Case Study: Analysis of End-User Requests on Electronic Medical Record and Computerized Physician Order Entry System of Seoul National University Hospital in Korea

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Abstract

Seoul National University Hospital (SNUH) in Korea has utilized the full Electronic Medical Record (EMR) system since October 2004. Unlike other countries, most EMR systems in Korean teaching and general hospitals are in-house development systems. Therefore, we can actively respond to user requests on EMR. Here, based on 5 years of experience in EMR system operation, we analyzed 2,339 SNUH EMR user requests from 2006 to 2008 for improvement of EMR system operation and management. We classify user requests into 9 criteria based on guidelines from the SNUH medical information management team. In conclusion, the most common requests (73 %) are for improvement of improving quality of care. However, requests associated with hospital enterprise, public policy, and customer service are gradually increased every year. Therefore, we suggest that suitable EMR management criteria are necessary for reliable EMR operation and management.

Keywords:

Computerized patient record, Computerized physician order entry, Management information systems

Introduction

Seoul National University Hospital (SNUH) is the first modern hospital in Korea since 1885. It now has 1,754 beds, with 563,712 inpatients and 1,850,473 outpatients per year. As one of Korea's largest teaching and general hospitals, SNUH received the Korea Brand Power Index Award for 9 consecutive years [1] and was ranked first in the 2004 National Hospital Evaluation Program by the Korean Ministry for Health and Welfare. SNUH is also the first hospital in Korea to adopt an electronic medical record (EMR) system in all hospital units. The computerized physician order entry (CPOE) system was launched in 1999, and the EMR system in 2004. Representative goals of EMR and CPOE in SNUH include saving space and time, integrating management of medical information, improving quality of medical records, supporting diverse data formats, data recombination, clinical decision support, information exchange among medical persons or hospitals, and

better communication. Consequently, SNUH is able to obtain significant outcomes using the EMR system [2], these include qualified medical products, prominent clinical research results, excellent medical evaluation rating, and good education guidance.

Active acceptance & application of end-user requests can result in achievement of these outcomes. 'End-user request' means requirements based on direct needs of medical and nursing users' on EMR. The requests can be actualized by EMR programming(including changing, improving, editing or supporting, etc.). Since most EMR and CPOE systems in Korea's teaching and general hospitals are in-house development systems, we can easily respond to user requests and implement them into the hospital information system (HIS). Besides the characteristics of system development, the reason that we actively collect end-user requests is to promote EMR ownership and participation. Adoption of the CPOE was relatively easy, due to its diverse and attractive merits. However, since SNUH has a long history of paper medical records, many hospital personnel were reluctant to use electronic medical records, in spite of the advantages of such as system.

In order to collect and reflect end-user requests, we set 'user-friendly' policy as a major HIS management policy at SNUH. 'User friendly' policy means that anyone who uses EMR or CPOE can meet his or her own requirements through diverse routes. In detail, there are three steps. The first step is to open diverse channels for acceptance of user requests, i.e. telephone call, bulletin boards, e-mail, and so on. This is important for encouraging active user participation. The second step is active and positive acceptance after discussion of requests through EMR system board members and end-users. At SNUH, the EMR system board member is composed of doctors, nurses, IT specialists, and programmers. The last step is suitable coordination. The EMR and CPOE systems are very complicated and are interconnected to each EMR program component. Therefore, the process of coordination with program developers and medical personnel is essential.

In this paper, we analyzed end-user requests for the three previous years for review in our study of 'user-friendly' policy. Based on 11 years of experience with the CPOE system and 5

years with the EMR system, we can propose a promising method for operation and implementation of a good quality HIS.

Materials and Methods

SNUH launched its CPOE system in October 1999 and its EMR system in October 2004. SNUH improved its CPOE and EMR systems with two major upgrades in 2005 and 2006.

We first collected SNUH end-user requests from 2006 to 2008, including requests for a second major upgrade in 2006 [3]. Unfortunately, no data on end-user requests was documented before 2006. The total number of requests for the previous three years was 2,339. We then classified the collected requests into 9 categories, which were defined by the SNUH medical information operation team on the authority of practical & political demands in SNUH. The categories are shown in Table 1. Detailed subcategories of each category are also shown in the table.

Table 1- Categories for EMR users' requests

Category	Sub-categories
Improving Quality of Care	Medical process optimization
	Newly established department
	Medical persons communication
	Program management
	Decision support
	Authority
	Device interface
Evaluation of Clinical Quality	Clinical quality index
	Hospital accreditation process
Service for Customer	Patient information privacy
	Patient safety
Government Regulation	National health insurance regulation change
	National health management policy change
Hospital Enterprise	Hospital process innovation
	Quality assurance
Statistics	Statistics of operation, admission, and discharge
Education	System for medical students
	Updating manuals
Clinical Research	EMR modification for clinical research supports
Miscellany	

Analysis Results

Table 2 summarizes user requests. The most frequent request category is "Improving Quality of Care," with a proportion of 73%. We can easily understand this result, since one of the most important purposes of using the EMR and CPOE systems is improvement of the quality of clinical care. The categories include "Evaluation of Clinical Quality" (12%), "Service for Customers" (5%), "Government Regulation" (4%), and "Hospital Enterprise" (1%). In 2007, the number of requests increased rapidly (from 540 to 913, 69.1%) due to nation-wide hospital accreditation in Korea, which is performed every three years. Therefore, the "Evaluation of Clinical Quality" category increased almost 1,000%. This rapid increase also confirms the importance of the EMR and CPOE systems in hospital management and operation.

Another interesting development is that as system end-users become accustomed to using the EMR system, they make more requests. The total number of requests in 2008 increased 64% compared to 2006. When we investigated user requests in detail, recent requests focus on more specific clinical purposes, rather than general bug fix requests. This means hospital personnel have begun to depend on the EMR or CPOE systems in their routine work.

Table 2- User requests on SNUH EMR

Category	2006	2007	2008	Total
Improving Quality of Care	466	572	674	1712
Evaluation of Clinical Quality	20	222	36	278
Service for Customer	24	27	72	123
Government Regulation	3	35	51	89
Hospital Enterprise	15	29	31	75
Statistics	2	10	9	21
Education	1	2	6	9
Clinical Research	1	6	0	7
Miscellany	8	10	7	25
Total	540	913	886	2339

As shown in Tables 2 and 3, the noticeable categories are "Government Regulation" and "Service for Customer." In government regulation, even though the number of requests is small, any request associated with this category is very complicated. For example, the Korean government pushed hospitals to integrate the real-time drug utilization review (DUR) system into their systems. The adaptation rate of electronic health records in US general hospital is very low [4]; however, the rate in Korea is relatively high [5] and has increased rapidly since 2004. Recently, most Korean general hospitals have

used EMR systems. In contrast to other countries, Korea has only one national health insurance agency, known as the National Health Insurance Corporation. Within this environment, the Korean government has begun to control hospital EMR or CPOE systems in order to promote public health.

Customer service is also important. As in Table 3, this category is almost 100% increased in its ratio (from 4.44% to 8.13%). This implies that EMR is an important tool for increasing the quality of patient service; SNUH is actively trying to utilize the EMR and CPOE systems in this category.

Table 3- Ratio of each EMR user requests category

Category	2006	2007	2008
Improving Quality of Care	86.30%	62.50%	76.07%
Evaluation of Clinical Quality	3.70%	24.32%	4.06%
Service for Customer	4.44%	2.96%	8.13%
Government Regulation	0.56%	3.83%	5.76%
Hospital Enterprise	2.78%	3.18%	3.50%
Statistics	0.37%	1.10%	1.02%
Education	0.19%	0.22%	0.68%
Clinical Research	0.19%	0.66%	0.00%
Miscellany	1.48%	1.10%	0.79%

Although the 'Improving quality of care' category has decreased in its proportion from 86.30% in 2006 to 76.07% in 2008, the number of requests has still increased from 466 in 2006 to 674 in 2008. This means that users have required much more diverse functionality from the EMR system by taking notice of its convenience and practicality, even though the EMR system is improved by reflection of every request.

A 2008 Survey of the HIMSS (Healthcare Information and Management Systems Society) shows results similar to those in Tables 2 and 3 [6]. Figure 8 of [6] shows "Improving Quality of Care," which increased from 56% in 2007 to 69% in 2008 and "Patient (Customer) Satisfaction," which increased from 36% to 55%. Our results show the same trends as mentioned above. Notice that results from the HIMSS survey of the "top business issues facing healthcare" are derived from CIOs or IT managers; however, our results are obtained from end-users. This implies that medical personnel, including doctors and nurses have begun to notice the importance of IT systems in healthcare.

However, there is a pitfall of 'user friendly' policy. Table 4 shows the number of medical user requests, accepted requests, requests implemented on EMR, and requests in progress. The "Accepted requests" category refers to requests approved by EMR board members; "implemented requests" refer to requests implemented on the EMR or CPOE system; "under

development" refers to requests still under development after being accepted; and "withdrawal" represents requests that are withdrawn after being accepted.

Table 4- Summary of practically implemented user requests in the case of medical part

	2006	2007	2008
Total Requests(in medical part)	286	783	688
Accepted Requests	143	391	323
Implemented Requests	93	292	214
Under development Requests	48	98	109
Withdrawn Requests	2	29	42
Under development/ Accepted(%)	33.6	25	33.7
Withdrawn/ Total(%)	0.6	3.7	6.1

As in Table 4, the number of requests still in progress has increased. By trying to accept all possible user requests, users begin to rush very individual demands onto the EMR or CPOE system. In addition, users become accustomed to the system; therefore, requests become more complicated and interconnected to other programs. In some cases, users make contradictory requests, due to conflicting interests; or make requests that require a change in the business process. These problems cannot be solved by EMR board members, so increment of withdrawn ratio should be happened.

Since IT resources are limited, it is difficult to implement all accepted requests in time. As in Table 4, the ratio of under-developed requests is about 25~34%. This situation(slow implementation of user requests) causes user dissatisfaction. Therefore, IT managers should try to catch essential requests and prioritize them, furthermore, control programmers for building the accepted requests in time.

Discussion

Since implementation of the EMR system at SNUH as the first trial among major Korean teaching and general hospitals, there have been many concerns regarding adoption and implementation of EMR. Therefore, we have chosen a 'user-friendly' policy in order to improve user participation.

Fortunately, results of our analysis confirm that our 'user-friendly' policy is one of the key elements of success in adoption of the HIS system. End-users make more frequent requests as they get used to the system. The total number of requests in 2008 increased 64% compared to 2006; and users made 3.5 requests per business day in 2008. End-users have recently shown a desire to use the EMR and CPOE systems for improving customer service, as well as quality of clinical care. The board of hospital directors has begun to use the EMR and CPOE systems for management of hospital enterprises, including process innovation or simple financial statistics. Moreover, the government has noticed that HIS can be a useful tool for improving public health. In conclusion, EMR and CPOE system must be an essential tool for improvement of the quality of care.

However, 'user-friendly' policy brings other problems. For example, the complexity of the system has increased and the speed of the system has slowed down. Therefore, a balance must be established between 'user-friendly' policy and limited resources.

We must mention that the EMR and CPOE systems at SNUH are in-house development systems. SNUH also has an IT team that includes programmers. Therefore, we can actively collect end-user requests and implement the accepted ones on our HIS system. This can mean a significant difference between the SNUH system and those of other countries. It might be a key element for our successful EMR implementation.

Acknowledgments

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