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Research paper

A study on the standardization of perioperative nursing activities based on the Nursing Intervention Classification (NIC)

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Abstract

This study was conducted to propose measures for standardizing perioperative nursing activities in Korea based on NIC. Perioperative nursing activities were reviewed by an expert group and compiled into a list. They were then classified based on NIC interventions, and a validity questionnaire was developed. The questionnaire was distributed to 39 clinical nurses who had at least 10 years of experience in operating rooms to investigate the classification validity. The general characteristics of research subjects were expressed in real numbers and percentages. The validity of NIC interventions and perioperative nursing activity factors was assessed using the validity of "clarity," "inclusiveness," "mutual exclusiveness," "homogeneity," and the mean validity score. The reliability of the questionnaire was assessed using Cronbach's Alpha, and the construct validity was assessed using exploratory factor analysis. Standardization measures were presented for perioperative nursing activities and classified into 5 domains and 14 classes. The proposed standardization measures for perioperative nursing activities, which take into account the circumstances in Korea, are expected to be useful in digitizing nursing records and serving as a basis for calculating nursing costs.

Keywords: *perioperative nursing, nursing activities, nursing intervention classification, standardization*

1. Introduction

1.1. Research Background

Perioperative nursing prioritizes patient welfare and safety with consideration of individual needs, rather than serving mechanical or subsidiary roles. The most important objective of perioperative nurses is to provide quality nursing services based on accurate knowledge. As a professional and dynamic nursing process, perioperative nursing involves the administration of planned nursing services to surgical patients. Perioperative nurses create a comfortable surgical environment and enhance the safety of surgical patients.

Medical advancements have led to a diversification of surgery types, methods, procedures, and equipment. Perioperative nurses play an increasingly important role in the care of patients before, during, and after operations[1]. They are assigned to a wide range of tasks, ranging from simple errands to complex procedures. To provide patients with quality medical services and enhance professionalism in nursing, the role of nurses must be clearly specified. It follows that utmost priority should be given to the standardization and systematization of nursing terminology[2].

The development of standardized nursing terminology is not only essential in laying the foundation for digitizing nursing records, but also in establishing an integrated system for nursing assessment, intervention, results, and costs. The use of standardized terminology and the establishment of a digital information system will enable comparison of nursing practices across fields, thereby facilitating communication, decision-making, and the provision of quality nursing services. They can also be utilized as a useful reference in nursing research. Considering that the most important objective of nurses is to provide quality care based on accurate knowledge, the development of standardized nursing terminology is necessary to help nurses provide standardized care under various clinical circumstances.

Many studies on perioperative nursing activities have been conducted in Korea. They have focused on various topics such as the content of perioperative nursing activities, the competence of nurses, the time involved in perioperative nursing activities, the amount of nursing care provided, and the amount of perioperative nursing activities. While many opinions exist for perioperative nursing, standardized international terminology for perioperative nursing activities has not been established.

To resolve the above issue, standardized classification systems for nursing interventions have been proposed. They include the Home Health Care Classification, Omaha System, International Classification of Nursing Practice and Nursing Intervention Classification.

In line with global attempts to develop a standardized classification system, researchers in Korea have studied the validity of NIC when applied to Korean circumstances and examined clinical applications of international classification systems, including perioperative nursing intervention analysis using PNDS. Some other studies on nursing intervention analysis have focused on coronary care units, nurseries, internal medicine wards, surgical wards, and recovery rooms. However, the lack of standardized definitions for nursing intervention activities has caused challenges in communication in the nursing profession and academia and has prevented the systematic development of nursing.

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Developed by McCloskey and Bulechek(1992), NIC is a comprehensive list of nursing interventions performed by nurses across all specialties. It is a standardization of independent nursing interventions, cooperative nursing interventions, interventions in general nursing practice, and interventions in segmented nursing practice and has existed since 1987. NIC was developed based on an inductive approach, allowing a comprehensive understanding and application of nursing interventions. It can be used by nurses in all settings and specialties since it takes into account all types of nursing care. The classification system focuses on the act of nursing by defining nursing activities based on various interventions and can evolve to reflect nursing trends. It was designed to help nurses in selecting the right nursing intervention during clinical decision-making and nursing diagnosis[3-5]. Steelman et al. (1994) confirmed the validity of NIC in describing perioperative nursing interventions, and 45 core nursing interventions were identified in a 1998 study involving the Association of Perioperative Registered Nurses.

Studies by local researchers on NIC-based nursing activities were mostly focused on hospital wards[6-11]. Similarly, research related to NIC interventions has not examined how they can be applied to perioperative nursing activity factors[12-14]. Many studies related to perioperative nursing activities have utilized NIC. They have been limited to examining core nursing interventions based on existing definitions or surveyed the frequency of nursing activities in relation to core nursing intervention. Core nursing interventions refer to nursing interventions performed several times a day by more than 50% of nurses in every specialized clinical field. While they are used frequently by most nurses, they do not reflect all intervention activities performed by nurses. For NIC to be efficiently applied to the field of nursing in Korea, the local context of nursing intervention activities must be considered**.** To facilitate the standardization of perioperative nursing activities, it is essential to first determine the scope of such activities and then explore possible ways of integrating NIC.

The use of standardized terminology and the compilation of perioperative nursing activities will enhance the professionalism of nurses in the delivery of medical services, facilitate communication related to nursing, and serve as a key reference in nursing research. They will add clarity to nursing activities performed in wards and specialized departments and present a more objective basis for calculating the costs of nursing.

Against this backdrop, this study seeks to examine perioperative nursing activities conducted in Korea and propose standardization measures for such activities based on a comparative analysis with NIC.

1.2. Research Goals

This study examines perioperative nursing activities based on NIC in order to explore the application of NIC to such activities in Korea. The specific goals are as follows.

1. Perioperative nursing activity factors conducted in operating rooms in Korea are examined through a literature review.
2. Perioperative nursing activity factors are classified using interventions in the fourth edition of NIC, and a validity questionnaire is developed.
3. Perioperative nursing activity factors are classified using interventions in the fourth edition of NIC, and a validity questionnaire is developed.

1.3. Definition of Terms

1.3.1. Perioperative Nursing Activity Factors

Perioperative nursing activity includes those activities performed by nurses in the preoperative, intraoperative and postoperative phases of surgery. Perioperative nursing activities are all nursing actions that have been provided to a surgical patient with a nursing plan to collect and assess the surgical patient's health data to make a nursing diagnosis and achieve the expected outcome[15]. Perioperative nursing activity factors in this study are the 46 perioperative nursing activities identified by the prior study of the care provided in the operating room.

1.3.2. Nursing Intervention Classification(NIC)

The Nursing Interventions Classification (NIC) is a care classification system which describes the activities that nurses perform as a part of the planning phase of the nursing process associated with the creation of a nursing care plan[16]. In this study the Nursing Intervention Classification is 4th edition consisting 6 domains, 30 classes, 514 nursing interventions.

1.3.3. Nursing Intervention

The nursing intervention performed by nurses based on clinical judgment and knowledge to deliver better results to patients includes both direct nursing and indirect nursing. In this study, nursing intervention refers to the NIC nursing intervention translated into the Korean language by Choi Soon-Hee (2005) and supplemented by Park Ok-Yeob (2005).

2.1. Research Design

The present research, which classifies perioperative nursing activity factors conducted in operating rooms in Korea using NIC interventions, is a descriptive survey study that investigates NIC-based perioperative nursing activities.

2.2. Research Subjects

The research subjects used to assess the validity of NIC-based classification of perioperative nursing activities were 39 clinical nurses with at least 10 years of experience in operating rooms of tertiary care hospitals in Seoul.

2.3. Research Tools

2.3.1. Questionnaire on Perioperative Nursing Activity Factors

For the investigation of perioperative nursing activity factors, this study developed preliminary items composed of 50 perioperative nursing activity factors based on the classification adopted by the Association of Perioperative Registered Nurses, “operating room nursing activities” as used by Gye-suk Yun (1987), “operating room nursing activities” as used by Jung-ho Park et al. (1997), “perioperative nursing activity factors” as defined by Sun-ok Yun (1999), and “perioperative nursing activity factors” as proposed by Kyung-hwa Kim (2000)[19, 20, 21, 22].
Content validity was assessed by an expert group, comprising one professor of nursing and five nurses with a master’s degree and at least 10 years of experience in operating rooms. A total of 46 perioperating nursing activity factors was derived.

Table 1: Perioperative Nursing Activity Factors

No.	Item
1	Opening sterile supplies, instruments, and packages
2	Scrubbing, gowning, and gloving
3	Assistance with gowning and gloving of team members
4	Preparation of antimicrobial solution for surgical site
5	Clean and arrangement of operating room
6	Surgical dressing preparation
7	Clean, packaging, sterilization of instruments
8	Sterilized field maintenance
9	Preparation, assembly, connection and disconnection of instrument and equipment
10	Arrangement of instruments and supplies on the instrument table
11	Giving instruments to team members by hand to hand
12	Supply needed supplies throughout the procedure
13	Assistance of the procedure
14	Observation on the procedure
15	Verification of grounding pad application
16	Counting of sponges, instruments, and sharps
17	Checking and management of instruments and equipments
18	Verification of patient, and patient's nursing & medical history
19	Verification of patient's preparation before surgery
20	Preparation of foley catheterization
21	Evaluation & interview
22	Communication & meeting
23	Maintenance of requirement on supplies
24	Drug management(include narcotics)
25	Computing business
26	Room temperature and environment control
27	Medication care
28	Nursing activities related to supply oxygen
29	Verification and management of patient's infection
30	Specimen management
31	Patient transport service
32	Documentation of nursing record related procedure
33	Transition
34	Participation in preparation for surgical position
35	Body temperature maintenance care
36	Ethical activity (patient's supporter)
37	Quality improvement activity
38	Order to staff
39	Participation in education
40	Patient monitoring
41	Research activity
42	Assessment and observation of patient before and after surgery
43	Fall prevention care
44	Environmental safety verification
45	Emotional support
46	Role of preceptor

2.3.2. Questionnaire on Classification Validity of Perioperative Nursing Activity Factors With NIC Interventions

Nursing activities were classified according to NIC interventions, and the list was reviewed by an expert group. When a nursing activity factor was associated with multiple interventions, it was assigned to the intervention that reflects its content most accurately. When the scope of interventions was larger than that of perioperative nursing activities, multiple perioperative nursing activity factors were classified under one intervention. When the scope of the perioperative nursing activity factors was larger than that of interventions, multiple interventions were classified under one perioperative nursing activity factor.
There were 22 interventions with a larger scope than the perioperative nursing activity factors.
As a result, perioperative nursing activity factors “Opening sterile supplies, instruments, and packages ,” “Scrubbing, gowning, and gloving ,” “Assistance with gowning and gloving of team members ,” “Preparation of antimicrobial solution for surgical site ,” “Clean

and arrangement of operating room ," "Surgical dressing preparation ," "Clean, packaging, sterilization of instruments ," and "Sterilized field maintenance" were classified under intervention "Infection control: intraoperative". Perioperative nursing activity factors "Preparation, assembly, connection and disconnection of instrument and equipment," "Arrangement of instruments and supplies on the instrument table," "Giving instruments to team members by hand to hand," "Supply needed supplies throughout the procedure," "Assistance of the procedure," "Observation on the procedure" were classified under intervention "Surgical assistance". Perioperative nursing activity factors "Verification of grounding pad application," "Counting of sponges, instruments, and sharps ," and "Checking and management of instruments and equipments" were classified under nursing intervention "Surgical precaution." Perioperative nursing activity factors "Verification of patient, and patient's nursing & medical history ," "Verification of patient's preparation before surgery ," and "Preparation of foley catheterization " were classified under nursing intervention "Surgical preparation". Perioperative nursing activity factors "Evaluation & interview ," and "Communication & meeting " were classified under nursing intervention "Staff supervision". Perioperative nursing activity factors "Maintenance of requirement on supplies ," "Drug management(include narcotics)," and "Computing business" were classified under nursing intervention "Supply management".

Among the 17 interventions, those matched to one perioperative nursing activity factor were interventions "Environmental management: comfort," "Medication," "oxygen therapy," "Infection protection," "Specimen management," "Transport," "Documentation," "Shift report," "Positioning: intraoperative," "Temperature regulation," "Patient rights protection," "Quality monitoring," "Delegation," "Staff development," "Vital signs monitoring," and "Research data collection" which were matched to nursing activity factors "Room temperature and environment control," "Medication care," "Nursing activities related to supply oxygen," "Verification and management of patient's infection," "Specimen management," "Patient transport service," "Documentation of nursing record related procedure," "Transition," "Participation in preparation for surgical position," "Body temperature maintenance care," "Ethical activity (patient's supporter)," "Quality improvement activity," "Order to staff," "Participation in education," "Patient monitoring," and "Research activity" respectively.

There were 14 nursing interventions with a smaller scope than the perioperative nursing activity factors. Nursing intervention "Skin surveillance" was classified under a perioperative nursing activity factor "Assessment and observation of patient before and after surgery", nursing intervention "Fall prevention," and "Physical restraint" under a perioperative nursing activity factor "Fall prevention care," "Fire setting precautions," "Pressure ulcer prevention," and "Pressure management" under a perioperative nursing activity factor "Environmental safety verification", nursing intervention "Emotional support ," "Presence ," "Touch ," "Active listening," and "Anxiety reduction" under a perioperative nursing activity factor "Emotional support" and nursing intervention "Preceptor: employee," and "Preceptor: student" under a perioperative nursing activity factor "Role of preceptor."

To determine the validity of classifying the 46 perioperative nursing activity factors under the 36 NIC interventions, this study established the following evaluation criteria: clarity, homogeneity, inclusiveness, and mutual exclusiveness.

1. Clarity
Are the names and definitions of perioperative nursing activities and nursing intervention classification interventions expressed in clear, comprehensible terms?
2. Inclusiveness
Do NIC interventions include possible perioperative nursing activities?
3. Mutual exclusiveness
Do NIC interventions exclude perioperative nursing activities that do not belong to the corresponding domain?
4. Homogeneity
Are all perioperative nursing activities classified under the same NIC intervention homogeneous in nature?

Each item was rated on a 5-point Likert scale, with a higher score indicating greater validity. The Cronbach's Alpha of items in the classification validity questionnaire fell in the range of .71 to .99, and the explanatory power obtained from an exploratory factor analysis was 61–89%.

2.5. Data Collection

After sending a request for cooperation to the tertiary hospital, the researchers explained the purpose of the study in person to the research subjects. The subjects were asked to respond to the questionnaire by self-marking, and the responses were collected by the researchers themselves. All 39 copies of the questionnaire were completed. None of the questionnaire items was omitted.

2.5. Data Analysis

The collected data were analyzed in Window SPSS 15.0 as described below.

1. The general characteristics of subjects were expressed in real numbers and percentages.
2. The reliability of the questionnaire was assessed using Cronbach's Alpha.
3. The construct validity of the questionnaire was assessed using an exploratory factor analysis.
4. The validity of NIC-based classification of perioperative nursing activity factors was assessed using the average value of each evaluation item: clarity, inclusiveness, mutual exclusiveness, and homogeneity.

2. Results

3.1. General Characteristics of Research Subjects

The subjects were 39 nurses with at least 10 years of working experience in operating rooms. Their general characteristics were as follows. By age, 33 fell in the 30–39 age group (84.6%) and 6 were age 40 or older (15.4%). By years of experience, 31 had worked for 10–14 years (79.5%) and 8 for 15 years or more (20.5%). By level of education, 30 had a university degree (76.9%), and 9 had at least a

master's degree (23.1%). By rank, 7 of the subjects were head nurses (17.9%), 20 were charge nurses (51.3%), and 12 were general nurses (30.8%). By marital status, 7 were unmarried (18.0%).

Table 2: General Characteristics of Participants

Characteristics		Frequency (%)
Age(year)	30-39	33(84.6)
	Above 40	6(16.4)
Career(year)	10-14	31(79.5)
	Above 15	8(20.5)
Education	Graduated from a university	30(76.9)
	Above master's degree	9(23.1)
Position	Head nurse	7(18.0)
	Charge nurse	20(51.3)
	General nurse	12(30.8)

3.2. Validity of Classification of Perioperative Nursing Activity factors Based on NIC Interventions

3.2.1. Classification Validity

Table 3 shows the classification validity of perioperative nursing activities by NIC intervention. The results show the percentage of respondents who answered "4 (Agree)" and "5 (Strongly agree)." The validity results by criteria are as follows. For the 34 items under "clarity," more than 90% of respondents chose "4" and "5."

For the 33 items under "inclusiveness," more than 90% of respondents chose "4" and "5." For the 25 items under "mutual exclusiveness," more than 90% of respondents chose "4" and "5." For "homogeneity," more than 90% of respondents chose "4" and "5" for 13 out of 19 items, after excluding the 17 items with one intervention matched to one nursing intervention factor.

The classification validity results for the eight nursing activity factors classified under intervention "Infection control: intraoperative" were 96.5% for clarity, 100.0% for inclusiveness, 100.0% for mutual exclusiveness, and 100.0% for homogeneity.

The classification validity results for the six nursing activity factors classified under intervention "Surgical assistance" were 99.6% for clarity, 100.0% for inclusiveness, 100.0% for mutual exclusiveness, and 100.0% for homogeneity. The three nursing activity factors classified under intervention "Surgical precaution" were 100.0% in all criteria.

The three nursing activity factors classified under intervention "Surgical preparation" obtained 99.1% for clarity, 89.8% for inclusiveness, 82.0% for mutual exclusiveness, and 79.5% for homogeneity. Intervention "Supply management" obtained 99.1% for clarity, 97.5% for inclusiveness, 97.5% for mutual exclusiveness, and 97.4% for homogeneity.

The two nursing activity factors classified under intervention "Staff supervision" obtained 100.0% for clarity, 97.4% for inclusiveness, 97.5% for mutual exclusiveness, and 97.4% for homogeneity.

Intervention "Environmental management: comfort" obtained 100.0% for clarity, 48.7% for inclusiveness, 92.3% for mutual exclusiveness, intervention "Medication" was 97.5% for clarity, 100.0% for inclusiveness, 94.9% for mutual exclusiveness. Intervention "Oxygen therapy" had a validity of 97.4 in all criteria.

Intervention "Infection protection" obtained 97.4% for clarity, while the others recorded 100.0%. Intervention "Transport" obtained 97.4% in mutual exclusiveness, while the others recorded 100.0%. Intervention "Positioning: intraoperative" obtained 97.4% for inclusiveness, while the others recorded 100.0%. The clarity of

"Patient rights protection," "Quality monitoring," and "Delegation" was 76.9%, 64.9% and 76.9% respectively, and the other criteria was 100.0%. Intervention "Specimen management," "Documentation," "Shift report," "Temperature regulation," "Staff development," "Vital Signs monitoring," "Fall prevention,"

Table 3: Classification Validity*

NIC Intervention	Perioperative Nursing Activity Factors No.	Classification Validity (%)			
		Clarity	Inclusiveness	Mutual Exclusiveness	Homogeneity
Infection control: intraoperative	1-8	96.5	100.0	100.0	100.0
Surgical assistance	9-14	99.6	100.0	100.0	100.0
Surgical precaution	15-17	100.0	100.0	100.0	100.0
Surgical preparation	18-20	99.1	89.8	82.0	79.5
Staff supervision	21-22	100.0	97.4	97.5	97.4
Supply management	23-25	99.1	97.5	97.5	97.4
Environmental management: comfort	26	100.0	48.7	92.3	-
Medication	27	97.5	100.0	94.9	-
Oxygen therapy	28	97.4	97.4	97.4	-
Infection protection	29	97.4	100.0	100.0	-
Specimen management	30	100.0	100.0	100.0	-
Transport	31	100.0	100.0	97.4	-
Documentation	32	100.0	100.0	100.0	-
Shift report	33	100.0	100.0	100.0	-
Positioning: intraoperative	34	100.0	97.4	100.0	-
Temperature regulation	35	100.0	100.0	100.0	-
Patient rights protection	36	76.9	100.0	100.0	-
Quality monitoring	37	94.9	100.0	100.0	-
Delegation	38	76.9	100.0	100.0	-
Staff development	39	100.0	100.0	100.0	-
Vital signs monitoring	40	100.0	100.0	100.0	-
Research data collection	41	94.9	97.4	94.9	-
Skin surveillance	42	100.0	71.8	87.1	-
Fall prevention	43	100.0	100.0	100.0	100.0

Physical restraint	43	100.0	100.0	100.0	100.0
Environment management: safety	44	100.0	97.4	87.2	100.0
Fire setting precautions	44	97.4	97.4	87.2	100.0
Pressure ulcer prevention	44	100.0	97.4	87.2	100.0
Pressure management	44	100.0	97.4	87.2	100.0
Emotional support	45	100.0	92.3	74.4	87.2
Presence	45	100.0	92.3	74.4	87.2
Touch	45	97.4	92.3	74.4	87.2
Active listening	45	100.0	92.3	74.4	87.2
Anxiety reduction	45	92.3	92.3	74.4	87.2
Preceptor: employee	46	97.4	94.9	94.9	97.4
Preceptor: student	46	97.4	94.9	94.9	97.4
Total		97.8	95.6	96.2	96.1

*Percentage of respondents to 5 (Strongly agree) or 4 (Agree)
**PNAF : Perioperative nursing activity Factors

Table 4 : Mean of Classification Validity Criteria

NIC Intervention	Perioperative Nursing Activity Factors No.	Mean±SD			
		Clarity	Inclusiveness	Mutual Exclusiveness	Homogeneity
Infection Control: Intraoperative	1-8	4.64±0.55	4.54±0.51	4.51±.0.51	4.56±0.50
Surgical Assistance	9-14	4.82±0.39	4.72±0.46	4.56±0.50	4.54±0.51
Surgical Precaution	15-17	4.92±0.27	4.64±0.49	4.56±0.50	4.69±0.47
Surgical Preparation	18-20	4.80±0.42	4.56±0.68	4.44±0.79	3.92±0.58
Staff Supervision	21-22	4.19±0.40	4.18±0.45	4.64±0.54	4.59±0.55
Supply Management	23-25	4.56±0.52	4.49±0.56	4.64±0.54	4.59±0.55
Environmental Management: Comfort	26	4.21±0.41	3.67±0.77	4.08±0.48	-
Medication	27	4.64±0.54	4.36±0.49	4.64±0.59	-
Oxygen Therapy	28	4.79±0.47	4.79±0.47	4.77±0.48	-
Infection Protection	29	4.74±0.50	4.54±0.51	4.82±0.39	-
Specimen Management	30	4.72±0.56	4.49±0.51	4.77±0.43	-
Transport	31	4.21±0.41	4.49±0.51	4.33±0.53	-
Documentation	32	4.90±0.31	4.92±0.27	4.79±0.41	-
Shift Report	33	4.92±0.27	4.51±0.51	4.79±0.41	-
Positioning: Intraoperative	34	4.69±0.47	4.46±0.55	4.82±0.39	-
Temperature Regulation	35	4.79±0.41	4.49±0.51	4.79±0.41	-
Patient Rights Protection	36	4.08±0.74	4.49±0.51	4.46±0.51	-
Quality Monitoring	37	4.74±0.55	4.46±0.51	4.85±0.37	-
Delegation	38	4.10±0.75	4.49±0.51	4.54±0.51	-
Staff Development	39	4.67±0.48	4.23±0.43	4.59±0.50	-
Vital Signs Monitoring	40	4.90±0.31	4.54±0.51	4.85±0.37	-
Research Data Collection	41	4.79±0.52	4.82±0.45	4.79±0.52	-
Skin Surveillance	42	4.79±0.41	4.08±0.81	4.21±0.66	-
Fall prevention	43	4.80±0.41	4.54±0.51	4.38±0.49	4.67±4.78
Physical Restraint	43	4.85±0.37	4.54±0.51	4.38±0.49	4.67±4.78
Environment Management: safety	44	4.72±0.46	4.72±0.51	4.15±0.63	4.79±0.41
Fire Setting Precautions	44	4.79±0.47	4.72±0.51	4.15±0.63	4.79±0.41
Pressure Ulcer Prevention	44	4.77±0.43	4.72±0.51	4.15±0.63	4.79±0.41
Pressure management	44	4.77±0.43	4.72±0.51	4.15±0.63	4.79±0.41
Emotional Support	45	4.77±0.43	4.46±0.64	4.00±0.73	4.36±0.71
Presence	45	4.69±0.47	4.46±0.64	4.00±0.73	4.36±0.71
Touch	45	4.72±0.51	4.46±0.64	4.00±0.73	4.36±0.71
Active Listening	45	4.54±0.51	4.46±0.64	4.00±0.73	4.36±0.71
Anxiety Reduction	45	4.59±0.64	4.46±0.64	4.00±0.73	4.36±0.71
Preceptor: Employee	46	4.69±0.52	4.39±0.59	4.74±0.55	4.77±0.49
Preceptor: Student	46	4.69±0.52	4.39±0.59	4.74±0.55	4.77±0.49
Total		4.68±0.51	4.48±0.58	4.58±0.57	4.53±0.57

and “Physical restraint” had a validity of 100.0 in all criteria. The classification validity of intervention “Research data collection” was 94.9% for clarity, 97.4% for inclusiveness, 94.9% for mutual exclusiveness. “Fall prevention” and “Physical restraint” obtained 100.0% in all criteria.

The clarity of “Environment management: safety,“ “Fire setting precautions,” “Pressure ulcer prevention ,” and “Pressure management ,” was 100.0%, 97.4%, 100.0% and 100.0% respectively, and 97.4% for inclusiveness, 87.2% for mutual exclusiveness, and 100.0% for homogeneity.

The clarity of five interventions classified under “Emotional support” was 100.0%, , 100.0%, 97.4%, 100.0% and 92.3% respectively, and 92.3% for inclusiveness, 74.4% for mutual exclusiveness, and 87.2% for homogeneity. The validity results for two intervention classified under “Role of preceptor” were 97.4% for clarity, 94.9% for inclusiveness, 94.9% for mutual exclusiveness, and 97.4% for homogeneity.

3.2.1. Mean of Classification Validity Criteria

The mean scores of classification validity are as follows (Table 4).

The highest overall mean was obtained for the criteria of clarity(4.68±0.51), followed by mutual exclusiveness(4.58±0.57). Homogeneity(4.53±0.57) and inclusiveness(4.53±0.57) had the same lowest mean.

All items had a score of 4.00 or higher for clarity. There were 31 items, including "Infection control: intraoperative," with a score of 4.50 or higher. Among these items, "Surgical precaution" and "Shift report" had the highest score of 4.92±0.27. "Patient rights protection" had the lowest score of 4.08±0.74.
For inclusiveness, 35 items had a score of 4.00 or higher. 23 items, including "Infection control: intraoperative," had a score of 4.50 or higher. "Documentation" had the highest score of 4.92±0.27. "Environmental management: comfort" had the lowest score of 3.67±0.77.
For mutual exclusiveness, all items obtained a score of 4.00 or higher. 22 items, including "Infection control: intraoperative," had a score of 4.50 or higher. "Delegation" and "Vital sign monitoring" had the highest score of 4.85±0.37. The five interventions classified under the perioperative nursing activity "Emotional support" had the lowest mean validity for the mutual exclusiveness at 4.00±0.73.
For homogeneity, there were 18 interventions with a score of 4.00 or higher and 12 with a score of 4.50 or higher. Among them, "Environment management: safety", "Fire setting precautions", "Pressure ulcer prevention", and "Pressure management" obtained the highest score of 4.79±0.41, and "Surgical preparation" had the lowest score of 3.92±0.58.

3.3. Standardization of Perioperative Nursing Activities

The standardization measures for perioperative nursing activities under NIC are as follows (Table 5): NIC was comprised of 5 domains, 25 classes, and 36 interventions. There were 2 measures proposed for the Immobility Management class, 1 for the Physical Comfort Promotion class under the Physiological: Basic domain, 11 for the Health System Management Class, and 1 for the Health System Mediation Class under the Health System domain.

4. Discussion

A validity questionnaire was employed as a tool for classifying perioperative nursing activities by NIC intervention. From among the perioperative nursing activities identified in previous research, this study extracted 46 nursing activities based on a validity assessment by an expert group. The activities were classified into 36 interventions through a comparative analysis with the fourth revised NIC by McCloskey and Bulechek(2004). The final list was compiled after correction and supplementation by the expert group. The developed questionnaire was used to assess the validity in four criteria: clarity, homogeneity, inclusiveness, and mutual exclusiveness. The respondents were 39 nurses with at least 10 years of experience working in operating rooms.
The validity results are as follows. The eight perioperative nursing activities classified under intervention "Infection control: intraoperative" were 96.5%(4.64±0.55) in clarity, 100.0%(4.54±0.51) in inclusiveness, 100.0%(4.51±0.51) in mutual exclusiveness, and 100.0%(4.56±0.50) in homogeneity, thus establishing their validity in all four criteria. Six perioperative nursing activities were classified under intervention "Surgical assistance" and recorded 99.6%(4.82±0.39) in clarity, 100.0%(4.72±0.46) in inclusiveness, 100.0%(4.56±0.50) in mutual exclusiveness, and 100.0%(4.54±0.51) in homogeneity.
There were three perioperative nursing activities classified under "Surgical precaution," and validity of 100.0% were achieved in all criteria. Four perioperative nursing activities were classified under "Surgical preparation," and their validity was relatively lower: 99.1%(4.80±0.42) in clarity, 89.8%(4.56±0.68) in inclusiveness, 82.0%(4.44±0.79) in mutual exclusiveness, and 79.5%(3.92±0.58) in homogeneity. This can be traced to "Preparation of foley catheterization" being of a more independent nature than "Surgical preparation." Two perioperative nursing activity factors were classified under "Staff supervision," and the average scores were 100.0%(4.19±0.40) in clarity, 97.4%(4.18±0.45) in inclusiveness, 97.5%(4.64±0.54) in mutual exclusiveness, and 97.4%(4.59±0.55) in homogeneity. The lower scores may have resulted from the scope of "Communication and meeting" being larger than that of "Staff supervision." Three perioperative nursing activity factors were classified under "Supply management," and the validity scores were 99.1%(4.56±0.52) in clarity, 97.5%(4.49±0.56) in inclusiveness, 97.5%(4.64±0.54) in mutual exclusiveness, and 97.4%(4.59±0.55) in homogeneity.
Each of the 17 NIC interventions was associated with one perioperative nursing activity. The activity factors are "Environmental management: comfort," "medication," "Oxygen therapy," "Infection Protection," "Specimen Management," "Transport," "Documentation," "Shift Report," "Positioning: Intraoperative," "Temperature Regulation," "Patient Rights Protection," "Quality Monitoring," "Delegation," "Staff Development," "Vital Signs Monitoring," "Research Data Collection," and "Skin Surveillance." Intervention "Shift report" had the highest mean validity of 100.0%(4.92±0.27) in clarity, while "Patient rights protection" and "Delegation" recorded the lowest of 76.9%. This may have been caused by the abstract definitions of "Quality monitoring" and "Staff development." In inclusiveness, "Environmental management: comfort" and "Patient rights protection" had the lowest validity at 48.7%(4.08±0.74) and 71.8%(4.10±0.75), respectively. This is because the perioperative nursing activities were defined to be of a broader scope than NIC interventions. In mutual exclusiveness, "Emotional support," "Present," "Touch," "Active listening," and "Anxiety reduction" had the lowest validity of 74.4%, while other interventions had relatively high validity. All items were found to be significantly valid in all criteria, thereby demonstrating the validity of the classification of perioperative nursing activity factors based on NIC interventions.
In the case of the five perioperative nursing activity factors and the 14 NIC interventions, multiple NIC interventions were classified under a single perioperative nursing activity because of the latter having a broader scope than the former.
Among the four interventions classified under "Environmental safety verification," "Touch" and "Anxiety reduction" obtained 97.4%(4.79±0.47) and 92.3(4.59±0.64) respectively in clarity, while the others recorded 100.0%.
Interventions "Emotional support," "Presence," "Touch," "Active listening," and "Anxiety reduction" were classified under "Emotional support," and showed a relatively low validity of 74.4%(4.00±0.73) in mutual exclusiveness. As pointed out by Park et al. (1999), NIC offers many advantages, but some nursing activities are repeated across nursing intervention classes[15].

Table 5 : Standardization of Perioperative Nursing Activity

Domain	Classes	Interventions	Perioperative Nursing Activity Factors
Physiological: Basic	Immobility Management	Physical Restraint	Fall Prevention Care
		Physical Restraint	Patient Transport Service
	Physical Comfort Promotion	Environmental Management: Comfort	Room Temperature And Environment Control
Physiological: Com-	Drug Management	Medication Management	Medication Care

plex	Perioperative Care	Infection Control: Intraoperative	Opening Sterile Supplies, Instruments, And Packages
			Scrubbing, Gowning, And Gloving
			Assistance With Gowning And Gloving Of Team Members
			Preparation Of Antimicrobial Solution For Surgical Site
			Clean And Arrangement Of Operating Room
			Surgical Dressing Preparation
			Clean, Packaging, Sterilization Of Instruments
			Sterilized Field Maintenance
		Positioning : Intraoperative	Participation In Preparation For Surgical Position
		Surgical Assistance	Preparation, Assembly, Connection And Disconnection Of Instrument And Equipment
			Arrangement Of Instruments And Supplies On The Instrument Table
			Giving Instruments To Team Members By Hand To Hand
			Supply Needed Supplies Throughout The Procedure
			Assistance Of The Procedure
			Observation On The Procedure
		Surgical Precaution	Verification Of Grounding Pad Application
			Counting Of Sponges, Instruments, And Sharps
			Checking And Management Of Instruments And Equipments
		Surgical Preparation	Verification Of Patient, And Patient's Nursing & Medical History
			Verification Of Patient's Preparation Before Surgery
			Preparation Of Foley Catheterization
	Respiratory Management	Oxygen Therapy	Nursing Activities Related To Supply Oxygen
	Skin/Wound Management	Pressure Management	Environmental Safety Verification
		Pressure Ulcer Prevention	Environmental Safety Verification
		Skin Surveillance	Assessment And Observation Of Patient Before And After Surgery
	Thermo-Regulation	Temperature Regulation	Body Temperature Maintenance Care
Behavioral	Communication Enhancement	Active Listening	Emotional Support
	Coping Assistance	Emotional Support	Emotional Support
		Presence	Emotional Support
		Touch	Emotional Support
	Psychological Comfort Promotion	Anxiety Reduction	Emotional Support
Safety	Risk Management	Environment Management : Safety	Environmental Safety Verification
		Fire Setting Precautions	Environmental Safety Verification
		Fall Prevention	Fall Prevention Care
		Infection Protection	Verification And Management Of Patient's Infection
		Vital Signs Monitoring	Patient Monitoring
Health System	Health System Mediation	Patient Rights Protection	Ethical Activity (Patient's Supporter)
	Health System Management	Delegation	Order To Staff
		Preceptor : Employee	Role Of Preceptor
		Preceptor : Student	Role Of Preceptor
		Quality Monitoring	Quality Improvement Activity
		Specimen Management	Specimen Management
		Staff Supervision	Evaluation & Interview
			Communication & Meeting
		Supply Management	Maintenance Of Requirement On Supplies
			Drug Management(Include Narcotics)
			Computing Business
		Staff Development	Participation In Education
	Information Management	Documentation	Documentation Of Nursing Record Related Procedure
		Research Data Collection	Research Activity
		Shift Report	Transition

Interventions “Preceptor: employee” and “Preceptor: student” were classified under “Role of preceptor,” and showed a relatively high validity with 97.4% in clarity, 94.9% in inclusiveness, 94.9% in mutual exclusiveness, and 97.4% in homogeneity.

Several classification types were observed in the classification of perioperative nursing activities by NIC intervention. They are the classification of multiple nursing activities under one NIC intervention, the classification of one perioperative nursing activity under one NIC intervention, and the classification of one perioperative nursing activity under multiple NIC interventions. All perioperative nursing activities were covered by NIC interventions. This can be attributed to the diverse range of perioperative nursing activity factors and NIC interventions examined in previous research. For example, eight perioperative nursing activity factors were classified under an NIC intervention of "Infection control: intraoperative," and interventions such as "Fall prevention" and "Physical restraint" were associated with the perioperative nursing activity factor "Fall prevention care."

Some difficulties were faced in classifying perioperative nursing activities due to the non-mutual exclusiveness among NIC interventions. For instance, "Preparation of foley catheterization" is included under "Surgical prevention," but the NIC intervention of "catheterization" exists independently. This study classified the perioperative nursing activity factor "Preparation of foley catheterization" under the NIC intervention "Surgical prevention" since "Preparation of foley catheterization" can be seen as being part of surgical preparations. Among the NIC interventions, "Surgical assistance" and "Skin surveillance" contained overlapping nursing activities, which made it difficult to classify the perioperative nursing activity "Assessment and observation of patient before and after surgery." In this case, expert opinion was sought, and the perioperative nursing activity was classified under an NIC intervention that better reflects its characteristics. These examples show that there were difficulties in classifying perioperative nursing activity factors due to the lack of mutual exclusiveness among the NIC interventions.

Since the perioperative nursing activity factors used in this study were limited to those identified in previous research, there were some limitations in the association of perioperative nursing activities with NIC interventions. For instance, "Preoperative coordination, " "Pressure management," "Fluid monitoring," "Laser precautions," "Latex precautions," and "Pneumatic tourniquet precautions" are NIC interventions deemed to exist in clinical practice, but they have been excluded from the present results as they do not pertain to any peri-operative nursing activity.

The 36 NIC nursing interventions were examined by the domain, and the results are as follows: NIC was comprised of 5 domains, 25 classes, and 36 interventions. There were 2 measures proposed for the Immobility Management class, 1 for the Physical Comfort Promotion class under the Physiological: Basic domain, 11 for the Health System Management Class, and 1 for the Health System Mediation Class under the Health System domain.

The results include the 16 core perioperative nursing interventions identified by Lee and Park (2002) based on NIC[18]. They also coincide with 23 out of 45 core perioperative nursing interventions proposed in a 1998 study of NIC by domain, class, and intervention with the Association of Perioperative Registered Nurses as subjects[5]. Several factors may have caused the differences in results. First, NIC interventions are not core nursing interventions. Second, the study was limited to perioperative nursing activities identified in previous research. Lastly, the nursing environment in Korea is different from that of the United States. In addition, slight differences were observed in the scope and level of nursing activities between NIC interventions and perioperative nursing activity factors.

These differences highlight the need for further research on the sociocultural characteristics of nursing practice in Korea when applying NIC interventions. NIC interventions that take into account the circumstances in Korea should be developed through in-depth studies on related nursing activities.

Many studies have examined nursing activities based on NIC. Lee(2000) examined 112 core nursing interventions in the recovery room, and Lee et al. (2001) found that there were 311 nursing interventions used at least once a day among nursing interventions in general surgery[19,21]. Yeom(1999) identified 193 nursing interventions conducted by a majority of nurses working in hospitals, Kim(1997) extracted 105 core nursing interventions for the coronary care unit, and Son(1998) showed that all 426 interventions were actively performed[22-24]. Yong et al. (2000) examined 95 interventions through a hospital-centered home nursing intervention analysis, while Oh and Park (2002) found that 210 nursing interventions were used at least once a month by neurosurgical nurses, and that there were 48 core nursing interventions[8,10]. Oh et al. (2000) showed that 166 interventions were used at least once a month by nurses working with newborns[25]. When comparing previous research with the 36 nursing interventions used in this study, we can see that it is necessary to examine NIC interventions in the context of the operating room.

This study aims to present standardization measures for perioperative nursing activities, instead of simply extracting perioperative nursing activities based on NIC nursing interventions. Using the perioperative nursing activities identified in previous research, this study proposed measures for standardizing perioperative nursing activities based on the NIC classification system. Standardization measures were proposed for NIC interventions, and they were comprised of 5 domains, 14 classes, and 27 perioperative nursing activities.

NIC was developed for important nursing tasks to be communicated and recorded in standardized language. The classification system promotes the use of standardized nursing terminology, highlights the significance of nursing in clinical practice, and encourages critical thinking. Nurses who lack experience or trainees can utilize NIC as educational material. On the administrative side, it can be used to estimate the demand for nursing personnel and equipment. Overall, NIC contributes to the development of a nursing information system.

In this study, the perioperative nursing activities classified based on NIC are an expression of activities performed in the operating room with standardized nursing terminology. As such, they can serve as a useful standard of procedures to follow in the operating room. Nursing activities must be standardized in order to digitize nursing records and facilitate the comparison of clinical nursing. The perioperative nursing activities examined in this study are expected to lay the foundation for the digitization and informatization of nursing activities.

To establish a rational compensation system, each nursing activity performed by nurses should be reflected in health insurance fees. The application of standardized nursing terminology to nursing services is not only cost-effective, but also adds clarity to nursing activities performed in wards and specialized departments. Furthermore, it presents a more objective and rational basis in calculating the costs of nursing, which can be accurately calculated by examining nursing activities and developing a classification method. NIC is comprised of 7 domains, 30 classes, 516 interventions, and 120,000 actions. The repeating of nursing activities across nursing intervention classes or excessive segmentation has been criticized as ineffective in nursing cost calculations. Existing weaknesses can be overcome through further NIC-based research on nursing activities in Korea, and the standardized nursing activities can have various applications, including nursing cost development.

Similar to the study by Park (2005), the examination of nursing interventions in Korea and comparison with nursing activities included in health insurance fees will reveal nursing activities yet to be considered, thereby serving as evidence for calculating nursing costs. The results may be a basic reference material for international research on nursing costs.

5. Conclusion

This study explored the possible application of NIC to the classification of perioperative nursing activities in Korea. A questionnaire on NIC-based classification of perioperative nursing activity factors was distributed to 39 clinical nurses with at least 10 years of experience in operating rooms. The collected data were analyzed in SPSS 15.0, and the validity index was calculated using the average values of classification validity. As a result, Korea's perioperative nursing activities were classified into 5 domains, 14 classes, 36 interventions, and 46 perioperative nursing activity factors.

The recommendations below have been derived from the results. First, there is a need to conduct research to develop NIC interventions and perioperative nursing activity names that reflect Korea's perioperative nursing activities and its environmental characteristics. Second, based on the proposed perioperative nursing activities, future research should focus on the computerization of perioperative nursing records and nursing cost development.

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