

# The Effectiveness of the Error Reporting Promoting Program on the Nursing Error Incidence Rate in Korean Operating Rooms

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**Purpose.** The purpose of this study was to develop and evaluate an error reporting promoting program(ERPP) to systematically reduce the incidence rate of nursing errors in operating room.

**Methods.** A non-equivalent control group non-synchronized design was used. Twenty-six operating room nurses who were in one university hospital in Busan participated in this study. They were stratified into four groups according to their operating room experience and were allocated to the experimental and control groups using a matching method. Mann-Whitney U Test was used to analyze the differences pre and post incidence rates of nursing errors between the two groups.

**Results.** The incidence rate of nursing errors decreased significantly in the experimental group compared to the pre-test score from 28.4% to 15.7%. The incidence rate by domains, it decreased significantly in the 3 domains - “compliance of aseptic technique”, “management of document”, “environmental management” in the experimental group while it decreased in the control group which was applied ordinary error-reporting method.

**Conclusion :** Error-reporting system can make possible to hold the errors in common and to learn from them. ERPP was effective to reduce the errors of recognition-related nursing activities. For the wake of more effective error-prevention, we will be better to apply effort of risk management along the whole health care system with this program.

**Key Words :** error incidence reporting, incidence rate, medical error, operating room

## INTRODUCTION

Medical errors may or may not do harm to patients (Leape, 1994). But adverse events result in potential harm such as prolonged hospital stay, additional medical treatment and increased health care costs (Anderson & Webster, 2001; Bates et al., 1997; Webster & Anderson, 2002). Recently, there is much attention being paid to managing and preventing errors, rather than simply re-

sponding to adverse events (Classen & Metzger, 2003). The Institute of Medicine’s “To err is human” report in 1999 emphasized that most medical accidents are the result of system failures, and that to make the healthcare delivery system safer, the whole system must be reformed. Systems should ideally both make errors less likely, and catch those that do occur (Kim & Bates, 2006). So many policy makers develop strategies to reduce errors with the most general and positive method being an error-reporting system (Bates et al., 1997).

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Error-reporting systems are one key strategy for improving safety through reporting and tracing the underlying causes, the induced situations, the types and results of errors. In addition, it offers information about potential problems and errors for the future (Suresh et al., 2004). The aim, rather, is to improve the quality of care, to use a voluntary and anonymous reporting system (Wu et al., 2002). Nevertheless, regarding security of voluntary disclosure of information and anonymity, it has been difficult to solicit volunteers from the health care fields' due to workers' overloaded situation and an uncomfortable reporting method. So a web-based error reporting system has been developed with complementary functions considering the rapidity and the comfort of reporting (Mekhjian et al., 2004). The maximum time to complete the report is approximately 5 minutes using web-based system and it is easy to identify and quantify the contents of the questionnaire (Kobus et al., 2001 ; Wu et al., 2002).

Already, web-based error reporting systems have been applied to clinical environments in many countries, including the USA, Australia, and England from the late 1990s (Beckmann et al., 1996; Donchin et al., 1995; Wright et al., 1991). However it was an unfamiliar system in Korea. In addition, previous studies were undertaken to develop the error-reporting system in Intensive Care Unit's (Flaatten & Hevroy, 1999; Thomas et al., 2003; Wu et al., 2002; Weingart et al., 2001) to describe the trait of errors (Stanhope et al., 1999), and to estimate the rate of error reporting. Yet it is difficult to find a study that uses a web-based error reporting system and to describe the changes in the incidence rate of nursing errors.

The aim of this study was to develop and evaluate a system, Error Reporting Promoting Program (ERPP) to systematically reduce the incidence rate of nursing errors in the Korean operating room.

## METHODS

### *Research design*

A non-equivalent control group non-synchronized design was used for this study (see Table 1). Because this research was performed in one operating room, this design was used to prevent the diffusion effect.

### *Population*

Populations of this study were operating room nurses with less than 4-years of experience, because they experienced errors more frequently and were more sensitive about nursing errors than any other career groups (Kim & Kim, 2003). There were 26 study participants in a 1,070-bed teaching hospital in Busan. They were allocated to the experimental and control groups stratifying their operating room experience. Thirteen each belonged to the experimental and control groups, respectively. Staff members' preference to participate in this study, by reporting incidents on the report form, was taken to imply consent.

### *Instruments*

Incidence rates of nursing error were measured by utilizing a Nursing Error Observation Sheet (NEOS) which was originally developed from the Scale of Nursing Malpractice in the Operating Room by Kim & Kim (2003). It was consisted of 5 categories with 30 items. Content validity index (CVI) was above 80% and reliability using split half was calculated as .7907. Questions were revised, supplemented, finalized to 21 questions with the help of two professors in the nursing college who majored in nursing management. Nursing Error Observation Sheet contained 6 domains and 21 items, "Compliance of Aseptic Technique (6 items)", "Management of Instrument (7 items)", "Management of Document (3 item)", "Environmental Management (1 item)", "Supervision for Patients (1 item)", and "Com-

Table 1. Research Design

Group	Pre (7 March-18 March)	Treatment (21 March- 1 April)	Post (4 April-8 April)	Treatment (11 April-22 April)	Post (25 April-29 April)
Exp.	Oe1		X1	Oe2	
Con.	Oc1	X2	Oc2		

X1: Error reporting promoting program X2: Oral reporting

Exp.: Experimental group, Con.: Control group

Oe1, Oc1 : pretest- incidence rate of error, Oe2, Oc2 : posttest- incidence rate of error

pliance of Count Principle (3 items)”. In this study content validity index (CVI) of Nursing Error Observation Sheet was above 85% and the reliability was calculated as 0.82 using Cronbach’s Alpha Coefficient. Question were originally developed a likert-type scale with rating 1 to 4, but were used ‘yes’ or ‘no’ question in this study. ‘Yes’ answer was scored 100%, ‘no’ was scored 0%.

**Procedures**

**Development of Error Reporting Promoting Program**

ERPP contains four categories as follows: framing guidance of error-reporting, making the pictorial poster, preparing a web-based error reporting tool, and feedback such as mobile phone messages and rewards.

First, the contents of the guidance of error-reporting dealt with key concepts regarding operating room nursing error, the necessity of error-reporting, and systematic error reporting methods, all of which took 30 minutes.

Second, to give participants notice regarding error reporting, we made pictorial poster. The poster detailed the classification of nursing errors in OR, a good-hand scrubbing-method, maintenance in the aseptic technique on aseptic area, importance of counting job, and management of instruments.

Third, the web-based error reporting tool was designed for participants to report contextual details about errors regarding “to whom it happened”, “when and where it happened”, “what happened”, “why it happened”, and “how it was treated after that”. Software for a web-based error reporting tool was developed by a computer specialist. The practical environment was above CPU 1.5 GHz and RAM 512M. The operating system of the soft-

ware was Windows 2003 server, the preparation tool was Window Sharpoint Services of Microsoft Word Office Frontpage 2003.

Fourth, we prepared two types of feedback.

**Application of Program**

ERPP was applied to the experimental group everyday from 11 April to 22 April (Table 2). On the other hand, ordinary method of error-reporting - oral reporting was applied to the control group from 21 March to 1 April.

ERPP contains four categories as follows: providing guidance of error-reporting, putting up the pictorial poster, applying a web-based error reporting tool, and feedback such as mobile phone messages and rewards.

First, we provide the guidance of error-reporting. Second, we put up the pictorial posters on the wall of the hospital locker room every two days. Third, participants were persuaded to report errors more than one time everyday using the web-based error reporting tool (Figure 1). The web site address (www.147.46.242.120/questionnaire.htm) was clearly placed on the computer of each operating room and was sent to participants by mobile phone message. It was permitted to report both themselves errors and the errors of others. We confirmed the participants’ names for the sake of accuracy, but the information was kept confidential. Fourth, we called or sent mobile phone messages to participants every day at 9 PM. And, we offered a prize, which was given to the best participant.

**Evaluation of ERPP**

The target objective of this program was to reduce the

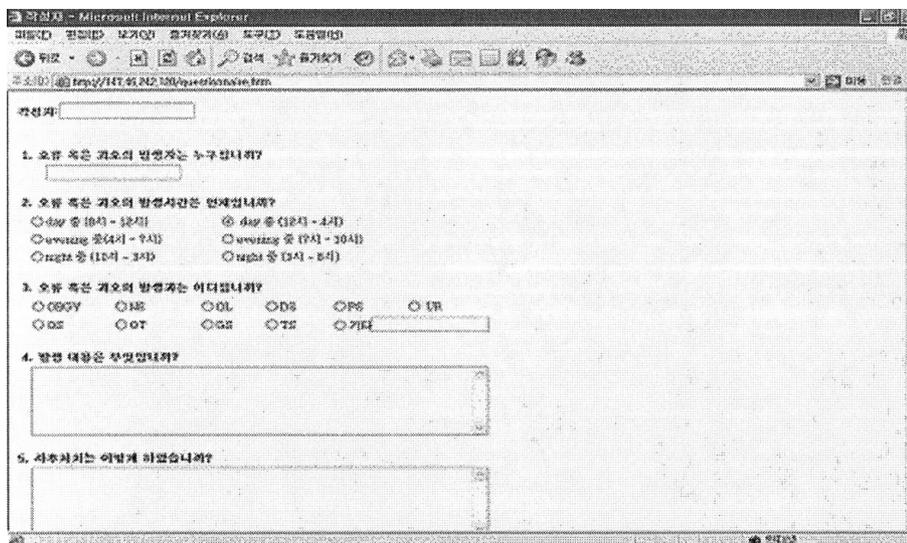


Figure 1. Computer-based Error Reporting Tool

incidence rate of nursing error. And, reporting and participating frequency was influenced by working environment regardless of incidence rate of nursing error. Therefore, we evaluated the effect of this program using incidence rate of nursing error.

A pretest and posttest were conducted for 26 participants for 2 weeks using observation method by 4 research assistants. For training the research assistants, we explained the purposes of this research. And then we offered information about standard nursing activity, definitions and induction situations of nursing error, and methods of precise observation during 4 hours. And we calculated the percent agreement through concurrent observation of a nurse two by two. Percent agreements between observers of this research were 81.2% to 100%. Research assistants checked the NEOS for 1 hour, 5 times a person, and calculated the incidence rate of nursing error of every nurse. This method preserved the accurate estimation of the nursing error incidence

rate, because several - time observations reduced bias.

Operating room nurses performed the scrub nurses' job and circulating nurses'. So, participants were observed playing both roles. We get the incidence rate of nursing error as average. It was used double blind method, research assistants and participants didn't know who were belonged to an experimental group or a control group.

### Data analyses

All statistical analysis was performed using SPSS WIN (ver 10.0). A two-tailed test was used with the significant level set at 0.05.

1) The Fisher's exact test and Mann-Whitney U Test were used to identify homogeneity of general characteristics between the experimental group and control group.

2) Mann-Whitney U Test was applied to identify the homogeneity between two groups' pre-test scores for the incidence rate of nursing error.

Table 2. Content of Error Reporting Promoting Program

Intervention	Domain	Content	Schedule	Effect
Error-Reporting Promoting Program	Providing guidance of error-reporting	<ul style="list-style-type: none"> <li>• Key concepts regarding operating room nursing error</li> <li>• Necessity of error-reporting</li> <li>• Systematic error reporting methods</li> </ul>	2005. 4. 9 ~ 4. 10	Information
	Putting up the pictorial poster	<ul style="list-style-type: none"> <li>• Notifying the poster</li> </ul>	2005. 4. 11 ~ 4. 22	Reinforcement of the recognition
	Applying a web-based error reporting tool	<ul style="list-style-type: none"> <li>• Web-based error reporting</li> </ul>	2005. 4. 11 ~ 4. 22	Convenience, Anonymity
	Feedback	<ul style="list-style-type: none"> <li>• Telephone message</li> <li>• Cellular phone letters message</li> <li>• Individual counseling</li> </ul>	2005. 4. 11 ~ 4. 22	Motivation

Table 3. Homogeneity of Characteristics between Participants

Characteristics		Exp. (n = 13) N (%) or M ±SD	Con. (n = 13) N (%) or M ±SD	p
Education level*	graduate college	5 (38.5)	4 (30.8)	> .99
	≥ bachelor's degree	8 (61.5)	9 (69.2)	
Marital Status*	unmarried	11 (84.6)	12 (92.3)	.50
	married	2 (15.4)	1 ( 7.7)	
	Career in Operating Room* (months)	below 12	3 (23.1)	
13-24	3 (23.1)	3 (23.1)		
25-36	2 (15.4)	5 (38.5)		
37-48	5 (38.5)	3 (23.1)		
Age (years)*		24.9 ±15.2	25.1 ±12.7	.55
	below 25	5 (38.5)	4 (30.8)	> .99
	26-30	8 (61.5)	9 (69.2)	
		28.3 ±4.8	27.6 ±4.2	

Exp.: Experimental group, Con.: Control group

\*Fisher's exact test

3) We also tested participants to observe the differences of incidence rates of nursing errors between the two groups using the Mann-Whitney U Test. In this test, a one-tailed test was used with the significant level set at 0.05.

## RESULTS

### General characteristics of participants

The characteristics of the experimental and the control group are shown in Table 2 and Table 3. The participants were all women. The mean age of the experimental group was 28.3 years and that of the control group 27.6 years. The mean experience in the operating room was

24.9 months in the experimental group and 25.1 months in the control group. There was no significant difference between the two groups in terms of important error-related variables such as educational level, marital status, age, or experience in OR, the incidence rate of nursing error during the pre-test.

### Changes in incidence rate of nursing errors between two groups

The changes in incidence rate of nursing errors between two groups in Table 4. Mean scores are average incidence rate of nursing error, so it means percentage. The incidence rate of nursing errors decreased significantly in the experimental group compared to the pre-test score from 28.4% to 15.7%. The control group showed a slight increase for the incidence rate of nursing error (25.1%) after intervention compared to that on the pre-test (23.6%) but the difference was not statistically significant. In addition, the decrease in incidence rate of nursing errors in the experimental group after intervention was greater than that in the control group ( $Z = -2.98, p = .001$ ).

As to the incidence rate by domains, it decreased significantly in the 3 domains- “compliance of aseptic technique”, “management of document”, “environmental management” in the experimental group while it decreased in the control group which was applied ordinary error-reporting method (respectively  $Z = -2.08, p = .020$ ;  $Z = -1.88, p = .040$ ;  $Z = -2.10, p = .021$ ).

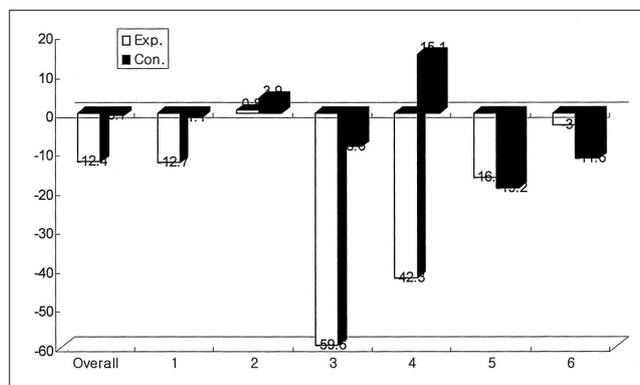


Figure 2. Change the Incidence Rate of Nursing Error

1. Compliance of aseptic technique
2. Management of instrument
3. Management of document
4. Environmental management
5. Supervision for patients
6. Compliance of count principle

Table 4. Homogeneity and Change of Incidence Rate of Nursing Errors Between Two Groups

		Pre-test	Homogeneity Z (p)	Post-test	Difference <sup>†</sup>	Z (p)
1. Compliance of aseptic technique	Exp.	34.2 ± 10.0	1.36 (.09)	20.8 ± 11.8	-13.4 ± 14.3	2.08 (.020*)
	Con.	35.5 ± 18.9		38.5 ± 13.5	-3.08 ± 19.0	
2. Management of instrument	Exp.	4.6 ± 5.7	-.21 (.42)	5.7 ± 9.2	1.1 ± 11.9	0.34 (.384)
	Con.	6.0 ± 7.5		7.9 ± 10.5	1.9 ± 14.3	
3. Management of document	Exp.	65.7 ± 41.3	-.54 (.30)	2.7 ± 6.7	-64.0 ± 42.4	1.88 (.040*)
	Con.	29.2 ± 36.5		9.0 ± 17.5	-18.8 ± 44.0	
4. Environmental management	Exp.	54.5 ± 42.2	1.78 (.05)	15.4 ± 29.6	-36.4 ± 37.8	2.10 (.021*)
	Con.	43.8 ± 50.0		43.6 ± 40.6	20.8 ± 58.9	
5. Supervision for patients	Exp.	72.9 ± 25.9	1.12 (.14)	42.3 ± 49.4	-35.4 ± 43.8	0.96 (.198)
	Con.	40.0 ± 39.4		26.9 ± 43.9	-15.0 ± 53.0	
6. Compliance of count principle	Exp.	12.8 ± 20.6	1.31 (.10)	3.5 ± 8.5	-9.35 ± 24.3	0.27 (.412)
	Con.	16.9 ± 31.0		6.4 ± 16.0	-14.2 ± 34.0	
Overall	Exp.	28.4 ± 7.5	-2.98 (.001*)	15.7 ± 5.9	-12.7 ± 8.8	2.98 (.001*)
	Con.	23.6 ± 9.3		25.1 ± 7.6	-1.5 ± 11.0	

Exp.: Experimental group (n = 13), Con.: Control group (n = 13), Values are mean ± SD

<sup>†</sup> Difference: posttest - pretest

\*p < .05

## DISCUSSION

### *Development of ERPP*

First of all, it is necessary to discuss the nature and importance of the Error Reporting Promoting Program development. In Korea, there is no general agreement about categories and meanings of errors or adverse events. In addition, only 3% of hospitals use their HIS for medical error reporting, even though use of Hospital Information System (HIS) overall in Korean hospitals is fairly advanced compared with many other countries (Kim & Bates, 2006). So, it is emphasized rationality and the inherent justice of the error-reporting system is made clear to all Koreans (Kim, 2002). As well, there are no error-reporting systems having clear ethical and legal rules that can be applied to the Korean clinical environment. For the purpose of developing an adequate error-reporting system for Koreans, first, we made participants cast away a prejudice about error reporting by educating them about error-reporting tools and encouraging them to report nursing error (Kim, 2002). Second, we set up the standards of nursing activity and kept nurses informed of it using pictorial posters. Third, our web-based error-reporting tool secured the convenience of participation as well as anonymity, while two kinds of feedback gave participants motivation to report nursing errors. Consequently, we added the ethical issues and reinforcement of recognition to web-based error reporting tool, and complete the ERPP.

### *Evaluation of Program*

Differences in the nursing error incidence rates between the pre-test and post-test in the experimental group decreased more significantly than those in the control group. Analyzing each category, we found that the domains “compliance of aseptic technique”, “management of document”, and “environmental management” decreased significantly, but the domain of “management of instrument”, “supervision for patients”, and “compliance of count principle” didn’t decrease significantly.

The domain of “compliance of aseptic technique” contained a significant statistical decrease. One of the reasons was that compliance of aseptic technique was a very important nursing activity, so it was always emphasized to stick to the standards (Ford & Koehler, 2001). Another reason was that it was easy to identify and rein-

force this type of error and thus avoid it with the nurses.

The domain of “management of document” decreased dramatically from 65.7% to 2.7% in the experimental group. According to the study of Lorenzonu et al (1999), the existence of a continuous watch, the training and the feedback of incomplete documents caused a reduction in the incidence rate of errors from 22% to 2.6%. It showed that error reporting is an intensified method to reduce documentation errors. The findings of this study are in agreement with those of the previous study.

Thus, ERPP might influence the consciousness of standard nursing activities, might make participants sensitive to error inducing, and then may perform the standards of nursing activities. It is considered that recognition related nursing activities might be more effective.

The domain of instrument management was not significant difference. The errors of instrument management were mostly slips and lapses due to the carelessness, vicious habit and absence of knowledge about treating instruments. It suggested to us that handling of instrument was not a direct solution to reporting nursing error because it was a skill-based activity. It is considered that skill-based activity must be reinforced by using a repetitive practical program, combined with the error reporting system (Rogers et al., 2002; Mc Connell, 1995).

Next, there was a high nursing error incidence rate for both the experimental and control groups in the domains of supervision for patients. There was not a significant difference between the pre-test and post-test. Nonetheless, because surgical nurses were responsible for admitted patients in the OR, operating room nurses in this study didn’t pay attention to them. It was considered that nurses didn’t feel keenly the necessity of responsibility for delivery of care to patients or for patient security. Therefore, an error protective system, such as the ERPP, should be offered to nurses, who must have the opportunity to learn how to better prevent fatal nursing error.

Last, non-compliance of the count principle was related to the conscience of health specialists. The incidence rate of nursing error was found to be very low compared to other domains, and changes in the incidence rate were not significant. Compliance of the count principle has been given emphasis to surgical nurses. In Korea today, it has been more recognized that like the physician, the nurse should be legally responsible for the survival of foreign objects in the interior of the patient’s body (Korean Nurses Association, 2003). The risk factors of

failure to comply with the count principle are caused by various factors such as environmental factors, healthcare workers' factors, characteristics of the operation, organizational policy of count principles, and the trait of sponges, instrument and sharps. Therefore, it is necessary to apply multiple implements to reduce the count-related errors.

Consequently, ERPP is more effective to reduce the errors in the domains of recognition-related nursing activities. On the other hand, it is less effective to the domains of habit-related, knowledge-based and multidimensional nursing activities such as cooperation.

## CONCLUSION and RECOMMENDATION

Error-reporting system can make possible to hold the errors in common and to learn from them. ERPP was effective to reduce the errors of recognition-related nursing activities. For the sake of more effective error-prevention, we will be better to apply effort of risk management along the whole health care system with this program.

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