# National Nursing Informatics Project - Discussion Paper (DRAFT)

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# Executive Summary

## 1.0 Introduction

The potential for Nursing Informatics to enhance nursing practice, study clinical problem-solving and ultimately improve the quality of care has been a long-standing expectation (Peterson & Gerden-Jelger, 1988). However, unlike many other information intensive industries, health care has been slow in adopting information technology. The U.S. National Advisory Council notes nurses, like other health care professionals, have yet to develop a culture "to promote acceptance and use of information technologies as basic tools for information management and exchange."

To begin to address these needs a National Steering Committee was formed with representatives from five key nursing organizations, including the Association of Chief Executive Nurses, Canadian Nurses Association, Canadian Association of University Schools of Nursing, Registered Nurses Association of British Columbia and the Nursing Informatics Special Interest Group of COACH. A Working Committee was struck to undertake a *National Nursing Informatics Project* which has four goals:

- to develop consensus on a definition of Nursing Informatics for Canada;
- to recommend Nursing Informatics (NI) competencies for entry level nurses and specialists, managers, educators and researchers;
- to identify curriculum implications and strategies for both basic and continuing nursing education; and
- to determine priorities for implementing national nursing informatics education strategies.

Following a review of the literature the Working Committee determined that an initial step in developing Nursing Informatics education strategies was to develop a discussion paper and elicit feedback from stakeholders in national nursing organizations, educational institutions and nursing employers.

## 2.0 Background

Nursing leaders and educators have recognized the need for every nurse to participate in *Nursing Informatics*, that is, the use of information and communications technologies in the collection of data, use of information and generation of knowledge to support nursing practice. The history of Nursing Informatics, however began with individual nurses who took on these responsibilities as representatives of nursing. This history is an important to recognize within the context of current advocacy for NI responsibilities in every domain and level of nursing practice.

The role of Nursing Informatics Specialists began in the early to mid 1980's as acute care facilities began implementing Hospital Information Systems. These systems included clinical applications such as order entry and results reporting that nurses were expected to use. Information Systems (IS) Departments quickly realized they could not implement these systems without some clinical knowledge of operations. Hospitals hired nurses to provide this clinical-technical bridge in response to the need for clinical input. These nurses had a

variety of titles such as "Nursing Systems Coordinator," "Nurse Analyst" and "Nursing Coordinator-Computer Project." A similar history is noted in the UK where the impetus for these positions arose from health system requirements and money allocated to HIS. Initially the NI Specialist role centered around implementation and training nurses to use the technology. In many institutions this role has been expanded to include support for all clinical areas, hence a change in title to *Clinical Systems Coordinator*.

It appears after 20 years of effort, Nursing Informatics continues to be seen as a purvey of specialists. This means relatively few nurses are involved in decisions around how information systems will be used by nursing to support nursing practice. For this reason, a national strategy for NI education should address ways to broaden all nurses' interest and involvement in Nursing Informatics as well as demonstrating the benefits of this approach.

There have been many promises around the benefits of using information technology (IT), but these often do not materialize. More sophisticated and powerful information systems are available and these have the potential to affect the work of nurses in clinical practice, education, research and administration (including governance and policy making). Nursing education and involvement with information and communications technologies (ICT) must change to keep pace with the increasing opportunities the technology provides. Nurses in all domains and at all levels must be computer literate to be able to participate in decision making and evaluation of systems. As well, this preparation enables them to take advantage of opportunities to use ICT to support nursing in information management and knowledge development as well as envision new ways of doing work.

## 3.0 Defining Nursing Informatics

A definition for Nursing Informatics (NI) is the starting point for establishing competencies related to informatics education and practice. Consensus on this definition supports the NI education project in moving forward in a coordinated and consolidated fashion. While the history of Nursing Informatics reflects one of specialization, the potential scope for nursing involvement and influence is more extensive than that. The intent of the current definition is to convey NI in a broader context, one that is relevant to all domains of practice:

Nursing Informatics (NI) is the application of computer science and information science to nursing. NI promotes the generation, management and processing of relevant data in order to use information and develop knowledge that supports nursing in all practice domains.

## 4.0 Establishing Nursing Informatics Competencies

Continued advances in IT and sophistication in information management suggests nurses in all domains would benefit from developing technical, conceptual and application skills in these areas. In addition, a move to evidence-based practice also requires informatics skills. However, there have been no systematic processes for determining competencies or the education required to meet them.

Three levels are proposed on a continuum of Nursing Informatics competencies:

1. Entry level RN/manager/educator/researcher who demonstrate core NI competencies;

2. Practicing (more experienced) RN/manager/educator/researcher who demonstrate intermediate NI competencies;
3. Nursing Informatics Specialists who demonstrate advanced NI competencies in one or more domains.

Nurses gather **data** (e.g. from client assessments) which they then interpret, organize and turn into **information** about the condition and care of the client. This information, combined with information from other clients is used to build new nursing **knowledge** about client conditions and nursing interventions. The CNA notes evidence-based decision-making, an important element of quality nursing practice, also includes information about the effectiveness of care and treatments from research and experiential evidence and also contributes to building knowledge.

Therefore, each competency level includes both knowledge and skills required to:
- use information and communication technologies to enter, retrieve and manipulate data;
- interpret and organize data into information to affect nursing practice; and
- combine information to contribute to knowledge development in nursing.

## 5.0 Achieving Nursing Informatics Competencies

The need to adopt a culture in nursing that promotes acceptance and use of information technology has been identified as an important parallel initiative to establishing Nursing Informatics competencies and educational strategies. Strategies for achieving NI competencies in the workplace include understanding theory and practice behind adoption of innovations, training, access to resources (e.g. CNA's plans for a "Virtual Library"), and opportunities for continuing education.

Barriers to achieving NI competencies in the workplace include restricted access to training and training systems for nurses and nursing students, few leaders and educators with NI skills, limited empirical support for the contributions ICT can or will realistically make to nursing and patient outcomes.

## 6.0 Issues and Strategies in Nursing Informatics Education

With the increasing potential for IT to influence all domains of nursing, it is imperative to prepare nurses to be knowledgeable participants in the process of selecting, developing, implementing and evaluating information technology to produce data, use information and generate knowledge.

There are four potential strategies for providing NI education:
- undergraduate and diploma nursing programs (integrated into the curriculum or as individual courses)
- graduate programs (NI specialty or electives);
- formal continuing education for practicing nurses/NI Certificate Program
- non-credit/informal continuing education.

No single strategy will adequately prepare all nurses with NI competencies. The emphasis on one strategy over another, and the resulting shifting of resources, requires discussion to develop an overall national NI education strategy.

Factors in a number of areas will influence the success of NI education initiatives, including funding for faculty preparation and innovative projects; policy changes around tenure requirements which recognize development of informatics resources; requiring NI competencies for all graduating nurses; including NI content in all certificate programs in nursing management; lobbying for NI specialists in each provincial nursing association, union and Ministry of Health.

Collaborative initiatives have been successful in furthering Nursing Informatics education in a variety of settings. These include collaboration among:

- nursing programs to identify the competencies needed and how these might be met;
- healthcare agencies within a geographic area to provide basic NI education programs for practicing nurses;
- departments of health care professions within the educational setting to provide core IT skills and resources to all students;
- educational institutions and industries to develop partnerships as avenues to address infrastructure requirements;
- faculties campus-wide to provide informatics education through core facilities, training all students in the basic competencies and providing forums for information exchanges (while responsibility for higher level competencies remains with each professional school);
- vendors, health care organizations and educational facilities to provide training facilities resulting in creative solutions for limited infrastructure budgets;
- vendors, consultants, other healthcare professions as well as educational institutions have also been successful in providing access to expertise, hardware and software.

Barriers to advances of NI in nursing education including integrating NI into the curriculum includes a need for a nursing culture to promote acceptance and use of information technologies as basic tools for information management and exchange. Barriers occur in three areas:

- **human resources** - lack of time, lack of knowledge, faculty preparation
- **technical resources** including unsuitable software, limited access to appropriate computer hardware and software and the rapid rate of change within the technology industry makes it difficult to keep skills and educational materials current
- **system resources** including little or no support from administration, financial burden of maintaining and upgrading computers and a lack of funding to develop and present programs, as well as declining financial support for continuing nursing education

Workplace constraints also contribute to difficulties in developing NI competencies. For example, nursing workload limits access to existing NI education programs, and few practical learning opportunities exist in the workplace. Without NI competencies, otherwise skilled and experienced nurses are not able to mentor students and there is limited student access to training facilities and trainers.

## 7.0 Developing a National Strategy for Addressing Nursing Informatics Education

The overall goal of this project is to propose a strategy for addressing Nursing Informatics education in Canada. At this stage of the process the Working Committee is attempting to:

- establish core Nursing Informatics competencies for Canadian nurses;
- identify Nursing Informatics education opportunities currently available to Canadian nurses;
- determine Nursing Informatics education priorities.

All of these will be done within the framework of extensive feedback from interested stakeholders.

The question to consider is this: "What difference will it make if Nursing Informatics is not part of the nursing curriculum - today and in the future?" The CNA Workbook *Nursing & Health Information: Toward Consensus on Nursing Care Elements* (January 1998) notes: "Nursing ... is invisible in most clinical and administrative databases. This invisibility has many consequences such as the following: nursing practice may be described as the practice of others, especially physicians; the costs of nursing care are not differentiated from other costs in the health system; and professional accountability is difficult to demonstrate; ... It is important ... for nurses to become knowledgeable about capturing nursing data because health information systems are being developed with the capacity to include nursing information."

As well, the ability to effectively use the available information and communication technologies contributes to managing data, creating information from that data and ultimately generating knowledge about the practice of nursing.

***An opportunity to provide feedback on six areas raised in the discussion paper is provided in a separate document, including:***

## 1.0 Introduction

The potential of Nursing Informatics to enhance nursing practice, study clinical problem-solving and ultimately improve the quality of care has been a long-standing expectation (Peterson & Gerden-Jelger, 1988). However, unlike many other information intensive industries, health care has been slow in adopting IT. Nurses, like other health care professionals, have yet to develop a culture "to promote acceptance and use of information technologies as basic tools for information management and exchange" (National Advisory Council, 1997).

Nursing leaders and educators find themselves with a longstanding need for:
-experts to contribute to shaping the use of computers in nursing;
-appropriate software and hardware to assist nurses in collecting and utilizing nursing/health information; and
-nursing and educational leadership in nursing informatics.

To begin to address these needs a National Steering Committee was formed with representatives from five key nursing organizations, including the Association of Chief Executive Nurses, Canadian Nurses Association, Canadian Association of University Schools of Nursing, Registered Nurses Association of British Columbia and the Nursing Informatics Special Interest Group of COACH. A Working Committee was struck to undertake a *National Nursing Informatics Project,* which has four goals:

- to develop consensus on a definition of Nursing Informatics for Canada;
- to recommend Nursing Informatics competencies for entry level nurses, NI specialists, managers, educators and researchers;
- to identify curriculum implications and strategies for both basic and continuing nursing education; and
- to determine priorities for implementing national nursing informatics education strategies.

In their literature review the Working Committee found limited information about NI competencies and education in Canada. Given their experience, the Committee members felt the U.S. and U.K. literature reflected a situation similar to one in Canadian schools.

For example, a survey of a stratified sample of National League for Nursing accredited diploma, associate, baccalaureate and master programs was conducted to determine the status of computer and information technology in nursing education (Carty & Rosenfeld, 1998). Fifty-five percent of the 347 selected schools responded and all programs were proportionately represented. They noted several key findings:

> Schools have almost universal access to computers and educational software. However, a majority of schools lacked a coordinated plan for technology implementation and were under-financed for technology and related personnel. In addition, less than one third of the schools addressed nursing informatics (the information of nursing) in the curriculum and only 19 schools indicated that nursing informatics was offered as a separate course. (p. 259)

The Working Committee determined little additional information could be gained at this time by surveying Canadian Nursing schools and faculties to determine current courses and competencies. Alternatively, they agreed a discussion paper outlining the issues would be a valuable first step in defining a national nursing informatics education agenda. The purpose of the discussion paper is to:

- outline the scope of Nursing Informatics today and in the future as background to the identification of issues;
- propose a definition for Nursing Informatics;
- identify informatics competencies for four domains of Nursing;
- outline basic and continuing education implications of these competencies;
- solicit feedback from nursing managers, educators and policy makers on the definition, competencies and suggested education strategies.

The long-term intent of the Working Committee is to make recommendations to appropriate National Nursing organizations with respect to developing a National Nursing Informatics Education Strategy. This will include educating nursing students, faculty and practising nurses to meet relevant and necessary competencies. These are essential to fulfill the requirements of data generation, information use and knowledge building today and in the future. The discussion paper is intended as an initial step in this process. A *Glossary of Terms* is provided to assists the reader in understanding terminology and the context in which terms are used in this document (Appendix A).

# 2.0 Background

## *2.1 Introduction*

Recently nursing leaders and educators have recognized the need for every nurse to participate in *nursing informatics*, that is, the use of information and communications technologies in the collection of data, use of information and generation of knowledge to support nursing practice. The history of nursing informatics, however began with individual nurses who took on these responsibilities as representatives of nursing. It is important to recognize this history within the context of current advocacy for NI responsibilities in every domain and level of nursing practice.

## *2.2 History and Role of Nursing Informatics Specialists*

In the early to mid 1980's, Canadian hospitals began implementing Hospital Information Systems (HIS). These systems included clinical applications such as order entry and results reporting that nurses were expected to use. Information Systems (IS) Departments quickly realized that they could not implement these systems without some clinical knowledge of operations. Hospitals hired nurses to provide this clinical-technical bridge in response to the need for clinical input. These nurses had a variety of titles such as "Nursing Systems Coordinator," "Nurse Analyst" and "Nursing Coordinator-Computer Project."

Similarly, in the UK, "Computer Project Nurses" were hired as a result of a flurry of computer implementations as Barnett (1995, p.1317) describes:

> "A centrally funded resource management program was implemented in 1989. This provided money for hardware and systems in all moderate-sized acute hospitals in the National Health Service. It created a short burst of growth in the number of nurses employed to implement nursing information systems. Many of these "Project Nurses" came into the post with little informatics knowledge or experience. They relied on the commercial companies providing the software and on their IT colleagues within the hospitals for technical advice".

In Canada as well NI positions were not initiated by nursing, but were in response to health system requirements. Nursing Systems Coordinators (NSC) were either hired in the nursing department, and worked in a joint relationship with IS, or hired directly by the IS department. (Both these reporting relationships had benefits and drawbacks. The location of these positions in the organization continues to reflect a debate around whether NI should be a nursing specialty within the CNA or an informatics specialty within health informatics.)

The role of early Nursing Systems Coordinators (NSC) was not generally one of reflection on the role of computers in nursing, but focused more on implementation and training nurses to use the system. Once massive implementation efforts were completed and the HIS operational, NSC were less in demand. As well, in response to budget cuts, ongoing training for new employees was often assumed by the Education Department and the NSC position phased out. However, in more recent years clinical expertise is again sought and the position is being reintroduced, but with a broader mandate. The *Clinical Systems Coordinator*, who is responsible for all clinical systems, may or may not be a nurse.

A newer concept of Health Care Informatics Specialist as "a health care professional with direct responsibility for automated information systems within a health care context" represents a recent acceptance of the general need for specialists in this area (Desborough, 1998) A variety of health care professionals may take on these roles, from nurses to physicians, lab technologists and pharmacists. Desborough notes that Health Care Informatics Specialists may assume a number responsibilities including identifying health care information requirements, assisting with the development and testing of hardware and software, preparing IS documents such as proposals or training manuals, implementing and evaluating IS, training staff and supporting IS operations.

Nationally and internationally, NI specialists have sought support from colleagues. Whether NI Specialists belong to a sub-specialty in nursing or health care informatics has not been resolved. For example, in Canada the Nursing Informatics Special Interest Group (NISIG) has been the first and strongest special interest group of COACH. There are also provincial chapters such as the Ontario Nursing Informatics Group, but they maintain a close affiliation with the Canadian Nurses Association. The British Computer Society has 5 Health Informatics Specialist Groups, with Nursing being one of them. The US also has a strong group of NI specialists. Annual conferences, meetings and publications have provided opportunities to network, for ongoing education and to share knowledge and expertise.

Barnett (1995, p. 1318) concluded that in the UK "it would appear after 20 years of effort, only a small proportion of the nursing and midwifery professions have become active in applying nursing informatics to their field of practice." Generally, Nursing Informatics

continues to be seen as a purvey of specialists. This means relatively few nurses are involved in decisions around how information systems will be used by nursing to support nursing practice. For this reason, a National Strategy for NI Education should address ways to broaden all nurses' interest and involvement in Nursing Informatics as well as demonstrating the benefits of this approach.

## *2.3 Moving from Technology to Information*

**Technology Promises Not Met...**

There have been many promises around the benefits of using information technology (IT), but these often do not materialize. For example, a sample of recent promises includes:

> "Informatics will change the way clinicians understand the information that is available to them" (Turley, 1996).
>
> Health care professionals "can make better clinical decisions through effective management of patient care information" (Nagelkirk, et al. 1998).
>
> "Nurses and others collect reams of data they can't access. Technology can transform that data into information nurses can use to help their patients" (Sibbald, 1998).

In a recent case study of the impact of Patient Care Information Systems, nurses noted that using the hospital system did not further the work of nursing (Hebert, 1998b). They felt automating the clerical functions was really a benefit to other departments. Automated information systems have been in place for 10-15 years in some hospitals and many of the benefits predicted for nursing have not materialized. One of the prime selling features for HIS is that nurses and other health care professionals will have more time to spend with patients. However, nurses in the study reported the opposite often occurs, as documentation requirements are increased and new programs become possible with the introduction of the computer system (Hebert, 1998a). Nurses are also often unaware of any empirical evidence supporting that benefits do occur.

In fact, it is not the technology that will bring about these expected changes, but knowledgeable users and developers of the technology that will make the difference. The emphasis must shift from using the technology to facilitating information management and knowledge generation. Activities such as developing critical pathways, performance indicators and outcome evaluation require information. However, in spite of a strong history of nurses who specialize in Nursing Informatics, there has not been widespread adoption of information technology into the culture of nursing. This is a key impetus for identifying necessary competencies and developing educational strategies to achieve them.

**More sophisticated and powerful information systems are available...**

McDonald (1998, p. 9-10) describes the information infrastructure as the nervous system for health care. His eight elements have the potential to affect the work of nurses in clinical practice, education, research and administration (including governance and policy making):

1. *Administrative information systems*, providing complex operating information on which to base decisions.
2. *Clinical information systems*, including the computerized patient record and clinical support systems which provide health professionals with easy access to individual case information as well as a rapidly expanding pool of global clinical knowledge.
3. *Telehealth*, including teleconsultation, telementoring, etc. uses telecommunications to bridge the distance between consumers and health professionals, or between those professionals and specialists who are not physically present.
4. *Population health databases* provide executives and policymakers the information they need to increase the health of the population. Researchers can also benefit from access to this kind of information.
5. *System coordination* provides "nuts-and-bolts" information tools such as geographic information systems (GIS) used to map out health needs in a population, e.g. immunization. Service delivery that is currently available can be overlaid on the key needs and mismatches between needs and service identified.
6. *Educational information systems* provide both clinical and non-clinical training for health professionals and consumers. For example, the use of simulation software may improve retention and help people understand complex procedures.
7. *Health informatics* provides consumers with easy access to personalized information and interactive self-management. Not only do some people have access to information about their health 24 hours a day, seven days a week, they also have decision support.
8. *Community networks* link consumers with similar problems, or to resources or healthy lifestyle interests. True healthy communities communications networks, using the tool sets we are developing, will allow users to both measure and influence the social ecology of health at the community level.

**Nursing education and involvement with ICT must change to keep pace...**
Nurses in all domains and at all levels must be computer literate to be able to participate in decision making and evaluation of systems. As well, this knowledge prepares them to take advantage of opportunities to use information and communications technologies (ICT) to support nursing or envision new ways of doing work. McDonald (1998) describes health system integration in the early 21st century that will offer new opportunities for "Virtual Health Management" through increasing use of the Internet. There are already many examples of this, such as empowering consumer's to take active roles in health decision making through on-line and telephone support (e.g. telephone triage pilot study in Victoria, B.C.).

**Nursing Informatics Education Projects in the US and Europe...**
Projects in other countries have already been initiated to address the concerns of nursing leaders and educators around the ability of nursing to shape its own destiny with respect to information systems and the use of ICT.

The US National Advisory Council on Nurse Education and Practice (NACNEP) "recognized a need to more adequately prepare the registered nurse workforce to manage information using technology." They commissioned a panel of 19 NI experts to consider the current status, future directions and major barriers to reaching full use of cutting edge

information technologies, telecommunications, distance learning, data sets and information systems. A nominal group technique was used to identify and prioritize informatics needs. From this process they developed *A National Informatics Agenda for Nursing Education and Practice* in December 1997.

The Nightingale Project in Europe has a different purpose in mind and limits its scope to providing curriculum development for Nursing Informatics. They began the project by reaching a consensus on NI competencies and developing partnerships with users, educators and software developers. Currently they are implementing the curriculum at various pilot sites across Europe and evaluating their success.

**Need for Nursing Informatics Education in Canada**

*Canadian Nursing Leaders and Educators* have reached similar conclusions on the need for NI education. This national project is part of the process of considering how nurses, now and in the future, can best be prepared to actively participate in the decisions related to using and evaluating information and ICT in their practice, as well as developing new applications which benefit nursing and seeing opportunities for new ways of doing work. While in the past the focus may have been more on using the technology, in all of these areas the preparation of nurses must focus more on producing and using information that supports knowledge generation in nursing.

# 3.0 Defining Nursing Informatics

## *3.1 Why Is It Important to Define Nursing Informatics?*

Understanding the scope of Nursing Informatics (NI) today and in the future provides a background for the identification of issues. The U.S. National Advisory Council on Nurse Education and Practice suggests that the definition of Nursing Informatics is a dynamic one that is "changing to reflect the maturity of the specialty." This is true in part because the technology is developing in sophistication and computing power, introducing new opportunities for application. For example, new internet based education tools hold much promise for nurses to support the health care consumer (Desborough, 1999). However, it remains imperative that the focus for NI be on information and its value to nursing, not the technology.

A definition is the starting point for establishing competencies related to informatics education and practice. Consensus on this definition supports the NI education project in moving forward in a coordinated and consolidated fashion. While the history of Nursing Informatics reflects one of specialization, the potential scope for nursing involvement and influence is more extensive than that. The intent of the current definition is to convey NI in a broader context, one that is relevant to all domains of practice.

A definition is the starting point for establishing competencies related to informatics education and practice. Consensus on this definition supports the NI education project in moving forward in a coordinated and consolidated fashion.

### *3.2 Proposed Definition of Nursing Informatics*

The proposed definition was developed through input from two sources:

- a literature review (summarized in Appendix B);
- discussion and debate among Working Group members.

A number of important elements have been identified, and consensus has yet to be reached on their roles in defining NI. They include:

- cognitive science (knowledge, reasoning & decision-making)
- information science and information
- computer science and technology
- nursing science
- health care and health care informatics
- interaction between discipline-specific science (e.g. nursing) and the area of informatics (Turley, 1996)

Consider the following proposed definition:

***Nursing Informatics (NI)*** **is the application of computer science and information science to nursing. NI promotes the generation, management and processing of relevant data in order to use information and develop knowledge that supports nursing in all practice domains.**

### *3.3 Key Points for Reflection and Discussion*

- **Do all nurses need to have NI competencies?**

NI is, and has been, a specialty, with competencies acquired through additional education and on-the-job training. However, with advanced and pervasive uses of information technology, NI skills are increasingly required in all domains. For this reason, competencies should be identified for each domain of practice: clinical (where direct patient care is provided), administration, education, and research. Equally important are the areas of policy development and governance. For the purposes of this discussion paper, it is assumed that nurses who are policy makers or in positions of governance, would be expected to demonstrate the NI competencies of a senior level practitioner in one of the other four domains before moving into these positions.

- **Should the definition be restricted to "nursing data"? Will it affect the intent of the definition and its implementation?**

The definition may refer to a specific type of data or simply to data that supports nursing practice. There may be some difficulty in deciding what is and is not nursing data as the technology makes it easier to move information among professional groups and organizations. If NI encompasses all domains of nursing and "supports patient centered computing" it will include clinical, educational, administrative and research data. As nurses become involved in other uses of ICT, e.g. patient teaching via the Internet, there may not be "nursing data" per se, but nurses will continue to require skills and knowledge to manage the technology and information, in the fulfillment of nursing responsibilities.

- **Is "Nursing Minimum Data Set" an essential element of the NI definition?**

While identifying a Nursing Minimum Data Set (NMDS) is critical to the use of information technology by nurses, is it necessary to include this in the definition of NI? This data set includes information on client assessment, nursing interventions, nursing resource use and client outcomes. It assists and supports clinical, administrative, educational, research and policy development decisions. This data must be collected to ensure nursing care is recorded for long term consideration in determining patient outcomes and documenting the care provided by nurses. For this reason, data categories reflecting nursing components of the health information to be collected (HI:NC) are being specifically identified in order to reflect nursing contribution to the health of Canadians (CNA Policy Statement, 1993).

**Feedback: Does the proposed definition of Nursing Informatics provide the basis for proceeding with identifying competencies and building an education strategy?**

# 4.0 Establishing Nursing Informatics Competencies

## *4.1 Nursing Informatics Knowledge and Skills Required in All Domains*

Reaching consensus on a definition of NI and the required competencies are necessary first steps in responding to statements such as, "Practicing nurses are not necessarily computer competent" (National Advisory Council, 1997). Both the baseline for determining a deficiency exists, as well as for the remedial steps, need to be clearly stated.

However, this is not a simple exercise, as continued advances in information technology and sophistication in information management suggests nurses from all domains would benefit from technical, conceptual and application skills. A move to evidence-based practice also requires informatics skills. However, there have been no systematic processes for determining competencies or the education required to meet them.

Environmental factors, particularly the degree and sophistication of computer implementation in the workplace also affect the competencies required. These differences are determined by:

- champions who are able to generate support and secure funding;
- geographic location (e.g. urban or rural may affect technical infrastructure available);
- size of facility (e.g. number of beds or clients may affect cost-benefit of investing in IT);
- type of facility (e.g. acute or community care), and
- area of specialty (e.g. ICU or extended care, which affects the complexity of data and need for quick turnaround of information).

Many examples from across Canada demonstrate the variety of NI projects being carried out by nurses working in all domains of nursing practice. A small selection of these projects illustrate the diversity:

- telehealth projects, e.g. Children's Hospitals in Vancouver and Toronto
- community health and home care projects, e.g. St. Elizabeth's HomeCare in Nova Scotia

- inclusion of nurses on provincial IT healthcare strategic planning task forces, e.g. PEI, Ontario, B.C.
- collaborative production of CD/Internet courseware for nursing by the Atlantic schools of nursing
- on-line courses, e.g. NI - Athabasca University; Health Information Science - University of Victoria
- CNA's Knowledge Network project.

In addition, nurses with specialty NI knowledge are needed to contribute to decision-making around system selection and to develop systems that will benefit nurses. A wide variety of roles and responsibilities for informatics nurses has evolved. A survey of 500 nurses in the U.S. identified 26 position titles for NI nurses (Arnold, 1996). Many others are experienced practitioners with informal training in NI, who have learned their specialty "on the job."

In spite of this variation in job title, results of a survey of 48 nurses currently in NI positions showed their professional responsibilities continue to include support for users, training, development and project management (Rosen & Routon, 1998). The NI nurses felt their major challenge was to bring the clinical voice to data-driven projects while meeting timelines, cost constraints, and facilitating desired outcomes.

Appropriate software and hardware are also needed to assist nurses in collecting and utilizing nursing/health information. Gaps in this area contribute to the difficulty in identifying core competencies that will apply across different geographic locations and domains of practice. A common nursing language, the goal of identifying the nursing components of health information (HI:NC) is expected to help set standards and further nursing use of information and communication technologies.

### *4.2 Nursing Informatics Competencies in Nursing Education Programs*

An informatics task force at the University of Maryland identified 3 levels of competencies for their multi-disciplinary student body that reflected technical, professional and advanced uses (Ball & Douglas, 1989). Based on earlier work describing informatics competencies for medical students, Grobe (1986) identified seven levels of competencies for nursing students (Table 1 - described in more detail in Appendix C). While Grobe's competencies are divided into more detailed categories, they are compatible with the three uses proposed by Ball & Douglas (1989): technical, professional and advanced.

### *4.3 Nursing Informatics Competencies in the Workplace*

NI competencies required by nurses in the workplace are classified in the literature in a number of ways. However, there are more similarities than differences in these classifications. Competencies found in the literature (Appendix D) are compared using three commonly used categories:

- use of information and communication technology (i.e. technical skills),
- use of automated information in a professional context (i.e. effectiveness skills) and
- decision-making with respect to planning for and using both the technology and information (i.e. advocacy or leadership skills).

| Grobe's competencies | BN/RN | MN | PhD | NI specialty | Ball & Douglas' competencies |
|---|---|---|---|---|---|
| 1. Use basic information handling tools | Π | Π | Π | Π | technical |
| 2. Independently learn about computers and information management | Π | Π | Π | Π | technical |
| 3. Use computer systems and access databases | Π | Π | Π | Π | professional |
| 4. Knowledgeably use systems and specialized databases | | Π | Π | Π | professional |
| 5. Perceive new applications | | | Π | Π | advanced |
| 6. Build systems for personal applications | | | Π | Π | advanced |
| 7. Build tools | | | Π | Π | advanced |

**Table 1 - Nursing Informatics Competencies in Nursing Education Programs**

Unfortunately, most of the taxonomies do not identify how the competencies were established, which makes it difficult to update them as needed. For this reason, Grobe's (1986) schema is particularly helpful as a place to begin identifying a comprehensive taxonomy of competencies. She suggests competency levels exist on a continuum and classifies them from *user* (use IS effectively), to *modifier* (analyze, manage, modify, critique and evaluate IS) and *innovator* (design and develop IS).

Grobe (1986) went one step further and developed a competency grid for each practice domain that identifies the role functions for each domain and then the corresponding range of NI competencies needed to perform those functions. This conceptualization provides a useful template which can be adapted in the process of identifying NI competencies. However, one word of caution is in its current relevance (developed in 1986), and to be useful it needs to be updated to reflect:

- changes in nursing role functions;
- sophistication of communication systems, software and information available through the Internet; and
- changes in NI competencies as a result of outmoded technology (e.g. online mainframe statistical applications versus PC-based software).

Grobe's taxonomy provides the basis for developing the proposed NI competencies (Table 2). Her complete role functions and competencies are listed in Appendices E1-4. Note that very few references specifically include extensive use of the Internet to provide and access information. Cheek & Doskatch (1998) caution these may be overlooked because effectively using the Internet requires extending information literacy skills in this area. This means

nurses need to learn how to define a search, develop a search strategy and analyze the information obtained.

### *4.4 Proposed Nursing Informatics Competencies*

There is no single set of Nursing Informatics competencies, but rather a series of competencies that may be thought of as on a continuum. As with skill and knowledge development in other content areas, only some of the competencies can be expected of entry level RN's, while additional ones are expected for practicing nurses who are more experienced.

Within this continuum of NI competencies, three levels are proposed:

1. Entry level RN/manager/educator/researcher who demonstrate core NI competencies;
2. Practicing (more experienced) RN/manager/educator/researcher who demonstrate intermediate NI competencies;
3. Nursing Informatics Specialists who demonstrate advanced NI competencies in one or more domains.

"The assumption underlying the nursing care information process is that nurses gather **data** (e.g. from client assessments) which they then interpret, organize and turn into **information** about the condition and care of the client. This information, combined with information from other clients is used to build new nursing **knowledge** about client conditions and nursing interventions (CNA, 1998a, p. 2). Note that the CNA defines clients as individuals, families, groups, communities and populations. Evidence-based decision-making, an important element of quality nursing practice, also includes information about the effectiveness of care and treatments from research and experiential evidence in building knowledge (CNA, 1998b).

Therefore, each competency level includes both knowledge and skills required to:

- use information and communication technologies to enter, retrieve and manipulate data;
- interpret and organize data into information to affect nursing practice; and
- combine information to contribute to knowledge development in nursing.

Based on Grobe's (1986) earlier work, a taxonomy of NI competencies is proposed (Table 2) as a starting point for discussion.

### *4.5 Key Points for Refection and Discussion*

- **Developing and adopting a framework which identifies NI competencies initially creates a gap between current knowledge and skills and those desired in the future.**

The education plan must balance the "need" for education created through introducing desired NI competencies and daily requirements in practice. Adopting a computer culture in nursing may be a higher priority.

- **Should information include both "automated" and paper-based systems?**

Nurses already learn how to manage paper systems such as flow charts, lab results and patient charts without the presence of technology. Does everyone agree that NI competencies assume these paper-based skills and knowledge?

- **Does information literacy belong in all competency levels, or should the initial level focus on competencies in using the technology?**

This question is strongly debated. However, without strong skills in understanding and using the technology, nurses will find it difficult to progress to generating information.

- **How important are Nursing Informatics issues for the nursing profession?**

Educating all nurses is an important consideration, so NI issues can be effectively addressed. However, adopting an "informatics culture" is also an important element in raising awareness of NI issues.

**Feedback: On what basis should competencies be determined? Is the taxonomy in Table 2 useful? Is it complete? Are there competencies to add or delete?**

| **Proposed Taxonomy of Nursing Informatics Competency Levels** | | |
|---|---|---|
| ***1. Nurses involved in direct care are responsible for:*** | | |
| ***1.1 Documenting Nursing Practice*** | | |
| **Core NI competencies include:**<br>-knowing about the type of system in use<br>-documenting patient care on-line<br>-knowing how health and nursing informatics impacts nursing | **Intermediate NI competencies include:**<br>-analyzing the strengths and weaknesses of the system in use<br>-demonstrating a broad knowledge of different systems that can be used for practice | **Advanced NI competencies include:**<br>-participating in designing and developing systems for nursing practice functions<br>-designing or participating in designing documentation tools for nursing |
| ***1.2 Accessing Information*** | | |
| **Core NI competencies include:**<br>-accessing the data used locally for patient care<br>-knowing information sources, resources and retrieval techniques | **Intermediate NI competencies include:**<br>-demonstrating awareness of other sources of data that relate to practice and care<br>-accessing and using these sources | **Advanced NI competencies include:**<br>-developing new ways to interact with information systems and to access data<br>-understanding the data structures used to organize patient data |
| ***1.3 Using Data and Information*** | | |
| **Core NI competencies include:**<br>-retrieving data for clinical decision making<br>-synthesizing data and information for clinical decision-making<br>-examining client data for | **Intermediate NI competencies include:**<br>-creating new information through retrieval and use of data from more than one source<br>-using decision support and communication systems | **Advanced NI competencies include:**<br>-contributing to organizational use of information<br>-synthesizing data and information to contribute to knowledge generation |

| Proposed Taxonomy of Nursing Informatics Competency Levels | | |
|---|---|---|
| emerging patterns<br>-understanding and complying with standards for privacy, confidentiality and security in the management of health information | -using information and communications technology support for evidence-based practice | |
| ***1.4 Coordinating information flow*** | | |
| **Core NI competencies include:**<br>-understanding how nursing care data elements are integrated with health information and contribute to client care | **Intermediate NI competencies include:**<br>-knowing how nursing informatics is integrated into components of the health information systems (e.g. documents, information systems, management systems, policy manuals, etc.) | **Advanced NI competencies include:**<br>?? |
| ***2. Nurse Managers/Administrators are responsible for:*** | | |
| ***2.1 Directing the organization of information*** | | |
| **Core NI competencies include:**<br>-communicating informatics' needs to a systems analyst | **Intermediate NI competencies include:**<br>-participating in system analysis for nursing management functions | **Advanced NI competencies include:**<br>-participating in the development of new tools for management purposes |
| ***2.2 Accessing information*** | | |
| **Entry level competencies** include:<br>-knowing data storage methods<br>-using data for management decision making<br>-understanding the principles of ergonomics and using workstations safely | **Intermediate NI competencies include:**<br>-evaluating data storage capacities of the system in use<br>-evaluating networks for communication purposes<br>-analyzing the health and safety aspects of the work station and its location | **Advanced NI competencies include:**<br>-participating in modifying or developing new methods to improve the efficiency and/or effectiveness of data storage & its communication<br>-participating in the design of the work station environment |
| ***2.3 Using data and information in decision-making related to a unit or department*** | | |
| **Core NI competencies include:**<br>-using available tools for data management | **Intermediate NI competencies include:**<br>-designing tools for collecting and managing data for decision-making<br>-using multiple sources of evidence for decision-making<br>-using data from various sources for cost analysis and providing information on quality management | **Advanced NI competencies include:**<br>-developing templates for general use by nurses<br>-contributing information for use in evidence-based decision making within the organization |
| ***2.4 Communicating and networking both inside and outside the organization*** | | |
| **Core NI competencies include:** | **Intermediate NI competencies** | **Advanced NI competencies** |

| Proposed Taxonomy of Nursing Informatics Competency Levels | | |
|---|---|---|
| -understanding the impact of system's implementation on nursing practice | **include:**<br>-evaluating the impact of a system's implementation on nursing practice | **include:**<br>-designing and developing methods for project management |
| ***2.5 Assuring ethical standards are met and data protected*** | | |
| **Core NI competencies include:**<br>-knowing the principles of data integrity, professional ethics and legal requirements<br>-understanding ways to protect data | **Intermediate NI competencies include:**<br>-monitoring and evaluating the system's capacity to protect data<br>-monitoring that ethical standards are upheld | **Advanced NI competencies include:**<br>-participating in the development and integration of security and data protection for information systems |
| ***3. Nurse Educators are responsible for:*** | | |
| ***3.1 Teaching about the use of available computer-based applications for providing care, administering care, and conducting research about care*** | | |
| **Core NI competencies include:**<br>-teaching and evaluating the required informatics competencies appropriate to the level of the learner | **Intermediate NI competencies include:**<br>-teaching and evaluating the informatics competencies required for practicing nurses, nurse administrators, and nurse researchers at the appropriate level | **Advanced NI competencies include:**<br>-participating with practicing nurses, nurse administrators, and nurse researchers to define new informatics competencies |
| ***3.2 Teaching with computer-based instructional materials*** | | |
| **Core NI competencies include:**<br>-preparing instructional materials using informatics tools | **Intermediate NI competencies include:**<br>-evaluating strengths and weaknesses of informatics tools and resources to support teacher preparation of instructional materials | **Advanced NI competencies include:**<br>-designing, developing and implementing informatics tools for instructional support activities |
| ***3.3 Determining what instructional material should be available and how it should be provided for learners*** | | |
| **Core NI competencies include:**<br>-reviewing, selecting, and operating computer-assisted learning materials, CAI and CMI systems<br>-reviewing and selecting internet-based materials | **Intermediate NI competencies include:**<br>-evaluating commercial CAI/CMI software for system wide use<br>-evaluating internet-based materials | **Advanced NI competencies include:**<br>-designing, developing and implementing hardware & software for CAI/CMI<br>-designing, developing and implementing internet based materials |
| ***3.4 Performing student assessment and evaluation functions*** | | |
| **Core NI competencies include:**<br>-using informatics tools for supporting student assessment activities | **Intermediate NI competencies include:**<br>-evaluating informatics tools for the assessment of student performance | **Advanced NI competencies include:**<br>-designing, developing and implementing informatics tools for student assessment & evaluation |

| Proposed Taxonomy of Nursing Informatics Competency Levels | | |
|---|---|---|
| ***4. Nurse Researchers are responsible for:*** | | |
| ***4.1 Retrieving bibliographic citations & primary source data electronically*** | | |
| **Core NI competencies include:**<br>-knowing appropriate search strategies for a variety of resources<br>-conducting literature searches using on-line resources and databases | **Intermediate NI competencies include:**<br>-extracting selected literature resources and integrating them into personally usable databases | **Advanced NI competencies include:**<br>-developing tools and strategies to assist nurses in literature searches |
| ***4.2 Accessing, communicating and storing data*** | | |
| **Core NI competencies include:**<br>-accessing shared data sets for multi-site research | **Intermediate NI competencies include:**<br>-transmitting and receiving research documents electronically | **Advanced NI competencies include:**<br>-organizing and directing central facilities for shared data sets |
| ***4.3 Managing and manipulating data*** | | |
| **Core NI competencies include:**<br>-defining, structuring and maintaining data sets | **Intermediate NI competencies include:**<br>-altering defined data structures to interface with other data structures | **Advanced NI competencies include:**<br>-manipulating data sets |
| ***4.4 Generating new knowledge*** | | |
| **Core NI competencies include:**<br>-preparing documents such as research proposals, data-gathering tools, consent forms, articles and reports | **Intermediate NI competencies include:**<br>-designing automated data collection tools<br>-using automated tools to analyze both quantitative and qualitative data | **Advanced NI competencies include:**<br>-analyzing information to generate new knowledge<br>-using on-line tools for disseminating findings |

**Table 2 - Proposed Taxonomy of Nursing Informatics Competencies**

# 5.0 Achieving NI Competencies

## *5.1 Adopting an Informatics Culture in Nursing*

The need to adopt a culture in nursing that promotes acceptance and use of information technology has been identified as an important parallel initiative to establishing NI competencies and educational strategies (National Advisory Council, 1997). In this respect, the process of developing a National NI Educational Strategy may be supported and moved forward by considering results of research in the adoption of innovations. Barnett (1995) found his research into adoption of the nursing process approach in one London Health Authority reflected results of a twenty year program of research that investigated the introduction of changes within the curriculum of selected North American schools (Hall & Hard, 1989).

Based on Fuller, et al.'s (1969) earlier work, Hall & Hard (1989) suggested individuals pass through 6 stages of concern when they are faced with introducing a specific innovation into

their daily work (Figure 1). Barnett (1995) confirmed that only as familiarity develops can individuals move on to learning in more detail, the impact or consequences of making that change on patients and colleagues. Those who gain confidence may then become concerned about collaborating with colleagues in the use of the innovation and a few may go on to concerns about refocusing the innovation and its wider application. (This is the role of the NI Specialists.)

Barnett (1995) concludes that in the UK it would appear that many professionals are still at level zero in relation to informatics in general. He notes that:

> "a skilled and expert group operating at levels 5 and 6 in their concerns about informatics may be able to ensure professions are provided with the systems tailored to their clinical and other professional needs. However, the evidence from some of the English studies shows this has not been achieved. To be able to achieve a much wider involvement in the development of systems to suit the clinical needs of practitioners, a much larger proportion of the professions need to move to level four in their concerns about the introduction of nursing systems. Raising the level of awareness of the implications for their personal professional practice appears to need the adoption of new strategies in order to raise the levels of concern to at least that of being ready to seek information. The policy makers have to assess the variations in the levels of concern both with organizations and in the different professional fields; then they can target their activities" (Barnett, 1995, p.1319).

These results suggest that singularly focusing on changes in curriculum will not accomplish changes in the health system or in nursing practice if the overall nursing culture has not adopted information technology. In developing a National Nursing Informatics Strategy for education, two areas could be considered:

- In order to support "informatics" as an element of nursing culture, it may be useful to identify strategies to ensure most nurses are at least stage 4 of acceptance.
- To move through the stages of acceptance, nursing informatics education must take a multi-pronged approach, with continued education in all domains of practice, as well as in basic and graduate education.

## *5.2 Strategies for Achieving NI Competencies in the Workplace*

**Understanding Theory and Practice Behind Adoption of Innovations**

A general understanding of the literature around adoption of innovations is helpful for nurses charged with the responsibility of selecting and implementing systems. Developing the necessary competencies is not only a factor of having the right technology and learning how to use it, but also of adopting new ways of approaching information and work. Organizational support and a "champion" have been associated with successful adoption of innovations, including the support required for implementation, e.g. training (Rogers, 1995).

Understanding factors that affect acceptance and use of the technology by nurses provides useful information in selection and implementation of IS and consequently cultural changes and development of competencies. Rogers identifies characteristics that influence adoption of innovations (like IS) including, how easy it is to use, relative advantage, compatibility, trialability (opportunity to try the innovation before adopting it), and observability (others can also see the benefits). A study of how these factors and others influence attitudes and the

use of bedside terminals also points to the influence of peers as well as managers, notably the Director of Nursing (Hebert & Benbasat, 1994). Equally important are opportunities to discuss how changes in the generation and use of information impact practice (Hebert, 1998b).

**0. Awareness**
Little concern about, or involvement with, the innovation.

**1. Informational**
A general awareness and interest in learning, unworried about self in relation to innovation.

**2. Personal**
Uncertain about the personal demands and personal adequacy for the new role, including: rewards, decision making, potential conflicts, commitment, personal status.

**3. Management**
Attention is focused on the processes and tasks of using the innovation, issues relating to: efficiency, organizing, managing, scheduling, time demands.

**4. Consequence**
Attention focuses on impact of the innovation on the student/patient in nurse's immediate sphere of influence: relevance, outcomes, changes needed to improve outcomes.

**5. Collaboration**
Outward focus on co-ordination and co-operation regarding the use of the innovation.

**6. Refocusing**
Outward focus on more universal benefits from innovation: major changes, replace with more powerful version, personal ideas for making further change.

**Figure 1 - Stages of Concern and Key Characteristics**
(Barnett, 1995, p. 1319 - Based on Hall & Hord, 1987, p. 60)

**Training**
Organizations that have implemented information systems provide training that is generally very comprehensive, but only directly relevant to using that particular system. Trainers note that having time and locations free from distractions are essential elements for ongoing training.

**Access to Resources**
On a national level a number of strategies support the development of workplace competence. The CNA is in the planning stages of a "Virtual Library" which will provide access to on-line resources for nurses from any location across the country. The Health Canada Infostructure under development will also provide both physical infrastructure through cables and hardware, and also increase access to resources.

**Continuing Education**

There are few hands-on learning opportunities in the workplace for practitioners in all domains to develop other core competencies (Simpson, 1996). While continuing education opportunities, both for developing core and advanced skills, are currently limited, this may change with opportunities to complete courses offered via the Internet. An additional concern is that nurses who do not have NI competencies, but are otherwise skilled practitioners, are not able to mentor nursing students in this area.

If NI Specialists are available, they provide valuable input into system selection and implementation including training. In the workplace there is also a need for expertise in NI at in practice and management domains in order to mentor new staff and students.

### *5.3 Barriers to Achieving NI Competencies in the Workplace*

**Restricted Access to Training and Training Systems**
Sometimes computer access may not be available for students. A study of nursing computer literacy in the Finnish health system revealed one of the difficulties in developing skills was the fact that student nurses on hospital wards were denied access to hospital information systems (Saranto & Leino-Kilpi, 1997). In Canada this situation may also occur if students do not have an opportunity to complete the necessary computer training offered to nursing staff. This may be the result of limited computer training facilities, nurses not being available to conduct the training and faculty not being skilled enough in use of the system to teach it to students.

**Few Leaders and Educators with NI Skills**

**Limited empirical support for the contributions ICT can or will realistically make to nursing and patient outcomes.**

### *5.4 Key Points for Reflection and Discussion*

- **With respect to the use of ICT for information management and knowledge generation in nursing, is there a consensus on the need for a cultural change in adopting more of a knowledgeable position?** If so, what strategies would be the most effective and cost efficient for supporting this change?

- **What are the priorities for human resource development,** i.e. start with nurses in practice, administration, education or research? Or start with faculty and students?

## 6.0 Issues and Strategies in Nursing Informatics Education

### *6.1 Introduction*

Given the past emphasis on NI as a specialty, both nationally and internationally, it is not surprising that programs for developing Nursing Informatics Specialists have drawn more attention than NI integrated into the nursing curriculum. This is in spite of the fact that the specialty attracts relatively few nurses. Although nurses have been in NI roles for many years, NI was only designated a specialty by the American Nurses Association in 1991.

Currently in Canada there are too few nurses specializing in informatics for the Canadian Nurses Association to develop NI Certification standards and exams. However, Laurie-Shaw & Remus (1999) report the ANA is potentially looking for partnering opportunities with respect to their process.

Arnold (1996) suggests that Nursing Informatics graduate and continuing education programs are necessary to meet the increased demand for informatics knowledge, if nurses are to stay on the "cutting edge." But beyond this need for specialists, the U.S. National Informatics Agenda for Nursing Education and Practice (1997) emphasizes the need to identify and incorporate informatics skills and competencies for all levels of education (basic, graduate, post-graduate, continuing education, and informatics specialization).

With the increasing potential for IS to influence all domains of nursing, it is imperative to prepare nurses to be knowledgeable participants in the process of selecting, developing, implementing, and evaluating information technology to produce data and use information as well as generate knowledge.

### *6.2 Nursing Informatics Education Strategies*

There are four potential strategies for providing NI education:

- undergraduate and diploma nursing programs (integrated into the curriculum or as individual courses)
- graduate programs (NI specialty or electives);
- formal continuing education for practicing nurses/NI Certificate Program
- non-credit/informal continuing education.

No single strategy will adequately prepare all nurses with NI competencies. The emphasis on one strategy over another, and the resulting shifting of resources, requires discussion to develop an overall national NI education strategy.

**NI Education in Undergraduate/Diploma Nursing Programs**

Two models are currently in use: integration of NI into the curriculum and separate NI courses. However, the general feeling is that nursing practice in every setting involves collecting, managing, processing, transforming, and communicating information (Lange, 1997). This points to the importance of integrating NI content into the nursing curriculum, a direction confirmed in a recent survey of 162 Finnish nurse educators (Saranto & Tallberg, 1998).

To a large extent RN/degree nursing programs in Canada do not have NI courses nor do practicing nurses have access to NI courses. There has been no consensus on the role of existing NI courses, which many feel tend to focus on the technology, rather than on information management. This is compounded by few nursing educators who are qualified or interested in teaching NI. Desborough (1999) notes that in basic and post-basic nursing education programs in Canada where NI content is currently included, this content is usually offered as a separate course, and is frequently taught by faculty who are not nurses. The emphasis in these courses is usually on the technology, with minimal discussion on its applicability to nursing" (Desborough, e-mail communication, 1999). However, in

Australia, Carter & McGuiness (1997) note that since 1992 the NI subject has undergone a transformation that has moved the focus away from computer skills (eg. word processing) to one of exploring the relevance of information technology for nursing practice.

The need for informatics education is not limited to nursing as other health professions are also attempting to integrate informatics into their curricula (Ball, et al., 1989). In medical schools there are examples of integrating medical informatics into other courses (Tuinstra, 1989), providing a block course in medical informatics (Hasman, 1989) and defining a national curriculum in informatics (Cameron, 1998).

Given this widespread interest it may be useful to explore ways to achieve common core competencies, while at the same time sharing the necessary resources (as some universities and colleges are already doing). Concepts in NI could be integrated through-out the nursing curriculum in a variety of ways with entry level competencies as the end goal. For example, one competency may be manipulation of patient data in a spreadsheet for a written report. While the focus of the nursing course is a particular clinical topic, general skills in using spreadsheet software would not be taught in the course. Rather, because these skills are required by all students, non-credit, introductory courses in word processing, spreadsheets and databases could be offered jointly with other faculties to students prior to beginning their respective programs or as credit elective courses.

The nursing applications of technology and management of information resources could also become a collaborative effort. Sharing technical, human and curriculum resources among Nursing Faculties or Programs is another way to address the need for NI additions to the curriculum. Some programs already do this for other resource requirements and, as Abbott (1998) describes, some are already collaborating on NI curriculum development.

**Graduate Education (NI specialty or elective courses)**

NI may be offered as specialty area in graduate studies. In-depth domain knowledge in conjunction with graduate preparation in informatics is the “hallmark” of the informatics nurse specialist (Lange, 1997). Mounting this type of specialty program requires a considerable dedication of resources to develop the requisite courses and fund the necessary technology, as well as faculty expertise to supervise students and projects. Another critical element for the program is opportunities for gaining practical experience with IS in a variety of settings. The program’s success also depends in part on having a minimum number of students enrolled. Of necessity, these types of programs are limited in number and a national strategy may consider supporting only selected sites across Canada.

In a needs assessment conducted with 664 graduates of a distance BSN program, the majority were interested in a Master’s in Nursing with an NI concentration rather than an NI certificate program (Nesler, et al., 1998). Participants wanted “hands on” practice, computer applications in health care, managerial and clinical practice systems and review of ethical and legal issues. There are a number of existing programs, such as the Master’s in Nursing Program at University of Maryland in Baltimore, which includes a specialty in Nursing Informatics (Romano & Heller, 1990).

Alternatively, NI may be offered as elective courses in a Nursing Graduate program. Some Canadian universities already offer graduate courses in Nursing Informatics (e.g. Faculty of Nursing - University of Toronto). It may be beneficial to investigate whether NI courses could become self-generating through offering the same content in non-credit courses. Alternatively, permitting students to audit the NI courses for a fee may increase the number of offerings for graduate students as well as provide additional NI courses for advanced practicing nurses, managers, educators and researchers.

**Formal Continuing Education for Practicing Nurses (NI Certificate Program)**
The type of NI education desired by practicing nurses appears to vary based on their educational preparation. As noted above, recent BSN graduates were primarily interested in graduate NI specialties. However, in a survey of 497 nurse managers, educators and informatics nurses to determine their information needs around informatics, most participants held a higher degree and expressed a preference for a certificate program (Arnold, 1996). Four of the five applications they identified as critical components (word processing, e-mail, HIS, databases and spreadsheets) might be considered entry level skills. The fifth application, presentation packages, may be considered an intermediate skill.

In addition, a certificate program has the advantage of being incorporated into a degree program and/or offered on a continuing basis (McGonigle & Eggers, 1991). Individual courses could be taken by nurses to meet their specific learning needs. Course development could be guided by the American Nurses Association's specific requirements for NI Certification (Simpson, 1995).

Alternatively, nurses may choose to participate in Health Informatics Programs, with a specialty in NI. Covvey & MacNeill (1999) describe Applied Health Care Informaticians as health care informatics professionals who are dedicated to the deployment of appropriate information technologies in support of health care processes. These professionals, if they are to competently serve the healthcare system, require a well developed knowledge base that encompasses the healthcare system, computer science, and healthcare information systems (related topics known as the "Body of Knowledge"), and a set of intellectual and procedural skills (called the "Body of Skills").

It may be appropriate to consider what specific skills and knowledge a Nursing Informatics specialist might need that would be different from other health care informatics professionals. Could nurses with strong clinical backgrounds become sufficiently skilled in a general health care informatics program to assist nursing in moving forward in this arena? There are a number of projects underway supporting education of health informatics specialists that nursing may develop partnerships with. For example, a distance learning health informatics project has been proposed to the National Office of Learning Technologies (Lau, Hebert, et. al., 1998) and HEALNet (a national research consortium) is investigating the possibility of a Health Informatics Graduate or Certificate Program (Briand & Royce, 1999, p. 68).

**Informal Continuing Education and Resources for Practicing Nurses**
Simpson (1994) notes there are few practical learning opportunities for practicing nurse managers to develop the necessary core competencies, including knowing how to actively participate in needs assessment, selection and maintenance of IT that will be used by nurses. It is precisely for this reason that NI Specialists can play a role in supporting nurse managers who have NI responsibilities. For example, the Nursing Informatics Special Interest Group of COACH published a *Framework for Planning Nursing Information Systems* (Cho, et al. 1992) which provides practical information for nurse managers.

This area of education is particularly important in supporting a change in culture.

**Feedback: How are Nursing Informatics competencies currently identified and taught in nursing programs and in continuing education? Where is the expertise in NI course development?**

### *6.3 Key Success Factors in Developing Nursing Informatics Education*

Factors in a number of areas will influence the success of NI education initiatives.

**Funding**-for faculty preparation, innovative projects, etc.

**Policy**-tenure requirements which recognize development of courseware, Web sites, etc.;
-requiring NI competencies for all graduating nurses; including NI content in all certificate programs in nursing management;
-lobbying for NI specialists in each provincial nursing association and union as well as each Ministry of Health, etc.

**Collaborative Initiatives**-healthcare agencies within a geographic area uniting to provide basic NI education programs for practicing nurses;

-schools of nursing collaborating to develop curricula and courseware.
Support for successful integration of NI into the curriculum has been found in a number of collaborative strategies, such as The *Collaborative Nursing Program in British Columbia* (Abbott, 1998). Nursing educators work together to identify the competencies needed and how these might be met. They share learning activities at annual course reviews in the spring. Abbott confirms that, "For nursing informatics integration throughout the curriculum to be successful, a clear commitment by faculty is critical."

-faculties collaborating to provide core informatics skills
Collaboration within the educational setting to provide IT skills and resources to all students as well as partnerships with industry have been suggested as possible avenues to address infrastructure requirements.

An Informatics Task Force at the University of Maryland identified a taxonomy of informatics competencies necessary for their multi-disciplinary student body (Ball & Douglas, 1989). To achieve this goal, they recommend support for campus-wide informatics through core facilities, training all students in the basic competencies and providing forums for information exchanges. Responsibility for higher level competencies resides with each professional school.

**Community Partnerships** - with vendors, consultants, other healthcare professions (medicine, pharmacy, etc.-these professions also have significant informatics education needs- as well as educational institutions so as to provide access to expertise, hardware & software.

Carter & McGuiness (1997) describe a highly effective and collaborative approach to NI curriculum development in an Australian Graduate Diploma program. Their goals were to provide faculty with opportunities to work with IT in the practice environment; to enable nurse informaticians to contribute to curricula design and delivery; and to facilitate research in the area of nursing informatics.

Collaboration among vendors, health care organizations and educational facilities to provide training facilities has resulted in creative solutions for limited infrastructure budgets. For example, collaboration among a Systems Analysis and Engineering Technology Department, private enterprise and an undergraduate nursing program allowed them to develop a health care integrated system laboratory (Vanderbeek, et. al., 1994). It was designed to provide potential nurses with the knowledge in the design, use and management of monitoring devices and computers so that they can provide competent care in a technical environment.

**NI Standards & Competencies**

NI can be integrated at different levels: diploma, baccalaureate, Master's of Nursing (NI concentration), or certificate programs for advanced preparation (Saranto & Tallberg, 1998). It must also be included in continuing education for all levels of practice. The difficulty is that while many NI courses and programs provide content descriptions, they do not identify the competencies they are trying to develop. This creates additional challenges in trying to keep up with the changes in technology.

**Feedback: How would you rank factors key to the success of Nursing Informatics Education? Are there others not identified in the discussion paper?**

### *6.4 Barriers to Advances of NI in Nursing Education*

**Culture of widespread NI competencies for all nurses is not in place yet.**

*A National Informatics Agenda for Nursing Education and Practice (1997)* in the US identifies a number of reasons why health care providers, including nurses, have been slower in adopting computers:

- The nursing culture needs to promote acceptance and use of information technologies as basic tools for information management and exchange.
- Computers are available in schools of nursing, however infrastructure support in terms of personnel, planning, and budgeting is often lacking in schools of nursing.
- Computer technology that is available is not fully utilized.
- Information technology must facilitate, not hinder information exchange.
- Practicing nurses are not necessarily computer competent and therefore more nursing informatics educational programs are needed.

As Saranto & Talberg (1998) and others have identified, barriers to integrating NI into the curriculum include:

- **human resources**

-lack of time, lack of knowledge, faculty preparation. Nursing faculty & staff educators lack an appreciation for the value of NI as well as lack experience with it
-need for faculty members who are knowledgeable in NI in order to teach students in formal education settings as well as educators who can teach continuing education.

- **technical resources**

-unsuitable software, limited access to appropriate computer hardware and software
-the rapid rate of change within the technology industry makes it difficult to keep skills and educational materials current

- **system resources**

-little or no support from administration,
-maintaining and upgrading computers places a considerable financial burden on educational institutions,
-lack of funding, including funding to develop & present programs, as well as declining financial support for continuing nursing education
-inadequate administrative and technical support.

**Workplace Constraints**

- Nursing workload limits access to existing NI education programs,
- few practical learning opportunities in the workplace,
- without NI competencies otherwise skilled and experienced nurses are not able to mentor students,
- limited student access to training facilities and trainers.

### *6.5 Key Points for Reflection and Discussion*

- **What are the priorities for resource allocation in continuing education** for practicing nurses, certificate programs, BScN programs or Master's specialty in NI?

- **How might faculty be prepared to develop and/or teach NI curriculum?**

- **How do other faculties support informatics integration into their programs and courses?**

- **Should courses be taught by NI specialists or other Informatics specialist?**

- **Can NI be taught as a specialty of Health Informatics?**

**Feedback: How would you rank the importance of barriers to the advances of NI in Nursing Education Are there other barriers not identified in the discussion paper?**

# 7.0 Developing a National Strategy for Addressing Nursing Informatics Education

## *7.1 Introduction*

The overall goal of this project is to propose a strategy for addressing NI education in Canada. At this stage of the process the Working Committee is attempting to:

- establish core NI competencies for Canadian nurses;
- identify NI education opportunities currently available to Canadian nurses;
- determine NI education priorities.

All of these will be done within the framework of extensive feedback from interested stakeholders.

The question to consider is this: "What difference will it make if NI is not part of the nursing curriculum - today and in the future?" The CNA Workbook *Nursing & Health Information: Toward Consensus on Nursing Care Elements* (January 1998) notes: "Nursing ... is invisible in most clinical and administrative databases. This invisibility has many consequences such as the following: nursing practice may be described as the practice of others, especially physicians; the costs of nursing care are not differentiated from other costs in the health system; and professional accountability is difficult to demonstrate; ... It is important ... for nurses to become knowledgeable about capturing nursing data because health information systems are being developed with the capacity to include nursing information."

In the health care arena those who are the most knowledgeable will continue to participate in decisions around what software to develop and what IS to implement. Nurses with NI education and experience should be part of these processes.

## *7.2 US National Advisory Council on Nurse Education and Practice*

Recommendations of the US National Advisory Council on Nurse Education and Practice (1997) closely reflect the needs in Canada and may provide a starting point for discussions in developing a similar Canadian agenda. Identifying priorities, responsibilities and resource allocations are all critical components of such a strategy. It is important to consider who must contribute to this partnership in order for it to succeed, including professional nursing organizations, health care employers and IT industries.

The Advisory Council recommended the following National Informatics Agenda for Nursing Education and Practice: (p. 6)

**1) Educate nursing students and practicing nurses in core informatics content.**
This includes promoting the inclusion of core informatics skills and knowledge leading to competency in nursing undergraduate, graduate, and continuing education programs.

**2) Prepare nurses with specialized skills in informatics.**
Support is required for innovative nursing and health informatics programs that teach specialized informatics skills needed to develop information technology that supports the national health goals of providing accessible, high quality, and cost effective care.

**3) Enhance nursing practice and education through informatics projects.**
Funding for innovative, collaborative telecommunication projects that would enhance the quality of clinical practice for populations at risk and contribute to the education of health care providers is critical.

**4) Prepare nursing faculty in informatics**
Support for increased nursing faculty preparation in informatics through the use of collaborative programs and technology is critical.

**5) Increase collaborative efforts in nursing informatics**
Efforts to facilitate the advancement of informatics in nursing through collaboration among public and private organizations need to be supported.

### *7.3 NIGHTINGALE Project in the UK*

In contrast to proposing an agenda for NI education, the NIGHTINGALE Project (see Nightingale web site) more narrowly defined the scope of their project as:

> "providing curriculum development in the multidisciplinary field of Nursing Informatics by consensus process at all levels of Nursing Education and Training as well as implementation and demonstration of the curriculum at various pilot sites across Europe. The training will be implemented using existing or extended multimedia tools of learning and education."

Their objectives are related to their scope and reflect specific strategies and time frames for achieving the overall goal of curriculum development, including:

1 To **survey the existing situation** of Nursing Informatics in Europe and register the running courses.

2 To investigate the **status of the Nursing Curricula** related to Informatics courses across Europe and identify the patterns.

3 To identify the **knowledge in Informatics** of the nursing profession in Europe.

4 To organize a series of **User Workshops** to study and identify the User Needs and Comment on the results of the previous items.

5 To organize **Workshops of Nursing Information Systems providers** in order to identify the needs of training in Nursing Informatics.

6 To organize **Workshops of Nursing Informatics Education and Training computer-based systems providers** to identify the needs and prospects of the market of related programs.

7 To **develop curricula of Nursing Informatics for nurses** employed at health care organizations, for students studying nursing in Nursing Schools, Colleges or University based education of Nursing.

8 To verify and **demonstrate the curriculum development approach** of Nursing Informatics at various Institutional sites and Hospitals.

9 To **integrate the multimedia educational and training approaches** in Nursing Informatics.

### *7.4 Developing a Canadian Plan for Nursing Informatics Education*

Identifying NI competencies and implementing educational strategies to meet these needs is of necessity an ongoing process. The national strategies may include an overall agenda (like the US model) as well as an implementation strategy for particular aspects of that strategy (like the European model). Overall the plan should include both an evaluation process to determine effectiveness of the plan and a process for routine review and revision of both competencies and educational strategies.

**Feedback: What are the key elements of a national plan for NI in nursing education? How would you rank the priority for action? Are there additional elements not identified in the discussion paper?**

Your feedback on six topics raised in the discussion paper is important in achieving consensus for developing a national plan for Canada. Please complete the accompanying Feedback Document in the following areas:

# Appendices

## *Appendix A. Glossary of Terms*

**COACH -** Canadian Organization for the Advancement of Computers in Healthcare. Canadian association for health informatics.

**Competence** - judicious application of knowledge, attitudes and skills required for performance in a designated role and setting (National Nursing Competence Project, June 1997)

**Competencies** - integrated knowledge, skills, attitudes and judgement expected of the entry-level practitioner (National Nursing Competence Project, June 1997)

**Domains of Nursing Practice**
-Clinical: direct patient care in varied locations, e.g. acute care, long term care, private, parish, prison, street
-Education
-Research
-Administration
-Policy Making/Governance

**Entry-Level Practitioner** - beginning R.N. at the point of registration or licensure following graduation from a nursing education program (adapted from the National Nursing Competence Project, June 1997)

**Health Information: Nursing Components (HI:NC)** - information that represents the most important pieces of data about the nursing care provided to a client during a health care episode. ... This includes data on client assessment, nursing interventions, nursing resource use, and client outcomes. Another term used is Nursing Minimum Data Set (Canadian Nurses Association Policy Statement, 1993).

**ICT -** information and communications technologies. Given the integrated use of computers and telecommunications in many applications, it may be appropriate to adopt a new term ICT, to replace IT.

**Informatics Taxonomy** (Blum, 1986 in Graves & Corcoran, 1989)
*Data* - discrete entities that are described objectively without interpretation
*Information* - data that are interpreted, organized or structured
*Knowledge* - information that has been synthesized so that interrelationships are identified and formalized
*Management Component* - functional ability to collect, aggregate, organize, move and re-present information in an economical, efficient way that is useful to users of the system
*Processing Component* - transformation of data into information and of information into knowledge. Knowledge is used both in making decisions and in making new discoveries.

**Information Science** -

**Information Systems -**

**Infrastructure** - the essential elements of a system or structure to support specific activities (Gage Dictionary, 1983)

**Standard** - a desired and achievable level of performance against which actual performance can be compared. (RNABC *Standards for Nursing Practice, 1998*)

## *Appendix B. Selected Definitions of Nursing Informatics from the Literature*

| Reference | Nursing Informatics Definition (Rationale = Why it is important) |
|---|---|
| Nesler, Sopczyk, Cummings & Fortunto (1998) | DEF: development and evaluation of applications, tools, processes and structures which assist nurses with the management of data in taking care of patients or in supporting the practice of nurses (ANA, 1994)<br>RATIONALE: tremendous potential to improve the quality, effectiveness and efficiency of nursing practice, administration, education and research |
| Nagelkerk, Ritola, Vandort (1998) | DEF: legitimate access to and use of data, information and knowledge to: standardize documentation, improve communication, support the decision-making process, develop and disseminate new knowledge, enhance the quality, effectiveness and efficiency of health care, empower clients to make health care choices and advance the science of nursing (Simpson, 1992)<br>WHY: make better clinical decisions through effective management of patient care information; advances in technology and treatments means nurses must become more proficient in the practice of nursing as well as use of computer technology |
| Sibbald (1998) | DEF: blends nursing science with information science and computer science (Graves & Corcoran, 1989). It involves understanding the information RNs need and use in practice, and discovering how information technology can help<br>RATIONALE: helps nurses improve quality of care, allows documenting worth; RNs need current information to help maintain primary roles as communicators and patient advocates; technology can transform data into information that can be used; can make more informed decisions; new emphasis on evidence-based practice; need data to prove effectiveness |
| Rosen & Routon (1998) | DEF: scientific discipline that serves the profession of nursing by supporting the information handling work of other nursing specialties |
| J.P. Turley (1997) | proceedings from the<br>Stockholm conference in 1997. It's from J. P. Turley at Indiana University, who suggests that nursing informatics is comprised of the interaction of cognitive science (knowledge, reasoning & decision-making),<br>information science , & computer science, within the discipline of nursing<br>science. |
| US National Informatics Agenda for Nursing Education (1997) | DEF: specialty whose activities center around information management and processing for the nursing profession<br>DEF (Division of Nursing): combining nursing science, information management science, and computer science to manage and process nursing data, information, and knowledge to deliver quality care to the public, particularly disadvantaged and under served populations |
| Lange (1997) | DEF: a combination of computer science, information science, and nursing science designed to assist in the management and processing of nursing data, information, and knowledge to support the practice of nursing and the delivery of nursing care.<br>-Nursing practice in every setting involves collecting, managing, processing, transforming and communicating information.<br>-Principle focus of NI is information - nursing data, information and knowledge<br>-Expert nurses in domain of NI<br>-Task of NI is to study the structuring & processing of nursing information to arrive at clinical decisions and to build systems to support and automate that processing |
| Turley (1996) | DEF: interaction between the discipline-specific science (ie nursing science) and the area of informatics |

| Reference | Nursing Informatics Definition (Rationale = Why it is important) |
|---|---|
| | RATIONALE: informatics will change the way clinicians understand the information that is available to them. The sheer volume of knowledge will require that data be automatically pre-processed before it is delivered to clinicians |
| Arnold (1996) | DEF: development & evaluation of applications, tools, processes, and structures which assist nurses with the management of data in taking care of patients or in supporting the practice of nursing<br>RATIONALE: NI graduate and continuing education programs will be necessary to meet the increased demand for informatics knowledge, if nurses are to stay on the cutting edge |
| Henry (1995) | DEF: combination of computer science, information science, and nursing science, designed to assist the management and processing of nursing data, information and knowledge to support the practice of nursing and the delivery of care (Graves & Corcoran, ANA; 1989; ref31)<br>-the task of NI is to study the structuring and processing of nursing information to arrive at clinical decisions and to build systems to support and or automate that processing |
| Simpson, R. (1995) | ANA nursing informatics certification; nursing informatician is a specialty role |
| Vanderbeek et al (1994) | DEF: the use of information science technology by nurses to care for patients (Hannah, 1995)<br>?definition is more recent than the article<br>?does this eliminate uses related to other nursing roles |
| Magnus, Co & Derkach (1994) | NI course emphasized integration and use of information technology in relation to the management and processing of data, information, and knowledge to support nursing practice and the delivery of care |
| Hannah, Ball & Edwards (1994) | DEF: use of information technologies in relation to those functions within the purview of nursing and that are carried out by nurses when performing their duties. Therefore, any use of IT by nurses in relation to the care of their patients, the administrators of health care facilities, or the educational preparation to practice the discipline is considered nursing informatics. |
| McGonigle & Eggers (1991) | DEF: synthesis of nursing science, information management science, and computer science to enhance the input, retrieval, manipulation, and/or distribution of nursing data<br>EDN: information and hands-on experience to enable the participants to integrate nursing information into all areas of the nursing profession: practice, administration, education, and research |
| Romano & Heller (1990) | NIS specialist; Masters program in Nursing Administration - specialty in Nursing Informatics: change agent, assessment of problems related to information use and handling |
| Chinn (1990) | issues in informatics are conceptual and organizational - not technological |
| Graves & Corcoran (1989) | DEF: a combination of computer science, information science, and nursing science designed to assist in the management and processing of nursing data, information, and knowledge to support the practice of nursing and the delivery of nursing care |
| Grobe (1989) | DEF: application of the principles of information science and theory to the study, scientific analysis, and management of nursing information for the purposes of establishing a body of nursing knowledge |
| Peterson & Gerden-Jelger (1988) | DEF: application of information science to nursing and patient care<br>WHO: practicing nurses; nurse-administrators; nurse-educators-nurse-researchers<br>RATIONALE: potential of NI to enhance nursing practice, to study clinical problem-solving & to ultimately improve quality of care |
| Hannah, (1988) | DEF: goal of NI is to guide the design, use, management, and evaluation of computer systems to meet the needs of nurses for use in health care agencies and institutions<br>RATIONALE: use of IT will necessitate a more scientific and complex approach to |

| Reference | Nursing Informatics Definition (Rationale = Why it is important) |
|---|---|
| | the nursing care process; NI will assist nurses in gathering and aggregating nursing data to make decisions related to patient care |
| Hannah, Buillemin & Conklin (1985) | DEF: the use of information technology in relation to any of the functions which are within the purview of nursing and which are carried out by nurses. Hence, any use of IT by nurses in relation to the care of patients or the educational preparation of individuals to practice in the discipline is considered nursing informatics. |
| Gorn (1983) | DEF: Application of computer science and information science to the management and processing of data, information and knowledge in the named discipline |

**Appendix B - Selected NI Definitions from the Literature**

## *Appendix C. NI Competencies for Basic and Graduate Nursing Education*

| | **Educational Program** | | | |
|---|---|---|---|---|
| **Grobe's Levels of NI Competencies**[1] | Bachelors/ Diploma[2] | Masters[3] | PhD | NI Specialist |
| 1. Use Basic Information-Handling Tools, e.g. use of computers for:<br>-course work documentation,<br>-electronic mail,<br>-consulting library resource systems,<br>-searching public databases and<br>-online statistical analysis of data | Π | Π | Π | Π |
| 2. Independently Learn About Computers and Information Management, e.g.<br>-have sufficient knowledge and skill to locate information, evaluate it, and apply it to learning and professional tasks | Π | Π | Π | Π |
| 3. Use computer systems and access databases, e.g.<br>-use computers and information tools well enough to develop information and education support systems for personal use<br>-be a knowledgeable consumer and be able to assess the value of new, emerging technologies in an informed manner | Π | Π | Π | Π |
| 4. Knowledgeably Use Systems and Specialized Databases | | Π | Π | Π |
| 5. Perceive New Applications | | | Π | Π |
| 6. Build Systems for Personal Applications | | | Π | Π |
| 7. Tool Building | | | Π | Π |

[1] Grobe (1986), based on original work by Matheson & Lindberg (1984)
[2] Bachelor's degree presumes skills for levels 1-3, but expanding them to apply to nursing and health care data and applications
[3] Nursing educators and researchers assume a minimum of Master's preparation

## *Appendix D. Selected Descriptions of NI Competency Levels from the Literature*

| Reference | Competency Level | | |
|---|---|---|---|
| | **Level 1-using the technology** | **Level 2-using the information** | **Level 3-decision-making (using tech. and information)** |
| -Nesler et al (1998)<br>-results of needs assessment - what do new BSN grads want | -hands-on practice | -computer applications in health care<br>-managerial and clinical practice systems | -review of ethical and legal issues |
| Cheek & Doskatsch (1998)<br>-role of Internet in continuing nursing education | | -information literacy must include more than obtaining information<br>-internet access skills to include:<br>--define search<br>--develop a search strategy<br>--analyze info obtained | |
| Vanderbeek & Beery (1998) | | -core concepts for graduating and practicing nurses<br>-they must be able to:<br>--define health care informatics<br>--examine the relationship of history of health care computing to current applications<br>--analyze practical considerations related to the use & development of IS | |
| Arnold (1996)<br>-survey to determine information needs around informatics | 5 applications seen as critical components of an informatics program<br>-word processing<br>-e-mail<br>-HIS<br>-databases<br>-spreadsheets<br>-presentation packages | | Examination topics for US NI Certification:<br>-systems analysis & design<br>-system implementation and support<br>-system testing and evaluation<br>-human factors<br>-computer technology<br>-information and database management<br>-professional practice trends and issues<br>-theories |
| Reinhard & Moulton (1995)<br>-graduate community health curriculum | | -assessment of populations (analysis of aggregated data)<br>-information | |

| Reference | Competency Level | | |
|---|---|---|---|
| | **Level 1-using the technology** | **Level 2-using the information** | **Level 3-decision-making (using tech. and information)** |
| -core competencies integrated | | management<br>-evaluation of nursing interventions (development & use of databases to measure outcomes) | |
| Vanderbeek, Ulrich, et al. (1994)<br>-NI competencies for practicing nurses adapted from NLN (1988)<br>-nursing elective focusing on NI | | -documenting nursing practice<br>-accessing information<br>-using data and information systems<br>-coordinating information flow | |
| Simpson (1994) (specifically nurse managers)<br>-managing NI means controlling information, e.g. clinical, financial, patient | -understand and have experience with IS technical tools and terminology | -understand value of IT to support executive decision-making<br>-recognize that IT is an interdepartmental tool<br>-recognize that IT can be a powerful educational tool<br>-value decision-support systems for strategic planning<br>-understand ethical issues related to IT (e.g. confidentiality)<br>-know how to use IT to comply with reporting requirements | -know how to actively participate in needs assessment, selection and maintenance of IT that will be used by nurses<br>-understand that nursing data must be primary consideration when selecting HIS<br>-know how to work with IT consultants<br>-know how to ID and work effectively with IT vendors |
| Grobe (1989)<br>-outcomes at baccalaureate level for nurse educators /researchers<br>-skills in nursing computer-based technology for managing nursing data & information for the purpose of creating nursing knowledge<br>-seven levels of competencies based on Matheson & Lindberg, (1984) | -level 1: using basic information-handling tools<br>e.g. use of computers for coursework (e-mail, word processing, literature searches)<br>-level 2: independent learning about computers and information management<br>-level 3: using computer systems and accessing data bases<br>e.g. use automated clinical records, on-line databases, office and personal business systems and time | -level 4: knowledgeably using systems and specialized data bases<br>e.g. locate information, evaluate and apply it to learning and professional tasks | -level 5: perceiving new applications<br>-level 6: building systems for personal applications<br>-level 7: tool building<br>e.g. assess the value of emerging technology |

| Reference | Competency Level | | |
|---|---|---|---|
| | **Level 1-using the technology** | **Level 2-using the information** | **Level 3-decision-making (using tech. and information)** |
| | management systems | | |
| Ball & Douglas (1989)<br>-taxonomy of competencies for multi-disciplinary student body at University of Maryland | campus-wide:<br>-word processing<br>-e-mail<br>-library access<br>-statistical analysis<br>-databases | profession specific:<br>-specialized databases and systems related to professional field | informatics specialists and researchers:<br>-new applications<br>-building systems<br>-tool building |
| Peterson & Gerden-Jelger (1988)<br>- 3 levels of competencies in each level of specialization | user - use IS effectively | modifier - analyze, manage, modify, critique and evaluate IS | innovator - design and develop IS |

## Appendix D - Selected Descriptions of NI Competencies

## *Appendix E. NI Competencies for Nursing Practice Domains*

*The following competencies are described by Grobe (1986, p. 117-138). The publisher should be contacted for permission if this substantial portion of her work is used prior to be adapted.

E1: Informatics Competencies for Nurses in Clinical Practice

E2: Informatics Competencies for Nursing Managers

E3: Informatics Competencies for Nursing Educators

E4: Informatics Competencies for Nursing Researchers

## Appendix E1: Grobe's (1986) Informatics Competencies for Nurses in Clinical Practice

| **Levels of Informatics Competencies** | | |
|---|---|---|
| **I. User** - has awareness; knows; understands; uses; interacts | **II. Modifier** - analyzes; manages; critiques; modifies; evaluates | **III. Innovator** - develops; designs |
| **Role Function 1: Documenting Nursing Practice** | | |
| -knows the type of system in use | -analyses the system in use | -participates in designing and developing systems for nursing practice functions<br>-serves as an innovator of applications for care and practice |
| -has the ability to interact with the system | -none | -none |
| -knows that the system has an impact on time allocation and tasks of care | -influences change to improve the impact of informatics on the system of care | -none |
| -has a balanced and objective approach to the use of computers in nursing | -participates in influencing the attitudes of other nurses toward computer use for nursing practice | -none |
| **Role Function 2: Accessing Information** | | |
| -understands the data structure and accesses the data used locally for patient care | -knows other sources of data that relate to practice and care and accesses and uses them as well | -develops new ways to interact with computer systems and to access data |
| -knows the system data security and data integrity components and acts in accord with this knowledge | -is responsible for the design and/or allocation of security codes and access to data | -none |
| **Role Function 3: Using a System's Data and Information** | | |
| -knows only the system in use | -has a broad knowledge of the different systems that can be used for practice and has experience in using some of them | -none existing |
| -knows the components of the system in use | -knows what is available in other systems | -identifies and participates in the design and development of new applications |
| -has an awareness of the use and/or importance of nursing data for improving practice | -uses available data for research purposes, that is for providing feedback to the practicing nurse about patterns of car and practice | -develops new methods of organizing data to enhance research capacities |
| -is aware of the capacity for data aggregation and integration | -integrates data and used these aggregated data for the evaluation of nursing practice, including the use of spreadsheets | -none |
| -knows and values that data sets are able to be used for statistical analysis | -uses data and statistical analyses to evaluate practice and perform quality control | -develops and participates in quality assurance programs |
| -uses computers for purposes of instructing patients | -identifies areas of need for patient instruction, conducts the instruction, and evaluates outcomes of this instruction | -assists in the development of specific patient instruction programs |
| -is aware of the costs and benefits of computer technology use in practice | -analyzes costs and benefits of the use of computer technology in nursing | -none |
| **Role Function 4: Coordinating Information Flow** | | |
| -uses computer technology safely | -analyzes the health and safety aspects of the work station and its location | -participates in the design of the work station environment |

| **Levels of Informatics Competencies** | | |
|---|---|---|
| **I. User** - has awareness; knows; understands; uses; interacts | **II. Modifier** - analyzes; manages; critiques; modifies; evaluates | **III. Innovator** - develops; designs |
| -understands the scope of an individual's professional responsibility | -writes policies to protect the professional nurses' roles and responsibilities | -none existing |

## Appendix E2: Grobe's (1986) Informatics Competencies for Nursing Managers

| **Levels of Informatics Competencies** | | |
|---|---|---|
| **I. User** - *has awareness; knows; understands; uses; interacts* | **II. Modifier** - *analyzes; manages; critiques; modifies; evaluates* | **III. Innovator** - *develops; designs* |
| **Role Function 1: Directing the Organization of Information,** e.g. financial, statistical, patient care, resource personnel/students, risk management, quality control, safety and infection control | | |
| -has the ability to communicate informatics' needs to a systems analyst | -participates in system analysis for nursing management functions | -participates in the development of new tools for management purposes |
| -can identify the requirements of an integrated patient care system and knows the steps of implementation | -evaluates and analyzes the impact of an integrated patient care system on the organization and efficiency of service delivery | -participates and consults in the design or enhancements to the integrated patient information systems |
| -makes decisions on the purchase of new technological developments and is aware of information theory | -monitors the impact of the new technology on the organization | -participates in the design of new technological developments including office automation |
| -is aware of basic nursing theories and uses them to establish the definitions of the data used by nurses; identifies the output and input requirements and dictates procedures to safeguard accuracy | -analyzes, evaluates, and modifies the nursing management information system | -develops new nursing management information systems |
| -uses strategies to obtain funding to develop information systems | -none existing | -none existing |
| **Role Function 2: Accessing Information** | | |
| -has an awareness of data storage methods and is able to use data for management decision making | -evaluates data storage capacities of the system in use, and can evaluate networks for communication purposes | -participates in the development of new methods or in making modifications to improve the efficiency and/or effectiveness of data storage and its communication |
| **Role Function 3: Using a System's Data and Information** | | |
| -has the ability to use a spreadsheet | -uses spreadsheets for more complex applications or modifies existing programs | -none existing |
| -is familiar with basic informatics terminology and the various components of computer systems | -none existing | -none existing |
| -conducts cost-effectiveness analyses of systems in use | -evaluates new technologies used for cost-effectiveness analyses | -develops and designs new standards and terminology for cost-effectiveness analyses |
| -possesses extensive knowledge of systems currently in use | -knows about other available hardware and software | -none existing |
| -understands data aggregation and analysis using statistical routines and other software | -is able to modify the available software programs to support data analysis | -none existing |
| -knows and uses management simulation models | -develops models for simulation purposes | -designs innovative analytic techniques |
| -has the ability to identify the systems effects on management decision making over time | -analyzes, identifies and improves computerized time management systems and evaluates the match between system capabilities and management needs | -adapts system output for specific purposes |
| -understands and uses staffing, scheduling and acuity control programs | -critically evaluates staffing and scheduling and acuity programs' | -assists in the development of staffing scheduling and acuity |

| Levels of Informatics Competencies | | |
|---|---|---|
| **I. User** - *has awareness; knows; understands; uses; interacts* | **II. Modifier** - *analyzes; manages; critiques; modifies; evaluates* | **III. Innovator** - *develops; designs* |
| | applicability to the organizational environment | programs |
| -understands the mathematical models underlying the fiscal management system | -evaluates the use of mathematical models of the fiscal management systems | -designs or participates in the development of new mathematical models for fiscal management systems |
| **Role Function 4: Communicating and Networking Inside and Outside the Organization** | | |
| -knows and understands the impact of system's implementation on the organization | -evaluates and analyzes the impact of system's implementation on the organization | -designs and develops methods for project management |
| **Role Function 5: Assuring Ethical Standards and Data Protection** | | |
| -is familiar with the principles of data integrity, professional ethics and legal requirements, and understands ways to protect data | -monitors and evaluates the system's capacity to protect data, and monitors that ethical standards are upheld | -participates in the development and integration of security and data protection for systems and personnel files |

## Appendix E3: Grobe's (1986) Informatics Competencies for Nursing Educators

| **Levels of Informatics Competencies** | | |
|---|---|---|
| **I. User** - *has awareness; knows; understands; uses; interacts* | **II. Modifier** - *analyzes; manages; critiques; modifies; evaluates* | **III. Innovator** - *develops; designs* |
| **Role Function 1: Teaching about the use of available computer-based applications for providing care, administering care, and conducting research about care.** | | |
| -has the ability to teach and evaluate the required informatics competencies appropriate to the level of the learner | -has the ability to teach and evaluate the informatics competencies required for specific role functions for the practicing nurse, the nurse administrator, and the nurse researcher at the appropriate level | -participates with practicing nurses, nurse administrators, and nurse researchers to define and develop new computer competencies |
| **Role Function 2: Teaching with computer-based instructional materials** | | |
| -prepares instructional materials using existing software, e.g.<br>--communication software for literature searching<br>--word processing software to update syllabi and to prepare handouts<br>--graphics software for preparing overheads | -evaluates strengths and weaknesses of hardware and software products available to support teacher preparation of instructional materials, e.g.<br>--word processing software<br>--communication software<br>--graphics software | -designs, develops and implements hardware and software systems for instructional support activities |
| **Role Function 3: Deciding from the variety of alternatives what instructional material should be available and how it should be provided for learners** | | |
| -reviews, selects, and operates computer-assisted learning materials, computer-assisted instruction (CAI), and computer-managed instruction (CMI) systems | -evaluates commercial CAI/CMI software for system wide use, examining:<br>--level of content<br>--ease of use<br>--instructional effectiveness<br>--possible placement in the curriculum | -designs, develops and implements hardware/software for CAI/CMI |
| **Role Function 4: Performing student assessment and evaluation functions** | | |
| -uses software for supporting student assessment activities, e.g. uses:<br>--database management software for item banking for tests<br>--word processing for constructing tests | -evaluates and modifies software for the assessment of student performance, e.g.<br>--data analyses software for grading purposes<br>--database management software for keeping grade books and student records | -designs, develops, and implements computer-based systems for student assessment and evaluation |

## Appendix E4: Grobe's (1986) Informatics Competencies for Nursing Researchers

| **Levels of Informatics Competencies** | | |
|---|---|---|
| **I. User** - *has awareness; knows; understands; uses; interacts* | **II. Modifier** - *analyzes; manages; critiques; modifies; evaluates* | **III. Innovator** - *develops; designs* |
| **Role Function 1: Using search strategies for electronically retrieving bibliographic citations and primary source data** | | |
| -conducts literature searches using large-scale library systems and databases | -extracts selected literature resources and integrates them to personally usable file | -none existing |
| **Role Function 2: Accessing, communicating and storing data** | | |
| -accesses shared data sets for multi-site research | -transmits and receives research documents electronically | -organizes and directs central facilities for shared data sets |
| **Role Function 3: Managing and manipulating data** | | |
| -defines, structures and maintains data sets | -alters a defined data structure to interface with another data structure | -none existing |
| -protects research data for security and integrity purposes | -none existing | -none existing |
| -accesses and extracts data from clinical data sets | -uses clinical database sources and modifies data structures for clinical research | -develops/design data-base structures to facilitate clinical research |
| -conducts data aggregation and does analyses using statistical routines and other software programs | -modifies available software programs to support data aggregation and analyses | -develops innovative and analytic techniques for scientific inquiry in nursing |
| -selects, operates and evaluates appropriate software for data gathering, e.g. uses real-time physiological monitors | -modifies existing devices for special nursing research purposes | -design unique technology for data gathering in nursing research |
| -directs the use of research resources including funds, personnel, and material by means of computer software | -none existing | -none existing |
| **Role Function 4: Processing text and graphic information** | | |
| -prepares documents such as research proposals, data-gathering tools, consent forms, articles and reports | -none existing | - none existing |

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[http://cac.psu.edu/~dxm12/edsourcesheila.html]

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