%	15,7%	10,0%	1,2%
Collect patient information (C10)	1 More difficult	3,90%	66,7%	1,9%	16,7%	1,0%					3,8%	1,0%		
	2 Difficult	2,00%							4,5%	1,0%	3,8%	1,0%		
	3 No change	3,00%					3,7%	1,0%	4,5%	1,0%			5,3%	1,0%
	4 Easy	47,70%	33,3%	1,0%	16,7%	1,0%	37,0%	9,7%	54,5%	11,7%	50,0%	12,6%	63,2%	11,7%
	5 Very easy	43,70%			66,7%	3,9%	59,3%	15,5%	36,4%	7,8%	42,3%	10,7%	31,6%	5,8%
Collect patient information for discharge reports (C11)	1 More difficult	4,50%	66,7%	2,3%	20,0%	1,1%							6,3%	1,1%
	2 Difficult	2,30%					12,5%	2,3%						
	3 No change	5,60%					6,3%	1,1%	14,3%	3,4%			6,3%	1,1%
	4 Easy	42,40%	33,3%	1,1%	20,0%	1,1%	37,5%	6,9%	47,6%	11,5%	38,5%	11,5%	56,3%	10,3%
	5 Very easy	44,70%			60,0%	3,4%	43,8%	8,0%	38,1%	9,2%	61,5%	18,4%	31,3%	5,7%
Register codes for diagnosis (C12)	1 More difficult	10,40%	33,3%	1,3%	25,0%	1,3%	9,1%	1,3%	9,1%	2,6%			27,3%	3,9%
	2 Difficult	7,80%							22,7%	6,5%	3,8%	1,3%		
	3 No change	5,20%					18,2%	2,6%	9,1%	2,6%				
	4 Easy	37,70%	66,7%	2,6%	25,0%	1,3%	45,5%	6,5%	36,4%	10,4%	34,6%	11,7%	36,4%	5,2%
	5 Very easy	39,00%			50,0%	2,6%	27,3%	3,9%	22,7%	6,5%	61,5%	20,8%	36,4%	5,2%

Table 4: Satisfaction with the Electronic Medical Record System (D01-D04)

Clinical Task	Values	Total	1 Civil servant		2 Technician		3 Nurse		4 Doctor		5 Academic		6 Other	
			Layer	Table	Layer	Table	Layer	Table	Layer	Table	Layer	Table	Layer	Table
Do you think the system provide sufficient information for you? (D01)	1 Never	2,40%			15,4%	1,6%							4,3%	,8%
	2 Seldom	6,40%			7,7%	,8%	6,1%	1,6%	9,1%	1,6%			13,0%	2,4%
	3 Half of the time	16,20%	16,7%	,8%			24,2%	6,5%	13,6%	2,4%	19,2%	4,1%	13,0%	2,4%
	4 Most of the time	57,80%	66,7%	3,3%	53,8%	5,7%	48,5%	13,0%	63,6%	11,4%	65,4%	13,8%	56,5%	10,6%
	5 Always	17,00%	16,7%	,8%	23,1%	2,4%	21,2%	5,7%	13,6%	2,4%	15,4%	3,3%	13,0%	2,4%
Do you satisfied with the format of output from the system? (D02)	1 Never	1,60%			7,7%	,8%							4,3%	,8%
	2 Seldom	10,10%			15,4%	1,7%	10,3%	2,5%	9,1%	1,7%	11,5%	2,5%	8,7%	1,7%
	3 Half of the time	17,80%					31,0%	7,6%	18,2%	3,4%	15,4%	3,4%	17,4%	3,4%
	4 Most of the time	41,10%	33,3%	1,7%	23,1%	2,5%	34,5%	8,4%	50,0%	9,2%	50,0%	10,9%	43,5%	8,4%
	5 Always	29,40%	66,7%	3,4%	53,8%	5,9%	24,1%	5,9%	22,7%	4,2%	23,1%	5,0%	26,1%	5,0%
Is the system easy to use? (D03)	1 Never	1,70%					6,7%	1,7%						
	2 Seldom	7,60%			30,8%	3,4%	10,0%	2,5%					8,7%	1,7%
	3 Half of the time	18,50%					30,0%	7,6%	14,3%	2,5%	19,2%	4,2%	21,7%	4,2%
	4 Most of the time	43,60%	33,3%	1,7%	38,5%	4,2%	36,7%	9,2%	61,9%	10,9%	61,5%	13,4%	21,7%	4,2%
	5 Always	28,60%	66,7%	3,4%	30,8%	3,4%	16,7%	4,2%	23,8%	4,2%	19,2%	4,2%	47,8%	9,2%
Are you satisfied with the accuracy of the system? (D04)	1 Never	8,30%			23,1%	2,5%	16,7%	4,2%	4,5%	,8%			4,3%	,8%
	2 Seldom	12,50%	33,3%	1,7%	30,8%	3,3%	13,3%	3,3%	9,1%	1,7%	3,8%	,8%	8,7%	1,7%
	3 Half of the time	29,20%			15,4%	1,7%	43,3%	10,8%	36,4%	6,7%	15,4%	3,3%	34,8%	6,7%
	4 Most of the time	30,90%	33,3%	1,7%	7,7%	,8%	16,7%	4,2%	40,9%	7,5%	57,7%	12,5%	21,7%	4,2%
	5 Always	19,20%	33,3%	1,7%	23,1%	2,5%	10,0%	2,5%	9,1%	1,7%	23,1%	5,0%	30,4%	5,8%

Table 5: Advantages of Electronic Medical Record System (E01-E05)

			1 Civil servant		2 Technician		3 Nurse		4 Doctor		5 Academic		6 Other	
Clinical Task	Values	Total	Layer	Table	Layer	Table	Layer	Table	Layer	Table	Layer	Table	Layer	Table
Easy access to the records (E01)	1 Strongly disagree	1,80%							4,5%	,9%	3,8%	,9%		
	2 Slightly disagree	3,50%					3,7%	,9%	13,6%	2,6%				
	4 Slightly agree	23,10%	16,7%	,9%	7,7%	,9%	18,5%	4,3%	18,2%	3,4%	30,8%	6,8%	34,8%	6,8%
	5 Strongly agree	71,80%	83,3%	4,3%	92,3%	10,3%	77,8%	17,9%	63,6%	12,0%	65,4%	14,5%	65,2%	12,8%
Disappearance of paper records (E02)	1 Strongly disagree	2,70%	16,7%	,9%	7,7%	,9%					3,8%	,9%		
	2 Slightly disagree	2,60%					3,6%	,9%	9,5%	1,7%				
	3 No idea	2,70%					3,6%	,9%	4,8%	,9%			4,3%	,9%
	4 Slightly agree	19,70%					21,4%	5,1%	23,8%	4,3%	19,2%	4,3%	30,4%	6,0%
	5 Strongly agree	72,70%	83,3%	4,3%	92,3%	10,3%	71,4%	17,1%	61,9%	11,1%	76,9%	17,1%	65,2%	12,8%
Ability to see and analyze the patient data as a whole (E03)	1 Strongly disagree	0,80%							4,5%	,8%				
	2 Slightly disagree	5,70%	16,7%	,8%			3,1%	,8%	13,6%	2,5%	7,7%	1,6%		
	3 No idea	0,80%											4,3%	,8%
	4 Slightly agree	14,90%	16,7%	,8%			9,4%	2,5%	13,6%	2,5%	30,8%	6,6%	13,0%	2,5%
	5 Strongly agree	78,00%	66,7%	3,3%	100,0%	10,7%	87,5%	23,0%	68,2%	12,3%	61,5%	13,1%	82,6%	15,6%
Ability to retrieve faster and reliable data for scientific research (E04)	1 Strongly disagree	3,30%					3,6%	,8%	4,5%	,8%	7,7%	1,7%		
	2 Slightly disagree	7,60%			7,7%	,8%	21,4%	5,1%	9,1%	1,7%				
	3 No idea	6,70%			23,1%	2,5%			9,1%	1,7%	3,8%	,8%	8,7%	1,7%
	4 Slightly agree	21,10%	66,7%	3,4%	7,7%	,8%	10,7%	2,5%	27,3%	5,1%	19,2%	4,2%	26,1%	5,1%
	5 Strongly agree	61,10%	33,3%	1,7%	61,5%	6,8%	64,3%	15,3%	50,0%	9,3%	69,2%	15,3%	65,2%	12,7%
Restructuring is possible for the necessities (E05)	1 Strongly disagree	2,50%					7,1%	1,7%	4,5%	,8%				
	2 Slightly disagree	8,40%					21,4%	5,1%	9,1%	1,7%	3,8%	,8%	4,3%	,8%
	3 No idea	7,60%	16,7%	,8%	15,4%	1,7%			9,1%	1,7%	7,7%	1,7%	8,7%	1,7%
	4 Slightly agree	19,40%	16,7%	,8%	15,4%	1,7%	10,7%	2,5%	22,7%	4,2%	15,4%	3,4%	34,8%	6,8%
	5 Strongly agree	61,90%	66,7%	3,4%	69,2%	7,6%	60,7%	14,4%	54,5%	10,2%	73,1%	16,1%	52,2%	10,2%

Table 6: Disadvantages of Electronic Medical Record System (F01-F05)

			1 Civil servant		2 Technician		3 Nurse		4 Doctor		5 Academic		6 Other	
Clinical Task	Values	Total	Layer	Table	Layer	Table	Layer	Table	Layer	Table	Layer	Table	Layer	Table
To spend more time compared to the paper systems (F01)	1 Totally agree	14,60%			16,7%	1,7%	25,0%	6,0%	13,6%	2,6%	11,5%	2,6%	9,1%	1,7%
	2 Partially agree	25,00%	16,7%	,9%	8,3%	,9%	28,6%	6,9%	36,4%	6,9%	26,9%	6,0%	18,2%	3,4%
	3 No idea	6,10%			16,7%	1,7%	7,1%	1,7%	4,5%	,9%	3,8%	,9%	4,5%	,9%
	4 Partially disagree	15,40%					7,1%	1,7%	18,2%	3,4%	26,9%	6,0%	22,7%	4,3%
	5 Totally disagree	38,80%	83,3%	4,3%	58,3%	6,0%	32,1%	7,8%	27,3%	5,2%	30,8%	6,9%	45,5%	8,6%
Privacy of patient information is decreased (F02)	1 Totally agree	26,30%			33,3%	3,5%	51,9%	12,3%	14,3%	2,6%	19,2%	4,4%	18,2%	3,5%
	2 Partially agree	35,10%	16,7%	,9%	50,0%	5,3%	33,3%	7,9%	33,3%	6,1%	46,2%	10,5%	22,7%	4,4%
	3 No idea	4,40%			8,3%	,9%			14,3%	2,6%	3,8%	,9%		
	4 Partially disagree	14,90%	50,0%	2,6%			7,4%	1,8%	23,8%	4,4%	11,5%	2,6%	18,2%	3,5%
	5 Totally disagree	19,40%	33,3%	1,8%	8,3%	,9%	7,4%	1,8%	14,3%	2,6%	19,2%	4,4%	40,9%	7,9%
Difficult to maintain the safety of records (F03)	1 Totally agree	28,20%			41,7%	4,4%	37,0%	8,8%	47,6%	8,8%	24,0%	5,3%	4,5%	,9%
	2 Partially agree	29,20%	33,3%	1,8%	33,3%	3,5%	40,7%	9,7%	14,3%	2,7%	24,0%	5,3%	31,8%	6,2%
	3 No idea	6,30%							14,3%	2,7%	12,0%	2,7%	4,5%	,9%
	4 Partially disagree	19,50%	16,7%	,9%	16,7%	1,8%	7,4%	1,8%	23,8%	4,4%	20,0%	4,4%	31,8%	6,2%
	5 Totally disagree	16,80%	50,0%	2,7%	8,3%	,9%	14,8%	3,5%			20,0%	4,4%	27,3%	5,3%
Need for frequent adjustments in parallel with technologic developments (F04)	1 Totally agree	32,50%	16,7%	,9%	25,0%	2,6%	34,6%	7,9%	47,6%	8,8%	34,6%	7,9%	21,7%	4,4%
	2 Partially agree	27,30%	33,3%	1,8%	25,0%	2,6%	38,5%	8,8%	19,0%	3,5%	23,1%	5,3%	26,1%	5,3%
	3 No idea	8,90%	16,7%	,9%	8,3%	,9%	7,7%	1,8%	9,5%	1,8%	15,4%	3,5%		
	4 Partially disagree	17,50%	16,7%	,9%	25,0%	2,6%	11,5%	2,6%	23,8%	4,4%	15,4%	3,5%	17,4%	3,5%
	5 Totally disagree	14,10%	16,7%	,9%	16,7%	1,8%	7,7%	1,8%			11,5%	2,6%	34,8%	7,0%
Possibility of breakdown or errors in computer system (F05)	1 Totally agree	58,80%	33,3%	1,7%	69,2%	7,4%	71,0%	18,2%	63,6%	11,6%	53,8%	11,6%	43,5%	8,3%
	2 Partially agree	19,10%	50,0%	2,5%	15,4%	1,7%	12,9%	3,3%	13,6%	2,5%	15,4%	3,3%	30,4%	5,8%
	3 No idea	2,50%							9,1%	1,7%	3,8%	,8%		
	4 Partially disagree	10,90%					6,5%	1,7%	9,1%	1,7%	23,1%	5,0%	13,0%	2,5%
	5 Totally disagree	9,10%	16,7%	,8%	15,4%	1,7%	9,7%	2,5%	4,5%	,8%	3,8%	,8%	13,0%	2,5%

Table 7: The Period of Time for Using the System (G01-G02) and General Opinion (H01)

			1 Civil servant		2 Technician		3 Nurse		4 Doctor		5 Academic		6 Other	
Clinical Task	Values	Total	Layer	Table	Layer	Table	Layer	Table	Layer	Table	Layer	Table	Layer	Table
What percent of your time (during an exam, procedure or recording ect.) do you spend for entering the clinical information or results of each patient? (G01)	1 Less than 10%	20,40%	60,0%	2,8%	44,4%	3,7%	12,5%	3,7%	4,5%	,9%	16,0%	3,7%	40,0%	5,6%
	2 10%-25%	39,80%	20,0%	,9%	22,2%	1,9%	46,9%	13,9%	40,9%	8,3%	48,0%	11,1%	26,7%	3,7%
	3 25%-50%	26,10%	20,0%	,9%	22,2%	1,9%	31,3%	9,3%	27,3%	5,6%	28,0%	6,5%	13,3%	1,9%
	4 50%-75%	14,00%			11,1%	,9%	9,4%	2,8%	27,3%	5,6%	8,0%	1,9%	20,0%	2,8%
What percent of your daily working time do you spent for using record system? (G02)	1 Less than 10%	20,80%	60,0%	2,7%	33,3%	2,7%	6,7%	1,8%	5,0%	,9%	40,0%	9,1%	19,0%	3,6%
	2 10%-25%	32,70%			33,3%	2,7%	50,0%	13,6%	35,0%	6,4%	32,0%	7,3%	14,3%	2,7%
	3 25%-50%	24,60%	40,0%	1,8%			33,3%	9,1%	30,0%	5,5%	24,0%	5,5%	14,3%	2,7%
	4 50%-75%	21,80%			33,3%	2,7%	10,0%	2,7%	30,0%	5,5%	4,0%	,9%	52,4%	10,0%
How would you rate the success of the electronic medical record system installed in your department? (H01)	1 Very poor	0,80%											4,3%	,8%
	2 Poor	5,90%			11,1%	,8%	12,5%	3,4%	9,1%	1,7%				
	3 Fair	27,90%	16,7%	,8%	22,2%	1,7%	43,8%	11,9%	27,3%	5,1%	19,2%	4,2%	21,7%	4,2%
	4 Good	59,30%	66,7%	3,4%	55,6%	4,2%	43,8%	11,9%	59,1%	11,0%	73,1%	16,1%	65,2%	12,7%
	5 Perfect	5,80%	16,7%	,8%	11,1%	,8%			4,5%	,8%	7,7%	1,7%	8,7%	1,7%

Figure 1: Use of Medical Record System

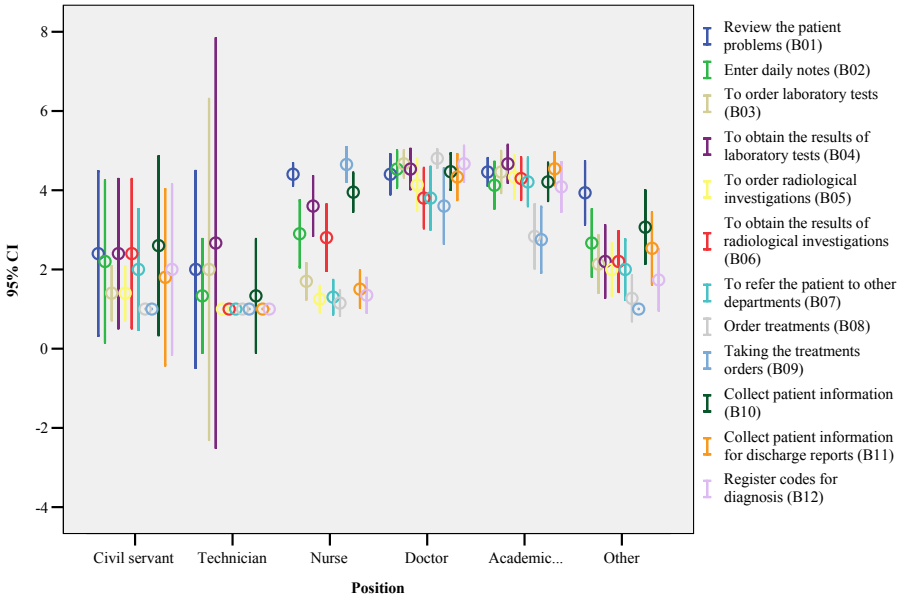

Figure 2: Comparison of the Easy Use of Electronic Record System with Paper Record System (C01-C12)

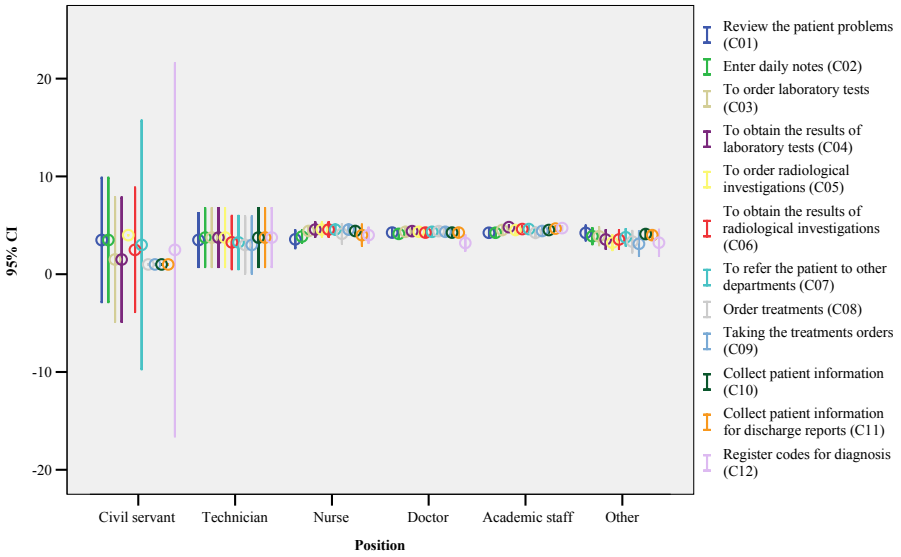

Figure 3: Satisfaction with Electronic Medical Record System (D01-D04)

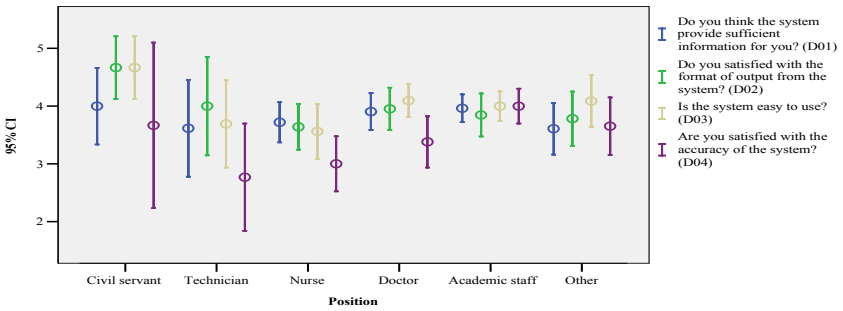

Figure 4: Advantages of the Medical Record System (E01-E05)

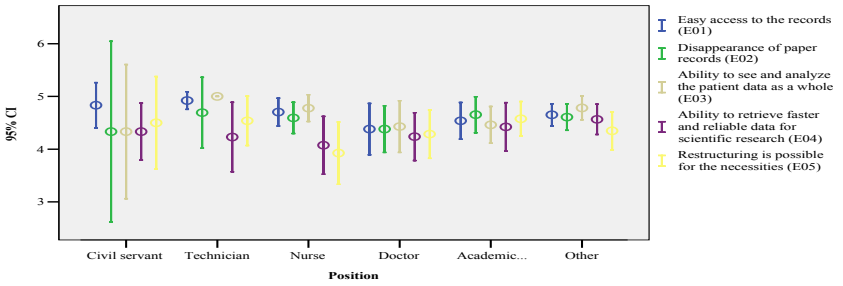

Figure 5: Disadvantages of Medical Record System (F01-F05)

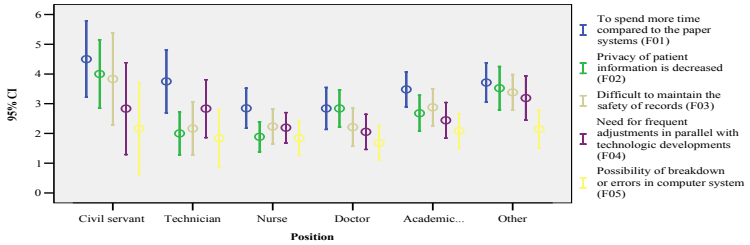

Figure 6: The Period of Time for Using the System (G01-G02) and General Opinion (H01)