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RESEARCH ARTICLE

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Developing and testing a Korean patient classification system for general wards based on nursing intensity

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Abstract

Aim: To develop a new general wards patient classification tool based on the nursing intensity level that reflects patients' clinical characteristics and indirect nursing activities.

Design: A cross-sectional design was adopted. This methodological study developed a patient classification system to sort general ward patients based on the intensity of their nursing needs and verified the validity and reliability of this classification system.

Methods: Thirteen experts verified the tools' content validity. Data collectors and head nurses classified 150 patients from two hospitals with four general wards and various nurse staffing levels. Inter-rater reliability was analysed. Staff nurses classified 846 patients following the Korean patient classification system on nursing intensity scores that reflected patients' clinical status. Content validity was verified based on the classification results. Using K-group cluster analysis, score ranges for four groups were identified.

Results: The developed tool includes 8 domains, (symptom management, infection control, nutrition and medication, personal hygiene and secretion, activity, sleep and rest, guidance in nursing/emotional support, nursing activity planning and coordination, indirect activity), 24 subdomains, 66 nursing activities and 124 criteria. Inter-rater reliability showed high agreement.

KEYWORDS

general ward, Korea, nursing intensity, patient classification system

1 | INTRODUCTION

In order to provide quality care that reflects clinical reality and is specific to patients' individual nursing needs, it is important to secure nursing personnel with the appropriate level of experience and skills (Moon et al., 2007). Accurately identifying the nursing intensity level by assessing patient severity and nursing needs allows for the calculation of an appropriate level of nursing personnel. Calculating an appropriate level of nursing personnel for nursing units is an important issue related to patient safety and improving nursing quality (Ko & Park, 2020).

Korea introduced differentiated inpatient nursing fees based on the level of working nursing personnel in November 1999. This type of financial incentive has helped develop policies to secure the optimal level of nursing personnel in medical centres throughout the country. Furthermore, starting in 2018, the calculation standards for nursing grade switched from the number of beds per nurse to the

number of inpatients per nurse in hospitals, to accurately reflect the procurement level of nursing personnel (Health Insurance Review & Assessment Service, 2019a).

Studies are being conducted to calculate the level of nursing workload by identifying the nursing needs of inpatients, which is a critical factor (Song et al., 2009). The first step in identifying inpatients' nursing needs is patient classification. "Patient classification" is the process of calculating scores of nursing needs for each inpatient and then categorizing the patients based on these scores. Since the development of the patient classification system by the Korea Hospital Nurses Association (KHNA) in 2000, most studies conducted in Korea have used the KHNA system to measure nursing workload. This scale was originally developed in the United States and was modified for use in Korean hospitals.

2 | BACKGROUND

Today, the modified KHNA version is mainly used in clinical settings and nursing studies. When used on general ward patients, this scale is large and complex, including 12 domains, 50 nursing activities and 73 items (Song et al., 2010).

The KHNA scale is mostly comprised of items designed to measure patient demands related to direct nursing activities. It is significantly limited in reflecting patient demands related to indirect nursing activities. Thus, it can be considered inadequate in reflecting patients' actual nursing needs. Moreover, these Korean scales are limited in that they cannot identify risk factors related to comorbidity.

Some Korean studies have attempted to validate patient classification systems that included direct nursing activities required for patient care but have overlooked indirect nursing activities. These also influence nursing intensity. Therefore, the current patient classification system for general ward patients cannot practically evaluate indirect nursing activities. Thus, the research question of this study is "how do we develop a new general ward patient classification tool based on the nursing intensity level that reflects patients' clinical characteristics and indirect nursing activities?"

2.1 | Aim

To develop a patient classification system for general wards based on the nursing intensity level. These specific objectives were used: to develop a general ward patient classification system based on patients' nursing needs, and to verify this classification system's reliability and validity.

3 | METHODS

3.1 | Design

This methodological study developed a patient classification system to sort general ward patients based on the intensity of their nursing needs and verified the validity and reliability of this classification system. The STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist for cross-sectional studies was followed to enhance methodological rigor.

3.2 | Methods

3.2.1 | Research patients and data collection

Verification of content validity for draft items included in the patient classification system

From May to September 2017, a literature review was performed to extract relevant items related to the basic components of patient classification systems. The following areas were reviewed: research that developed general ward patient classification systems based on nursing needs (Fagerström et al., 2000a; Kang et al., 2001; Kim et al., 2013; Liljamo et al., 2016; Park & Kim, 2007; Rainio & Ohinmaa, 2005; Rauhala & Fagerström, 2004; Song et al., 2009, 2010), measuring nursing duration (Park et al., 2003; Song et al., 2010; Song & Lee, 2005) and appropriate nursing personnel models (Aschan et al., 2009; Fagerström et al., 2000b; Fagerström & Vainikainen, 2014; Levenstam & Bergbom, 2002; Sermeus et al., 2008).

Then, pilot items were created based on the literature review. From September 27, 2017 to October 12, 2017, four nursing professors, one professional researcher and two nursing managers provided advice on revising the validity content of the basic items. After the content was revised, five nurses who had more than three years of clinical experience and master's degrees revised the protocol and terminology to reflect current nursing reality.

Verification of content validity for items in the first revision

Expert group formation and the Delphi method. A group of 3–10 experts is considered sufficient for content validity (Lynn, 1986). This studies expert group comprised six nursing unit managers, with more than five years' experience, and seven nurses. This totals 13 experts. The Delphi method was used to validate the content.

Verification of content validity. From October 13 to 30, 2017, the first round of the Delphi method was completed with the expert group. It involved the scoring and writing of qualitative sections for each item, including domains of the patient classification system, nursing activity and nursing activity standards. For items with low scores, the expert group was asked to provide alternatives to refine them.

The second round of the Delphi method was carried out from November 6 to 16, 2017. This round involved verifying the content validity for items to evaluate the patient classification system. The verification of content validity was measured on a 4-point scale—"very valid" = 4, "valid" = 3, "somewhat valid" = 2 and "not valid at all" = 1. The experts were required to provide alternatives for the items they indicated as "somewhat valid" and "not valid at all." The content validity index (CVI) was calculated, and items were selected when agreement

was 80% or higher. The second round resulted in all items having an acceptable relevance ratio, which completed the second revised version.

Verification of construct validity and concurrent validity (clinical validity) of the second revised version. To verify the clinical validity of the second revised version, four hospitals were selected using convenience sampling from December 26, 2017 to January 30, 2018. At each of the four hospitals, a seminar was held to train the nurses involved in patient classification to explain the need for the study and research methodology. The nurses who participated in the research had three or more years of clinical experience and had worked on their ward for at least two years.

This study also received recommendations to have one data collection manager per ward who explained the data collection method. The data collection managers explained the patient classification method to the nurses and the nurses who engaged in charge of the day.

A total of 25 nurses who worked in the internal medicine and surgical wards were selected using convenience sampling. The patient classification system in its second revision was applied to 30–60 patients per nurse, for a total of 848 patients. Two sets of responses were excluded due to insincere answers.

The application of the patient classification system also involved the collection of patient data. Furthermore, the same patients were classified using the patient classification system currently used in the hospital to verify concurrent validity.

Inter-rater reliability of the second revised version. Five nurses with more than 5 years of experience were selected to check for inter-rater reliability during the same time period using the second revised version as explained above. Inter-rater reliability was verified by performing inpatient classification with the same 150 patients for each general ward. To verify inter-rater reliability, the intraclass correlation coefficient was calculated. To minimize the error that is caused by patient movement and severity that varies by day of the week, the data were collected on one day. Data collection occurred on a Tuesday, Wednesday or Thursday, during the 2017 data collection period. Patient classification was conducted twice for each patient, and the results were compared to verify reliability and conformity among the scorers.

3.3 | Ethical considerations

Prior to the study, the researchers explained the research purpose and asked for cooperation from the managers of the hospitals. The researchers visited the nursing departments of the participating hospitals to distribute the questionnaires. The research purpose was explained to each research patient, and written consent was obtained from each participate. Participants were guaranteed confidentiality and were given the freedom to cease participation at any time during data collection. This study received approval from the Institutional Review Board (WKIRB-201705-SB-025) and the head of the nursing departments of the participating hospitals.

3.4 | Data analysis

The research patients' general characteristics were analysed, and the classification tool verification of content validity was completed using item-level CVI. The classification tool inter-rater verification of reliability was conducted using the intraclass correlation coefficient. For the verification of construct validity of the classification tool, *t* test and ANOVA were used in the analysis of differences between patient classification scores.

4 | RESULTS

4.1 | Validity

4.1.1 | Content validity

Development of a draft patient classification system for general wards

Through literature review and discussion among the study's researchers, eight nursing domains were identified. The minimum activity level per day, or by work shift, was determined to provide scores for each nursing activity. The draft that was finalized after verification by two sessions of content validity contained the following eight domains: symptom management (monitoring, treatment, examination, terminal care, respiration nursing); infection control (isolation, catheter management); nutrition and medication (nutrition, medication); personal hygiene and excretion (hygiene, excretion, drainage management); activity, sleep and rest (activity daily of living, sleep and rest, safety management); guidance, education in nursing and emotional support (communication, educational and emotional support, hospitalization/transfer management); nursing activity planning and coordination (handoff, making rounds, compliance); and indirect activities (additional nursing activity required, cognitive workload, education/oversight for beds). The second revision, reflecting the content validity of the first revision, was found to have an overall CVI of 0.93. This confirmed that the tool included 8 domains, 24 subdomains, 66 nursing activities and 124 criteria.

4.1.2 | Construct validity (Clinical validity)

Patients' general characteristics

A total of 846 patients' data were analysed. The research patients were male 398 (47.3%) and female 443 (52.7%), and the 60–79 years age group was the largest with 411 patients (48.6%). The weight group of 70 kg and below was the largest with 635 patients (75.3%). 441 patients (52.1%) were admitted through outpatient and clinic sources. 690 patients had a normal consciousness level (81.6%), and 98 (11.6%) suffered from confusion, delirium or dementia. A total of 34 patients were terminally ill (4.0%), and 561 patients required caregivers (66.3%) (Table 1).

TABLE 1 Patient classification score by patient characteristics ($N = 846$)

Variables	*N* (%)	Mean (*SD*)	*t* or *F*	*p*-Value
Gender ($n = 841$)				
Male	398 (47.3)	39.53 (14.55)	−4.65	<.001
Female	443 (52.7)	44.17 (14.30)		
Age (years) ($n = 844$)				
Under the age of 59[a]	299 (35.8)	38.06 (12.73)	17.78	<.001
60–79 years of age[b]	411 (49.3)	43.12 (15.34)		a < b, a < c
More than 80 years[c]	124 (14.9)	46.15 (14.07)		
Weight ($n = 843$)				
Under 70 kg	635 (75.3)	42.13 (14.78)	1.22	.301
70–89 kg	190 (22.6)	40.82 (14.21)		
More than 90 kg	18 (2.1)	46.50 (12.65)		
Route of hospital admission				
Out Patient Department	441 (52.1)	40.90 (14.10)	2.41	.065
Transfer from another hospital	36 (4.3)	44.17 (15.85)		
Emergency room	362 (42.8)	43.05 (15.02)		
Other	7 (0.8)	34.00 (14.08)		
Surgery				
No	432 (51.1)	40.55 (14.01)	−2.76	.006
Yes	414 (48.9)	43.32 (15.09)		
Treatment ($n = 834$)				
No	713 (85.5)	41.38 (13.95)	−1.99	.048
Yes	121 (14.5)	44.81 (18.03)		
Mental illness				
Clear consciousness[a]	690 (81.6)	39.57 (13.37)	53.72	<.001
Depression, bipolar disorder[b]	58 (6.8)	52.05 (16.88)		a < b, a < c
Confusion, delirium, dementia[c]	98 (11.6)	52.34 (14.54)		
End-stage				
No	812 (96.0)	41.17 (14.06)	−7.43	<.001
Yes	34 (4.0)	59.59 (16.43)		
Caregiver				
No	285 (33.7)	34.38 (11.67)	−12.30	<.001
Yes	561 (66.3)	45.73 (14.47)		
Nurse's subjective cognition				
Group 1[a]	205 (24.8)	34.15 (11.48)	88.490	<.001
Group 2[b]	309 (37.4)	37.64 (12.16)		a < b<c < d
Group 3[c]	220 (26.6)	48.37 (13.53)		
Group 4[d]	92 (11.2)	54.86 (14.50)		

Note.: Missing data excluded.

[a,b,c,d] are arbitrary marks to describe the results of the ANOVA test post-comparison.

Intensity of nursing by general characteristics

Herein, we discuss the differences in patient classification scores by patient type (Table 1). The analysis showed that with regard to gender, women scored 44.17 points in the patient classification score, statistically higher than men with 39.53 points. The patient classification score was higher for older patients, and patients who had undergone surgery. The patient classification score was statistically significantly higher for patients who had received treatment and who had mental illness, who were terminally ill and who required caregivers. To confirm whether the nursing intensity level had different scores depending on inpatient type, the scores were compared to patients who were hospitalized through outpatient visits, emergency rooms and transfers from different hospitals. The patient classification score was higher for patients who transferred

TABLE 2 Inter-rater reliability for each domain ($n = 150$)

Domain	Staff nurse	Head nurse	*r*	*p*-Value
Symptom management	11.08 ± 4.70	10.42 ± 4.01	.88	<.001
Infection control	0.84 ± 1.56	0.74 ± 1.30	.81	<.001
Nutrition and medication	3.97 ± 2.01	3.92 ± 2.00	.83	<.001
Personal hygiene and secretion	4.45 ± 4.67	4.27 ± 4.49	.83	<.001
Activity/sleep and rest	3.13 ± 2.35	2.96 ± 2.16	.81	<.001
Guidance in nursing/emotional support	4.94 ± 2.29	4.54 ± 2.00	.91	<.001
Nursing activity planning and coordination	4.98 ± 1.79	4.85 ± 1.25	.84	<.001
Indirect activities	6.80 ± 2.53	6.89 ± 1.83	.74	<.001
Total	40.42 ± 16.67	38.50 ± 12.96	.87	<.001

TABLE 3 Distribution of the minimum/maximum score by patient classification domain ($N = 846$)

Domain	Minimum	Maximum	Mean	*SD*	Potential maximum value
Symptom management	0	26	9.58	4.27	46
Infection control	0	6	0.76	1.37	8
Nutrition and medication	0	13	3.76	2.24	16
Personal hygiene and secretion	0	20	3.62	3.88	23
Activity/sleep and rest	0	11	3.18	2.62	15
Guidance in nursing/emotional support	0	22	8.36	5.57	23
Nursing activity planning and coordination	0	7	5.13	1.35	7
Indirect activities	0	16	8.20	2.90	17
Total	0	85	41.91	14.61	155

from different hospitals. But these results did not show statistically significant differences. The last question concerned "patient classification groups based on the subjective perception of nurses," and the patient classification score of the group subjectively recognized as high in severity was statistically significantly higher.

4.1.3 | Concurrent validity

To verify the concurrent validity, this study categorized patients using the patient classification tool we developed, and the existing patient classification system used in the participating hospitals. We then calculated the gamma coefficient between the classification results, with a value of 0.571 ($p < .001$). The distribution of patient classification according to the existing classification system from the participating hospitals indicated Group 1 of 24.0%, Group 2 of 50.1%, Group 3 of 20.1% and Group 4 of 5.8%. According to the new patient classification system based on nursing intensity, Group 1 was 24.6%, Group 2 was 63.6%, Group 3 was 11.5%, and Group 4 was 0%.

4.2 | Verification of inter-Rater reliability

Five managers and nurses engaged in patient classification with the same patient group (150 patients) to verify inter-rater reliability utilizing the intraclass correlation coefficient. The results indicated a high degree of fit (0.87) for the overall nursing intensity scores between the managers and the nurses. The inter-rater reliability verification for the second revision used single measure intraclass correlation. The inter-rater reliability is shown in Table 2.

4.3 | Setting score ranges for group classification

4.3.1 | Level of patient classification by domain

The results of the minimum and maximum score distribution of the patient classification score analysis by domain of 846 patients are shown in Table 3. The average patient classification score was 41.91 ± 14.61 points.

4.3.2 | Results of the cluster analysis

Non-hierarchical cluster analysis was used to identify the patient classification score clusters. This was chosen as it is an effective method to analyse a large volume of input variables (Song et al., 2010). The analysis was conducted after dividing the patient classification into four groups. The patient classification scores, according to the non-hierarchical cluster analysis, were 0 to 27 points

TABLE 4 Patient classification score by classification groups according to non-hierarchical cluster analysis (K-means cluster analysis) ($N = 846$)

Cluster	*N*	Mean	*SD*	Minimum	Maximum
Group 1	129	22.84	4.45	0	27
Group 2	291	32.92	3.51	28	40
Group 3	289	47.91	4.69	41	57
Group 4	137	66.28	6.53	58	85
Total	846	41.91	14.61	0	85

TABLE 5 Patient classification system of general wards

Patient classification group	Patient classification score	Patient classification score reflecting potential maximum value	Final scoring interval
1st	0–27	0–49	1–30
2nd	28–40	50–73	31–60
3rd	41–57	74–103	61–90
4th	More than 58 points	104	More than 90 points

for Group 1, 28–40 points for Group 2, 41–57 points for Group 3 and 58–85 points for Group 4 (Table 4).

4.3.3 | Determining the groups

Table 5 shows the results of the general ward group as determined by the researchers, based on the aforementioned patient classification results from the non-hierarchical cluster analysis, and considering the range of latent maximum values. Score ranges were calculated by reflecting latent maximum values, comparing the real score range and latent score range. This was done based on the advice from a statistician and two nursing professors. The final score range was determined according to each patient classification. The actual maximum value of the measured score was 85, and the latent maximum score was 155 (155/85 = 1.8). 1.8 was multiplied to each score range to reflect the latent maximum in determining the final score range.

4.4 | Completion of the final patient classification tool

After the draft patient classification system was developed, first and second revisions were carried out following a verification process of content validity. The final patient classification system was completed after verifying inter-rater reliability. This study concluded that the patient classification system for general wards differed from the existing patient classification systems about its inclusion of indirect nursing activities. We feel that this difference in the assessment of the nursing intensity level better reflects actual patient demand. Construct validity was confirmed in clinical settings. Thereafter, following a meeting of the researchers, the subdomain of special nursing was modified to contain terminal care, the presence of intubation and cardiopulmonary resuscitation status. The domain of infection control had the subdomain of isolation modified from air isolation to droplet and air isolation.

The nursing intensity for general wards was formulated into eight domains.

5 | DISCUSSION

This study confirmed that the developed tool can be used to classify general ward patients based on nursing intensity. Upenieks et al., (2007) argued that nursing activity should include bedside activities and cooperating with team members, reviewing charts, preparing medication, engaging in training and communicating with family members. It is difficult for a patient classification system to be applied completely and universally to all fields of nursing (Song et al., 2010). Furthermore, it is difficult to develop a universally applicable patient classification system which reveals the difficulty in calculating the level of demand for nursing personnel. This is because a nurse's workload varies based not only on patient characteristics (age, condition and treatment plans), but also various factors surrounding the patient. These factors include the patient's ability and the abilities of the physician and his/her colleagues (DeLisle, 2009).

This study attempted to measure the indirect nursing activities that were not considered in existing classification systems. It aimed to identify the frequency with which nurses had to notify doctors and differentiated the scores for educational activities such as new nurse training and oversight. Furthermore, distinctions based on the time involved to complete activities were made. These included additional factors, such as patient-related calls, activities involving moving patients and supplies, and cooperative, interdisciplinary calls. Other activities consumed nurses' time, such as developing nursing care plans. The patient classification time varies by hospital, most of which identify and categorize nursing activities performed during the evening or night shifts within the same day. Furthermore, nursing records may be missed in cases where additional nurses, other than those in charge of a specific patient, support the care of said patient. As such, accuracy in nursing records is necessary to ensure that all nursing activities are reflected in the patient classification system.

The domains for the patient classification system in this study were selected by referencing the OPC (Oulu Patient Classification) domains in Finland's RAFAELA system. The RAFAELA system contributes to guaranteeing the quality of neurological care and was developed at the Oulu University Hospital of Finland in 1994 (Fagerström et al., 2000b; Fagerström & Rauhala, 2007; Rauhala & Fagerström, 2007). Based on this system, our study divided nursing activities into eight domains. The symptom management domain

comprises monitoring, respiration nursing, treatment, examination and special nursing. The subdomains of treatment consist of dressing assistance, wound care and number of intravenous (IV) lines. The new consideration for the number of IV lines in calculating scores underlines the differences with current existing tools. Furthermore, the infection control domain was newly added and includes the subdomains of isolation and catheter management. This is because this domain is emphasized in the accreditation of medical institutions in Korea. It is significant that this study has set infection control as a separate domain, unlike other tools, especially at a time when the prevention of hospital infections is emphasized.

Another difference between the current study and existing studies is the development of a new domain called "guidance in nursing and emotional support." Nursing activity related to personal/family dynamics, which recognizes that nurses spend a large amount of time communicating with caregivers and family, has not been included before in the existing tools. The education of persons with communication disabilities was also separately considered in this study. Particularly, existing research has only included the number of notifications to doctors and preceptor education in indirect nursing activities. Specifically, in this study, the times that the nurses notified doctors were divided into frequency per shift team, which then received differentiated scores. Furthermore, nursing activities necessary for patient management with insufficient training orientation were newly added in this tool.

When comparing the classification scores by patient type, the scores were highest for patients who transferred from different hospitals, then for those entering from emergency rooms and then for those entering as outpatients, in that order. Nursing intensity was statistically significantly higher for women, older patients, patients who had undergone surgery, patients who had received treatment, patients with psychiatric disorders, terminally ill patients, and patients requiring guardians or caretakers. Song et al., (2008) compared the patient classification scores for patients in general wards. They reported statistical significance in patients who were hospitalized from emergency rooms with a score of 16.03 points, which was higher than patients being hospitalized from outpatient visits, at 12.66 points. While this study indicated that the group of patients coming from other hospitals had the highest patient classification scores, these results were not statistically significant.

Existing general ward patient classification systems have been unable to evaluate nursing skill differences. The current system does not calculate the composition of new and experienced nurses, support systems (Urden & Roode, 1997), various situations such as CPR that can occur during shifts, and situations of the ward and the hospital. This ultimately leads to underestimating nursing intensity. In other words, the focus has been only on patient classification systems. The inability to practically evaluate indirect nursing activities has led to failure in recognizing various factors that impact nursing intensity in clinical settings. Thus, this study is significant as a developed tool that evaluates indirect nursing activities using a more detailed evaluation criteria, leading to the verification of real nursing intensity.

Presently, the required scores for items, such as hospitalization fees, include medical management fees for hospitalized patients (40%), nursing management fees (25%) and hospital management fees (35%). These scores are calculated according to type of hospital (Health Insurance Review & Assessment Service, 2019b). Ko and Park (2017) indicated that the nursing fees per hospitalized patient and the nursing management fees applied under Korea's health insurance system showed significant differences and that translating these differences into cost recovery rates showed that the cost recovery of nursing management fees were very low. Between 1977 and 2017, medical fee items have increased more than tenfold and now stand at 9,246 items (as of January 2019) (Shin et al., 2012). Establishing nursing fees in accordance with nursing activities indicates a poor cost recovery for direct and indirect nursing activities. This is calculated based on the low percentages of nursing management fees included in the hospitalization fees, and some 30–40 items included under the caretaker fee schedule covered under health insurance. The findings of this study are expected to contribute to securing nursing fees, as indirect nursing activities are not being properly compensated. This could also be used as baseline data to prepare a nursing fee system that can guarantee fair nursing fees by reflecting indirect nursing activities that occur but remain unseen under the current fee calculation system. Furthermore, under the current nursing fee system, nursing management fees are fixed, irrespective of patient severity. However, this should be amended to consider the severity of the patient's condition, and consider subsequent indirect nursing activities, leading to differentiated nursing fee payments by patient classification.

There are also limitations to this study. Data were collected from only four medical institutions. Follow-up studies with an increased number of medical institutions and general ward nursing units should be conducted in the future. Additionally, the data represent a limited timeframe (i.e. May to September 2017). Future studies should consider contemporary data over a longer time span. Moreover, future research should also examine advanced general hospitals with high patient severity. An upward patient classification system was proposed based on the study results to reduce score variation for high-severity hospitals, which also limits the results of our study.

6 | CONCLUSION

This study referred to domestic and foreign literature and developed a general ward patient classification tool comprising 8 domains, 24 subdomains, 66 nursing activities and 124 criteria. It used the Delphi method to check for clinical validity. While the validity and reliability were confirmed in some hospitals in Korea, this study proposes the following future points of research to enable the universal use of this tool across clinical settings. An additional study that applies this tool to tertiary general hospitals is required as they have patients with conditions of comparatively higher severity. Ongoing research on the criteria for each activity developed in this study is required.

While the nursing fee system currently involves a fixed fee for nursing management irrespective of patient severity, it is necessary to develop policy measures to differentiate nursing fees by considering patient severity and the resulting indirect nursing activities.

7 | IMPLICATIONS FOR NURSING MANAGEMENT

Utilizing the patient classification system developed in this study will allow for qualification of the indirect nursing activities that have been difficult to measure previously. This will allow for more appropriate nursing fees and provide foundational data for the development of policies that promote the comparative value of nursing. The tools developed in this study can calculate an appropriate number of nurses by reflecting non-direct nursing activities and can be used as a theoretical basis for securing nursing staff.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR'S CONTRIBUTIONS

YK: Conceptualization, design participation and coordination. HJ and DW: Drafting. BP: Design and statistical analysis. All authors read and approved the final manuscript.

DATA AVAILABILITY STATEMENT

The authors will not share the data from this study.

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