ORIGINAL ARTICLE

Navigating the Digital Shift: Review of Literature and Recommendations for Enhancing Nursing Informatics Education in the Philippines

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ABSTRACT

Objectives. The objective of this study was to synthesize existing literature on nursing informatics (NI) and propose updates to the Philippine Nursing Informatics curriculum that embrace current trends and integrate a globally acknowledged framework.

Methods. A literature search was conducted on PubMed and ScienceDirect. This search identified 79 articles, of which only eight met the inclusion criteria. The Technology Informatics Guiding Education Reform (TIGER) initiative provided the framework for analyzing the literature review outcomes and for developing the revised course structure for the Nursing Informatics (NI) curriculum in the Philippines.

Results. The revised course outline incorporated 31 topics across the six domains outlined by the TIGER framework. Upon comparison, it was found that numerous topics identified were absent from the existing NI curriculum in the Philippines. Key subjects identified for inclusion encompass research, examination of standards and terminologies, application in community health, cybersecurity, project management, and advocacy. These areas hold particular relevance for the Philippines, attributed to the limited recognition of NI and the ongoing advancements related to technological applications in healthcare.

Conclusion. The nursing informatics curriculum in the Philippines is not up to date, failing to align with global NI standards. It is recommended that a thorough revision and enhancement be undertaken to ensure alignment with international frameworks and current industry practices.

Keywords: nursing informatics, nursing education, curriculum, review, Philippines

INTRODUCTION

The Philippine healthcare system is evolving into a paperless system by investing in eHealth as it tries to fulfill its promise to provide financial protection, better health outcomes, and responsiveness to the Filipino people. With this fast-paced development, some healthcare professionals could not keep up and tend to feel lost with how this new system works.[1]

There are several factors in the failure of health information technology (HIT) adoption. Some of these include a lack of computer skills, poor system interface making it not user-friendly, and increased time consumption and inconvenience on workflow.[2,3] Nurses are one of the healthcare professionals who could face these problems as they are at the forefront of health service delivery.[4]

One way to bridge this gap is to increase nurses' knowledge of the use of HIT. The Commission on Higher Education

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(CHED) introduced Informatics to the Philippine Nursing Curriculum in 2009 as part of its general education courses. Part of the Commission's memorandum order is the course outline which included topics that would relate the said course to nursing.[5] It was only in 2017 that nursing informatics was added to the professional courses of the said curriculum. This memo emphasized the inclusion of the course in the curriculum, requiring nursing schools across the Philippines to teach Nursing Informatics at the undergraduate level.[6] Since this is relatively new to the profession, the majority of practicing nurses are still not equipped with adequate knowledge and skills to use these new systems.[7]

Nursing informatics as a course was described in the current curriculum as one that introduces theories, evolving practice applications, and skill development related to nursing informatics. It also aims to discuss human factors that are essential to effectively apply nursing informatics in practice. It aims to integrate nursing informatics into nursing education and clinical practice settings through the application of technical skills and processes.[8]

Despite the memorandum of CHED, we still seldom observe nursing informatics being taught at the undergraduate level. Although there are already proposals for the program of informatics nurse specialist certification, its approval from the Board of Nursing is still pending.[9] Moreover, the certification program is not meant for undergraduate students but for registered nurses. Although this could bridge the gap between the actual and required nursing informatics skills of practicing nurses, it does not prepare freshly graduated students for the demands of their future work.

This study aims to formulate recommendations for updating the Philippine nursing informatics curriculum to incorporate current trends and recent advancements. A review of related literature was done to know which emerging trends are relevant to be included in the said update. An international framework for nursing informatics education was then reviewed and incorporated into the pool of data. Common themes were determined and incorporated into the recommendations. The output was compared to the course outline of the current nursing informatics education from CHED which then helped see a better picture of what needs to be updated in the said curriculum.

The results of this review will be useful to nursing educators in ensuring that the body of knowledge they are teaching about nursing informatics is up-to-date and relevant to the current practice. Results, however, are limited to what has been gathered in the literature review and were not consulted with any experts due to limitations in time and resources.

MATERIALS AND METHODS

This study seeks (a) to explore the emerging trends in nursing informatics and (b) to review the existing nursing informatics curricula of various countries that can inform and recommend possible revisions to the nursing informatics course in the Philippines. To achieve these objectives, a review of the literature published from March 1, 2016 to March 31, 2020, was done using PubMed and ScienceDirect databases. Given the circumstance, the literature search was delimited to these two databases due to limited accessibility. Additionally, it was also found that these two databases yielded the most robust searches considering all relevant literature.[10] Inclusion of other online resources and study registries, and employment of multi-database searching was not done. Publications not directly related to the study objectives were eliminated. Additional articles were also retrieved after reviewing the reference list of eligible articles derived from the databases. No additional studies were sought from experts, manufacturers, or other authors. Only articles published in English were included in this review.

For the first part of the study, a literature search was done in PubMed using the keywords "nursing," "informatics," and "trends," and combinations of these words were used during the literature search. Except for language restrictions, no other search filters were employed. The search yielded a total of 73 articles. The initial list was reviewed and duplicates were removed manually from the same list. The search strategy is relayed as follows:

> "(("nursing"[MeSH Terms] OR "nursing"[All Fields] OR "nursings"[All Fields] OR "nursing"[MeSH Subheading] OR "nursing s"[All Fields]) AND ("informatics"[MeSH Terms] OR "informatics"[All Fields] OR "informatic"[All Fields] OR "informatization"[All Fields]) AND ("trend"[All Fields] OR "trended"[All Fields] OR "trending"[All Fields] OR "trends"[MeSH Subheading] OR "trends"[All Fields])) AND (english[Filter])"

After screening and assessing for eligibility, a total of five articles were included in this review. A parallel search was done in ScienceDirect using the same keywords and yielded a total of six articles. A total of three articles from ScienceDirect were included in this review after screening and assessing for eligibility. A total of 71 articles were excluded from the list because they lacked relevance in answering the objectives of the study (Figure 1).

The abstracts of selected articles were organized in a literature review matrix which included the names of the authors, year of publication, name of the journal in which the article was published, methodology, results, and central theme or category. After a thorough review of the articles, content analysis was performed by one author to identify prominent themes and patterns. One reviewer conducted the review independently, ensuring an unbiased and consistent assessment of the included studies. This approach was chosen to streamline the review process while maintaining the rigor of the selection criteria.

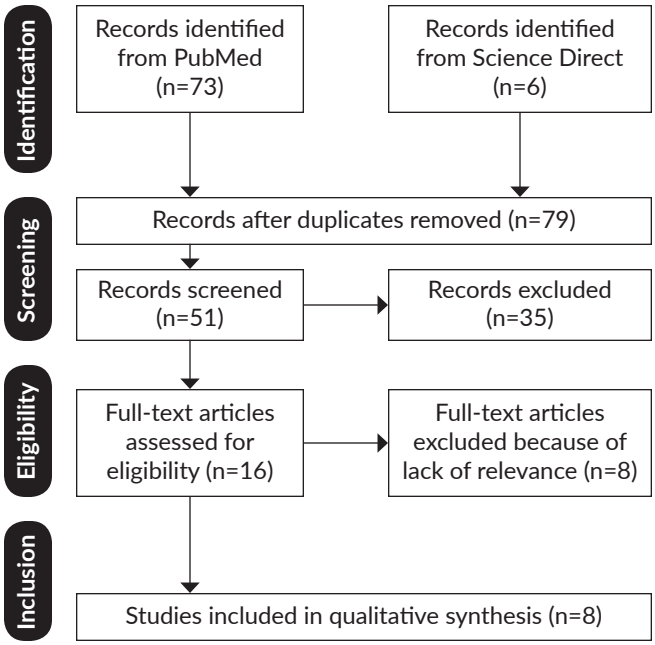

Figure 1. PRISMA flow diagram.

Every selected article was read in its entirety for the full-text review in order to assess its applicability to the study's goals. A comprehensive, methodical evaluation was used on each article as part of the process. Pertinent information was gleaned with an emphasis on the populations examined, methodological approaches, main conclusions, and limitations. Uniformity in data was guaranteed upon alignment with the inclusion criteria, data was methodically documented in a review matrix to arrange the information according to major topics. In order to improve theme analysis and provide trustworthy evidence synthesis, the review placed a strong emphasis on evaluating methodological rigor and relevance. Findings were cross-checked against the study's goals. Data was broken down into smaller units, coded, and named according to the content they represented. These smaller units were eventually clustered based on similarities and hierarchies that conceptualized the texts on different levels of abstraction.

A deductive approach was utilized in analyzing the data wherein an existing framework was used during the coding process. The Technology Informatics Guiding Education Reform (TIGER) was used as the international reference for the nursing informatics curriculum. The TIGER Initiative serves as an international coordinating body in educating nurses about informatics and in bringing together stakeholders to develop a shared vision, strategies, and actions in improving nursing education, research, and practice through the use of HIT.[11] Currently, its international committee comprises members from 23 countries, including the Philippines, who have contributed to the development of globally accepted competencies in informatics.[11,12] Their suggested framework for the nursing informatics curriculum was used in sorting

Table 1. Domains of Competency Areas Aligned with the TIGER Framework

Domain of competency area	Associated core competency areas
Data, information and knowledge (DIK)	• Principles of nursing informatics • Information and knowledge management in patient care • Nursing documentation (including terminologies) • Decision support by IT • Information management in research • Information management in teaching, training and education • Resource planning and logistics
Information exchange and information sharing (IEIS)	• eHealth, telematics and telehealth • Assistive technology for ageing people • Information and communication systems
Ethics and legal issues (EL)	• Data protection and security • Ethics and IT
Systems life cycle management (SLCM)	• Information and communication systems • Applied computer science/informatics • Process management • Project management • IT risk management
Management in informatics (MAN)	• Principles of management • Strategic management and leadership • Quality management • Change management and stakeholder management • Financial management • Human resource management
Biostatistics and medical technology (STAT&TECH)	• Assistive technology for ageing people • Biomedical imaging and signal processing • Biostatistics/statistics

the results of the literature review and in the formulation of the updated course outline for the nursing informatics curriculum in the Philippines. The Nursing Informatics course according to CHED Memorandum Order No. 5, s. 2008 focuses on the integration of information technology and data standards in nursing practice, enhancing patient care management and decision-making. Nursing students seek to apply informatics concepts, discuss relevant issues and trends, and utilize clinical information systems effectively in nursing. Key topics include electronic health records, data processing, administrative applications, consumer informatics, and international perspectives on nursing informatics, preparing students for future challenges in healthcare technology.[5]

Since the TIGER framework is internationally recognized, using it to form this update will help us align the said course outline with what is currently considered an international standard of the nursing informatics curriculum. A priori codes from the TIGER framework were used to code the data. Table 1 elaborately illustrates these domains of the professional areas according to the TIGER Framework (adapted from Hübner U, Shaw T, Thye J, Egbert N, de Fatima Marin H, Chang P, et al.).[12]

RESULTS

The eight articles included in this review revealed trends across different locations that described their interactions with nursing informatics. These studies evaluated the necessary competencies, considerations, frameworks, and applications that were essential in understanding informatics as it relates to nurses in leadership roles, in the public health setting, and in direct patient care. These trends that were observed from reviewed data can be seen in Table 2.

As shown in Table 2, the trends in nursing informatics reveal several key themes that shape current practice. Nursing informatics must remain contextually conscious for most effective use. The practice itself acknowledges that policy and continuous evaluation in the context of usability, feasibility, and acceptability drive meaningful and continued application of informatics tools. Nurses are one of the largest groups of healthcare workers and with that become essential guardians in patient and stakeholder information. Their actions serve to impact personal and financial data which echoes not only the importance of the prioritizing resources for training, collaboration, and evaluation, but also its integration into nursing curricula to ensure standards and advocating cybersecurity best practices are met. These when combined together provide the building blocks of evidence generation for the benefits of nursing informatics which emphasize patient safety and care efficiency.

Table 2. Trends in Nursing Informatics

Research Title and Authors	Methodology	Trends/Results
Models of collaboration and dissemination for nursing informatics innovations in the 21st century[14]	Design: Comparative cross-case analysis Participants: Four case studies in informatics projects led by nurse scientists were described and analyzed through the lens of the Informatics Research Organizing Model (IROM) which was modified to include policy and interoperability contexts.	Nursing informatics must consider cultural, social, economic, physical, and policy contexts for effective use. Policy influences interoperability and meaningful application of informatics tools. Continuous evaluation in IROM fosters improvement and innovation toward targeted outcomes. Usability, feasibility, and acceptability are essential components of IROM. Informatics tools should support both individual and population health needs, enhancing existing systems and building technical capacity based on care requirements.
Cybersecurity: Nurses on the Front Line of Prevention and Education[19]	PubMed (Medline), Cumulative Index of Nursing and Allied Health Literature (CINAHL), and ProQuest databases were used to conduct literature searches related to cybersecurity threats in healthcare and cybersecurity education in nursing programs with various inclusion and exclusion criteria.	Nurses, as the largest group of healthcare workers, are essential in protecting patient and stakeholder information. Due to frequent access, nurses' actions can impact the security of patient data. Medical record numbers are valuable on the black market as they contain extensive personal and financial data. Informatics education is integrated into nursing curricula to ensure nurses meet competency standards for safe technology use. Recommended cybersecurity practices include securing documents, password protection, training on data safety, prompt breach response, phishing awareness, and regular system updates.
Adapting and validating informatics competencies for senior nurse leaders in the Canadian context: Results of a Delphi study[18]	Modified Delphi technique Participants: panel of nurse leaders (25) with significant informatics knowledge from across Canada. In Round 1, participants were provided a series of 26 potential competency statements obtained from a review of the literature; they were asked to comment on the clarity and wording of each statement. Two statements were eliminated after Round 1 due to redundancy. In Rounds 2 and 3, participants rated the remaining competency statements on a 7-point Likert scale for relative priority to nurse leaders.	Nurse leaders support the adoption and effective use of information and communication technologies (ICT) for safe, quality care. They lead ICT implementation through strategic planning, collaboration with key stakeholders, and fostering change management. Leaders prioritize resources for training, set evaluation metrics, and uphold ethical standards in data use. Collaboration with C-suite and IT colleagues ensures ICT aligns with nursing practice needs and organizational goals. They advocate for data integrity, secure patient information, and address potential risks to maintain high standards of patient care.

Table 2. Trends in Nursing Informatics *(continued)*

Research Title and Authors	Methodology	Trends/Results
Adapting nurse competence to future patient needs using Checkland's Soft Systems Methodology[16]	Checkland's Soft Systems Methodology, focusing on the enriched CATWOE and PQR elements of the root definitions, combined with our own developed "Too much – Too little constraint" approach was used to devise impending knowledge, competence, and skill sets.	Proficiency in digital literacy, health technology management, and AI in healthcare. Competence in advanced health tech (P7), including wearables, nanotech, and robotics. Skills in telecare, system thinking, and virtual healthcare environments. Leadership skills for optimizing processes, funding, teamwork, and cross-cultural communication. Emphasis on personalized care, patient safety, genomics, and addressing global health needs.
The impact of healthcare informatics competencies on dynamic capabilities: A multilevel study of paramedic services[17]	Data from Canadian paramedic services (n = 43) and paramedics (n = 502) was analyzed. Exploratory Factor Analysis (EFA) was used to detect factors from the competency models, which were then aggregated to the group level. Partial Least Squares (PLS) were used to measure the impact of group-level competency on organization-level dynamic capabilities, specifically sensing, learning, integrating, and coordinating capabilities.	Factor 1: Technology Application Competencies: Skills in utilizing IT for health assessments, secure information systems, and broadcasting health alerts, with proficiency in emerging tech for public health. Factor 2: Information Processing Competencies: Competence in evaluating, interpreting, and presenting health data, using specialized search engines, and synthesizing data from multiple sources. Factor 3: Understanding of Technology: Basic knowledge of the Internet, web navigation, and using media and networks for public health communication.
Emerging professionals' observations of opportunities and challenges in nursing informatics[15]	Discussions were synthesized from a panel held at the International Conference on Nursing Informatics entitled "ICT to Improve Quality and Safety at the Point of Care" held in Guadalajara, Mexico, in June 2018.	Key themes in nursing informatics (NI) include strengthening collaboration, enhancing visibility, and expanding evidence dissemination, each facing longstanding challenges. Advocacy is needed to showcase NI's impact on patient outcomes and address misunderstandings in academia and practice. While NI research is growing, more evidence is required to link NI directly to patient care improvements.
Competency recommendations for advancing nursing informatics in the next decade: International survey results[13]	The SEP developed an international survey focusing on current and future trends in NI based on contemporary NI literature and recommendations from NI experts in the field. It was translated from English into Arabic, Korean, Mandarin, Portuguese, Spanish, and Swedish. It was distributed online through Google forms. Any nurse or other allied health professional with experience in NI in the clinical setting or in academia was eligible to respond. They used snowball sampling. Out of 402 total survey participants, 272 (67.7%) responded to the question regarding recommendations on the advancement of NI. Responders were from 31 different countries in Asia, Africa, North and Central America, South America, Europe, and Australia. The majority of respondents were nurses (87.8%).	Education and Training: Focused on building NI competencies, especially in data science and clinical decision support. Research: Emphasizes evidence generation for NI's benefits, including patient safety and care efficiency. Practice: Advocates for high-quality, nursing-specific information systems with a patient-centered approach. Visibility: Promotes increasing awareness and relevance of NI across healthcare levels. Collaboration and Integration: Stresses multidisciplinary teamwork in health information systems, with skills in data management and public health as key areas for further exploration.
Nursing informatics research and emerging trends in 2015[20]	A literature review using key words "informatics" and "nursing informatics" in the following search databases: PubMed, AcademicOne, CINAHL, and ScienceDirect. Inclusion criteria included research papers published in peer-reviewed journals between August 1, 2014, and August 1, 2015, with an RN as the first author. Key articles from AMIA-NIWG members were solicited on the basis of being influential in members' thinking and research.	Research in acute care settings was most common, followed by nursing education. A wide variety of research designs are represented by many qualitative studies; randomized controlled trials are uncommon. Development of technology or system for patient safety.

The TIGER framework identified five major roles of nurses based on surveys, literature searches, and expert consultation. These roles are (a) clinical nursing or direct patient care, (b) quality management, (c) coordination and inter-professional care, (d) nursing management, and (e) IT management in nursing. The nursing informatics competencies under each role were sorted into six domains which were formulated according to the common themes gathered from the analysis of their data.[10] These competencies can also be considered topics to be discussed in nursing informatics education.

The current NI curriculum was compared with the results of the literature review, guided by the TIGER Framework. Courses under the Philippine NI curriculum were mapped to the various domains and themes identified through the review of literature (Table 3).

Data, Information, and Knowledge

Nursing informatics research is one of the most common themes in the literature review.[12-17] Many authors believe that although there are already plenty of existing nursing informatics innovations, the evidence of its effect on patient outcomes still needs to be established.[13] Research can include the evaluation of these innovations in terms of their usability, feasibility, and acceptability.[14] The evidence that will be generated needs to be disseminated across various health settings to improve their understanding of the importance of nursing informatics.[15]

Information Exchange and Information Sharing

Two notable themes under this domain are the application of nursing informatics in primary care and population health, and the review of standards and terminologies related to

Table 3. Comparison of Literature Review Results with the Current Philippine Nursing Informatics Curriculum

Results of Literature Search and Analysis	Philippine Nursing Informatics Program
Data, information, and knowledge	
Principles of nursing informatics (Hübner et al., 2018)	A1. Computers and nursing A2. Historical perspectives of nursing and the computer D1. Theories, models, and frameworks
Information and knowledge management in patient care (Hübner et al., 2018; Dohan et al., 2017)	C2. The role of technology in the medication-use process E2. Clinical care applications
Nursing documentation (including terminologies) (Hübner et al., 2018; Strudwick et al., 2019)	C6. Nursing minimum data set systems
Decision support by IT (Hübner et al., 2018)	F2. Decision support for consumers
Information management in research (Hübner et al., 2018; Ronquillo et al., 2016; Wang et al., 2019; Peltonen et al., 2019; Železnik et al., 2017; Dohan et al., 2017) ***Information management in teaching, training, and education (Hübner et al., 2018; Ronquillo et al., 2016; Dohan et al., 2017);*** ***Resource planning and logistics (Hübner et al., 2018)***	Applicable to patient care, research, teaching, training, and education: E1. Practice application E5. Internet tools for advanced nursing practice
Information exchange and information sharing	
eHealth, telematics, and telehealth, mHealth (Hübner et al., 2018; Ronquillo et al., 2016; Železnik et al., 2017; Dohan et al., 2017) ***Assistive technology for aging people (Hübner et al., 2018)***	
Application of nursing informatics in primary care and population health (Ronquillo et al., 2016; Železnik et al., 2017; Dohan et al., 2017)	E3. Community health applications F1. Consumer and patient use of computers for health
Review of standards related to nursing informatics for data exchange and interoperability (Ronquillo et al., 2016; Strudwick et al., 2019)	C3. Healthcare data standards D2. Advanced terminology systems
Information and communication systems (Hübner et al., 2018; Ronquillo et al., 2016; Dohan et al., 2017)	A3. Electronic health record from a historical perspective B7. Incorporating evidence: use of computer-based clinical decision support system for health professionals C4. Electronic health record systems: US federal initiatives and public/private partnerships C5. Dependable systems for quality care E4. Ambulatory care systems E6. Informatics solutions for emergency preparedness and response
Ethics and legal issues	
Data protection and security (Hübner et al., 2018; Kamerer & McDermott, 2020) ***Ethics and IT (Hübner et al., 2018; Strudwick et al., 2019)***	
National policies affecting the practice of nursing informatics (Wang et al., 2019; Strudwick et al., 2019)	C1. Nursing informatics and healthcare policy

Table 3. Comparison of Literature Review Results with the Current Philippine Nursing Informatics Curriculum *(continued)*

Results of Literature Search and Analysis	Philippine Nursing Informatics Program
Systems life cycle management	
Applied computer science/informatics (Hübner et al., 2018)	B1. Computer hardware B2. Computer software and systems B3. Open-source and free software B4. Data processing B5. The internet: a nursing resource
Process management (Hübner et al., 2018)	
Project management (Hübner et al., 2018; Strudwick et al., 2019; Kamerer & McDermott, 2020; Carrington et al., 2016)	D3. Implementing and upgrading clinical information systems
IT risk management (Hübner et al., 2018; Strudwick et al., 2019)	
Management in informatics	
Principles of management (Hübner et al., 2018)	
Strategic management and leadership (Hübner et al., 2018; Peltonen et al., 2019; Strudwick et al., 2019)	H1. Future directions
Quality management (Hübner et al., 2018; Wang et al., 2019; Strudwick et al., 2019; Kamerer & McDermott, 2020)	
Change management and stakeholder management (Hübner et al., 2018; Ronquillo et al., 2016; Peltonen et al., 2019; Železnik et al., 2017; Strudwick et al., 2019) ***Financial management (Hübner et al., 2018; Železnik et al., 2017; Strudwick et al., 2019)*** ***Human resource management (Hübner et al., 2018; Strudwick et al., 2019)*** ***Advocacy for nursing informatics (Ronquillo et al., 2016; Peltonen et al., 2019; Strudwick et al., 2019)***	E7. Vendor applications
Biostatistics and medical technology	
Assistive technology for aging people (Hübner et al., 2018; Železnik et al., 2017) ***Biomedical imaging and signal processing (Hübner et al., 2018)*** ***Biostatistics/statistics (Hübner et al., 2018)*** ***Artificial intelligence in healthcare (Železnik et al., 2017)***	B6. PDA and wireless devices
	Unmatched topics: G1. Nursing informatics in Canada G2. Nursing informatics in Europe G3. Pacific Rim G4. Nursing Informatics in Asia G5. Nursing informatics in South America

Sections of the Philippine Nursing Informatics Program: A – Computers and nursing, B – Computer system, C – Issues in informatics, D – Informatics theory, E – Practice application, F – Consumer's use of informatics, G – International perspectives, H – The future of informatics

nursing informatics. These topics were notable because they were not part of the international framework but they appear frequently in the literature review.[13,16,17]

Nurses were seen as a valuable asset in achieving universal health care. Because of this, nurse innovators have to give more focus to the applications of nursing informatics in the community.[13,16,17] Moreover, standards and terminologies related to nursing informatics also need to be included in the curriculum to facilitate understanding of data exchange and interoperability.[14,18] There are several standards, terminologies, and classification systems that the nursing community has been exposed to at the moment, including Nursing Interventions Classification (NIC), Nursing Outcomes Classification (NOC), NANDA Classification for Nursing Diagnosis, International Classification for Nursing Practice (ICNP), and International Classification of Diseases 10th Revision (ICD-10).

Ethics and Legal Issues

Cybersecurity is a concern in the digitalization of patient records. Nurses are one of the most frequent users of patient records since they access them repeatedly during the workday. Without due care and knowledge, they may be unaware of how their actions affect patient safety.[19] This is why awareness of data protection and security was considered to be an important competency of nurses in nursing informatics.[12,19] The following items were seen as vital to be included in nursing informatics education in terms of this aspect[19]:

- securing patient documents, both electronic and physical copies
- protecting accounts and passwords
- legal and ethical implications of EHR use
- reporting of any suspicious employee actions on EHR use
- immediate response to breaches

- education on the deletion or use of data
- protection from insecure or unknown links from workstations
- recognition of suspicious emails

Negligence to protect personal health information can have legal consequences. This is why nurses also have to be aware of the national policies affecting the practice of nursing informatics.[14,18] Aside from these, ethical consequences of human-computer interactions were also seen to be important to be tackled, especially in terms of their effect on patients.[18]

Systems Life Cycle Management

Many articles showed that nurses also play essential roles in the planning, design, implementation, and evaluation of HIT for patient care. This is why it is suggested that they be introduced to the system development life cycle and this be included in the curriculum.[12,18-20]

Management in Informatics

Nursing leadership and management is one of the professional courses being taught at the undergraduate level of the nursing program.[6] More or less, the same principles in this course also apply to that of nursing informatics. Some articles stressed that nurse leaders should proactively identify emerging trends and issues of technology, and their impact on nursing management and patient care.[12,15,18]

In terms of quality management, evaluation of existing tools and frameworks was suggested to be included.[12,14,18,19] Stakeholder management was also emphasized especially in terms of collaborating with all health professionals and various stakeholders in the planning, design, development, implementation, and evaluation of HIT.[12.13,15,16,18] In terms of human resource management, skills in change management to support HIT implementation were recommended.[12,18] Financial management was also deemed important because nursing informatics managers are expected to secure sources of funding for project development.[12,16,18]

Advocacy was added under this domain since it appeared frequently in the literature review.[13,15,18] Nursing informatics is not a widely recognized field. Efforts must be made to increase awareness and knowledge of what it is across practice, organizational, and policy levels, as well as to the public.[13,15] Nurse leaders are encouraged to promote the use of HIT in their institutions for the improvement of patient care and nursing practice.[17]

Biostatistics and Medical Technology

In the TIGER framework, this domain was added in addition to the major roles of nurses that were identified through literature searches, surveys, and expert consultation.[12] This domain introduces technologies that nurses can encounter in their practice. These technologies may include sensors, activity trackers, nanotechnology, robotics, wearable/ digestible/ blood sensors, 3D printing, and artificial intelligence.[16]

Table 2 shows the merged data of the literature review and the topics from the current nursing informatics program of the Philippines. Similar topics were merged and topics that are not aligned with the international framework were removed. This list is the final recommendation for the update of the course outline of said program (Table 2).

DISCUSSION

Nursing informatics is an underappreciated field in nursing.[15] Despite being required in the Philippines, there is still insufficient instruction in teaching this at the undergraduate level.[21] Moreover, the topics under the current nursing informatics curriculum are very far from the ones being recommended by an internationally recognized framework. This warrants adequate attention to assist nurses in becoming globally competitive in the application of this emerging and inevitable practice.

Nurses were considered to have five major roles in the practice of nursing informatics. The TIGER framework outlined topics that nurse educators must look into to equip students with the required competencies for nursing informatics. This framework was updated by incorporating emerging trends in nursing informatics found through a literature search. Updating this framework will help nurse educators ensure that what their teaching is relevant to the current trends of the field.

Fundamental concepts in nursing informatics (NI), information management, and the focus on data security and protection are shared by the Philippine Nursing Informatics Program and the TIGER Framework. They vary, nonetheless, in certain areas of specialization and competency. Unique features of the nursing informatics program include a thorough integration of patient-oriented systems, a particular agency application, and a strong emphasis on the history and global perspectives of NI. In contrast, the TIGER framework places a strong emphasis on direct patient care informatics applications, system life cycle management, and fundamental computer skills.

Research in nursing informatics was one of the most common themes that were found in the analysis. This is an important addition to the current program since this can help stakeholders and users understand the importance of the field, especially when research builds evidence to support that nursing informatics innovations improve nursing practice. This supports the advocacy for nursing informatics which is another common theme in the analysis. Priming students in these topics can help them appreciate the program and can later on turn them into advocates of nursing informatics.

Stakeholder management, human resource management, and change management were also noted to be part of the recommendations. These topics are useful in terms of engaging people to the practice of nursing informatics. An important skill that needs to be developed here is translating informatics terms and practice into layman's terms which is

really helpful in communicating its importance to various stakeholders.

Standards and terminologies in nursing are introduced in the undergraduate years, especially in terms of formulating nursing care plans. Its importance, however, has not been emphasized enough.[22] One probable reason for this is its low adaptation in the actual practice or in the clinical area. It is imperative to start establishing the importance of health data standards in the actual practice to help nurses understand its purpose in information exchange and interoperability of systems.

Laws related to health informatics have been recently approved in the Philippines. Nurses should be aware of laws such as the Data Privacy Act and Cybercrime Prevention Act so that they can take seriously their responsibilities to protect patient health information. This will also help them realize the legal consequences if these responsibilities are neglected to be performed.

It is important to note that while applications of nursing informatics in the community are already in the current nursing informatics education of the Philippines, the same is not present in the international framework. Despite this, we can still see a lack of applications of nursing informatics in the community. This needs to be further emphasized especially now that the health care system is positioned to universal health care.

Following this, there are areas where the Philippine curriculum does not match the topics identified in the literature review, such as nursing informatics' role in various regions. This comparison suggests potential areas for curriculum enhancement to align with international standards and emerging trends in nursing informatics.

The most commonly observed themes from the literature review are sorted into each domain of the TIGER framework. For the complete list of recommendations, see Table 4.

Table 4. Recommended Course Outline of the Nursing Informatics Program in the Philippines

Domains	Outline of topics

Data, information and knowledge	• Principles of nursing informatics
	  ◦ Historical perspectives
	  ◦ Theories, models, and frameworks
	• Information and knowledge management in patient care
	• Nursing documentation (including terminologies)
	• Decision support by IT
	• Information management in research
	• Information management in teaching, training, and education
	• Resource planning and logistics

Information exchange and information sharing	• eHealth, mHealth, telematics, telehealth, and clinical decision support systems • Assistive technology for aging people • Application of nursing informatics in primary care and population health ◦ Informatics solutions for emergency preparedness and response • Review of standards related to nursing informatics for data exchange and interoperability • Information and communication systems
Ethics and legal issues	• Data protection and security • Ethics and IT • National policies affecting the practice of nursing informatics

Systems life cycle management	• Applied computer science/informatics
	  ◦ Computer hardware
	  ◦ Computer software and systems
	  ◦ Open-source and free software
	  ◦ Data processing
	  ◦ The internet: a nursing resource
	• Process management
	• Project management
	• IT risk management

Management in informatics	• Principles of management • Strategic management and leadership • Quality management • Change management and stakeholder management • Financial management • Human resource management • Advocacy for nursing informatics
Biostatistics and medical technology	• Assistive technology for aging people • Biomedical imaging and signal processing • Biostatistics/Statistics • Artificial intelligence in healthcare • PDA and wireless devices

Limitations of the Study

Our literature review's scope and coverage were restricted to a few databases, therefore it might not have included all pertinent nursing informatics studies. A less thorough understanding of current trends may come from the underrepresentation of particular regional or international developments in the area. Furthermore, we might have unintentionally missed important works from past years or more recent publications that might have provided fresh perspectives on the quickly developing subject of nursing informatics by limiting the period range.

Furthermore, the main goal of the descriptive analysis was to highlight important themes. Language and access restrictions also limited the review, limiting it to papers published in English and those accessible through particular databases. This method can be biased and miss important studies from areas where English is not the primary language. The synthesis is made more difficult by the differences in definitions and methodology between research, which may have an impact on how broadly applicable our findings are in various healthcare contexts. Future assessments could offer a more comprehensive and internationally representative understanding of nursing informatics by addressing these shortcomings.

CONCLUSION

Healthcare professionals have to adjust to the transitioning of the healthcare system into a paperless, digital

version. One way of doing this is by preparing students on the practice of informatics through training and education. As frontline healthcare professionals, nurses must have strong informatics competencies to navigate the shift to a digital healthcare system. To guarantee that nursing graduates are competitive in an increasingly digital world, this study emphasizes the necessity of updating the Philippine Nursing Informatics (NI) curriculum to meet international standards. The study found important nursing informatics trends and competencies, incorporated them into a global framework, and recommended curricular revisions that take advantage of these developments.

The nursing informatics curriculum in the Philippines is outdated and poorly implemented. It also realized that this curriculum is incongruent with the international nursing informatics framework. This study identified emerging trends in nursing informatics through a literature search, incorporated them into an international framework, and merged them into the current nursing informatics curriculum. It is recommended that this final output be presented to a panel of experts for discussion and revision as necessary before presenting it to the Board of Nursing and CHED. It is hoped that this will help them ensure that newly graduate nurses are competitive in this rapidly emerging field of nursing.

Practical informatics education that stresses the application of contemporary technology and techniques pertinent to clinical settings should be incorporated into nursing education. In a world of digital health, this will assist nurses in gaining the necessary skills to provide safe, effective, patient-centered care.

Future studies should concentrate on assessing how well revised NI curricula enhance nurses' informatics proficiency and patient outcomes. Examining local obstacles to implementing international NI standards help improve curricular congruence with international frameworks.

Integrating globally coordinated informatics standards into nursing education regulations should be a top priority for policymakers, especially the Board of Nursing and CHED. This guarantees graduates' uniform NI competencies, bolstering their preparedness for a digital healthcare landscape and boosting the nation's competitiveness in international healthcare practice.

Statement of Authorship

Both authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

Both authors declared no conflicts of interest.

Funding Source

None.

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