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Current Status of Nursing Informatics Education in Korea

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Objectives: This study presents the current status of nursing informatics education, the content covered in nursing informatics courses, the faculty efficacy, and the barriers to and additional supports for teaching nursing informatics in Korea. **Methods:** A set of questionnaires consisting of an 18-item questionnaire for nursing informatics education, a 6-item questionnaire for faculty efficacy, and 2 open-ended questions for barriers and additional supports were sent to 204 nursing schools via email and the postal service. Nursing schools offering nursing informatics were further asked to send their syllabuses. The subjects taught were analyzed using nursing informatics competency categories and other responses were tailed using descriptive statistics. **Results:** A total of 72 schools (35.3%) responded to the survey, of which 38 reported that they offered nursing informatics courses in their undergraduate nursing programs. Nursing informatics courses at 11 schools were taught by a professor with a degree majoring in nursing informatics. Computer technology was the most frequently taught subject (27 schools), followed by information systems used for practice (25 schools). The faculty efficacy was 3.76 ± 0.86 (out of 5). The most frequently reported barrier to teaching nursing informatics (n = 9) was lack of awareness of the importance of nursing informatics. Training and educational opportunities was the most requested additional support. **Conclusions:** Nursing informatics education has increased during the last decade in Korea. However, the proportions of faculty with degrees in nursing informatics and number of schools offering nursing informatics courses have not increased much. Thus, a greater focus is needed on training faculty and developing the courses.

Keywords: Nursing Informatics, Nursing Education Research, Competency-Based Education

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I. Introduction

As the use of information technology in healthcare increases, the demand for healthcare professionals equipped with the necessary knowledge and skills for utilizing and managing information also increases. The Institute of Medicine specified the use of information technology as one of the top-five abilities that healthcare professionals needed, and also emphasized the importance of information technology in ensuring patient safety and the quality of healthcare [1].

Nurses are no exception to this. The multidisciplinary field that uses health information technology to improve health care is called health informatics. Nursing informatics is a sub-component of health informatics pertaining to nurses and nursing care [2]. The increasing use of information and communications technology (ICT) and Electronic Medical Records (EMRs) at the point of care has led to a consensus that nurses need to understand technology, as well as there is a greater demand for nursing informatics education [3].

The American Nurses Association (ANA) defined different abilities in using computers and information technology from novice to expert as part of the core competencies required for nurses [4]. The American Association of Colleges of Nursing and the National League for Nursing (NLN) recommended that nursing schools should include nursing informatics in the nursing curriculum so as to teach the use of ICT to ensure patient safety and the quality of healthcare [5]. There have been various proposals for core competencies in nursing informatics education [6]. For example, the Technology Informatics Guiding Education Reform (TIGER) Initiative proposed the following three essential components of nursing informatics competencies: basic computer competencies, information literacy, and information management [7]. The Quality and Safety Education for Nurses (QSEN) Framework comprises knowledge, skills, and attitudes for nursing competencies in informatics [8].

The first nursing informatics courses were introduced in the early 1980s in the United States by nursing informatics leaders such as Ronald, Saba, and Skiba. The ANA and NLN subsequently developed educational materials, passed resolutions, and recommended practice strategies and professional competencies in the mid-1980s. In 1988, the first graduate education program in nursing informatics was introduced at the University of Maryland [9]. As of 2008, 58% of undergraduate and graduate nursing programs included nursing informatics courses and 15% of nursing schools offered nursing informatics degree programs in the United States [10].

The first nursing informatics course was introduced in Korea in 1992 at Chonbuk National University, and the first nursing informatics degree program was introduced in 2003 at Seoul National University [2,11]. The proportion of nursing schools offering nursing informatics courses increased from 14% in 1999 [11] to 28.7% in 2007 [12].

Yom et al. [12] reported that 86.7% of faculties were not qualified to teach nursing informatics since they did not have a degree in this subject. It would be interesting to examine the faculties' teaching efficacy, the types of barriers they experience in teaching nursing informatics, and the types of additional support they need to improve their teaching.

It is also important for nursing informatics courses to reflect up-to-date competencies reported by various international organizations. No previous study has analyzed what is being taught in nursing informatics courses since the new sets of nursing informatics competencies were reported as part of the TIGER Initiative and QSEN Framework. It is therefore necessary to compare the subjects being taught in nursing informatics with the competency items proposed by the recognized international organizations.

With this background, the present study aimed to determine the current status of nursing informatics education in Korea, the subjects taught in nursing informatics courses, and the faculty efficacy, barriers to teaching, and additional supports to improve teaching.

II. Methods

1. Research Subjects

We surveyed 204 nursing schools (160 offering a baccalaureate programs and 44 offering a 3-year diploma program as of 2014) from a list available on the website of the Korean Nurses Association in order to ascertain the current status of nursing informatics education in Korea. We further surveyed faculty who are teaching nursing informatics in order to assess faculty efficacy, the barriers to and additional supports for improving teaching, and to obtain course syllabuses. Course syllabuses were used for quantitative content analysis of subjects taught in the nursing informatics.

2. Tools

1) Questionnaire for nursing informatics education

The questionnaire used to determine the current status of nursing informatics education consisted of 12 items for undergraduate programs and 6 items for graduate programs. The questionnaire items were extracted from Park et al. [11], Yom et al. [12], and Yun [13]. They included the type

of nursing program (baccalaureate or 3-year diploma program), the availability of the nursing informatics course, the type of degree programs (undergraduate or graduate), the year in which it was first offered, the number of courses offered, whether or not it is mandatory, the number of credits, the place of teaching, the faculty's educational background, the availability of practicums and their associated number of credits, and the willingness of the institution to offer a nursing informatics course if this is not offered yet.

2) Core content domains of nursing informatics competencies

The subjects taught in the nursing informatics courses were classified and quantified by analyzing the content of course syllabus using 14 core content domains with 41 subcategories developed in this study by reviewing previous recommendations and studies on nursing informatics competencies. They include 'basic computer competencies', 'information literacy' and 'information management' extracted from the TIGER Initiative [7]; 'attitude' extracted from the QSEN Framework [8]; 'informatics', 'computer technology', 'theory', 'telehealth', 'latest trends', 'careers/roles in nursing informatics', 'information systems used for practice', 'information systems used for education, administration, and research', and 'ethics' from McNeil and Odom [6]; and 'nursing' from Graves and Corcoran [14].

3) Survey of faculty efficacy and the barriers to and additional supports for teaching nursing informatics

A questionnaire developed by Yi and Kwon [15] assessing the faculty efficacy when teaching community health nursing in Korean was used to measure the efficacy of nursing informatics faculty. This questionnaire has six items rated using a 5-point Likert scale from 'strongly disagree' to 'strongly agree.'

The barriers and additional supports in teaching nursing informatics were surveyed using the two open-ended questions developed by Adamson [16]. The questions were translated into Korean by the present authors and validated by two bilingual professors who taught nursing informatics.

3. Data Collection and Analysis

Data were collected from October 14, 2014 to November 26, 2014 using both the postal service and email. The set of questionnaires and requests for nursing informatics course syllabuses were mailed to the deans or directors of 204 nursing schools. If a reply had not been received after 2 weeks, we again emailed the deans and professors in charge of nursing informatics at those nursing schools. If there were any incomplete or missing data, we telephoned or again emailed the deans or professors in charge of nursing informatics to complete the information. Data were analyzed using descriptive statistics such as frequencies, means and standard deviations. Narrative text data from the nursing informatics course syllabus were analyzed using quantitative content analysis [17].

III. Results

1. Current Status of Nursing Informatics Education

Out of 204 nursing schools, 72 schools (offering 58 baccalaureate and 14 3-year diploma programs) responded to the nursing informatics education survey (response rate: 35.3%). Nursing informatics courses were offered in 33 of the 58 baccalaureate programs (56.9%) and 5 of the 14 3-year diploma programs (35.7%). Among 34 nursing schools that had not yet established nursing informatics courses, 12 (35.3%) replied that they planned to offer such courses in the near future.

Out of 38 undergraduate programs offering nursing informatics, 55.3% of the schools (n = 21) had introduced the nursing informatics course within last 5 years. Most of the schools (68.4%) offered them as elective rather than mandatory courses (Table 1). The courses were being offered most frequently at the sophomore level (36.8%). Most of the courses (71.1%) were two-credit courses, and less than one-third of the schools (28.9%) included practicums in their nursing informatics courses. Lecture rooms were the most popular place of teaching (71.1%), followed by computer or simulation laboratories (28.9%). The educational background of the faculties varied from nursing to computer science, business, and health management. The most popular educational background was nursing management (34.1%). Only 25.0% of the faculties had themselves majored in nursing informatics.

Nine of the 32 schools with graduate nursing programs offered nursing informatics courses, with only 1 school having master's and PhD degree programs in nursing informatics. Most of nursing informatics courses in graduate nursing programs had been introduced prior to 2010 (66.7%). The educational backgrounds of the faculties included nursing informatics (44.5%), nursing management (44.5%), and medical informatics (11.0%).

2. Subjects Taught in the Course

The results of a content analysis of the 27 syllabuses are presented in Tables 2 and 3. Computer technology was the pre-

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Table 1. Status of nursing informatics education in Korea

Variable	n (%)
Undergraduate courses (n = 38)	
Year established	
1990–1999	1 (2.6)
2000–2009	14 (36.8)
2010–2014	21 (55.3)
No response	2 (5.3)
Optionality	
Mandatory	12 (31.6)
Elective	26 (68.4)
School year	
Sophomore	14 (36.8)
Junior	12 (31.6)
Senior	9 (23.8)
Freshman or junior	1 (2.6)
Sophomore, junior, or senior	1 (2.6)
No response	1 (2.6)
Number of credits	
1	8 (21.0)
2	27 (71.1)
3	1 (2.6)
No response	2 (5.3)
Practicums	
Yes	11 (28.9)
No	27 (71.1)
Faculty's educational background (n = 44)	
Nursing[a]	38 (86.4)
Nursing management	15 (34.1)
Nursing informatics	11 (25.0)
Adult nursing	3 (6.8)
Gerontological nursing	3 (6.8)
Maternity nursing	3 (6.8)
Community health nursing	2 (4.6)
Fundamental nursing	1 (2.3)
Others	6 (13.6)
Place of teaching	
Lecture room	27 (71.1)
Computer or simulation laboratory	11 (28.9)
Graduate courses (n = 9)	
Year established	
1990–1999	1 (11.1)
2000–2009	5 (55.6)
2010–2014	2 (22.2)
No response	1 (11.1)
Degree program in nursing informatics	
Yes	1 (11.1)
No	8 (88.9)
Faculty's educational background	
Nursing informatics	4 (44.5)
Nursing management	4 (44.5)
Medical informatics	1 (11.0)

[a]Multiple choice.

Table 2. Classification of subjects taught in core content domains (27 syllabuses)

	Core content domain	n (%)
1	Computer technology	27 (100)
2	Information systems used for practice	25 (92.6)
3	Telehealth	24 (88.9)
4	Informatics	23 (85.2)
5	Nursing	23 (85.2)
6	Ethics	21 (77.8)
7	Information systems used for education, administration, and research	19 (70.4)
8	Information literacy	17 (63.0)
9	Theory	7 (25.9)
10	Basic computer competencies	6 (22.2)
11	Careers/roles in nursing informatics	5 (18.5)
12	Latest trends	5 (18.5)
13	Information management	4 (14.8)
14	Attitude	0 (0.0)

dominant core content domain taught in all 27 courses. The most frequently taught subject in this core domain was networks and the Internet (n = 23, 85.2%). Information systems used for practice was the second most frequent core content domain (n = 25, 92.6%). Electronic health record systems was the most frequently taught subject under this core domain (n = 23, 92.0%) followed by taxonomies and classification (n = 10, 40.0%) and clinical decision support systems (n = 10, 40.0%).

There are no courses covering desirable attitudes for nurses dealing with information, which was recommended in the QSEN Framework.

Table 3. Classification of subjects taught in specific content domains (27 syllabuses)

Specific content domain & keywords	n (%)
Computer technology (n = 27)	
- Networks & Internet: Internet and communications, Web 2.0, computer communication networks, electronics & telecommunications, introduction to the Internet	23 (85.2)
- Current technology: Data mining, radio frequency identification, data warehouse, human–computer interactions, interfaces, consumer-centered technology, security	8 (29.6)
- Databases: Databases, relational databases, database management systems, data dictionary	5 (18.5)
- History: Computer revolution, history of computers, computer development	4 (14.8)
- Hardware: Hardware, basic computer components	4 (14.8)
- Software: Application software, operating systems, software	2 (7.4)
- Computer languages: Extensible markup language, object-oriented language	1 (3.7)
- ICT: Information technology, communication technology	1 (3.7)
Information systems used for practice (n = 25)	
- EHR system: Hospital information system (HIS), picture archiving and communication system, order communication system, EMR, ENR, EHR, inventory control system, performance management system, customer relation management system, knowledge management system	23 (92.0)
- Taxonomies and classification systems: Taxonomy, ontology, information modeling, standard terminology	10 (40.0)
- Clinical decision support system: Decision making process, statistical decision making, clinical decision support system	10 (40.0)
- Standardization: Nursing terminology standardization, medical terminology standardization	8 (32.0)
- Nursing standard terminology: Nursing terminology standards, nursing minimum data set, nursing interventions classification, nursing outcomes classification, North American Nursing Diagnosis (NANDA) Association International Nursing Diagnoses, International Classification for Nursing Practice	7 (28.0)
- Next-generation information systems: The future of EMRs, overview of the HIS	1 (4.0)
Telehealth (n = 24)	
- U-health: Ubiquitous healthcare system, U-health	15 (62.5)
- Telehealth: Telemedicine system, telehealth, telenursing	13 (54.2)
- Personal health record	6 (25.0)
- E-health: E-doctor, E-health, ePatient	4 (16.7)
- M-health: Healthcare apps, m-health, health management using social networking technology.	3 (12.5)
- Others: Virtual and online patient communities	1 (4.2)
Informatics (n = 23)	
- Definitions: Bioinformatics, medical informatics, nursing Informatics, health informatics, public health informatics	18 (78.3)
- Use of ICT in healthcare: Utilization of nursing informatics field, health information technology, biosurveillance	8 (34.8)
- History: History, changes in information, information society, nursing, information and society	6 (26.1)
- Future of nursing informatics: Future of nursing informatics, future of informatics	4 (17.4)
- Competencies: TIGER, nursing informatics competency	3 (13.0)
Nursing (n = 23)	
- Consumer health informatics: Consumer health informatics, consumer education, empowerment, care providers and consumer relations	14 (60.9)
- Evidence-based practice	13 (56.5)
- Patient safety	7 (30.4)
- Healthcare policy	1 (4.3)
- Community health promotion	1 (4.3)

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Table 3. Continued

Specific content domain & keywords	n (%)
Ethics (n = 21)	
- Privacy and confidentiality: Secrecy, confidentiality, privacy	17 (81.0)
- Security: Security, data security methods, security legislation	7 (33.3)
- Ethics: Information ethics, medical ethics	6 (28.6)
- Law: Health information regulations, medical lawsuits, the Health Insurance Portability and Accountability Act, Privacy Act	2 (9.5)
Information systems used for education, administration, and research (n = 19)	
- Research: Nursing research and information system, use of information technology in nursing research, research in nursing informatics	12 (63.2)
- Education: Use of information technology in nursing education, using computers in education, computer-assisted learning, e-learning, nursing educational software	11 (57.9)
- Administration: Nursing services marketing, computer and human resource development, use of information technology in nursing management	9 (47.4)
Information literacy (n = 17)	
- Search: Evidence search, database search, literature search, using search engines, data collection, information search	12 (70.6)
- Analysis and evaluation: Internet health information quality assessment, health information quality assessment, value of information analysis, data analysis, health website evaluation	10 (58.8)
Theory (n = 7)	
- Informatics frameworks/research studies: Information theory, DIKW (data, information, knowledge, and wisdom) pyramid	4 (57.1)
- System development: Systems development life cycle, structured methodology, data flow diagram	3 (42.9)
Basic computer competencies	
Internet access, using Microsoft Word, sending an email	6 (100)
Careers/roles in nursing informatics	
Responsibilities of the relevant records nurse, role of informatics nurses, role of a systems analyst, informatics nurse training courses and certification	5 (100)
Latest trends	
Big data, Health 2.0, Gamecare, health literacy	5 (100)
Information management	
Importance of information management, types and forms of nursing records, information exchange, data management	4 (100)
Attitude	0 (0.0)

EMR: Electronic Medical Record, ENR: Electronic Nursing Record, EHR: Electronic Health Record.

3. Faculty Efficacy, Barriers, and Additional Supports in Teaching Nursing Informatics

In total, 35 out of 38 nursing informatics faculties responded to the faculty efficacy survey, and the questions about barriers and additional supports. Table 4 presents the faculty efficacy scores. The faculty efficacy score was 3.76 ± 0.86. The efficacy score was highest for "I can use diverse teaching methods depending on the content" (3.89 ± 0.90) and lowest for "I can use various methods to evaluate whether the students understood the content" (3.63 ± 0.88).

Table 5 presents the answers to questions on barrier and additional support. The most frequently reported barrier to nursing informatics education was a lack of awareness of the importance of nursing informatics (n = 9), followed by a lack of administrative support from the school (n = 5). These barriers are due to schools just focusing on nursing courses covered by the nurse license examination. Eight of the faculties mentioned the lack of support for materials required to

Table 4. Faculty efficacy in nursing informatics (n = 35)

Item	Mean	SD
I can use diverse teaching methods depending on the content.	3.89	0.90
I can explain the content easily depending on the level of the students.	3.83	0.75
I can organize systematic teaching and learning activities to keep students interested.	3.83	0.92
I can deal with unexpected questions from the students.	3.74	0.86
I can create a lively atmosphere when students are bored.	3.66	0.87
I can use various methods to evaluate whether the students understood the content.	3.63	0.88
Total	3.76	0.86

run practicums, such as textbooks, software, and educational Electronic Nursing Records (ENRs).

The additional support most frequently requested by the faculties was training or educational opportunities (n = 5), followed by support for developing standardized and practice-centered text books (n = 4) and technical support (n = 4).

IV. Discussion

The present study has provided comprehensive information about the current status of nursing informatics education, the content of nursing informatics courses, faculty efficacy, and barriers and additional supports in nursing informatics education, with the aim of improving nursing informatics education in South Korea.

Even though the proportion of schools teaching nursing informatics increased by 30% from 1999 (20.8%) [11] to

Table 5. Faculty-reported barriers and additional supports

Item	Detailed responses	Number of responses
Are there any conditions that you perceive as barriers to teach nursing informatics? If so, please describe them.	Lack of awareness of the importance of nursing informatics (less emphasis on nursing informatics national nurse license examination)	9
	Lack of administrative support from school (e.g., faculty staff, number of credits)	5
	Lack of facilities	4
	Lack of textbooks for practicums	3
	Lack of software for practicums	3
	Various informatics knowledge levels of the students	3
	Passive attitude of the students	3
	Low instructor ability	3
	Rapid changes in information technology	2
	Lack of educational ENR system	2
	Opened for inappropriate school year	2
	Ambiguity of nursing informatics	1
	Lack of time to learn current trends in nursing informatics	1
What resources or incentives would you recommend for improving the teaching of nursing informatics?	Training or educational opportunity for the instructors	5
	Support for developing standardized and practice-centered textbooks	4
	Technical support	4
	Financial incentives	3
	Supporting educational ENR systems	3
	Administrative support (e.g., faculty staff, number of credits)	2
	Curriculum development support	2
	Support equipment	2
	Support for linking schools and hospitals	1

ENR: Electronic Nursing Record.

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2014 (52.8%), and the proportion of faculties with an educational background in nursing informatics increased by 12% from 2007 (13.3%) [12] to 2014 (25.0%), there is still a dearth of qualified faculties in Korea. Although this problem also exists in the Unite States [18], it is worse in Korea due to the much shorter history of offering nursing informatics education in that country, with there being only one nursing informatics degree program [9,11].

This problem could be alleviated by introducing continuous educational programs or certificate programs on nursing informatics, such as the Certified Professional in Healthcare Information and Management Systems offered by the Healthcare Information and Management Systems Society.

Our content analysis of the subjects taught in nursing informatics courses revealed that there are few concepts related to basic computer competency being taught in Korea, which is one of the core content domains suggested in the TIGER Initiative. This could be due to it being mandatory for elementary-school students to take a computer course in Korea [19], which reduces the need to include basic computer use in nursing informatics education in Korea.

Another core content domain, information management, was only taught in 4 schools (14.8%). This is due to information management mostly being taught using simulated Electronic Health Records (EHRs) rather than using a real information management system with real patient data. Since patient privacy issues make it impossible for students to learn information management with real patient data, it is recommended for nurses to receive additional on-the-job training on information management just before they start providing patient care in the clinical setting.

Furthermore, the attitude toward technology, which is one of core content domains suggested in the QSEN Framework, was not taught at all in Korea. This attitude influences the adoption of nursing informatics and ultimately the use of technology to improve patient care [20]. It is therefore important to include the attitude toward technology in nursing informatics education so that nurses understand the usefulness of ICT and become involved more actively in the development of systems such as EMRs and ENRs.

The mean faculty efficacy for teaching nursing informatics was 3.76 out of 5, which is lower than that of new nurse-faculty teaching other nursing subjects [21]. This could be due to many of the faculties who were teaching nursing informatics not majoring in nursing informatics in their degree programs. Two faculties expressed that they lacked confidence in teaching nursing informatics because their degrees were in nursing specialties other than nursing informatics. In order to improve their teaching efficacy, it is important to provide faculties who do not have a nursing informatics educational background with a faculty training program.

The most significant barrier to teaching nursing informatics is the lack of awareness of what nursing informatics is and why it is important. As can be observed in the responses related to barriers, the awareness and recognition of the importance of nursing informatics first need to be improved. The IMIA-NI SIG Student Working Group surveyed future trends in nursing informatics in the 31 different countries. The paper presented the responses to the survey question: "What should be done (at a country or organizational level) to advance nursing informatics in the next 5–10 years?". That study found that visibility and representation—one of the key themes in the study—can be improved to demystify nursing informatics within nursing and also across other disciplines, to clarify nursing-specific data in EHRs, to use that data to improve patient care as part of nursing work, and to be involved in decisions at the leadership, organizational, and policy levels [22]. The same effort is required in Korea to increase the general awareness of nursing informatics in order to facilitate the effective teaching of nursing informatics.

The most significant additional support for nursing informatics education is providing faculties with additional educational and training opportunities. This is expected given the lack of suitably qualified faculty in Korea. Nursing informatics faculty can be kept abreast of current trends in nursing informatics by providing continuous educational programs or certificate programs on nursing informatics [18].

This study has provided recommendations for improving the effectiveness of nursing informatics education in Korea. First, qualified faculty with a high level of teaching efficacy are needed. This could be achieved in the short term by offering continuous educational programs or certificate programs, and in the long run by offering degree programs in nursing informatics. Second, nursing informatics courses need to be developed based on the international nursing informatics competency guidelines. Third, the awareness of nursing informatics at the leadership, organization, and policy levels needs to be increased in order to remove barriers to and promote additional supports for nursing informatics education in Korea.

This study was subject to some limitations. Responses were sought from 204 colleges, but only 72 institutes (35.3%) replied to our survey, and so not all nursing colleges's data were in Korea were analyzed. This response rate is relatively low given that a rate greater than 65% is generally considered

to be desirable [23]. While this study performed analyses using international nursing informatics competency recommendations, further studies are needed with the competencies that are more suitable to the environment of nursing informatics especially in Korea.

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

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