

ORIGINAL ARTICLE

## Relationships between core factors of knowledge management in hospital nursing organisations and outcomes of nursing performance

Eun Ju Lee, Hong Soon Kim and Hye Young Kim

**Aims and objectives.** The study was conducted to investigate the levels of implementation of knowledge management and outcomes of nursing performance, to examine the relationships between core knowledge management factors and nursing performance outcomes and to identify core knowledge management factors affecting these outcomes.

**Background.** Effective knowledge management is very important to achieve strong organisational performance. The success or failure of knowledge management depends on how effectively an organisation's members share and use their knowledge. Because knowledge management plays a key role in enhancing nursing performance, identifying the core factors and investigating the level of knowledge management in a given hospital are priorities to ensure a high quality of nursing for patients.

**Design.** The study employed a descriptive research procedure.

**Participants.** The study sample consisted of 192 nurses registered in three large healthcare organisations in South Korea.

**Method.** The variables demographic characteristics, implementation of core knowledge management factors and outcomes of nursing performance were examined and analysed in this study.

**Results.** The relationships between the core knowledge management factors and outcomes of nursing performance as well as the factors affecting the performance outcomes were investigated. A knowledge-sharing culture and organisational learning were found to be core factors affecting nursing performance.

**Conclusion.** The study results provide basic data that can be used to formulate effective knowledge management strategies for enhancing nursing performance in hospital nursing organisations. In particular, prioritising the adoption of a knowledge-sharing culture and organisational learning in knowledge management systems might be one method for organisations to more effectively manage their knowledge resources and thus to enhance the outcomes of nursing performance and achieve greater business competitiveness.

**Relevance to clinical practice.** The study results can contribute to the development of effective and efficient knowledge management systems and strategies for enhancing knowledge-sharing culture and organisational learning that can improve both the productivity and competitiveness of healthcare organisations.

### What does this paper contribute to the wider global clinical community?

- This study contributes to the development of effective and efficient KM systems and strategies for improving both the productivity and competitiveness of healthcare organisations.
- This study's results will be basic data to ensure high quality of nursing for patients through identifying the core factors and investigating the level of KM in healthcare organisations.

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**Key words:** knowledge management, nursing organisation, outcome of nursing performance

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## Introduction

In the information society of the 21st century, knowledge is the leading strategic element for enhancing the international competitive power of organisations (Solow 1997, Stewart 1998), and knowledge is being emphasised as the most important resource for an enterprise to survive and become more robust (Lee 2006). Therefore, effective management of knowledge is very important to achieve strong organisational performance (Chun-Ming *et al.* 2012). Knowledge management (KM) can promote such organisational performance only when members of an organisation actively share and use their knowledge (Shih-Hsiung & Gwo-Guang 2013).

In a healthcare organisation, the quality of the nursing workforce, which constitutes the greatest portion of healthcare staff, strongly impacts the productivity of the institution (Oh & Chung 2011). In particular, nurses must be extremely knowledgeable as primary professional healthcare providers. To improve nurses' productivity, nursing departments have tried to implement effective KM in ongoing patient assessments and scientific nursing care as well as in hundreds of professional guidelines and protocols (Böhmer 2009). In South Korea, most large hospitals – those with more than 300 beds – are using hospital information systems (HIS) incorporating nursing job manuals and clinical pathways and guidelines provided by the Korea Institute for Healthcare Accreditation (KIHA) to improve the quality of nursing care. In one approach to improving KM for clinical nurses, the Korea Nurses Association (KNA) has applied web-based learning, cyber-learning, web-based medication instruction developed by Samsung Seoul Hospital and other educational methods.

However, the effectiveness of the KM approach varies for each hospital (Choi 2005). The reason for this variation might be that KM has recently been focusing on the use of information technology (IT) systems that facilitate storage, retrieval and application of knowledge to enhance nurses' competence (Hsia *et al.* 2006, Wu *et al.* 2010, Chen *et al.* 2011). However, KM practices should combine core elements of technical infrastructure such as IT with a culture that facilitates and drives the KM process, an organisational system that supports and rewards sharing of knowledge, encouragement of group learning and the presence of responsible team leaders (Sanchez-Polo & Cegarra-Navarro 2008). A suitable combination of these KM factors at a

given hospital should result in improved organisational performance. At this time, studies are needed to investigate the levels of KM achieved in Korean healthcare organisations where varying KM practices are conducted and to determine how much practical impact the core KM factors have had on nursing performance.

Studies of KM in healthcare organisations have been conducted to investigate the effects of the development and application of informatics systems (Hsia *et al.* 2006, Ghosh & Scott 2007, Juarez *et al.* 2009, Wu *et al.* 2010), to consider the necessity for and methods of KM (Dreher 2009), to identify factors affecting healthcare KM (Chen *et al.* 2011), to examine effective levels of KM implemented by team leaders and care providers (Sanchez-Polo & Cegarra-Navarro 2008) and to explore the relationship between KM and nursing competence (Hwang 2011). However, few recent studies have attempted to identify the relationships between KM and outcomes of nursing performance. Therefore, this study was undertaken to investigate the levels of implementation of KM and outcomes of nursing performance, to examine the relationships between core KM factors and nursing performance outcomes and to identify core KM factors affecting these outcomes.

## Background

### Knowledge management

'Knowledge management' is a term that was newly introduced by Nonaka, who originated the concept of a 'knowledge-creating organization' in 1991 (Nonaka 1991), and it is defined as organisational activities related to exploring what knowledge is and how to create, transfer and use it (Davenport *et al.* 1998). KM is a management method used to rapidly improve the problem-solving skills within an organisation by discovering the knowledge and know-how of organisation members and sharing them throughout the organisation (Nonaka 1991).

For effective KM to be performed, the core factors constituting KM had to be identified. The core factors are the essential contents to be included in KM systems. In cases where these factors for enhancing organisational performance are overlooked, the probability of the success of KM is low (Guak 2011). The core factors of KM have been somewhat differently identified in previous studies.

According to a study by Sanchez-Polo and Cegarra-Navarro (2008), KM practices have four core factors: technical infrastructure, people to facilitate and drive the KM process, a system that supports and rewards sharing of knowledge, and the presence of good leadership. Ghosh and Scott (2007) identified the core factors of KM as organisational structure, organisational culture and organisational technology. Their study suggested that a KM process for a nursing organisation should include making knowledge visible and showing the role of knowledge in the organisation, developing a knowledge-sharing culture by encouraging and aggregating behaviours that involve seeking and offering knowledge, and building a knowledge infrastructure to allow organisation members to interact and collaborate. Finally, Choi's (2005) study suggested that to investigate the level of nursing KM in a healthcare organisation, one must examine the level of sharing culture, the use of a nursing KM system, the presence of effective leadership, the level of organisational learning and the presence of a reward system based on business performance as core factors.

Based on previous studies, the core KM factors can be viewed as including culture and people, the KM technical system, leadership, the strategic organisational system, and organisational learning. Therefore, these five factors were the focus of this study. Because KM plays a key role in enhancing nursing performance, assessing the core factors and identifying the level of KM in a given hospital are priorities to ensure a high quality of nursing for patients.

### Outcomes of nursing performance

The outcomes of nursing performance mean the level of the achievement of healthcare organisational goals through nurses who are members of the organisation and who perform reasonable roles based on professional nursing (Yoon 1995).

In a modern healthcare organisation, the outcomes of nursing performance are determined by the quality of nursing care for patients, which is mainly measured according to patient outcomes and the achievement of organisational goals (Morrison *et al.* 1997). Recently, competition among healthcare organisations has become fierce, and this competition has resulted in strong efforts to enhance nursing performance. To attain a high quality of nursing service, nurses must have the ability to carry out their professional responsibilities based on scientific knowledge and the needs of patients. This is possible only

when nursing leaders make accurate estimates of the capacity, attitude and level of knowledge of their nursing staff members (Choi 2005).

Outcomes of nursing performance can be evaluated by considering the quality and quantity of nursing performance, usage of time and resources, and other factors (Jeffs *et al.* 2011). In the study of Ko *et al.* (2007), four measurement categories for outcomes of nursing performance were identified: the capacity of nursing performance, attitude of nursing performance, improvement of the performance level and application of the nursing process. In addition, recent studies have shown the relationships of nursing performance to empowerment (Ryu 2009), leadership (Bae 2007, Ryu 2009, Brady & Cummings 2010), work satisfaction (Bae 2007) and KM (Choi 2005). However, the research into KM for nursing in healthcare organisations is in its early stages, and the studies that investigate the relationships between KM and the outcomes of nursing performance are few. Therefore, the purpose of this study was to investigate the levels of implementation of KM and outcomes of nursing performance, to examine the relationships between core KM factors and nursing performance outcomes and to identify core KM factors affecting these outcomes. The study results provide basic data that can be used to formulate effective KM strategies for enhancing nursing performance in hospital nursing organisations.

## Methods

### Design

This study used a cross-sectional survey design to describe the relationships between implementation of core KM factors and levels of nursing performance in healthcare organisations as well as to determine the core factors most strongly affecting nursing performance.

### Research questions

In this study, research questions are as follows.

- What are the levels of implementation of KM and the outcomes of nursing performance with respect to general nurse characteristics, and what are the total levels of these among nurses in hospital nursing organisations?
- What is the relationship between core KM factors and nursing performance outcomes in hospital nursing organisations?
- What are core KM factors affecting nursing performance outcomes in hospital nursing organisations?

## Sample

For this study, we recruited nurses registered in three large healthcare organisations – all having more than 300 beds – in Kyungbuk Province in South Korea. During the recruiting process, posters were displayed in each nursing department to attract study participants.

The sample size was calculated using G POWER 3 ANALYSIS SOFTWARE (Heinrich Heine University, Düsseldorf, Germany). In order to have an effect size of 0.2, have a power of 0.8 and apply correlation analysis, 191 subjects were needed for the study (Faul *et al.* 2007). Assuming a 10% attrition rate for study participants, a total of 210 nurses who were interested in the study and who attended an introductory presentation on the study were recruited. Of the 210 nurses, a total of 192 ultimately participated in the study (18 nurses failed to complete the study survey).

To be eligible for the study, participants had to meet the following inclusion criteria: they had to (1) possess at least one year of nursing experience, (2) be working at a healthcare organisation with more than 300 beds and (3) sign informed consent forms for participation in the study.

## Instruments

Based on previous investigations in the KM and nursing performance areas (Choi 2005, Ko *et al.* 2007), the following variables were examined: demographic characteristics, implementation of core KM factors and outcomes of nursing performance.

### *Demographic characteristics*

The demographic characteristics examined included age, sex, marital status, religion, educational level, work area, total years of nursing experience and professional position.

### *Implementation of core KM factors*

The level of implementation of core KM factors was assessed using the questionnaire addressing implementation of core KM factors developed by Choi (2005). This questionnaire contains a total of 23 items and uses a five-point Likert scale. The 23 items consist of five items for knowledge-sharing culture, six items for the nursing management system, four items for innovative management leadership, five items for organisational learning and three items for a reward system for performance outcomes. The higher the score achieved, the higher the level of implementation of KM. In our study, the Cronbach's  $\alpha$  for the reliability of the questionnaire was 0.93.

### *Outcomes of nursing performance*

The outcomes of nursing performance were assessed using the performance measurement scale (PMS) developed by Ko *et al.* (2007). This questionnaire contains a total of 17 items and uses a five-point Likert scale. The 17 items are grouped in the four categories of performance competency (seven items), performance attitude (four items), willingness to improve performance (three items) and application of the nursing process (three items). The higher the score achieved, the higher the level of nursing performance. In the study of Ko *et al.* (2007), the reliability of this questionnaire was established with a Cronbach's  $\alpha$  of 0.92. In our study, the Cronbach's  $\alpha$  was 0.94.

## Procedure

After being reviewed for any potential ethical problems with the study process and being approved by hospital committees, this study was conducted in August and September 2010. Three research assistants (three graduate students in a nursing college) received two hours of training about the study questionnaires' contents and how to collect the study data. During the recruitment process, the research assistants explained the purpose and methodology of the study to potential participants and guaranteed their anonymity, and then, signed informed consent forms were obtained from all the participants.

## Analysis

The data were analysed using SPSS, version 20.0 (SPSS, Chicago, IL, USA). To examine the levels of implementation of core KM factors and the levels of outcomes of nursing performance, mean and standard variation scores were calculated using the mean test. An independent *t*-test and ANOVA were used to examine the differences between the levels of implementation of core KM factors and outcomes of nursing performance based on general demographic characteristics. In addition, Scheffe's test was used as a *post-hoc* test. The correlation between the levels of implementation of core KM factors and outcomes of nursing performance was calculated using Pearson's correlation coefficient. To identify the core factors most strongly affecting nursing performance, the data were analysed using stepwise multiple regression.

## Results

The study results with respect to demographic characteristics, core KM factors and nursing performance outcomes are presented below.

### Demographic characteristics of study participants

The nurses were predominantly female (95.8%), college graduates (80.7%), atheists (61.3%) and single (60.3%). Their mean age was  $28.7 \pm 5.2$  years, and 65.4% were under 29 years of age. Of the nurses, 54.8% were working in general wards, and 83.8% were general nurses. Regarding their length of nursing experience, 40.1% of the nurses had five years or less and 36.5% had between 5–10 years of experience.

### Levels of implementation of core KM factors

The total mean score for implementation of KM was 3.21, as shown in Table 1. For the five core KM factors, the mean score for knowledge-sharing culture was 3.44,

which was the highest score. The mean score for organisational learning was 3.3, the mean score for innovative management leadership was 3.16, the mean score for the nursing management system was 3.12, and the mean score for the reward system for performance outcomes was 3.05.

### Comparison of implementation of core KM factors with respect to general nurse characteristics

As shown in Table 2, when the data for the total implementation scores for core KM factors were compared with the general characteristics of nurses, the results indicated significant differences only between nurse managers and general nurses in terms of position ( $t = 3.49$ ,  $p = 0.001$ ). The total implementation scores for core KM factors for

**Table 1** Implementation scores for core KM factors among nurses,  $n = 192$

Core KM factors	Content	Mean $\pm$ SD
Knowledge-sharing culture	Sharing ideas and resources with members	3.57 $\pm$ 0.70
	Active exchange of information with other ward workers	3.21 $\pm$ 0.70
	Head of the nursing department understanding the importance of exchanging information among wards	3.63 $\pm$ 0.77
	Nursing department setting a high value on applying new ideas	3.41 $\pm$ 0.81
	Knowledge-creating activities, knowledge sharing and applying knowledge related to nursing work	3.36 $\pm$ 0.85
	Subtotal	3.44 $\pm$ 0.56
Nursing management system	Presence of a technology system for sharing knowledge	3.38 $\pm$ 0.97
	Management of a database of new information, know-how and other items that nurses need for work	3.16 $\pm$ 0.85
	Accessibility of knowledge that nurses need for work	3.02 $\pm$ 0.85
	Establishment of a search method for accumulated information and knowledge	3.03 $\pm$ 0.92
	Establishment of an evaluation system for accumulated information and knowledge	3.01 $\pm$ 0.85
	Usefulness of information and knowledge that are applied by a nursing department through the homepage, electronic board or electronic mail of the nursing department	3.13 $\pm$ 0.91
Subtotal	3.12 $\pm$ 0.71	
Innovative management leadership	The willingness of the head of the nursing department to apply KM	3.32 $\pm$ 0.93
	Promoting innovative strategies for nursing work and change	3.22 $\pm$ 0.96
	Treating nurses as equal members of the healthcare team	2.77 $\pm$ 0.96
	Presence of a coordinator or manager for KM in the nursing department	3.35 $\pm$ 0.89
Subtotal	3.16 $\pm$ 0.73	
Organisational learning	Knowledge serving as a basis for improving the quality of nursing	3.67 $\pm$ 0.81
	Recognising 'core knowledge' related to nursing work and continuously applying it	3.24 $\pm$ 0.68
	Implementing educational programmes within the nursing department	3.22 $\pm$ 0.84
	Assessing the usefulness of education and training to nursing work	3.31 $\pm$ 0.82
	Actively supporting nurses who try to learn	3.13 $\pm$ 0.95
Subtotal	3.31 $\pm$ 0.61	
Reward system for performance outcomes	Fair and objective evaluation of nurses' performance	3.02 $\pm$ 0.94
	Evaluation system partially based on nurses' education/training efforts and knowledge sharing	3.20 $\pm$ 0.90
	Monetary or nonmonetary compensation for nurses based on the evaluation results	2.94 $\pm$ 1.03
	Subtotal	3.05 $\pm$ 0.83
Total	3.21 $\pm$ 0.57	

KM, knowledge management.

**Table 2** Comparison of implementation of core knowledge management factors with respect to general characteristics of nurses

General characteristics of nurses	Knowledge-sharing culture Mean $\pm$ SD	Nursing management system Mean $\pm$ SD	Innovative management leadership Mean $\pm$ SD	Organisational learning Mean $\pm$ SD	Reward system for performance outcomes Mean $\pm$ SD	Total ( $n = 192$ ) Mean $\pm$ SD
<b>Age</b>						
$\leq 30$	3.39 $\pm$ 0.51	3.09 $\pm$ 0.69	3.10 $\pm$ 0.71	3.28 $\pm$ 0.60	3.01 $\pm$ 0.84	3.17 $\pm$ 0.55
31–40	3.50 $\pm$ 0.68	3.15 $\pm$ 0.79	3.25 $\pm$ 0.80	3.33 $\pm$ 0.65	3.10 $\pm$ 0.82	3.27 $\pm$ 0.64
$\geq 41$	3.68 $\pm$ 0.44	3.28 $\pm$ 0.54	3.58 $\pm$ 0.49	3.60 $\pm$ 0.45	3.30 $\pm$ 0.85	3.49 $\pm$ 0.47
<i>F</i>	1.69	0.40	2.45	1.28	0.68	1.71
<i>p</i>	0.187	0.671	0.089	0.281	0.508	0.183
Scheffe	–	–	–	–	–	–
<b>Education</b>						
College	3.41 $\pm$ 0.56	3.08 $\pm$ 0.71	3.10 $\pm$ 0.75	3.27 $\pm$ 0.59	3.03 $\pm$ 0.82	3.18 $\pm$ 0.57
University	3.50 $\pm$ 0.55	3.22 $\pm$ 0.64	3.39 $\pm$ 0.49	3.47 $\pm$ 0.66	3.06 $\pm$ 0.88	3.35 $\pm$ 0.52
<i>t</i>	1.29	1.70	2.94	2.11	0.91	1.67
<i>p</i>	0.278	0.168	0.034	0.101	0.437	0.176
<b>Workplace</b>						
General ward <sup>a</sup>	3.47 $\pm$ 0.54	3.17 $\pm$ 0.74	3.24 $\pm$ 0.71	3.36 $\pm$ 0.63	3.03 $\pm$ 0.90	3.26 $\pm$ 0.59
ICU <sup>b</sup>	3.14 $\pm$ 0.59	2.73 $\pm$ 0.65	2.84 $\pm$ 0.70	3.21 $\pm$ 0.52	2.98 $\pm$ 0.84	2.98 $\pm$ 0.45
Special clinic <sup>c</sup>	3.42 $\pm$ 0.58	3.18 $\pm$ 0.59	3.17 $\pm$ 0.76	3.23 $\pm$ 0.61	3.07 $\pm$ 0.73	3.21 $\pm$ 0.55
Outpatient clinic <sup>d</sup>	3.74 $\pm$ 0.51	3.11 $\pm$ 0.90	3.11 $\pm$ 0.83	3.46 $\pm$ 0.62	3.19 $\pm$ 0.83	3.30 $\pm$ 0.65
<i>F</i>	3.42	2.23	1.65	0.91	0.19	1.34
<i>p</i>	0.018	0.086	0.180	0.435	0.904	0.263
Scheffe	b < a	–	–	–	–	–
<b>Total years of work experience</b>						
<5	3.35 $\pm$ 0.52	3.15 $\pm$ 0.69	3.11 $\pm$ 0.68	3.29 $\pm$ 0.59	3.09 $\pm$ 0.76	3.20 $\pm$ 0.53
5–10	3.44 $\pm$ 0.60	3.03 $\pm$ 0.72	3.11 $\pm$ 0.82	3.28 $\pm$ 0.66	2.98 $\pm$ 0.95	3.16 $\pm$ 0.62
>10	3.55 $\pm$ 0.55	3.20 $\pm$ 0.73	3.30 $\pm$ 0.65	3.38 $\pm$ 0.56	3.08 $\pm$ 0.76	3.33 $\pm$ 0.54
<i>F</i>	1.67	0.84	1.02	0.34	0.36	1.06
<i>p</i>	0.192	0.434	0.363	0.714	0.698	0.350
Scheffe	–	–	–	–	–	–
<b>Position</b>						
Nurse manager	3.79 $\pm$ 0.48	3.46 $\pm$ 0.63	3.59 $\pm$ 0.53	3.58 $\pm$ 0.51	3.23 $\pm$ 0.76	3.54 $\pm$ 0.49
General nurse	3.36 $\pm$ 0.54	3.05 $\pm$ 0.70	3.07 $\pm$ 0.73	3.25 $\pm$ 0.61	3.01 $\pm$ 0.84	3.15 $\pm$ 0.56
<i>t</i>	3.94	2.99	3.68	2.73	1.33	3.49
<i>p</i>	0.000	0.003	0.000	0.007	0.185	0.001
<b>Gender</b>						
Female	3.39 $\pm$ 0.51	3.08 $\pm$ 0.67	3.09 $\pm$ 0.72	3.26 $\pm$ 0.60	3.01 $\pm$ 0.84	3.16 $\pm$ 0.56
Male	3.51 $\pm$ 0.64	3.18 $\pm$ 0.76	3.26 $\pm$ 0.73	3.39 $\pm$ 0.61	3.09 $\pm$ 0.80	3.29 $\pm$ 0.58
<i>t</i>	–1.45	–0.95	–1.62	–1.49	–0.58	–1.47
<i>p</i>	0.150	0.341	0.107	0.138	0.563	0.142

nurse managers (3.54  $\pm$  0.49) were higher than those for general nurses (3.15  $\pm$  0.56).

mean score for application of the nursing process was 3.44  $\pm$  0.65.

### Levels of outcomes of nursing performance

The total mean score for outcomes of nursing performance was 3.68  $\pm$  0.55, as shown in Table 3. Among the four subcategories of nursing performance outcomes, the mean score for performance competency was 3.83  $\pm$  0.61, which was the highest score. The mean score for performance attitude was 3.71  $\pm$  0.62, the mean score for willingness to improve performance was 3.54  $\pm$  0.66, and the

### Comparison of nursing performance outcomes with respect to general nurse characteristics

As shown in Table 4, when the data for the total outcome scores for nursing performance were compared with the general characteristics of nurses, the results indicated significant differences between ages ( $F = 3.63$ ,  $p = 0.028$ ), between workplaces ( $F = 3.54$ ,  $p = 0.018$ ), between total years of work experience ( $F = 8.01$ ,  $p < 0.001$ ), and

Table 3 Levels of outcomes of nursing performance,  $n = 192$ 

Subcategories	Content	Mean $\pm$ SD
Performance competency	Understanding prescription content and performing appropriate tasks without errors or omissions within a given period of time	3.75 $\pm$ 0.85
	Dealing with and performing many tasks within a reasonable time limit	3.82 $\pm$ 0.87
	Performing accurately according to the guiding principles of medication management	3.97 $\pm$ 0.83
	Possessing the knowledge and skills needed to carry out tasks	3.79 $\pm$ 0.70
	Accurately taking control of patients' information during shift changes	3.93 $\pm$ 0.78
	Accurately recording data according to nursing guidelines	3.78 $\pm$ 0.73
	Managing nursing jobs correctly	3.77 $\pm$ 0.76
	Subtotal	3.83 $\pm$ 0.61
Performance attitude	Showing concern and a receptive attitude towards patients and their families	3.90 $\pm$ 0.75
	Encouraging harmony among health team members within the department and promoting a climate of mutual trust and respect	3.70 $\pm$ 0.78
	Showing trust in others	3.75 $\pm$ 0.72
	Taking the initiative and setting an example for others, often by seeking additional responsibility	3.51 $\pm$ 0.80
	Subtotal	3.71 $\pm$ 0.62
Willingness to improve performance	Monitoring for and reporting missing items and faulty equipment and facilities	3.65 $\pm$ 0.77
	Completing learning credits by participating in continuing education and pursuing competency development and improvement	3.48 $\pm$ 0.81
	Identifying the aetiology of problems and applying appropriate problem-solving methods	3.49 $\pm$ 0.76
Subtotal	3.54 $\pm$ 0.66	
Application of nursing process	Implementing nursing assessments accurately using instruments identified on nursing information forms	3.37 $\pm$ 0.75
	After assessing patients, planning and implementing nursing care according to order of priority	3.51 $\pm$ 0.77
	Demonstrating and teaching self-care skills to patients and their families	3.44 $\pm$ 0.71
	Subtotal	3.44 $\pm$ 0.65
Total	3.68 $\pm$ 0.55	

between nurse managers and general nurses ( $t = 2.65$ ,  $p < 0.001$ ).

In *post-hoc* analysis, the total outcome scores for nursing performance showed no significant difference between ages. However, workplaces showed significant differences between the general ward ( $3.62 \pm 0.56$ ) and outpatient clinic ( $3.13 \pm 0.48$ ), and total years of work experience showed significant differences between below five years ( $3.50 \pm 0.49$ ) and 5–10 years ( $3.74 \pm 0.55$ ) and between below five years ( $3.50 \pm 0.49$ ) and above 10 years ( $3.90 \pm 0.56$ ).

#### Correlations between implementation scores for core KM factors and outcome scores for nursing performance

The total implementation scores for core KM factors showed significant positive correlations with the total

outcome scores for nursing performance ( $r = 0.38$ ) and for the subcategories of performance competency ( $r = 0.33$ ), performance attitude ( $r = 0.32$ ), willingness to improve performance ( $r = 0.36$ ) and application of the nursing process ( $r = 0.35$ ). The total outcome scores for nursing performance showed positive correlations with the implementation scores for the core KM factors: knowledge-sharing culture ( $r = 0.42$ ), nursing management system ( $r = 0.29$ ), innovative management leadership ( $r = 0.31$ ), organisational learning ( $r = 0.38$ ) and reward system for performance outcomes ( $r = 0.23$ ) (see Table 5).

#### Factors affecting the outcomes of nursing performance

Stepwise regression analysis was conducted to analyse factors affecting the outcomes of nursing performance for

**Table 4** Comparison of outcomes of nursing performance with respect to general characteristics of nurses

General characteristics of nurses	Performance competency Mean ± SD	Performance attitude Mean ± SD	Willingness to improve performance Mean ± SD	Application of nursing process Mean ± SD	Total (n = 192) Mean ± SD
<b>Age</b>					
≤30	3.75 ± 0.58	3.62 ± 0.58	3.47 ± 0.63	3.42 ± 0.63	3.61 ± 0.51
31–40	3.96 ± 0.68	3.85 ± 0.67	3.66 ± 0.74	3.49 ± 0.71	3.81 ± 0.62
≥41	4.14 ± 0.42	4.10 ± 0.47	3.74 ± 0.32	3.59 ± 0.57	3.94 ± 0.36
<i>F</i>	3.465	4.624	1.985	0.458	3.63
<i>p</i>	0.033	0.011	0.140	0.633	0.028
Scheffe	–	–	–	–	–
<b>Education</b>					
College	3.77 ± 0.59	3.66 ± 0.60	3.48 ± 0.65	3.43 ± 0.63	3.63 ± 0.53
University	4.09 ± 0.65	3.91 ± 0.67	3.79 ± 0.64	3.50 ± 0.75	3.78 ± 0.60
<i>t</i>	–2.89	–2.162	–2.592	–0.541	–1.326
<i>p</i>	0.004	0.032	0.010	0.589	0.186
Scheffe	–	–	–	–	–
<b>Workplace</b>					
General ward <sup>a</sup>	3.75 ± 0.62	3.65 ± 0.63	3.44 ± 0.64	3.44 ± 0.65	3.62 ± 0.56
ICU <sup>b</sup>	3.77 ± 0.69	3.71 ± 0.61	3.66 ± 0.75	3.56 ± 0.68	3.70 ± 0.60
Special clinic <sup>c</sup>	3.88 ± 0.52	3.73 ± 0.55	3.64 ± 0.64	3.37 ± 0.65	3.72 ± 0.50
Outpatient clinic <sup>d</sup>	4.40 ± 0.51	4.28 ± 0.55	3.89 ± 0.56	3.74 ± 0.65	3.13 ± 0.48
<i>F</i>	4.642	4.233	2.71	1.255	3.548
<i>p</i>	0.004	0.006	0.047	0.291	0.018
Scheffe	a,b,c < d	a,b,c < d	–	–	a > d
<b>Total years of work experience</b>					
<5 <sup>a</sup>	3.59 ± 0.55	3.54 ± 0.58	3.44 ± 0.60	3.36 ± 0.59	3.50 ± 0.49
5–10 <sup>b</sup>	3.94 ± 0.60	3.77 ± 0.57	3.53 ± 0.70	3.45 ± 0.72	3.74 ± 0.55
>10 <sup>c</sup>	4.06 ± 0.62	3.91 ± 0.68	3.71 ± 0.68	3.57 ± 0.62	3.90 ± 0.56
<i>F</i>	10.72	5.726	2.251	1.491	8.014
<i>p</i>	<0.001	0.004	0.108	0.228	<0.001
Scheffe	a < b, c	a < c	–	–	a < b, c
<b>Position</b>					
Nurse manager	4.28 ± 0.51	4.14 ± 0.58	3.90 ± 0.65	3.73 ± 0.66	4.10 ± 0.50
General nurse	3.74 ± 0.60	3.63 ± 0.59	3.47 ± 0.64	3.39 ± 0.63	3.60 ± 0.52
<i>t</i>	5.141	4.502	3.382	2.605	4.650
<i>p</i>	<0.001	<0.001	0.002	0.013	<0.001

**Table 5** Correlations between implementation scores for core KM factors and outcome scores for nursing performance, n = 192

	Knowledge-sharing culture	Nursing management system	Innovative management leadership	Organisational learning	Reward system for performance outcomes	Total scores for implementation of KM
Performance competency	0.38**	0.25**	0.26**	0.34**	0.16*	0.33**
Performance attitude	0.37**	0.21**	0.25**	0.33**	0.21**	0.32**
Willingness to improve performance	0.37**	0.27**	0.31**	0.34**	0.24**	0.36**
Application of nursing process	0.34**	0.29**	0.27**	0.33**	0.26**	0.35**
Total of outcome scores for nursing performance	0.42**	0.29**	0.31**	0.38**	0.23**	0.38**

KM, knowledge management.

\**p* < 0.05; \*\**p* < 0.001.



nurses in healthcare organisations. To satisfy the conditions for the use of stepwise regression analysis, nine enabling variables were investigated to analyse the factors affecting the nursing performance outcomes: (1) age, (2) workplace, (3) total years of work experience, (4) position, which had significantly different effects on the outcomes, and (5 through 9) implementation of the five core KM factors, which showed significant positive correlations with the outcomes. For the stepwise regression analysis, categorical variables were recorded as dummy variables.

In summary, only four of the variables were found to be significant, and the model explained 27.7% of the variance in the outcome scores for nursing performance among the nurses. As shown in Table 6, knowledge-sharing culture was found to be the strongest factor affecting nursing performance outcomes ( $\beta = 0.28$ ,  $p = 0.001$ ), followed by workplace ( $\beta = 0.02$ ,  $p = 0.028$ ), total years of work experience ( $\beta = 0.01$ ,  $p = 0.001$ ) and organisational learning ( $\beta = 0.17$ ,  $p = 0.018$ ).

## Discussion

As stated above, this study was a descriptive research effort to investigate the levels of implementation of KM and outcomes of nursing performance, to examine the relationships between core KM factors and nursing performance outcomes and to identify core factors affecting these outcomes.

Regarding the levels of KM implementation, the total mean score obtained in the study was 3.21. This result was similar to the total mean scores of 3.44 obtained in the study of Hwang (2011) and 3.27 obtained in the study of Choi (2005), both of which involved nurses at healthcare organisations and which used the same measurements for KM implementation. In our study, of the five core KM factors, knowledge-sharing culture had the highest mean score of 3.44, followed by organisational learning with a score of 3.33, innovative management leadership with a score of 3.16, the nursing management system with a score of 3.12 and the reward system for performance outcomes with a score of 3.05. These results differed somewhat from those of Choi (2005) and Hwang (2011). In each of those studies, the mean score for organisational learning was the highest,

followed by the scores for innovative management leadership, knowledge-sharing culture, nursing management system and reward system for performance outcomes. The reasons that our study's result for knowledge-sharing culture differed from the results of those studies might be that the results reflect different organisational cultures and characteristics, different employee perceptions of the quality of the work environments and different organisational attitudes towards knowledge-sharing (Shih-Hsiung & Gwo-Guang 2013). All of our study's mean implementation scores for the five core KM factors were higher than the middle score. This indicates that in the information society of the 21st century, nurses in healthcare organisations are participating in KM to improve their problem-solving skills by discovering the knowledge and know-how of other organisation members and sharing them throughout the organisation.

In our study, when the total mean implementation scores for core KM factors were compared with the general characteristics of the nurses who participated, the scores for nurse managers were higher than those for general nurses. The attitudes of nurse managers with respect to the implementation of core KM factors could support the success of their general nurses' knowledge-sharing efforts because nurse managers could serve as role models encouraging a problem-solving and knowledge-seeking environment in their units (Sanchez-Polo & Cegarra-Navarro 2008). From this perspective, we could say that the core KM factor implementation scores for nurse managers being higher than those for general nurses indicated the possibility of strong support for KM development among the general nurses in their organisations.

Regarding the levels of outcomes of nursing performance, the total mean score was 3.68. This result corresponded closely with the mean score of 3.69 obtained by Ryu (2009), who identified levels of nursing performance outcomes using the same instrument as was used in our study. With respect to the four subcategories of nursing performance outcomes, in both our study and the Ryu study, performance competency had the highest mean score, followed by performance attitude, willingness to improve performance and application of the nursing process. Recently, a

**Table 6** Factors affecting the outcomes of nursing performance,  $n = 192$

Variable	$\beta$	$t$	$p$	Cum $R^2$	$R^2$	Adjusted $R^2$	$F$	$p$
Knowledge-sharing culture	0.28	3.393	0.001	0.176	0.277	0.259	15.615	<0.001
Workplace	0.02	2.219	0.028	0.227				
Total years of work experience	0.01	3.437	0.001	0.255				
Organisational learning	0.17	2.388	0.018	0.277				

growing interest in service to healthcare customers is causing significant changes in the overall healthcare environment. For this reason, nursing departments have engaged in multilateral efforts to enhance the quality of nursing care, a goal that can be achieved only through application of the scientific nursing process (Brady & Cummings 2010). Therefore, the fact that application of the nursing process had the lowest mean score in both our study and that of Ryu (2009) indicates that improvement in this activity among nurses must be a priority to enhance their overall professional performance.

The levels of outcomes of nursing performance with respect to the general characteristics of nurses showed significant differences between ages, between workplaces, between total years of work experience, and between nurse managers and general nurses. Similarly, in Bae's (2007) study, the levels of nursing performance outcomes showed significant differences between ages and between total years of work experience of nurses. The findings of both our study and Bae's can be explained by improvements in nursing knowledge and skills related to increased work experience over time. Based on these findings, enhancement of nursing performance within nursing departments may require development of special systems such as manpower management programmes for long-term employees.

In our study, the factor most strongly affecting the outcomes of nursing performance was knowledge-sharing culture, followed by workplace, total years of work experience and organisational learning. The levels of implementation of the five core KM factors and the nursing performance outcomes showed significant positive correlations among all variables. However, only two core KM factors, knowledge-sharing culture and organisational learning, were identified as affecting the outcomes of nursing performance. Choi's (2005) study, which investigated the factors affecting the outcomes of nursing performance in healthcare organisations, identified only organisational learning as a core KM factor affecting the outcomes. But the importance of a knowledge-sharing culture has been emphasised in the studies of Shih-Hsiung and Gwo-Guang (2013) and of Thom (2007), who investigated organisational cultures and concluded that shared knowledge, experience and values are critical enablers and success factors for KM implementation. Mustapha (2012) indicated that the ultimate goal of KM is to create a learning organisation in a knowledge-sharing atmosphere. A knowledge-sharing organisational atmosphere has been found to make a large impact on the organisation members' propensity to create knowledge and share it with other members (Ghosh & Scott 2007). Therefore, nursing leaders have a responsibility to create a

knowledge-sharing environment by implementing personalisation strategies such as incentive programmes because knowledge creation and knowledge sharing are intangible activities (Chang 2011). Development of strategies to enhance knowledge-sharing culture could strengthen organisations' competitiveness by reducing their nursing labour costs and working hours.

Organisational learning, which was identified as a core factor affecting the outcomes of nursing performance in our study, was found to play a major role in KM by Choi (2005). In addition, Guak (2011) and Noruzy *et al.* (2013) found that among the five core KM factors, organisational learning facilitated organisational innovation and consequently improved organisational performance. Even though in our study, the effects of organisational learning on the outcomes of nursing performance were limited, organisational learning could support achievement of sustained organisational growth through promotion of continuous learning, field education and job training. In this regard, nursing departments should provide continuous support for the development of nursing educational systems and programmes to encourage nurses' professional improvement, and individual nurses should take advantage of these opportunities.

Based on these results, the practical implications of this study would be of consideration to basic data in developing the KM programme for enhancement of the outcome of nursing performance, and it can also contribute to improving both the productivity and competitiveness of healthcare organisations.

## Conclusion

Effective nursing requires many complex and knowledge-intensive professional skills. For a healthcare organisation to enhance its overall nursing performance, the knowledge and experiences of its individual nurses should be identified and shared throughout the organisation. Therefore, identifying core KM factors that can be used to effectively manage and share nursing knowledge is vital to improving the outcomes of nursing performance.

This study identified the relationships between five core KM factors and outcomes of nursing performance, and two factors – knowledge-sharing culture and organisational learning – were found to affect nursing performance outcomes. Therefore, prioritising the adoption of a knowledge-sharing culture and organisational learning in KM systems might be one method for organisations to more effectively manage their knowledge resources and thus to enhance the outcomes of nursing performance and achieve greater business competitiveness.

Few recent studies have attempted to identify the relationships between KM and outcomes of nursing performance. Therefore, the greatest strength of our study is that it investigated the levels of implementation of KM and outcomes of nursing performance, examined the relationships between core KM factors and nursing performance outcomes and identified core KM factors affecting these outcomes.

Even though our study provided useful findings that can be applied to KM in healthcare organisations, one limitation is that a cross-sectional study design was employed. Therefore, caution was needed in interpreting the causal relationships between core KM factors and outcomes of nursing performance. In future studies, researchers should consider using a longitudinal study design to evaluate the effects of core KM factors on nursing performance outcomes.

### Relevance to clinical practice

Effective management of knowledge is very important to achieve strong nursing performance within healthcare organisations. This study demonstrates that a knowledge-sharing culture and organisational learning are vital core KM factors affecting the outcomes of nursing performance.

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The study results can contribute to the development of effective and efficient KM systems and strategies for enhancing knowledge-sharing culture and organisational learning that can improve both the productivity and competitiveness of healthcare organisations.

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The authors have confirmed that all authors meet the ICMJE criteria for authorship credit ([www.icmje.org/ethical\\_1author.html](http://www.icmje.org/ethical_1author.html)), as follows: (1) substantial contributions to conception and design of, or acquisition of data or analysis and interpretation of data, (2) drafting the article or revising it critically for important intellectual content, and (3) final approval of the version to be published.

### Conflict of interest

All the authors report no conflicts of interest relevant to this article.

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