Chapter 11
The Role of the Informatics Nurse

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Abstract Over the past 2 decades, the scope of practice for nurses in informatics roles has been evolving and shifting in response to the needs of health care organizations. While informatician practice has been seldom consistently defined or circumscribed in terms of role responsibilities and scope, the work has significantly contributed to the evolution and dissemination of information and communication technology (ICT) across the globe. Further the advent of formalized education in nursing and health informatics has led to the establishment of associated credentials and situated informatics as a specialty within nursing and other health professions. In this chapter, the author will review the types of informatics roles that have been assumed by nurses working in the field of informatics, key role functions, and a perspective on the essential leadership roles and potential areas of specialization for the next generation of nurse informaticians.

Keywords Nurse informatician · Informatics role · Informatics specialist · Analyst Information and communication technology · Health informatics

Learning Objectives for the Chapter
1. Describe the types of roles and responsibilities assumed by nurses working in the field of informatics.
2. Identify the importance of the nursing perspective in the field of health informatics and nursing informatics as a specialty.

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3. Discuss efforts focused on the development of informatics competency development (e.g., certification).
4. Consider current informatics practice domains and potential role functions for the future.

11.1 Introduction

The various roles, practice and competencies of nurses in informatics have been evolving for several decades. Similarly, academic opportunities and credentials in the field have become increasingly available and sought after by nurses. From the 1960s through the 1980s, information and communication technology (ICT) initiatives in health care organizations were almost exclusively led by traditional information technology (IT) and or telecommunications departments. When deemed necessary, clinicians, often nurses, were seconded for a period of time to bring a clinical perspective to ICT discussions. Anecdotally, these positions were largely time limited and focused mostly on system implementation and user training. These incidental assignments often came with the designation of *IT nurse* as the titles nurse informatician, informatics specialist or informaticist were uncommon until the emergence of formal programs of study and opportunities to obtain formal certification. More often than not, nurses were engaged after ICT choices and designs were finalized, with little consideration for the potential impacts on the daily work of the largest group of health care providers, nurses.

Today a majority of healthcare organizations recognize that successful implementation and adoption of ICT necessitates the inclusion of all clinician perspectives and not just that of physicians. Furthermore, studies are demonstrating that organizations with the foresight to involve nurses and other clinicians at the outset of ICT initiatives, including the acquisition and design phases, are more likely to achieve success in adoption and use (Ash et al. 2003; Ash and Bates 2005; Leatt et al. 2006; Studer 2005; Warm and Thomas 2011). While a wide variety of "informatics" positions are often filled by nurses, consistency and clarity of what constitutes the *work* of these positions is lacking. Over the years, many unique position descriptions have been created with an array of titles, roles and responsibilities. Nursing positions in informatics run the gamut from the unit-based "*nurse super user*" to the organizational executive level, "*Chief Information Officer*" (CIO) or nurse executive position of "*Chief Nursing Informatics Officer*" (CNIO). Accompanying the variability of work is a range of requisite experience, education and associated competencies even among those with similar titles. However, the finding of variability in the work of informatics' nurses is not unique to nursing and has been recognized as an area needing greater specificity and uniformity in healthcare practice (Hersh 2006; McLane and Turley 2011; Smith et al. 2011). In this chapter, the author provides an overview of informatics as a nursing specialty, and the various roles, responsibilities, and activities assumed by nurse informaticians. Although not formally sanctioned by any regulatory body, the title *nurse*

informatician will be used as the default reference to nurses working in informatics in order to provide illustrations within the context of this chapter. Additionally, speculation on directions for future informatics roles for nurses is offered for the reader's consideration.

11.2   Informatics as a Specialty in Nursing

> …a specialty that integrates nursing science, computer science, and information science to manage and communicate data, information, and knowledge in nursing practice. Nursing informatics facilitates the integration of data, information, and knowledge to support patients, nurses, and other providers in their decision-making in all roles and settings. This support is accomplished through the use of information structures, information processes, and information technology (Staggers and Thompson 2002).

Small groups of nurses interested in informatics and its potential application to practice, education, administration and research began organizing internationally in the 1960s. Organized international and national gatherings of nurses occurred over many years in several nations long before nursing informatics became formally recognized as a specialty (Scholes et al. 2002). In the early years, a contingent of nurses organized as a special interest group of the International Medical Informatics Association (IMIA) and became established as the Nursing Informatics Special Interest Group (IMIA NI-SIG). The IMIA NI-SIG currently serves as a unifying body supporting networking and collaboration among nurse informaticians around the globe, while also advancing the practice and research of informatics. Table 11.1 reflects the current goals and objectives of the NI-SIG which are each supported by specific activities and challenges to the community.

In 1992, the American Nurses Association (ANA) recognized the specialty of nursing informatics, publishing *The Scope of Practice for Nursing Informatics (*American Nurses Association 1994*)* and *The Standards of Practice for Nursing Informatics (*American Nurses Association 1995*)*. These were subsequently revised into a single publication in 2008 to reflect the scope and standards of practice and professional performance for the informatics nurse specialist; a 2nd edition was published in 2016 (American Nurses Association (ANA) 2016). See Table 11.2 for the overarching dimensions of the ANA nurse informatics specialist standards for practice and professional performance.

In the late 1980s, Canadian nurses working in informatics were initially organized as the Nursing Informatics—Special Interest Group (SIG) of the Canadian Organization for the Advancement of Computers in Health (COACH). Disbanded in 2001, this group was reconstituted in 2002 as an independent corporate entity, the Canadian Nursing Informatics Association (CNIA). A year later, the CNIA was granted Affiliate Group status with the Canadian Nurses Association (CNA), formally recognizing the specialty within the Canadian nursing community. Shortly thereafter, the CNIA became the COACH nominee to the represent Canadian nurses on the IMIA NI-SIG. During the last decade, although CNIA members have been

Table 11.1 IMIA Special Interest Group—nursing informatics goals & objectives

Goals and Objectives
The focus of IMIA-NI is to foster collaboration among nurses and others who are interested in Nursing Informatics to facilitate development in the field. We aim to share knowledge, experience and ideas with nurses and healthcare providers worldwide about the practice of Nursing Informatics and the benefits of enhanced information management.
Specific Objectives
• Explore the scope of Nursing Informatics and its implication for health policy and information handling activities associated with evidence based nursing practice, nursing management, nursing research, nursing education, standards and patient (or client) decision making and the various relationships with other health care informatics entities.
• Identify priorities or gaps and make recommendations for future developments in Nursing Informatics
• Support the development of Nursing Informatics in member countries and promote Nursing Informatics worldwide.
• Promote linkages and collaborative activities with national and international nursing and healthcare informatics groups and nursing and health care organisations globally.
• Provide, promote and support informatics meetings, conferences, and electronic communication forums to enable opportunities for the sharing of ideas, developments and knowledge.
• To participate in IMIA working group and special interest groups to present a nursing perspective.
• Develop recommendations, guidelines, tools and courses related to Nursing Informatics. Encourage the publication and dissemination of research and development materials in the field of Nursing Informatics
• To support and work with patients, families, communities and societies to adopt and manage informatics approaches to healthcare.
• Ensure the group is more visible by providing up to date information on the web site enabling external groups e.g. WHO, ICN to access as required.

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IMIA-NI International Medical Informatics Association—Nursing Informatics

invited to participate in several international initiatives, they have been most active in the development of national health data standards, core informatics competencies for basic nursing curricula, resources for nurse educators and formal education and certification programs in Canada.

Although beyond the scope of this chapter, nurses working in informatics have continued to organize worldwide and are convening regularly to network and address shared issues and challenges in national and international meetings and conferences. IMIA member and non-member countries are invited to participate in a number of scientific meetings (e.g., Medinfo, International Nursing Informatics Congress, European Federation for Medical Informatics), which take place every 2–3 years in a variety of locations. In the early days, these forums were commonly the venue by which a majority of nurses obtained the foundations of their training and education in informatics. For nurses from countries in which informatics learning options are few or non-existent, this is likely still their primary means of garnering informatics knowledge.

Table 11.2 Informatics nurse specialist standards of practice and professional performance

Standards of Practice	
1.	Assessment
2.	Problem and issues identification
3.	Outcomes identification
4.	Planning
5.	Implementation
5a.	Co-ordination of activities
5b.	Health teaching and health promotion and education
5c.	Consultation
6.	Evaluation
Standards of Professional Performance	
7.	Education
8.	Professional practice evaluation
9.	Quality of practice
10.	Collegiality
11.	Collaboration
12.	Ethics
13.	Research
14.	Resource utilization
15.	Advocacy
16.	Leadership

Adapted from: American Nurses Association (ANA) (American Medical Informatics Association 2020)

11.3   Specialty Preparation, Certification and Competencies

In conjunction with the recognition of nursing informatics as a specialty, several college and university based programs were launched in the early 90s, offering individuals an opportunity to obtain a wide variety of certificates, diplomas and undergraduate and graduate degrees focused in informatics. Today there are numerous programs with varied areas of focus, duration and terminal credentials but each is intended to provide nurses and others with the specialized knowledge and skills needed to become effective informaticians. Over the last 10 years, many online program offerings have also been developed further extending the reach of continuing education opportunities. The American Medical Informatics Association (AMIA) maintains a comprehensive inventory of US and internationally based informatics program and course offerings on their website (American Medical Informatics Association 2020). Similarly, the Canadian health informatics association, Digital Health Canada, maintains a listing of educational opportunities targeting individuals with technical and/or clinical backgrounds (Digital Health Canada 2020). In addition to these education offerings, there are now a number of professional journals that have a specific focus on issues of practice and research in nursing informatics including: (a) *CIN*: *Computers*, *Informatics*, *Nursing* and (b) the

Online Journal of Nursing Informatics. Although the publication of nurse informaticians' work is not limited to these journals, they do offer nurses opportunities to publish their experiences and learnings from practice, education and research with a nursing audience in mind.

In addition to taking formal programs of study, those with health informatics expertise may realise a nationally recognized professional designation upon successful completion of national certification examinations. Among these is the Health Information Management Systems Society (HIMSS) designation of Certified Professional in Healthcare Information and Management Systems (CPHIMS) (Health Information Management Systems Society 2020). A Canadian variation of this credential, CPHIMS-CA, is also offered for interested individuals with clinical or technology backgrounds. Upon successful completion of the certification exam, individuals receive a credential signifying that they have the health informatics "skills, knowledge and abilities to perform safely and effectively in a broad range of practice settings" (Digital Health Canada 2020). While the ANA has afforded nurses the option of securing a Board certification in nursing informatics for several years now (American Nurses Credentialing Center (ANCC) n.d.) this type of nursing specific professional certification is not widely available to nurses in other countries. In addition to nursing and informatics education credentials, many nurses have also completed a course of study and exam to achieve a Project Management Professional® (PMP) certification in response to the demand for project leadership skills within healthcare settings. With the establishment of nursing informatics organizations and the creation of opportunities to complete formal informatics education offerings, informatics has achieved recognition as a specialty within nursing (Warm and Thomas 2011; McLane and Turley 2011; Health Information Management Systems Society 2017). Nonetheless many nurses remain unaware of the potential career opportunities in the field and often encounter these by chance rather than design. Until core informatics competencies become integrated into the curricula of all entry level nursing programs, informatics may not even be recognized by many nurses as a specialty option. Increasing awareness and knowledge of informatics within the broader nursing community continues to be a key area of focus for many nursing informatics specialty groups.

Beyond a specialization in informatics, there are key competencies essential for individuals in all areas of nursing practice and others specific to those in leadership positions. The delineation of core entry-to-practice informatics competencies for all registered nurses has been undertaken by several countries (Association of Schools of Nursing 2012; Honey et al. 2017; Nagle et al. 2014). In particular, a recent publication by members of the IMIA-NISIG (Goosen and Murphy 2017), provides a comprehensive overview of informatics competency requirements for now and into the future. Further to these efforts, informatics competency self-assessment tools for student nurses, registered nurses, registered practical nurses, ((Kleib and Nagle 2018a; and nurse leaders, (Collins et al. 2017; Yen et al. 2017; Strudwick et al. 2019a; Strudwick et al. 2019b) are currently in development and/or being tested for their psychometric properties. Despite these efforts, systematic integration of core informatics competencies into undergraduate nursing curricula remains inconsistent

and simply lacking in many schools of nursing. A recent national study of Canadian schools of nursing revealed that a majority of undergraduate programs have limited informatics content but on a positive note, there is a willingness among faculty to address these gaps (Nagle et al. 2018). There is no doubt that core informatics competency is fundamental for the delivery of safe, quality practice by all nurses and other healthcare providers in the twenty first century.

11.4 Domains of Nurse Informatician Work

According to an earlier paper by McLane and Turley (McLane and Turley 2011), "*informaticians are prepared to influence*, *contribute to*, *and mold the realization of an organization*'*s vision for knowledge management*" (p. 30). This remains an apt description today as many individuals, including nurses, have attained credentials that denote their knowledge, expertise and experience in the field of health informatics. Over the years, many nurses have moved into senior executive positions including the role of Chief Information Officer; some of the challenges for a nurse in this role have been described previously (Nagle 2000). Roles for nurses have actually evolved to the extent that executive positions with the designation of CNIO have been established in some health care organizations. Recognition of the essential role of informatics savvy nurse leaders has led to continued advocacy for more CNIO positions and the development of informatics competency among nurse leaders (Kennedy and Moen 2017; Kannry et al. 2016; Nagle 2016). It is most common to find nurses specializing in the field of informatics referred to as informaticists, informaticians, informatics nurse specialists and/or clinical informatics specialists, sometimes but not always, denoting that they have advanced training or a credential in informatics. However, despite the emergence of informatics specific educational offerings and positions, many nurses do not have formalized training and often find themselves in informatics roles for which they are ill-prepared. And as was found in a recent HIMSS survey, a majority of nurse informaticians continue to derive much of their knowledge and experience through on-the-job training (Health Information Management Systems Society 2017).

Nurse informaticians can be found working within health care organizations, leading and participating in ICT initiatives. Others have secured roles working in government and legislative bodies, advancing standards, policy and strategic initiatives. In academic settings, nurses are advancing informatics education and research and informing innovations in teaching and learning. And still others have been recruited by ICT software and hardware developers and suppliers to bring their expertise to bear on the evolution of technology solutions to support clinical care delivery. The evolution of nurse informatician roles has occurred as a direct result of the need to converge nursing expertise with the knowledge of informatics to better inform systems design, implementation, education, and evaluation. Their knowledge and skills have been acknowledged as integral to the effective implementation

of ICT as well as effective information and knowledge management (Warm and Thomas 2011; McLane and Turley 2011; Smith et al. 2011).

Informatics roles in practice settings have been widely varied in scope and function but have largely focused on components of the system lifecycle (e.g., design, implementation, training, and evaluation). Hersh (Hersh 2006) underscored the ill-defined relationship between the practice of informaticians and job titles. McLane and Turley (McLane and Turley 2011) highlighted the intricacy and complexity of the knowledge and skills required by organizations endeavouring to deliver on an ICT agenda that will lead to safer, more effective care and also support clinical practice.

According to Sewell (Sewell 2019) "There are two roles in informatics: the informatics specialist and the clinician who must use health information technology. This means in essence that every nurse has a role in informatics" [p4]. However, for the purpose of this chapter, the roles and responsibilities of nurse informaticians will be highlighted using broad categories of informatics practice domains. Table 11.3 provides a synthesis of seven domains of informatician work:

1. Leadership
2. ICT Life Cycle Management
3. Health System Use
4. Entrepreneurship
5. Vendor Support
6. Education
7. Research

11.5   Leadership

Notwithstanding the fact that all informatics roles require an element of leadership capacity, for the purpose of this discussion, the domain is applied to those roles that are typically senior positions within healthcare organizations, ICT companies or government. These individuals typically provide strategic or operational oversight of organizational, regional and national ICT solutions. They may provide expert consultation on issues of ICT strategy, including support for the processes of acquisition, deployment, implementation, evaluation and education. Some nurses in these senior roles may focus on issues of advocacy or political action to drive broad ICT or health and professional policy directions. To date, the number of nurses recognized for their informatics expertise at government and policy tables has been limited but there is clearly an opportunity and need for the voice of nurses to be heard. The concept of *change leadership* is an essential role function for the senior nurse informatician such that the ICT vision, strategy and solutions, management teams and supporting actors and activities are provided with explicit and committed executive support. Titles such as Chief Information Officer, CNIO, Vice-President or Director of Nursing Informatics, Nurse Informatics Consultant or Advocate are most commonly used to designate these positions.

Table 11.3 Domains and areas of focus for nurse informaticians

Domain	Areas of focus
Leadership	Strategy
	Strategic planning
	Change leadership
	Consultation
	Advocacy
	Political action
	Health policy
	Customer relations
ICT life cycle management	Systems analyses
	Workflow
	Process improvement
	Usability
	Ergonomics
	Socio-cultural
	Functional specification
	Acquisition
	Application design
	Data representation
	Terminology
	Standards development
	Interoperability/integration
	Implementation
	Change management
	Education
	Competency assessment
	Training & education
	Evaluation
	Formative
	Summative
	Systems support
Health system use	Data analytics
	Aggregate reporting
	Utilization management
	Decision support
	Generation of new knowledge
	Use of data, information, and knowledge
	Outcomes Management
	Quality Improvement
	Ethical use
	Protection of privacy
Entrepreneurship	Software/hardware solution development
	Consulting

Table 11.3 (continued)

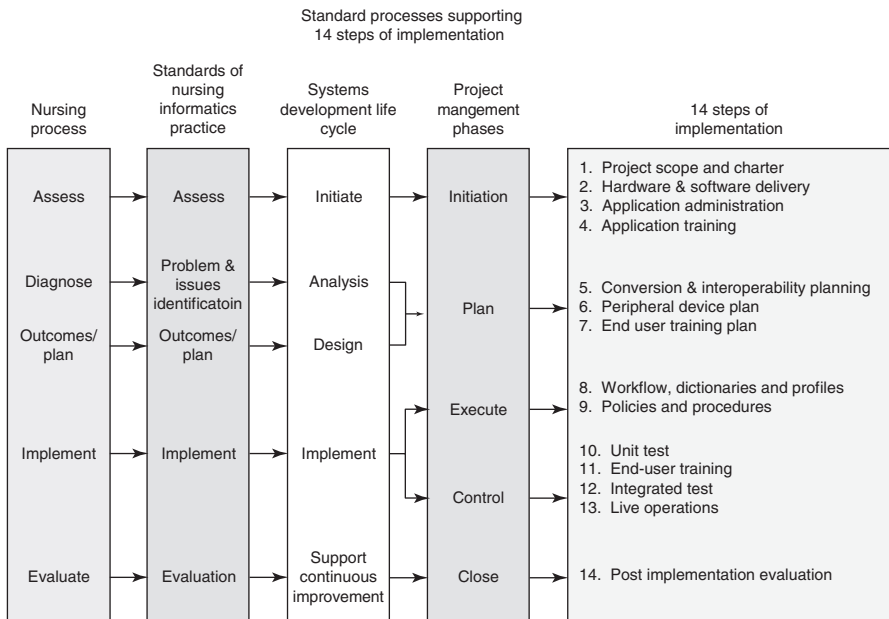| Domain	Areas of focus
Vendor support	Product development
	Sales
	Customer support
Education	Curriculum/course development & delivery
	Competency assessment
	ICT innovation in education
Research	Conduct of research focused on applications of informatics in practice, education, and/or administration

Fig. 11.1 Standard processes supporting 14 steps of implementation (With permission © McGraw Hill)

11.6   ICT Life Cycle Management

Smith and Tyler (Smith and Tyler 2011); p78] described the system development life cycle (SDLC) as comprised of five phases: initiation, analysis, design, implementation, and continuous improvement or support (Fig. 11.1). Further they illustrated the alignment of the SDLC with the standards of nursing informatics practice (see Table 11.2), the project management process and the nursing process.

The roles encompassed within this domain constitute by far, a majority of positions currently filled by nurse informaticians. Given the breadth and depth of activities needed to manage the ICT life cycle, these roles typically vary widely in title,

scope of responsibility and employers' requisite qualifications. The work of nurses in this area may include:

- providing oversight (e.g., project management) or hands-on involvement in the tasks of information gathering and analyses to inform ICT functional specifications for solution acquisitions and designs;
- process mapping and analyses of current and desired future states;
- supporting or engaging in application design and build activities;
- assuring the use of data and interoperability standards;
- usability testing;
- ergonomic evaluation;
- developing methods and tools for initial and ongoing user support, training and education;
- leading and supporting evaluation activities, formative and summative;
- system optimization focused on increasing productivity and efficiency with ICT use;
- reviewing, revising, and developing relevant practice related ICT policies.

These work efforts are largely focused on getting the solution functionality and supporting processes and infrastructure optimally designed to achieve successful clinician adoption and integration into practice. Each of the core work elements requires oversight, expertise, and iterative engagement of the targeted user community. To this end, project management, clinical expertise, and skilled change management are necessary ingredients to success. Not all nurse informaticians will have the experience, skill, and knowledge to contribute to all aspects of the ICT lifecycle, but in the course of time and with experiential practise, it is likely that most will garner exposure and an understanding of each dimension. The work of systems analyses is typically undertaken by a combination of technical and clinical experts. Nurse analysts will generally focus on the clinical systems pre- and post-ICT, starting with activities to inform the solution acquisition through to understanding the chosen solution's impact on clinical and associated business processes. The work usually encompasses the capture and documentation of clinical operations in the context of specific settings and is inclusive of all clinicians and non-clinicians for whom a new technology will potentially change or impact the flow of their day to day activities.

Expertise in the areas of data standards, terminologies, and systems interoperability (See Chaps. 2, 5 and 6) is of utmost importance but as yet not well understood by many clinicians. The adoption and use of clinical data standards among nurses are particularly challenging as the use of standardized language is a foreign concept to most. Perhaps the most universally understood and applied standard is the rubric of the nursing process, but the standardized terminologies that underpin the documentation of the steps are less so (e.g., nursing diagnosis, interventions, outcomes). The integration nursing data standards and codification of these in electronic health records is an area needing the engagement of many more nurse informaticians, given that a future which includes comparable, analyzable and reportable nursing relevant metrics depends upon it.

The area of human factors encompasses a myriad of socio-technical issues not the least of which is the usability of ICT solutions. As a division of cognitive psychology, in the context of informatics human factors is largely concerned with human-machine or human-computer (i.e., devices and applications) interactions. The emphasis on human factors has emerged in recent years as a consideration that is germane to the ultimate success of ICT deployment. Nurses working in this area will concern themselves not only with the cognitive impact of ICT solutions on nurses' and others' work but also with the physical or ergonomic design issues (e.g., workstation height, lighting).

Role designations such as Project Manager, Data/Terminology/Standards Specialist, Application Specialist, Nurse Informatics Specialist, Clinical Informatics Specialist, Business/Clinical Process Analyst, Usability Specialist, Nurse Ergonomist, ICT Policy and Procedure Manager are examples of some of the commonly used titles associated with these responsibilities.

11.7   Health System Use

The area of health system use is emerging to likely be the most important focus of health informaticians' work in the years ahead. Health system use reflects the shift from the investment and development in information systems to the analysis and use of data to inform business and clinical decisions. Health data analytics may inform or drive reactive, proactive or retrospective actions or decisions. The increasing sophistication of health information systems is affording decision-makers, managers, and clinicians the capacity to make better informed decisions to achieve both short and long term outcomes. In addition to the phrase health system use, the terms *business intelligence* and *clinical intelligence* are being increasingly applied to describe the processes and outputs of this work. The outputs may be driven by specific business, clinical or research questions, focused on specific financial or clinical performance metrics and outcomes, and often encompass the provision of benchmarking and performance measurement reports. In its most basic application, health information use can occur at the patient/client, unit/program, organizational, regional or national level. In this regard, one might deem the staff nurse or nurse manager as the first level of user, focused on the use of clinical data, information and knowledge to inform clinical or management practice decisions respectively.

Although it is still early days for ICT supported clinical decision-making, nurses have been using tools such as nursing workload management systems for more than three decades. Originally designed to support staffing decisions based upon patient acuity scores, these tools became pervasive in healthcare during the 1980s and 90s. (For additional information about these systems, refer to Chap. 9) While not commonly used to adjust daily staffing levels, the data from these systems have been used to track patient acuity, a proxy for the costs of nursing care, and often to guide organizational decisions about issues such as staff mix. Nurses supporting the

implementation and use of these systems were typically designated as the *vendor name* (e.g., Medicus™, GRASP™), *workload* or *systems* nurse. Commonplace among the nursing workforce, these were likely the first informatics nurses found in clinical settings, but the position titles did not denote the importance of their activities as data managers and custodians, assuring data quality, reliability and completeness of workload data. These roles continue to exist in many health care organizations today, but as clinical system vendors are beginning to design tools to generate nursing workload and patient acuity as bi-products of clinical documentation, they may well become unnecessary in the future and subsumed by the work of the nurse informatician.

At local levels, many health care provider organizations have acquired business analytic software tools that support the mining and analysis of data to inform business and clinical decisions. Considering broader levels of system use, data and information from health information systems can support program quality and safety improvements, planning and resource allocation, clinical utilization review, and management of public health issues and substantially support health services research. At present, these are the most common applications to which the term health system use is being applied. Health system use analyses are being conducted at regional, national and international levels to inform funding directions, health policy, and overall health system improvements. In some countries, national data repositories have been created to house data for these purposes (e.g., Canadian Institute of Health Information [CIHI], National Database of Nursing Quality Indicators® [NDNQI®], Institute for Clinical Evaluative Sciences [ICES]). For examples of national reports being generated by CIHI go to Chap. 8. While not necessarily solely staffed by nurse informaticians, many health care organizations have dedicated departments delivering analytic outputs in the form of performance dashboards or scorecards. The supporting roles are commonly referred to by titles such as Decision Support Analyst, Business Analyst, Clinical Decision Support Analyst and Quality and Safety Improvement Officer.

11.8   Vendor Support

In recent years, vendors, particularly those developing software solutions to support clinical care, have begun to recognize the invaluable perspectives and knowledge of nurses to inform the design of tools that are deemed to be useful in support of practice. Nurses working for software and hardware companies often find themselves attending sales meetings and informatics conferences, conducting product demonstrations for prospective clients, and supporting healthcare customers postsales. Others have assumed roles focused on product design, development and functional evaluation activities. Positions such as Nursing Product Consultant, Sales Representative, Application Specialist and, in some large software organizations, senior level positions (e.g., Chief Nursing Officer or VP Nursing) are not uncommon.

11.9   Education

Nurse educators have been introducing the concepts of informatics to students in undergraduate and graduate programs for many years. Despite the number of faculty early adopters in this area, a majority of nursing schools still have limited or no informatics content in the undergraduate nursing curricula.

> *Whether recognized or not, in today's world, informatics is simply a part of every faculty member's tool kit. Therefore, it should not be offered or developed as a separate course. Rather it should be integrated with approaches to the theoretical and practical teachings in every course.* [(Nagle 2007), p24]

Typically offered as a single course, elective or required, the need to integrate informatics content as a thread throughout entry level nursing programs remains significant. Because of its niche nature to date, there are a limited number of nursing faculty who have a comfort level with the delivery of informatics content. Despite many informatics concepts being central to basic nursing practice (e.g., evidence-informed decision-making), it would seem that many educators see informatics as a wholly separate area of expertise. Albeit the practice of a nurse informatician is quite different from that of a bedside nurse, they are conceptually and practically interconnected. But until informatics becomes explicit and integral to the work of practitioners and educators, it is likely that the number of nurse informatician educators in schools of nursing will remain few in number. See Chaps. 14 and 15 for a detailed discussion on informatics and education.

In practice however, the role of the nursing informatician in educating and training clinicians in the use of ICT solutions is much more common. The assumption of these responsibilities by clinical nurse educators is not necessarily included with the delivery of other types of clinical teaching. Rather ICT education and training is commonly separate and within the purview of those in the role of "system educators" who may or may not have clinical backgrounds. These educators typically report to the IT or informatics department. In addition to these roles, it is common for unit-based or program-based nurses to be designated as "super users" to provide staff with ongoing support following the implementation of a new solution. These are often nurses who have expressed an interest or affinity for technology but not always; at times individuals are conscripted into these roles—not usually a successful strategy.

11.10   Research

Over the years, nurse researchers have committed entire careers studying the concepts and practice of informatics in nursing (See Chaps. 12, 13 for more on research in nursing informatics). Relative to other areas of nursing research, the extent of informatics nursing research being conducted world-wide is growing. But there is a need for considerably more research in the field and additional evidence to advance

our informatics knowledge base. Within each of the domains of *Leadership*, *ICT Life Cycle Management*, *and Health System Use* as highlighted in Table 11.3, there are as yet many unanswered questions regarding ICT effectiveness, efficiency, outcomes and overall benefits to nursing and the health care system as a whole. The future development of researchers in the field will be largely dependent upon there being an increased recognition of informatics within the academic arena. Budding researchers will need the guidance and mentoring of nurse educators with informatics and research expertise.

11.11   Entrepreneurship

Over the years, many enterprising nurses have undertaken the creation of an independent business operation. The scope of these businesses has encompassed the provision of expertise to support any of the previously described domains of informatics work. Most commonly nursing informatics consultants have supported the work of ICT vendors and health care organizations lacking the requisite knowledge and experience to successfully execute an ICT acquisition, deployment and/or evaluation. The nurse informatics consultant is typically a seasoned practitioner who has an established track record in the field and viewed by actual and prospective clients as a valuable and trusted advisor. As previously discussed, nurses working solo or in partnership with other companies, have also led or contributed to the design, development, and distribution of proprietary software products to support the clinical, administrative, research and educational work of other nurses.

In this section, the key domains that may provide the focus of a nurse informatician's work have been broadly described and summarized. Table 11.4 provides the reader with a further synthesis of various role functions, position titles and some of the activities associated with each. Although the delineation and separation of some role functions may not be consistent within or among health care organizations, this discussion is intended provide a simplified framework of the types of work that the nurse informatician may undertake. Neither the position titles nor designated activities are meant to be authoritative or prescriptive, but representative of a specialty that is in evolution.

11.12   Nurse Informatician Roles for the Future

Across the globe, the healthcare industry continues to wrestle with clinician acceptance and full integration of ICT solutions into the processes of care delivery. Although seemingly protracted, the duration of this journey is not surprising and the evolution of systems will continue for many years to come. However, at this juncture it is important to rethink the role of nurse informaticians for the next decade. Some organizations have created formal informatics leadership positions or

Table 11.4 Role focus, position titles and activities

Role focus	Position titles	Activities
Change leadership	Chief information officer	Strategic planning
	Chief nursing informatics	Innovation
	Officer	Sponsorship
	Director nursing	Team building
	Informatics	System acquisition and funding
	Consultant	Health policy & political action
	Advocate	
Change management	Project manager	Operational management
	Informatics nurse specialist	Problem-solving
	Informatician	Budget management
	Informaticist	Team building
		User relationship management
		Vendor management
Systems analyses	Clinical analyst	Process analysis
	Business analyst	Standards
	Application specialist	System acquisition
	Usability specialist	Application design & build
	Nurse ergonomist	Human factors testing
	Data standards specialist	Ergonomics
	Interoperability specialist	Evaluation
Implementation	Informatics nurse	User support
	Application support specialist	Application support
		Device support
Education	Systems educator/trainer	Education
	Nurse educator	Training
		Support
		Orientation
Evaluation	Informatics researcher	Pilot testing
	System user	Interative design/usability testing
	Informatics specialist	Formative/summative System optimization
Systems support	Informatics nurse	Ongoing support in use of ICT
	Nurse educator	Program/department/unit based
	Nurse super user	
	Application support	
System use	**Nurse as**:	Nurse as knowledge worker
	Data gatherer	Outcomes management
	Information user	Evidence-based practice
	Knowledge user	
	Knowledge generator	

dedicated informatics departments, and most continue to designate a small number of willing individuals to represent the clinical perspective within ICT initiatives. Additionally, a majority of nurses continue to derive their knowledge and expertise via the school of hard knocks as the *informatics* or *IT nurse* within an organization. Until the core concepts and competencies of informatics become embedded within the undergraduate curricula of the health professions and recognized as essential for current practice in every setting, this landscape is unlikely to change. The specialty has been recognized within the profession for more than 3 decades, but the essential nature of nursing informatics roles has yet to be widely recognized and embraced by academia and healthcare organizations.

Heightened concerns for safety and quality have been directly linked to the need for timely access to information and evidence to support optimal clinical decision-making. In the context of increasingly ICT enabled clinical environments equipping nurses with advanced informational support, there is a place for informatics in the work of all nurses (Nagle 2016; Nagle et al. 2007). However, in contemplating future roles for nurse informaticians, it is important to consider that the evolving context of ICT use in healthcare delivery organizations (see Chaps. 2, 14, and 15) will likely include:

(a) organizations and providers reaching greater levels of maturity in their use of systems, necessitating an enhanced understanding of meaningful use among clinicians;
(b) increased integration of ICTs across care sectors (e.g., acute care, primary care, long-term care, home care)
(c) citizens taking an increasingly active role in managing their health and health information;
(d) expanded virtualization of health service delivery (e.g., telehomecare, mHealth, telehealth, cloud computing);
(e) increased emphasis on cost containment to assure that services are accessible and affordable;
(f) inclusion of genomic information as core data within electronic health records will introduce new ethical issues;
(g) increased use of artificial intelligence (AI) and robotics in the delivery of health services.

These emerging contexts will necessitate the evolution of nurse informatician roles to contend with the resultant issues that will surely arise. Envision the nurse informatician who specializes in the virtualization of care, robotics nurse, nurse genomic ethicist, personal health record nurse specialist, AI nurse specialist, health data integration and continuum of care and cost management expert, to mention but a few. For further discussion of future informatician roles and responsibilities, see Nagle and colleagues (Nagle et al. 2017). The authors anticipate new roles for nurse informaticians in the face of a universal, aging demographic characterized by sustained chronic, complex conditions, consumerism, ubiquitous technology and virtual-connected care. In particular, they highlight the need for new dimensions of informatics expertise in the areas of data science or "big data", robotics, artificial

intelligence, genomics and perhaps even within new settings such as outer space. Each of these areas invite the development of new informatics knowledge and know-how, much of which is as yet unknown.

Imagining the world beyond today's reality, consider a future that allows for the extension of healthcare services to address the needs of developing nations and underserved communities and the potential to address current health inequities. In the context of healthcare delivery throughout the world, and perhaps beyond, consider the possibilities for the future, and appreciate that nurse informaticians are well situated to provide critical roles and responsibilities for many years to come. Chapters 13, 14, and 15 presents a vision of the future and how nursing informatics will support professional practice, advocacy, and the delivery of optimal client care.

11.13   Review Questions

1. Identify some of the roles and responsibilities assumed by nurses working in the field of informatics.
2. In your opinion, why is a nursing perspective is valuable to the work of health informatics.
3. What opportunities currently exist to obtain formal and informal education in the field of nursing/health informatics?
4. Describe some of the current informatics practice domains and potential role functions for the future.

11.13.1   Answers

1. Nurses interested in the field of informatics today will likely find opportunities in the following areas:

   - Practice
   - Academia
   - Government
   - Consulting

2. Nurses understand the processes of care delivery across all healthcare settings. Without a nursing perspective, health technology solutions may not provide the appropriate functionality or data and information to effectively and appropriately inform clinical decision-making.
3. Nurses may acquire informatics expertise formally and informally. Nurses commonly acquire knowledge and experience on the job but may also derive learnings from networking with colleagues at conferences and workshops. Many college and university programs offer certificates, diplomas, and undergraduate and graduate degrees focused in informatics. In some countries (e.g., Canada and

US), nurses may acquire a formal certification in health informatics (e.g., CPHIMS). Competencies have been developed in several countries for entry-to-practice and nurse leaders.

4. Today informatics practice domains may include the following: Leadership, ICT life cycle management, health system use, entrepreneurship, vendor support, education and research. In the future, nurse informaticians will likely be needed in the areas of: data science, artificial intelligence, robotics, genomics and perhaps space aeronautics, to name a few.

Glossary

AMIA American Medical Informatics Association

Business intelligence The use of data and information to inform decision impacting any aspect of a business

Clinical intelligence The use of data and information to inform decisions that are specifically clinical in nature

CNIA Canadian Nursing Informatics Association

CNIO Chief Nursing Informatics Officer

CPHIMS Certified Professional in Healthcare Information and Management Systems

Health informatics The intersection between health care, information management and information technology

HIMSS Health Information Management Systems Society

HSU Health System Use, where information is aggregated and analyzed to inform decisions

IMIA NI-SIG International Medical Informatics Association Nursing Informatics Special Interest Group

IMIA International Medical Informatics Association

PMP Project Mangement Professional, a professional credential granted by Project Management International (PMI)

SDLC Systems Development Life Cycle

References

American Medical Informatics Association. Academic informatics programs. 2020. Accessed at: https://www.amia.org/education/programs-and-courses. Accessed 26 Feb 2020.

American Nurses Association. Scope of practice for nursing informatics. Washington, DC: ANA; 1994.

American Nurses Association. Standards of practice for nursing informatics. Washington, DC: ANA; 1995.

American Nurses Association (ANA). Nursing informatics:Scope and standards of practice. 2nd ed. Silver Spring: Nursesbooks.Org; 2016.

American Nurses Credentialing Center (ANCC). (n.d.). Nursing informatics. At: https://www.nursingworld.org/our-certifications/informatics-nurse/. Accessed 26 Feb 2020.

Ash JS, Bates DW. Factors and forces affecting EHR system adoption: report of a 2004 ACMI. discussion. J Am Med Inform Assoc. 2005;12:8–12.

Ash JS, Stavri PZ, Dykstra R. Implementing computerized physician order entry: the importance of special people. Int J Med Inform. 2003;69:235–50.

Canadian Association of Schools of Nursing. Nursing Informatics Entry-to-Practice Competencies for Registered Nurses, Ottawa, ON: Author; 2012. At: http://www.casn.ca/2014/12/casn-entry-practice-nursing-informatics-competencies/; Accessed 20 Feb 2020.

Collins S, Yen PY, Phillips A, Kennedy MK. Nursing Informatics Competency Assessment for the Nurse Leader: The Delphi Study. J Nur Admin. 2017;47(4):212–8.

Digital Health Canada. Health informatics education. 2020. https://digitalhealthcanada.com/core-hi-education/. Accessed 26 Feb 2020.

Goosen W, Murphy J, editors. Forecasting Informatics Competencies for Nurses in the Future of Connected Health. Amsterdam: IOS Press; 2017.

Health Information Management Systems Society (HIMSS). HIMSS 2017 nursing informatics workforce survey. 2017. At: https://www.himss.org/resources/2017-himss-nursing-informatics-workforce-survey. Accessed 26 Feb 2020.

Health Information Management Systems Society (HIMSS). Health IT certifications. 2020. At: http://www.himss.org/health-it-certification?navItemNumber=13588. Accessed 26 Feb 2020.

Hersh W. Who are the informaticians? What we know and should know. J Am Med Inform Assoc. 2006;13(2):166–70.

Honey MLL, Skiba DJ, Procter P, Foster J, Kouri P, Nagle LM. Nursing informatics competencies for entry to practice: the perspective of six countries. Stud Health Technol Inform. 2017;232:51–61.

Kannry J, Sengstack P, Thyvalikakath TP, et al. The Chief Clinical Informatics Officer (CCIO): AMIA task force report on CCIO knowledge, education, and skillset requirements. Appl Clin Inform. 2016;7(1):143–76.

Kennedy MA, Moen A. Nursing leadership and informatics competencies: Shaping transformation of professional practice. In: Goosen W, Murphy J, editors. Forecasting Informatics Competencies for Nurses in the Future of Connected Health. Amsterdam: IOS Press; 2017. p. 197–206.

Kleib M, Nagle LM. Development of the Canadian Nurse Informatics Competency Assessment Scale (C-NICAS) and evaluation of Alberta's Registered Nurses' self-perceived informatics competencies. Com Inf Nur. 2018a;36(7):35–358.

Kleib M, Nagle LM. Factors Associated with Canadian nurses' informatics competency. Com Inf Nurs. 2018b;36(8):406–15.

Leatt P, Shea C, Studer M, Wang V. IT solutions for patient safety: best practices for successful implementation in healthcare. Healthc Q. 2006;9(1):94–104.

McLane S, Turley J. Informaticians: how they may benefit your healthcare organization. J Nurs Adm. 2011;41(1):29–35.

Nagle LM. Nurses *Carpe Diem*. In: One step beyond: the evolution of technology and nursing. Proceedings of 7th International Congress Nursing Informatics Conference on CD, Auckland, 2000.

Nagle LM. Everything I know about informatics, I didn't learn in nursing school. Can J Nurs Leadersh. 2007;20(3):22–5.

Nagle LM. The importance of being informatics savvy. Can J Nurs Leadersh. 2016;28(4):1–4.

Nagle LM, Crosby K, Frisch N, Borycki E, Donelle L, Hannah K, Harris A, Jetté S, Shaben, T. Developing entry-to-practice competencies for registered nurses. Proceedings 12th International Congress on Nursing Informatics, 2014, Taipei, Taiwan.

Nagle LM, Sermeus W, Junger A. Evolving role of the nursing informatics specialist. In: Goosen W, Murphy J, editors. Forecasting informatics competencies for nurses in the future of connected health. Amsterdam: IOS Press; 2017. p. 212–21.

Nagle, LM, Furlong, K, Kleib M. (Eds). Study of digital health in Canadian schools of nursing: curricula content and nurse educator capacity. 2018. Ottawa, ON: Canada Health

Infoway. At: https://www.infoway-inforoute.ca/en/component/edocman/resources/reports/benefits-evaluation/3716-study-of-digital-health-in-canadian-schools-of-nursing. Accessed 26 Feb 2020.

Scholes M, Tallberg MA, Pluyter-Wenting E. International nursing informatics: a history of the first forty years: 1960–2000. London: British Computer Society; 2002.

Sewell J. Informatics and nursing: opportunities and challenges. 6th ed. Philadelphia: Wolters Kluwer—Lippincott Williams & Wilkin; 2019.

Smith K, Tyler DD. Systems life cycle: planning and analysis. In: Saba VK, McCormick KA, editors. Essentials of nursing informatics. 5th ed. New York: McGraw-Hill; 2011. p. 77–92.

Smith SE, Drake LE, Harris J-G, Watson K, Pohlner PG. Clinical informatics: a workforce priority for 21st century healthcare. Aust Health Rev. 2011;35:130–5.

Staggers N, Thompson CB. The evolution of definitions for nursing informatics: a critical analysis and revised definition. J Am Med Inform Assoc. 2002;9(3):255–61.

Strudwick G, Nagle LM, Kassam I, Pahwa M, Sequeira L. Informatics competencies for nurse leaders: a scoping review. J Nurs Admin. 2019a;49(6):323–30.

Strudwick G, Nagle LM, Morgan A, Kennedy MA, Currie LM, White P. Adapting and validating nurse leader informatics competencies in the Canadian context: Results of a Delphi study. Int J Med Inform. 2019b;129:211–8.

Studer M. The effect of organizational factors on the effectiveness of EMR system implementation: what have we learned? Healthc Q. 2005;8(4):92–8.

Warm D, Thomas B. A review of the effectiveness of the clinical informaticist role. Nurs Stand. 2011;25(44):35–8.

Yen PY, Phillips A, Kennedy MK, Collins S. Nursing informatics competency assessment for the nurse leader: Instrument refinement, validation, and psychometric analysis. J Nurs Admin. 2017;47(5):271–7.