의료과오를 줄이기 위한 효율적인 병원서비스운영에 대한 실증적 연구

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An Empirical Study on the Efficient Hospital Service Operation Management for the Reduction of Medical Errors

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Key Words : Medical Error, Employee Satisfaction With Organizational Support, Organizational Systems.

Abstract

This paper presents a research model, which identifies a relationship between medical error reduction, efficiency of organizational systems, and employee satisfaction with organizational support. The proposed model was tested through hypotheses, based on data collected from 210 respondents from the medical staff of large-sized (i.e., more than 500 beds) residential hospitals in cities of South Korea.

The results of the study showed that medical error reduction is associated with corrective system and employee satisfaction with organizational support. Therefore, it is very important that organizations improve their employees' satisfaction by providing sufficient support (e.g., information support and sharing, work guide book, etc.) for their work. In addition, in organizational systems, the corrective system has positive relationship with medical error reduction. In terms of corrective procedures, leaders or managers can make improvements by providing and supporting a friendly work environment where errors may be reported without blame and discussed in order to be corrected.

1. Introduction

Health care providers have been striving to improve quality of care, which positively impact both patient satisfaction and organizational performance. At the same time, the society has seen increasing needs of patients and customers (e.g., protectors, employees and potential customers) for good quality of care, treatment, and use of high technology. In turn, these needs require the medical industry to improve health care quality, reduce medical errors and contain costs in terms of extra expense incurred due to errors in the health care system.

To improve quality of care, medical errors should be reduced during the treatment or diagnosis in hospitals. The reports of the Institute of Medicine (IOM) (2001, 2000) emphasized the importance of reducing medical errors in the health care system. For example, US hospitals have reported more

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than 98,000 medical error-related deaths per year; 58% of the deaths might have been preventable (Stock et al., 2007). According to the HealthGrades (2008) study involving 41 million Medicare patient records, medical error cost in the U.S. was $8.8 billion and resulted in 238,337 potentially preventable deaths during 2004 through 2006. Interestin gly, the report indicated that those patients treated at the top performing hospitals had, on average, a 43 percent lower chance of experiencing one or more medical errors as compared to the poorest-performing hospitals.

The problem of medical errors has grown to be of a critical importance throughout the world. Tucker (2004) found that human errors or operational failures had significant financial implications to hospit als. Accordingly, hospitals are striving to reduce medical errors and improve quality of care for patient satisfaction. In an effort to reduce medical errors, hospitals invest in a variety of advanced technological equipment and information systems (IS). Information technology (IT) spending in health care grew by more than 9% in year 2003 to $23.6 billion from $21.6 billion in 2002 (Carpenter, 2004). Additionally, IT can be used to interface with the patient database to evaluate medical treatment results, which contributes directly to the cost reduction in treating patients (Carpenter, 2004). The quality of care will improve as hospitals invest in advanced IT and IS (Bernstein et al., 2007; Young et al., 2007; Fiscella and Geiger, 2006; Li and Benton, 2006).

This study focuses on the relationship between medical error reduction, organizational systems, and employee satisfaction with organizational support. This study proposes a research model to reduce medical errors based on previous studies. Survey data are collected and analyzed from hospital employees. The rest of this paper is organized as follows: Section 2 presents a review of previous studies and concepts relevant to this study. Then Section 3 proposes a research model. Section 4 shows a research methodology. Section 5 reports the result of the model using the SPSS 15.0 prog ram. Sec tion 6 presents the conclusion and limitation of the study.

2. Review of Relevant Literature

2.1 Medical error

Traditionally, errors occur when mistakes are made by individuals, systems, and/or machines. Acco rding to an IOM (2000) study, a medical error is defined as "the failure of a planned action to be completed as intended (i.e., error of execution) or use of a wrong plan to achieve an aim (i.e., error of planning)." This research mentioned that some medical errors may lead to an adverse event that is defined as "an injury resulting from a medical intervention, but not due to the underlying condition of the patient" (IOM, 2000). Stock et al. (20 07) stressed the fact that all adverse events are caused by medical treatment or diagnosis, but not all are attributable to errors. Thus, they defined a medical error as "an error occurring in the context of the health care system." Accordingly, in this study a medical error is defined as an error that occurred in the entire process of patient care within a health care system.

Medical errors can occur due to inaccurate diagnosis and/or treatment of a disease (i.e., injury, syndrome, infection, or behavior) by low skilled or inexperienced physicians, new procedures, complex or urgent care, or other complications. Also, poor communication between the patient and care teams (e.g., language), improper or illegible documentation, wrong information and data, and similarly named medications are also known to contribute to medical errors. Previous research has identified several categories of medical errors: medication errors (Coile, 2001; Leape et al., 1991), surgical errors (Coile, 2001; Kovner and Gergen, 1998; Leape et al., 1991), therapeutic errors, diagnostic errors, and anesthesia errors (Coile, 2001; Cooper et al., 1984).

Stock et al., (2007) presented seven items for medical error reduction outcomes. These are divided into two variables: quality and operational benefits, and knowledge-related benefits. Quality and operational benefit variables include quality improvement, increased patient satisfaction, reduced frequency of errors, and reduction in the severity of errors. On the other hand, knowledge-related benefit variables include an increased understanding of errors and increased awareness of errors. In this study, the measurement items of medical error reduction outcomes are developed based on the measurements of Stock et al., (2007).

2.2 Organizational systems

Introduction of IS and IT in hospitals has received the ever increasing attention in the medical community (Bernstein et al., 2007). The use of IS in hospitals can be found in various ways. For instance, implementing security programs and devices (ISPD) can be used to protect the privacy of patients' health care information. Computerized physician order entry (CPOE) systems can help prevent prescription errors. Bar coding can be used to match patients to their medications. Radio frequency identification (RFID) is beginning to be used for inventory control and managing such procedures as patients' medications, medical process, and outpatient compliance with treatment plans after discharge. Electronic health records (EHRs) can reduce medical errors and costs (Young et al., 2007; Wicks et al., 2006).

Carpenter (2004) suggested that IT is effective for collecting data in the patient database to track medical treatment, which contributes directly to the cost of treating a particular disease. The implementation of IT often changes the organizational culture and structure, business processes, and employee skill requirements (Kazahaya, 2005; Carpenter, 2004; Ball et al., 2003). IT reduces processes and variations in the healthcare service delivery process. For instance, patients' data are entered only once into a database, and the data can be shared by various departments in hospitals. Quality of care will improve in hospitals that are investing in advanced technology and supported by medical manpower that is continuously learning new technology and improving clinical competencies (Li and Benton, 2006). Therefore, IS and IT are a necessary factor in hospitals to reduce medical errors, save medical cost, improve operational effectiveness and efficiency, enhance patient satisfaction, and prevent prescription errors.

In this study, the organizational system is defined as the entirety of employee activities to improve quality of care and reduce medical errors in diagnosis and treatment of patients. The organizational system also includes IS and IT for managing patients' information. The system is used to prevent and correct errors that might occur during diagnosis and treatment. That is, the organizational system consists of two sub-systems that perform two functions: a preventive function and a corrective function. The preventive system involves all of the activities needed to reduce medical errors, especially focusing on preventive activities of medical errors. These activities involve education and training programs for employees (e.g., doctors, nurses, and technicians), maintaining patient records, and procedure (Bernstein et al., 2007; Stock et al., 2007). The corrective system includes activities or methods ensuring that the same medical errors do not reoccur (i.e., the preventive system of the recurrence), such as education and training programs for employees, analysis of error data, open discussion, cultural shift, and system redesign (Stock et al., 2007). Bernstein et al. (2007) propose applications of IS and IT for effective operations such as maintaining patient records, allowing information to be shared, and the management and operations of the hospital. Stock et al. (2007) suggest that hospitals need to develop education and training programs for employees, to perform statistical analysis of error data, and to redesign systems (equip ment of diagnosis and treatment, technology, procedures, etc.). Our study adapted measurement items of organizational systems based on studies of Bern stein et al. (2007) and Stock et al. (2007).

2.3 Employee satisfaction with organizational support

Employee satisfaction is a synthetic emotion which an employee feels in relation to work life as well as his or her own task (Heskett et al., 1997). As employee satisfaction is the result of an organizat ion's support policy (Rodeney et al., 2001; Heskett et al., 1997), activities involved in support policy lead to employee satisfaction, and which, in turn, would improve customer satisfaction. In other words, a higher quality of service leads to a higher level of customer satisfaction (Heskett et al., 1994).

Employee satisfaction can be measured with three concepts: job satisfaction, employee absorption, and employee satisfaction with organizational support (Chung and Lee, 2005). Job satisfaction is a pleasant and positive state of feelings about a task or work experience (Locke, 1976). Beatty and Sch niner (1981) defined job satisfaction as state of enjoyment received from job evaluation. Robbins and Coulter (1999) explained job satisfaction as the attitudes and determinations about one's work. Porter and Steers (1978) defined employee absorption as strong reception of the goal and values of an organization, and thus an employee's wish to make efforts for his or her organization, and desire to remain a member of the organization. Employee satisfaction with organizational support is defined as satisfaction with the organization for providing needed support for their work (Chung and Lee, 2005).

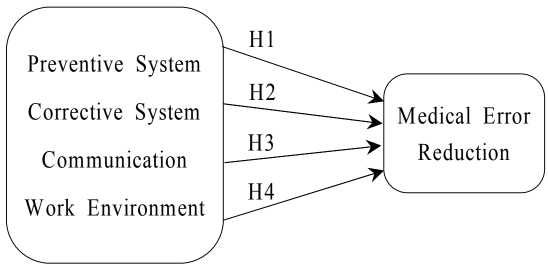
Job satisfaction and employee absorption are expressed by an attitude of subjective experience and emotional reaction (Chung and Lee, 2005). How ever, employee satisfaction with organizational sup port is a concept of the process that leads to emotional reaction of the employee. If organizations provide sufficient support to employees for what they need in their work place, satisfaction of employees will increase. Then the satisfied employees provide high quality of care to patients. Cons equently, employee satisfaction with organizational support to attain employee satisfaction is an important construct. In this study, employee sati sfac tion with organizational support is used, since it leads to an emotional reaction of the employee that would consequently lead to reduced medical errors.

Employee satisfaction with organizational support consists of two-sub factors: communication and work environment. The measurement items of com munication and work environment are developed based on Chung and Lee's study (2005).

3. Research Model and Hypotheses

3.1 Research model and hypotheses

Figure 1 shows the research model describing how employee satisfaction with organizational support and organizational systems affect medical error reduction. The organizational system and employee satisfaction with organizational support help employees improve the efficiency of their work, which will improve patient satisfaction.



<Figure 1> The proposed research model

Quality of care will improve when hospitals invest in advanced technology and medical manpower is continuously upgraded by learning new technology and improving their clinical competencies (Bernstein et al., 2007; Young et al., 2007; Fiscella and Geiger, 2006; Li and Benton, 2006). Organizational systems can prevent and correct errors in the hospital operation during patients' diagnosis and treatment, and also while building and maintaining equipment and/or procedure. Hence, organizational systems including the preventive and corrective systems will play a role in reducing medical errors. Therefore, the following hypotheses are proposed:

H1: The preventive system will positively affect medical error reduction.
H2: The corrective system will positively affect medical error reduction.

If sufficient support is provided to enable the employees to attain a higher level of satisfaction, failures of work process will be reduced, satisfied employees will provide better services to patients, and patient satisfaction will be increased. Satisfied patients positively impact organizational performance such as improved customer loyalty, word-of-mouth, and profitability (Chung and Lee, 2005; Meyer and Collier, 2001; Heskett et al., 1994). In this study, employee satisfaction with organizational support consists of work environment and communication with co-workers and/or superiors in the work place. Consequently, employee satisfaction with organizational support to attain employee satisfaction is an important factor to reduce medical errors. The following hypothesis is proposed:

H3: Effective communication will positively affect medical error reduction.
H4: A supportive work environment will positively affect the medical error reduction.

4. Research Methodology

4.1 Data collection

A survey questionnaire was developed to collect data in large-sized (i.e., more than 500 beds) residential hospitals in cities of South Korea and to test the proposed model. An initial questionnaire was tested in a pilot survey; we sent it to three departments in one of the hospitals in South Korea. In the pilot survey, we reduced the number of measurement items of the organizational system (e.g., change in thinking about errors, system redesigns, etc.) and medical error reduction outcomes (e.g., increased understanding of errors, net cost savings, etc.) as suggested by managers of these departments, as employee perceptions were difficult to measure precisely through the questio nnaire. All of the constructs in this study were measured by perceptions of individual employees. The final questionnaire was refined slightly after the pilot test.

<Table 1> Hospitals' characteristics and respondents' demographic data

Hospital characteristics		Frequency	Percent
Hospital type	Teaching hospital	100	47.6%
	Public hospital	110	52.4%
Number of beds		> 500	100.0%
Total		210 hospitals	
Respondents' demographic data		**Frequency**	**Percent**
Gender	Male	74	35.2%
	Female	136	64.8%
Age Range	≤ 30	82	39.0%
	31-40	81	38.6%
	41-50	40	19.0%
	≥ 51	5	2.4%
	Missing	2	1.0%
Work experiences in this hospital	≤ 1	27	12.9%
	2- 5	62	29.5%
	6-10	69	32.8%
	11-15	18	8.6%
	16-20	22	10.5%
	≥ 21	12	5.7%
Occupation	Nurse	84	40.0%
	Physician	50	23.8%
	Technician	76	36.2%

For data collection, we selected public and teach ing hospitals. Out of a total of 250 questionnaires distributed to care team members (e.g., doctors, nur ses and technicians) who have frequent contacts with patients in the hospital, we received 213 (85.2%) responses. Three incomplete or missing item ques tionnaires were removed in the study. The final sample consisted of 210 (84.0%) valid, returned ques tionnaires from respondents. The responding hos-pitals' characteristics and respondents' demographic data were summarized in Table 1. About 52% of respondents were from public hospitals and about 48% were from teaching hospitals.

Occupations of the respondents were as follows: nurse – 40.0%; technician – 36.2%; physician – 23.8%. Work experience of the respondents in these hospitals were from less than 1 year to more than 21 years.

4.2 Variables of the model

The questionnaire utilized 5-point Likert scales to collect measures for the main constructs. Scales to measure each of the constructs were developed based on the scales of prior studies as much as possible. Some measures were modified to adapt to this research.

Reliability was calculated based on Cronbach's alpha value (Table 2). All of the coefficients of re-liability measures for the constructs exceeded the threshold of 0.70 (Nunnally, 1978). In reliability test results, the Cronbach's alpha value for com-munication was highest, .904 and the work envi-ronment was the lowest, .734. All of the Cronb ach's alpha values were significant at $p < .05$.

Factor analysis was performed to extract sepa-rate constructs for the main variables. In selecting a rotation strategy for factory analysis, Varimax rotation was used as most variables used in the current study were from previous studies and the factors were correlated with one another. Overall, the loadings of the items for the five factors provided support for the constructs as formulated.

The loadings for all the factors and the correla-tions between the factors are shown in Table 2. The loading values of each factor ranged from .675 to .878. All measurement instruments met the threshold. Eigen values for PS(Preventive System), CS(Corrective System), COMM(Communication), and WE(Work Environment) were 4.61, 3.55, 1.26 and 1.03, whose total variance explained was 69.80%. Also, Eigen values for ME(Medical Error) showed 2.5 and variance explained was 62.50%.

The bottom elements in Table 3 present the square roots of average variance extracted (AVE) of latent variables, while the off-diagonal elements are the correlation between latent variables. For adequate discriminant validity, the square root of AVE of any latent variable should be greater than the correlation between the particular latent varia-ble and other latent variables (Barclay et al., 1995). Statistics shown in Table 3 therefore satisfy this re-quirement, lending evidence to discriminant validity. Also, the results of the correlation between each variable are shown in Table 3. As shown Table 3, medical error reduction has a positive relationship with COMM and WE, however, PS and CS do not. PS and CS have a positive relationship.

<Table 2> Results of Reliability and Factor Analysis

Dependent Variable	Component
	Medical error reduction
Quality improvement	.822
Patient satisfaction	.878
Reduced frequency of error	.746
Severity of error	.705
Initial Eigenvalues	2.500
Variance explained (%)	62.497
Reliability	.795

Independent Variables	Component			
	Preventive System (PS)	Corrective System (CS)	Communi -cation (COMM)	Work Environment (WE)
Information technology system	.839	.170	.023	.078
Education & training to prevent error	.799	.192	-.105	.003
Keeping and using	.726	.231	-.029	-.058
Procedures	.866	.154	-.026	-.019
Education & training to correct error	.184	.841	-.070	.072
Reporting and supportive	.319	.675	.054	-.060
Statistical analysis of error data	.217	.822	.046	-.092
Easy access to information	-.079	.066	.857	.217
Information support	.005	.006	.853	.162
Sharing information	-.003	.039	.824	.184
Easy contact to supervisors	-.065	-.042	.823	.168
Communication with supervisors/ colleagues	-.065	-.047	.815	.216
Work guide book	-.132	.032	.351	.757
Safe environment	.062	.020	.356	.742
Construction of work environment	.043	-.100	.145	.718
Initial Eigenvalues	3.558	1.262	4.614	1.036
Variance explained (69.797%)	23.722	8.413	30.757	6.905
Reliability	.845	.748	.904	.734

<Table 3> Correlation Matrix and Average Variance Extracted (AVE)

Factor	PS	CS	COMM	WE	ME	Org. system	Org. support
PS	1						
CS	.516**	1					
COMM	-.103	.038	1				
WE	.034	.008	.394**	1			
ME	-.035	.118	.451**	.234*	1		
Org. system	.897**	.842**	-.040	-.015	.020	1	
Org. support	-.043	.028	.841**	.828**	.413**	-.032	1
Mean	3.23	3.04	3.79	3.58	3.48		
SD	.696	.586	.650	.627	.733		
CR	.668	.589	.765	.634	.635		
AVE	.888	.809	.941	.832	.870		
Sqrt (AVE)	.788	.654	.885	.692	.757		

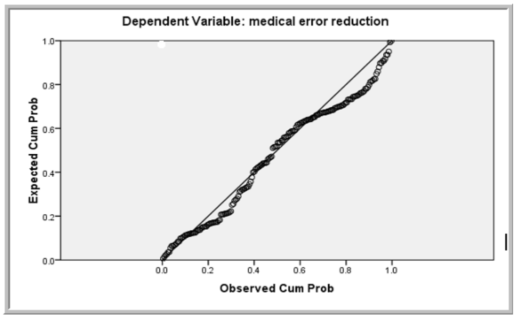
CR (critical ratio) = ∑ (factor loading2)/(∑(factor loading2)+∑(error))
AVE = ∑ (factor loading)2/(∑(factor loading)2+∑(error))
*p < .05, **p < .01

5. Results

Linear regression analysis was used to test the hypotheses of the model using the SPSS 15.0. Three major assumptions (normality, linearity, and multicollinearity) of multiple regression were tested: As shown in Table 4, the tolerance value for each independent variable is ranged from .691 to .725 ,which is not less than .10 (recommend) there fore, the model has not violated the multicollinea rity assumption). This is also supported by the VIF value, which is from 1.379 to 1.446, which is well below the cut-off of 10. Probability plot of the regression standardized residual was analyzed. As shown in Figure 2 as normal probability plot (P-P), each point lies in straight diagonal line from bottom left to top right ($p > .045$). It means no major deviations from the normality. From the normal P-P plot in Figure 2, one can see that the points do not vary a great deal from the straight line. Since the line represents a perfectly normal distribution, one can see that the plot may be approximately normal. However, there is a little concern around above the .8 point on the x-axis. This may be a cause for concern and may need to be investigated further. That being said, there are no extreme values from the plot above to cause an extreme concern. Therefore, major assumptions for the study were satisfied.

Table 4 reports the correlation coefficient as R=49.8%, R Square statistic=24.8, and adjusted R Square=23.2. The value of adjusted R Square statistic provides a better estimate of the true population value. In words, 23.3% of the variability in medical error reduction is accounted for by PS, CS, COMM, and ME analytical. The second table is the ANOVA summary table that tests the null hypothesis that all regression coefficient equal zero (i.e., H0: PS=CS=COMM=WE=0, H1=not H0). The null hypothesis is rejected because the overall $F(4,181)=14.941$ was statistically significant at .05 level.

To find out how well each variable contributes to the final equation, their coefficients were analyzed as shown in Table 4. The summarized result, with all the variables entered into the equation, is shown in Table 4. For H1 and H2, the corrective system was statistically significant at .05 level, but the preventive system was not. Therefore, H1 was not supported, while H2 was supported. The value of B indicates that a higher level of the corrective system was associated with better medical error reduction. Although the preventive system was not supported in this study as an effective reducing factor for medical errors, it has been suggested to be important for improving quality of care. For example, the computerized physician order entry system was credited for the decrease of more than 80% of non-missed-dose and 55% of serious medication errors (Bates et al., 1999), and .89 day of the average length of stay in the hospital and 12.7% of medical charges (Tierney et al., 1993). For H3 and H4, communication and the work environment were both statistically significant at the .05 level and their signs were positive. Therefore, H3 and H4 were supported. It means that higher levels of employee satisfaction with organizational support for communication and work environment of were associated with better medical error reduction. Ineffective communication among medical team members affects medical error and patient harm (Leonard et al., 2004; Woolf et al., 2004). For instance, although 83% of medical errors are due to mistakes in treatment or diagnosis, 2 of 3 were set in motion by errors in communication (Woolf et al., 2004)



<Figure 2> Normal P-P Plot Regression Standardized Residual

<Table 4> Regression result

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.498[a]	.248	.232	.585	2.217

a. Predictors: (Constant), workenvironment, corrsystem, presystem, communication
b. Dependent Variable: medical error reduction

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	20.441	4	5.110	14.941	.000a
	Residual	61.908	181	.342		
	Total	82.349	185			

Coefficientsa

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	1.166	.386		3.024	.003	.405	1.928		
	presystem	-.100	.071	-.108	-1.416	.159	-.240	.039	.719	1.390
	corrsystem	.180	.086	.158	2.091	.038*	.010	.350	.725	1.379
	communication	.354	.077	.358	4.618	.000***	.202	.505	.691	1.446
	work environment	.186	.089	.160	2.086	.038*	.010	.362	.704	1.421

a. Dependent Variable: medical error reduction
*p < .05, **p < .01, ***p < .001

Based on these results, we developed a linear equation model to estimate medical error reduction.

$$\widehat{Y} = 1.17 + (\text{corrective system}*.18) + (\text{communication}*.35) + (\text{work environment}*.19) - (\text{preventive system}*.10)$$

Where, $\widehat{Y}$ is the medical error reduction.

Communication variable might make the largest unique contribution (beta = .36) although CS (beta = .16), work environment also made a statistically significant contribution (beta = .16). To reduce medical errors, organizational leaders should provide sufficient organizational support and develop efficient organizational systems to improve quality of care through the corrective system.

6. Conclusion

Efforts to reduce medical errors in the health care system have continued through the world in hospitals and related institutions. Our study proposed a research model to describe how organizational systems and employee satisfaction with organizational support influence medical error reduction in hospitals. This model was tested using four hypotheses and data from 210 respondents from large-sized residential hospitals in cities of South Korea.

The study has a similar result to previous studies (Stock et al. 2007, Leape 1997, Chung and Lee 2005). This study showed that medical error reduction is associated with employee satisfaction with organizational support. This seems reasonable in that the various efforts to reduce medical errors are related to the activities of medical manpower. A supportive environment leads individuals to work efficiently with supervisors/colleagues and help each other avoid mistakes (Leape, 1997; Chung and Lee, 2005). So it is very important that organizations improve their employees' satisfaction by providing sufficient support for their work.

Second, in organizational systems, the corrective system has a positive relationship with medical error reduction, but preventive system showed no significant relationship in the study. However, the preventive and corrective systems of profess ional practice reduce medical errors and improve quality of care (Leape, 1997; Bates et al., 1999). For medical error reduction, the prevention system can be developed based on "root causes-errors in design and implementation of the system" rather than on errors themselves (Leape, 1997). Therefore, health care organizations should ensure adequate information availability and better work schedules for the care team to eliminate mistakes, as well as training for improving their tasks. Also, it would be important that leaders or managers provide a flexible and positive work environment. For instance, when medical errors occur, employees should freely report and discuss to correct them. In general, most medical errors are not reported and difficult to eva luate because of strong medical sanctions (Leape, 1997). If managers and/or administrators do not implement a change for better systems, occurred medical errors might be repeated. Thus, organizational system applications can help devise solutions in flexible ways to reduce medical errors.

There are some limitations of the study. First, this study assumed that organizational systems used in each hospital are basically the same. Second, the survey data used in this study were collected from large-sized residential hospitals in cities of South Korea. Nevertheless, this empirical study provides evidence between medical error reduction and employee satisfaction with organizational support including organizational systems.

Future research may conduct a cross-cultural study to compare medical error reduction in different countries. In addition, as organizational culture in each department of a hospital might be different, we may study the culture of each department such as physicians, nursing, laboratory, emer gency, and surgical. Also, an empirical study needs a longitudinal study over several years to analyze the impact of various interventions to reduce medical errors over time.

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Appendix A: Major Items of the Questionnaire

1. Organizational system to reduce medical error	
※ In system to prevent medical error of our hospital,	
· efficiency of information technology system	
· education and training of employees to prevent error	
· efficiency of electronic record of keeping and using	
· procedures are useful to prevent medical error	
※ In system to correct after medical error occurrence, the following are provided	
· education and training to correct error	
· reporting errors without blame and supportive follow up discussion	
· statistical analysis of error data	
· change in thinking about errors; no more naming, blaming & shaming	deleted items in final survey
· system redesigns (restructuring the functioning of equipment, technology, etc.)	

2. Employee satisfaction of organizational support	
※ supports from our hospital,	
· easy access to information	
· support availability of needed information	
· sharing information about customer experience	
· easy contact to supervisors	
· communication with supervisors or colleagues	
· work guide book applicable related work	
· safe environment/ protocols	
· construction of work environment in related departments	

3. Medical error reduction outcome	
※ Results of effort to reduce medical error	
· quality improvement	
· increased customer satisfaction	
· reduced frequency of errors	
· reduction in the severity of errors	
· increased understanding of errors	deleted items in final survey
· net cost savings	
· heightened awareness of errors	

Appendix B: Frequency of Respondents

Statistics								
		IT	Edupre	EPUsing	procedure	education	report	statistical
N	Valid	210	210	210	210	210	210	210
	Missing	0	0	0	0	0	0	0
Mean		3.18	3.20	3.33	3.21	3.03	3.07	3.16
Minimum		1	1	1	1	1	1	1
Maximum		5	5	5	5	5	5	5

Statistics									
		inform -ation	support	sharing	super -visors	communi -cation	work -manual	safe	construc -tion
N	Valid	210	210	210	210	210	210	210	210
	Missing	0	0	0	0	0	0	0	0
Mean		3.67	3.67	3.81	3.952	3.88	3.35	3.70	3.70
Minimum		1	1	1	1	1	1	1	1
Maximum		5	5	5	5	5	5	5	5

Statistics					
		quality improvement	satisfaction	reduced error	severity
N	Valid	210	210	210	210
	Missing	0	0	0	0
Mean		3.48	3.51	3.50	3.79
Minimum		1	1	1	2
Maximum		5	5	5	5

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