

Exemplar Case Studies (in alphabetical order)**Exemplar Case Study Brazil***Undergraduate Course for Nursing Students*

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The main purpose of this case study is to describe experiences in education on nursing informatics. In Brazil, the development of nursing informatics coincides with the establishment of nursing education programs in the curriculum and the research since the pioneers were faculty and researchers. The nursing education curriculum comprises 4,000 hours and most schools of nursing (over 800 in the country) incorporated related content whether as a discipline of Nursing Informatics integrated into the curriculum or classes and seminars for discussing nursing and health informatics scope and application. The course or discipline integrate to the undergraduate program comprises 30 hours in face-to-face classes and distance learning approach. There are also several graduate programs, both at the specialization level, and the Master's and Doctorate programs focused on training nurses as users, developers, educators and researchers in nursing informatics. These courses aim to train professionals in order to increase the quality and safety of patient care and the outcomes through the development, implementation and evaluation of information and telecommunication tools at different levels of education.

The discipline of Nursing Informatics for the undergraduate program is designed to cover basic knowledge focusing in nursing documentation in 30 hours classes [1,2].

Table 1: Example of core competency areas in the course and competencies details

TIGER core competency area	competencies	Description – Brazilian application
Information management	1. Determine the nature and extent of the information needed	Understand what information has to be documented considering that Nursing Process documentation is requested by the Brazilian Law. Understand the legal point of view of nursing documentation Analyse the consistency between data collection, analyses and outcomes from nursing documentation Evaluate nursing care provided by examples of nursing documentation extracted from patient record Understand nursing data sets as fundamentals for patient care analytics. Know, understand and apply nursing terminologies: ICNP, NANDA, NIC and
Principles of Nursing informatics	2. Access needed information effectively and efficiently	
and	3. Evaluate information and its sources critically and incorporates selected information into his or her knowledge base and value system	
Nursing documentation	4. Individually or as a member of a group, use information effectively to accomplish a specific purpose	
	5. Evaluate outcomes of the use of information	

		NOC
Data protection and security	Confidentiality Access control Security	Know and understand the Brazilian Laws related to the ethics access and permission to the patient record Understand how to assure the confidentiality, privacy of EHR content Know resources to maintain data security and protection
Process management	Understand the principles upon which organizational and professional Health Information System use by healthcare professionals and consumers are based.	Know the organization of Brazilian Health System and The Unified Health System (SUS) Understand the process of data capture and management
Information management and knowledge management in patient care	Have the User Skills as outlined in direct care component of the HL7 EHR model, which includes all of the ECDL-Health User Skills of Navigation, Decision Support,	Understand how to capture, store, retrieve and analyse data on nursing information Manage medication list Understand nursing protocols and guidelines and how to integrate within electronic nursing system Understand principle of decision support systems and best practice to implement DSS
Seminar		Discussion on clinical application examples Exercise and discussion on Moodle Platform

The material is provided by online resources of distance learning education at Moodle Platform used by the University [3]. The content of nursing informatics is constantly updated, since the year 2000, when the content was incorporated to the nursing curriculum at the Federal University of São Paulo. The use of face-to-face classes and well as the distance learning integrated is important to provide opportunities to the students for exercises and discussion among colleagues and faculty members. Distance Learning environment is ideal for inserting content on Health Informatics promoting professional practice, enabling the student to be informed by the current market demands, considering the rapid incorporation of resources IT for health services.

However, the main core of the course content (Tab. 1) is based on TIGER competencies that drive the decision on the learning process evolution and support faculty on discussions to assists the student in the relevant training, providing resources for use and handling of information in nursing and health.

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Exemplar Case Study Germany*Continuing Education Course for Nursing Managers – “The analytics organisation”*

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This case study describes the current efforts undertaken to establish the continuing education course “The analytics organisation - the perspective of nursing”. Analytics has been named as a core competency in several recommendations already from the beginning of the millennium onwards [1, 2] and was either embedded into other programs [3] or selected as a focus for a specialised program [4]. University AS Osnabrück is a University with 13,000 students of which 1,500 attend bachelor and masters programs in healthcare. Most of these programs include at least one mandatory course in health or nursing informatics with 5 credit points and a typical workload of 30 hours face-to-face classes. The University AS looks back at a history of offering continuing education courses for more than 30 years. As many of these original certificate programs were transformed into bachelor programs during the last years, there is a need to revive the tradition of continuing education in particular in nursing management. Supported by a grant from the Federal Ministry of Education and Research, the Health Informatics Research Group of the University contacted other stakeholders in the nursing domain particularly those with an interest in combining nursing documentation and data analytics. The goal was to develop a part time certificate program for registered nurses working as nursing managers. The course is designed as face-to-face classes with online material available to provide background information. It embraces a workload of a total of 90 hours with 30 hours face-to-face classes. This is equivalent to 5 credit points. The course development made use of the priority list of the 24 core competency areas from which the first 9 were selected in addition to biostatistics/statistics as the prerequisite for data analytics (Tab. 1).

Table 1: Example of core competency area and further competencies within this area

TIGER core competency area	Details of competencies
Strategic management and leadership	<i>Procedural knowledge and skills - information driven enterprise:</i> Understand, apply, evaluate and create strategies for the transition to an enterprise that is driven by information from the care process along the continuum and a patient-centred perspective.
Nursing documentation	<i>Fundamental knowledge - legal and organisational basis for documentation:</i> Understand what information has to be documented from a legal point of view. Analyse information that provides good insight into the care process and therefore needs to be documented. <i>Fundamental knowledge - data capture devices:</i> Evaluate current status of data capture via desktop PC, tablet PC and combination, create new ways to capture and enter data. <i>Procedural knowledge and skills – intelligent data entry:</i> Apply and evaluate clinical pathways and clinical decision support systems for data entry and documentation. Understand the design of menus for data entry in particular intelligent menus based on roles and activities.

Information and knowledge management	<p><i>Fundamental knowledge – utilising data warehouses for analytics:</i> Understand the mechanisms of how data warehouses work and how they can be utilised for information management from extracting, transforming and loading the data to analysing them in the most suitable manner.</p>
Principles of management	<p><i>Fundamental knowledge – the value of nursing documentation:</i> Understand the value of nursing activities to generate a) information for governing the organisation in terms of quality, b) financial reimbursement (DRGs and other mechanisms). Understand other types of documentation (e.g. PKMS, PEP) that are required for the reimbursement and what patient data from the nursing record are needed.</p> <p><i>Procedural knowledge and skills – exploitation of nursing data:</i> Understand, apply and evaluate the transfer of data from the primary nursing documentation to other types of documentation (e.g. PKMS, PEP) with the help of IT systems</p>
Principles of nursing informatics	<p><i>Fundamental knowledge – the value of structured and standardised data:</i> Understand the structure of nursing data sets (e.g. nursing process, “Strukturmodell”) and their value to form the basis for analytics.</p> <p><i>Procedural knowledge and skills – nursing and clinical terminologies:</i> Understand, apply and evaluate nursing and clinical terminologies (ICNP, NANDA, LEP, apenio, ePA C, ICF) and their use for different purposes (e.g. data analytics, clinical communication, legally conform records).</p>
Statistics	<p><i>Procedural knowledge and skills – data analytics:</i> Understand, apply and evaluate statistical procedures to analyse the information in the nursing records and in medical/health records in general in particular a) by using nursing sensitive outcomes b) including patient information about medical diagnoses, length of stay, severity of the disease, medical risks and others c) including management information, e.g. workload, staffing, using of health IT, proper reporting process.</p> <p>Understand, apply and evaluate statistical procedures to visualise the analytics results, e.g. scatterplots, box plots, net diagrams, time series, heat maps.</p>
Quality management	<p><i>Procedural knowledge and skills - checking data for quality:</i> Understand, apply, evaluate and create the measures to ensure the completeness, plausibility of data in nursing records (check for outliers using descriptive statistics, e.g. frequencies and correlations).</p> <p><i>Procedural knowledge and skills - Visualising data at case level:</i> Understand, apply, evaluate and create meaningful lists, diagrams, tables, cognitive maps and outliers.</p> <p><i>Procedural knowledge and skills – integrating nursing, medical and other data sets:</i> Understand, apply the integration of data sets, understand the underlying problems (e.g. patient and case identifiers, terminology).</p>
Process management	<p><i>Procedural knowledge and skills – reporting process:</i> Understand, apply, evaluate and create a reporting process that is sufficient in providing the information for what purpose, at what time, to whom, and in what format and depth.</p> <p><i>Fundamental knowledge – information chains:</i> Understand the value and process of information chains to ensure information continuity across shifts, departments and care settings. Understand the value of the information and the format of the information (case summaries) that is exchanged at change of shifts and</p>

	that is transferred at the discharge of a patient.
Human resource management	<i>Procedural knowledge and skills – human resource planning:</i> Understand, apply, evaluate and create algorithms for short term, medium term and long term plans for human resource planning at different levels of the organisation, e.g. wards, departments.
Change Management and stakeholder management	<i>Procedural knowledge and skills – change management:</i> Understand, apply, evaluate and create practical measures a) for the transition to an enterprise that is driven by information from the care process and b) for involving the staff in these activities

This course is meant to develop the cognitive competencies necessary to move the organisation towards information driven decision making at executive level. Information incorporated into this new thinking and behaviour includes first and foremost information that is immediately derived from the care process, along the continuum of care within the organisation and across settings. The motivation is to enable nursing managers to reconcile quality and economic issues and utilise existing information to develop a vision for the organisation in terms of greater patient-centeredness. The course is currently under construction with the involvement of high ranking nursing managers for validating the course content. It will be piloted within the project KeGL, which is a German acronym that stands for competency development in healthcare professions for lifelong learning.

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Exemplar Case Study New Zealand*A Postgraduate Course in Health Informatics*

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This case study provides one example of how health informatics is taught within one postgraduate course in New Zealand. Nursing informatics postgraduate education options have not been viable in a small country such as New Zealand and an alternative approach arose where “health informatics education has evolved to provide nurses the opportunity to study informatics in a broad context alongside other health professionals” [1]. “Health informatics” has been the preferred approach in New Zealand, and nurses are able to enrol in these courses as part of their postgraduate nursing studies or to complete a qualification in health informatics. This aligns with the national direction where we have an interdisciplinary health informatics group called Health Informatics New Zealand (HiNZ) with members including clinicians, academics, and business, health and IT professionals [2]. A HiNZ working group of New Zealand university educators collaborated to devise the core health informatics competencies needed and these were: health domain knowledge, social/ethics/legal aspects of health IT, basic computer science, basic data management, basic health IS/IT management, clinical information systems and health informatics concepts [3,4]. These are described in relation to the TIGER competencies as an example of country specific competencies on the Healthcare Information and Management Systems Society (HIMSS) website [5].

Table 1 provides a detailed map against the TIGER competencies and the HiNZ competencies for this course. A number of the Basic Computer Competencies are entry-knowledge for any student enrolling in tertiary education, so are not addressed here.

Table 1: Mapping of core competency area and HINZ competencies

TIGER core competency area	HiNZ competency
Principles of nursing informatics	What is health informatics? Security, ethics, clinical information systems, evidence based medicine, consumer informatics
Information management and knowledge management in patient care (encompasses the context in NZ rather than focussing solely on the patient)	Basic management of information systems, information and knowledge management, basic data management
Nursing documentation	Basic management of information systems, information and knowledge management, basic data management
Decision support by IT	Emerging technologies, basic computer science (applicable to computer science students), evidence based medicine
Information management in research	Research
Resource planning and logistics	Information and knowledge management
Data protection and security	Security, ethics
Ethics and IT	Ethics, security
eHealth, telematics and telehealth	Clinical information systems, basic management of information systems, information and knowledge management, consumer health informatics, emerging

	technologies
Assistive technology for ageing people	Included in eHealth, telematics and telehealth
Information systems and communication systems	Included in eHealth, telematics and telehealth
Applied computer science/informatics	Included in all courses
IT risk management	Ethics, health informatics standards, clinical information systems, information and knowledge management
Quality management	Included above
Change management and stakeholder management	Information and knowledge management

Some competencies are not covered in the course because they are covered in other courses that are part of the Postgraduate Certificate/Diploma.

Table 2 summarizes the core TIGER competencies, maps them to the HiNZ competencies and course goals.

Table 2: Core competency area and content details in the course

HiNZ competency area	Content goals of the course
What is health informatics Security Ethics	Explain the nature of health informatics. Identify the role and importance of information management and technology in healthcare.
Information and knowledge management Emerging web and mobile technologies	Demonstrate the relevance of health informatics to the delivery of healthcare in New Zealand, particularly with respect to continuity of care and healthcare quality improvement.
Information and knowledge management Clinical information systems Consumer health informatics	Expose the technical and ethical issues associated with the use of information management and technology.

The basic TIGER competencies of 2009 [6] will be considered in relation to a core (compulsory) health informatics course, “Principles of Health Informatics” at The University of Auckland, New Zealand. Typical of most courses at the university, the course represents 15 credits towards a Postgraduate Certificate (four courses) or Diploma in Health Sciences in Health Informatics (eight courses). The course occurs over one semester, and attracts students with clinical, business, and computer science backgrounds, and those who want to make a major career change from for example business to health. This course aims to introduce healthcare professionals to the scope and relevance of the field of health informatics (Tab. 1 and 2). It covers basic principles and concepts, such as data, information, knowledge; clinical reasoning; probability and decision making; standards and interoperability; innovation and disruptive technological innovation; change management; consumer informatics; technology-mediated care (e.g. telehealth, mhealth, ehealth, digital health); and strategy and governance. Ethics, risk management, and the applied nature of health informatics are built into every aspect of the course. Local and international examples are used to illustrate how concepts are applied in practice. There are three assessments: a literature review of a transformative innovation of their choice (30%), a group assignment of a Wikipedia-like entry on a topic from a list (30%), an open book test accompanied by a 30 minute viva about their

test answers (40% of course grade). This course is offered online, enabling local and international student enrolment. Student numbers are rising as the demand for health informatics increases and in 2016 27 students were enrolled.

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Exemplar Case Study Taiwan/China

Translational Competency Building-up Program for Clinical Nurses by the TIGER-based Taiwan Model

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This case study illustrates how an enhanced version of a cost-effective Taiwan model establishing individual and organizational nursing informatics competencies were successfully applied to a medical centre and a cardiovascular specialized hospital in Tai Yuan, Shanxi and Xiamen, Fujian of China. The Taiwan model was designed, based on the TIGER vision of “allowing informatics tools, principles, theories and practices to be used nurses to make health care safer, effective, efficient, patient-centred, timely, and equitable; interweaving enabling technologies transparently into nursing practice and education, making information technology the stethoscope for the twenty-first century [1],” and implemented by using an Excel spreadsheet with its embedded automating VBA (Visual BASIC for Application) programming environment as an easy-to-use and useful personal productivity enabling tool based on computer and information sciences concepts [2][3]. This model was further enhanced by implementing three unique components in China:

- 1) the strong organizational leadership to mobilize organizational resources and unify team missions;
- 2) a commitment from the nursing staff to learn and integrate this tool;
- 3) leveraging WeChat, a world-class social media app, to link and coordinate team members.

The three steps outlined above were taken back to these two institutes to assist with building up their organizational competency and to help solve their information management problems faced by the Hospital Nursing Informatics Commission.

First Step

A 7 day, hands-on workshop was conducted to teach the advanced version of Microsoft Excel along with the VBA. A total of 80, out of 1,500, nursing staff from 40 wards participated in this workshop. Their staff director joined the first 2 days of training which covered important informatics issues and real life examples. 9 head nurses stayed for the entire workshop. These examples cases, such as health consultation with BMI (Body Mass Index) and patient satisfaction survey, were used to teach and demonstrate how they could automate for data collection, information processing, decision and action support, and information management, as this interface is easy to use. The workshop covers 12 of the 24 core competency components outlined in TIGER's International Competency Synthesis Project.

Table 1: Examples of core competency components covered in the VBA Programming Training Workshop

TIGER core competency area	Explanation
Principles of Nursing Informatics	Covered how data should be collected, processed, analysed, and stored in digital formats with decision support to automate diagnosing nursing problems and to prepare interventions the system developed with macros and stylish user forms.
Applied Computer Science/Informatics	VBA programming for data management and modelling with effective software architectures.
Information Systems and Communication Systems	How to design the application framework to obtain a good human-computer which helps realize the benefits of digital processing of assessment data, nursing guidelines. Knowing how to design this framework will help simplify nursing tasks and enhance patient safety.
eHealth, Telematics and Telehealth	The VBA know-hows used to train developing Android Apps on mobile phones [4]
Assistive Technology for Aging People	App design for discharged elder people with wounds self-care needs
Information Management and Knowledge Management	Access the satisfaction problems with by integrating the automatic pivot-table analysis and chart visual presentation.
Nursing Documentation	Print and sign off on the results in compliance with legal regulations
Decision Support by IT	Design BMI calculation, diagnosis and education intervention formula within each module.
Resource Planning and Logistics	Learn how to design resource and logistics management in the Excel application
Process Management	Know how important process analysis and reengineering are before programming begins and how to do this with Visio.
Quality Management	Know how to automatically generate the quality index to conduct quality control with Excel.
Change Management and Stakeholder Management	Know the difference between traditional paper work and new digital applications. Nurses must get involved in system development to plan for and lead change.

Second Step

The second step focused on VBA application case studies and hands-on application development process from need and process analysis, design plan, coding and testing demonstration. The Chinese version of Excel VBA tool was heavily used [5] as it leverages many useful example codes and provides a clear explanation that supports self-study. All nurses in attendance were encouraged to start designing Excel application(s) to solve the daily problems they face such as Braden Scale assessment, medical supply management, quality control survey, work analysis, etc. At this stage, face-to-face group meetings and discussions were used to enhance learning outcomes, and addressed WeChat group account setup. This allowed all team members to share

their most updated information, progress made, and provided the opportunity to have their questions answered. During this step, a team leader was identified and charged with coordinating all outlined activities. At the end of this stage, we discovered that one-third of the nurses in attendance were able to easily learn and manage their training materials. This elite informatics group can now lead and make invaluable contributions to advance these projects at their respective medical centre and hospital.

Third Step

Our third and final step pairs up our trained nurses with real projects to complete initiated by a proposal outlining the analysis need. Some teams were also able to demonstrate their prototype designs. Project-based mentoring and technical assistance were provided. The final stage is expected to last for at least six-months to ensure our informatics nurses are confident in execute their projects successfully [2].

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Exemplar Case Study United Kingdom - Scotland*Educating baccalaureate nursing students about technology enabled care*

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This case study briefly describes an initiative underway to improve the digital knowledge and skills of undergraduate nursing students in a higher education institute in Scotland. The gap in informatics expertise among nurses has been noted [1] and current national education policies in Scotland identify this as an area that needs investment [2]. Therefore, a core set of informatics competencies and curricula aimed at pre-registration (baccalaureate) nursing students is being created by faculty at Edinburgh Napier University knowledgeable in the field of health informatics. Additional expertise is being drawn from the TIGER initiative [3] and a Fulbright U.S. Scholar based at the University of Pittsburgh, United States to enhance the teaching and assessment materials under development.

In collaboration with a number of academic and nurse practitioners, individual learning units in digital health are being designed. The initiative draws its pedagogic framework from the spiral learning approach [4], which advocates revisiting competencies throughout a program to deepen students understanding of a complex subject. It is not simply a matter of repetition but introducing students to the basic concepts and components of a topic and building on their knowledge, understanding and application of these over time. As learning progresses, more and more details are introduced in an intuitive way, while at the same time being related to previous educational content, to enable students construct a broader understanding of a subject and allow transferrable knowledge and skills to develop [5,6]. Specific learning units corresponding to key informatics competencies are being designed, so they can be incorporated into current subjects delivered on a Bachelor of Nursing program.

Table 1: Translation of TIGER core competency areas

TIGER core competency area	Learning unit	Competencies
Information and communication systems	Information and communication technology	Understand basic concepts and components of information and communication technology (ICT) and their development over time e.g. hardware, software, computer systems (including mobile platforms) and electronic networks.
		Recognize how ICTs can contribute to health e.g. collecting, storing, processing, managing and sharing information to support decision-making and the delivery of different models of care across a range of settings.
Information and knowledge management in patient care	Information management	Understand the concepts and components of data quality and the differences between data, information and knowledge in healthcare.
		Realize how ICTs are used for documenting, managing and communicating clinical and organizational information to support decision-making and care delivery.
		Demonstrate an ability to access and manage electronic health information and communicate information via a range of

		technologies.
		Identify the legal and ethical issues with collecting, accessing, using, sharing and destroying health information and the role of information governance in healthcare.
		Comprehend how ICTs are utilized for evidence-based healthcare to influence education, practice and policy.
Information and communication systems	Information systems	Appreciate the basic types of health information systems e.g. administrative, clinical (such as laboratory, electronic health records, clinical decision support systems, ePrescribing, telehealth) and public health and their contribution to health services over time.
and		Understand how the context (e.g. physical, social, cultural, economic, political) can affect how information is recorded, accessed, interpreted, used and communicated by both health professionals and patients/citizens.
Change management and stakeholder management		Recognize how the context (e.g. physical, social, cultural, economic, political) can affect how ICTs are applied in practice by both health professionals and patients/citizens.
		Identify emerging trends in ICT (e.g. Big Data, Internet of Things, nanotechnology, biotechnology) and the implications these have for nurses, midwives, allied health professionals and patients/citizens.
Applied computer science/informatics	Information systems management	Understand the concepts and components of interoperability of ICTs and the importance of data standards and clinical coding (e.g. SNOMED-CT, ICD-10, HL7, ICNP).
and		Realize the principles and components of ICT security and how they help to protect data and ensure confidentiality of information including legislative frameworks and the role of regulatory authorities.
Data protection and security		Appreciate how ICTs help to organize, deliver and evaluate health services including managing risk and measuring quality and outcomes.
and		Comprehend the need for organizational policies and procedures to support ICTs and their safe and effective use in healthcare.
IT risk management		Differentiate the role of nurses, midwives and allied health professionals in information management and the design, development, implementation and evaluation of ICTs in healthcare in collaboration with computing, engineering and other professionals.
and		
Quality management		
Assistive technology for ageing people	Patient/citizen digital health literacy	Understand why patients/citizens need access to electronic health information and digital health services and what ICTs are available for these purposes including their benefits, risks and limitations.
and		Realize the importance of patients/citizens accessing health information and social support via online applications such as social media, virtual communities, avatars including their benefits, risks and limitations.
eHealth, telematics and telehealth		Ascertain how other types of ICTs e.g. wearable devices, assisted living sensors and equipment, gaming technology and personalized medicine approaches can support patients/citizens health and recognise their benefits, risks and limitations.

Furthermore, the program includes health service literacy (Tab. 2).

Table 2: Competencies associated with health service literacy

Health Service Literacy	Understand the basic structure and function of the National Health Service (NHS) in Scotland and how it is organized, funded and managed.
	Comprehend the basic demographics and determinants of health of the people in Scotland.
	Distinguish the role of nurses, midwives and allied health professionals in the NHS and how they care for and support the health of people in Scotland.

The goal is to create a suite of learning units that will encompass key informatics competencies and outcomes to complement current nursing curricula. This will include online lectures, activities, and assessments in addition to core reading and exposure to a range of technologies used in the National Health Service (NHS) in Scotland, as well as future trends in informatics that will impact on nursing and patient care. Once designed, it will be piloted and evaluated by nursing students and refined to become integrated into a Bachelor of Nursing program. Examples of key informatics competencies students will gain are outlined in Table 1. This initiative will help nursing students gain foundational knowledge and understanding of digital health, so they can become competent to deliver technology enabled care in the health service.

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Exemplar Case Study United States of America*Preparing Advanced Practice Nurses for Connected Health*

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This case study provides one example of a graduate level online course required for all Master of Science and Doctoral of Nursing Practice Students. This online course is targeted to nurse practitioners, clinical nurse specialists, nursing administration and informatics students. The 3-credit course addressed the competencies set forth by the American Association of Colleges of Nursing's (AACN) Essentials for the Doctoral Education for Advanced Nursing Practice (DNP) [1]. An inter-professional team developed the course and it was integrated into the curriculum over 5 years ago. Table 1 shows a mapping of the course competencies to the AACN DNP competencies.

Table 1: AACN Competency and Course Competencies

AACN Competency [1]	Course Competencies
Design, select, use, and evaluate programs that evaluate and monitor outcomes of care, care systems, and quality improvement including consumer use of health care information systems	Examine the use of health information and communication technologies to improve the quality, safety and efficiency of patient care.
Demonstrate the conceptual ability and technical skills to develop and execute an evaluation plan involving data extraction from practice information systems and databases	Explicate the relationships among acquiring & manipulating data, applying information for clinical decision making and the generation of knowledge for evidence based practice.
Evaluate consumer health information sources for accuracy, timeliness, and appropriateness	Evaluate patient care technologies that enhance the health care delivery to diverse populations (under-represented minorities, ESL, incarcerated, elderly, homeless) and communities (inner city, rural, medically underserved).
Analyze and communicate critical elements necessary to the selection, use and evaluation of health care information systems and patient care technology	Analyze and communicate critical elements necessary for the selection and implementation of clinical systems.
Provide leadership in the evaluation and resolution of ethical and legal issues within healthcare systems relating to the use of information, information technology, communication networks, and patient care technology.	Provide leadership in the examination of ethical, legal, social and public policy issues associated with the use of current and emerging health information technologies.

This course builds on the basic 2009 TIGER competencies [2]. It also specifically targets the TIGER 2016 competencies of information and knowledge management and expands upon the telehealth and consumer engagement competencies [3]. The course was also built on the principles of a learning health system [4] and prepares advanced practice nurses to use this knowledge to practice in an inter-professional connected care ecosystem [5]. The course contains four modules with each module lasting for 4 weeks and is designed to allow learners to do a deep dive into a content area rather than

weekly surface learning (new topic every week). Within each module, there is a learning guide to facilitate student learning of the content. The learning guide provides opportunities for learners to select their learning pathway based on their current level of knowledge in the content area. It also provides them with remedial pathways to gain pre-requisite knowledge. Learning activities are interspersed throughout the modules and serve as instructional scaffolding. This scaffolding facilitates their learning and systematically builds upon their prior knowledge and experiences as they learn new content. The culmination of the module is a competency outcome assessment to demonstrate their knowledge. The four modules with the content focus and corresponding module outcome assessments are illustrated in Table 2.

Table 2: Module content and outcomes assessments

TIGER core competency area	Module Title	Content	Outcomes Assessment
Principles of nursing informatics and Applied computer science/informatics	Core Informatics Concepts & HIT Promise	Informatics definitions, Federal and organizational initiatives, interoperability and the promise and value of HIT tools in a continuously learning health system.	A position statement to demonstrate one's knowledge of meaningful use and the value (evidence) of HIT tools that will facilitate your future practice role.
Information management and knowledge management in patient care and Nursing documentation (including terminologies) and Decision support by IT And Quality management	Core Skills & Tools	DIK Continuum, Knowledge-based care, clinical information management, clinical data warehouses, Health IT Ecosystem, capturing high quality data (semantics interoperability structured vs unstructured data and copy & paste), and clinical decision support & quality management.	Group project to select a clinical problem relevant to your practice. Identify data elements and information needed to address the clinical problem as well as knowledge/evidence-based practice sources. Using these sources, develop a decision support tool to help with this clinical problem.
Assistive technology for ageing people and eHealth.	Consumer Engagement in a Connected Care Ecosystem	Connected Care concept, IOT, digital tools (m-app, patient portals, social media) consumer engagement & health literacy, and patient	Patient Portal Clinical Response with recommendations for website, m- app and social network to help a patient manage their health

telemedicine and telehealth		generated health data.	problem.
Data protection and security and Ethics and IT and Information management in research	Professional Issues	System Life cycle and APRN roles and responsibilities, unintended consequences, legal, ethical, social and policy issues including Big Data & secondary use of clinical data.	Patient Portal campaign as a component of selecting & implementing a clinical information system.

Here is a case study used in the connected care module. In this module, learners are introduced to the concept of connected care and how a patient is incorporated as a team member of a collaborative care team. As part of their learning, they are introduced to the concept of patient/family/caregiver engagement and health literacy. The course receives positive evaluations with learners declaring that they have the knowledge and skills necessary to practice in a connected care ecosystem.

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