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Preparing Student Nurses, Faculty and Clinicians for 21st Century Informatics Practice: Findings from a National Survey of Nursing Education Programs in the United States

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Abstract

Because healthcare delivery increasingly mandates data-driven decision-making, it is imperative that informatics knowledge and skills are integrated into nursing education curricula for all future nurse clinicians and educators. A national online survey of deans/directors of 266 baccalaureate and higher nursing education programs in the U.S. identified perceived informatics competencies and knowledge of undergraduate and graduate nursing students; determined the preparedness of nurse faculty to teach and use informatics tools; and elicited perceptions of informatics requirements of local practicing nurses. Frequency data and qualitative responses were analyzed. Approximately half of the programs reported requiring word processing and email skills upon entry into the nursing major. The use of standardized languages and the nurse's role in the life cycle of an information system were the least visible informatics content at all levels. Half of program faculty, rated as "novice" or "advanced beginners", are teaching information literacy skills. Findings have major implications for nurse educators, staff developers, and program administrators who are planning faculty/staff development opportunities and designing nursing education curricula that prepare nurses for professional practice.

Keywords:

Nursing informatics, Nursing education/Curriculum in nursing informatics, Education and training

Introduction

The U.S. system of healthcare is facing a crisis as it seeks new ways to improve the healthcare quality and safety for Americans. Concurrently, the nation faces a severe nursing shortage, partly as a result of nurses' dissatisfaction with current working conditions. Professional organizations including the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) and the American Academy of Nurses (AAN) are attempting to find solutions to these crises in patient care. The uses of new and emerging technologies are being considered key to decreasing medical errors and easing the burden of paperwork for the nurse. As healthcare increasingly focuses on timely information to drive decision-making, the use of informatics to support practice must be integrated into nursing education program curricula to prepare graduates for the workforce of which informatics is increasingly an integral part.

The importance of including informatics knowledge and skills within nursing curricula is well supported in nursing literature and by major professional organizations [1-4]. In 1997, the Division of Nursing of the Health Resources and Services Administration (HRSA) convened the National Nursing Informatics Work Group (NNIWG) comprised of 19 experts in the country to advise the National Advisory Council on Nurse Education and Practice (NACNEP) about priorities for nursing informatics education and practice in the U.S. From these recommendations, the National Informatics Agenda for Nursing Education and Practice was generated as well as recommendations for including core computing and nursing informatics (NI) concepts in nursing curricula [5].

The American Nurses Association recently revised the Scope and Standards for Nursing Informatics Practice [6]. Within these standards, computer literacy skills, information literacy skills and overall informatics competencies are delineated for the beginning nurse, experienced nurse and the Informatics Nurse Specialist. Computer literacy skills include use of word processor, database, spreadsheet, and using email and other informatics applications to document care. Information literacy is a skill set that enables the nurse to locate, access and evaluate information. Access includes the ability to conduct bibliographic retrievals and to locate, retrieve, and evaluate information from the Internet. Overall informatics competencies are those that relate to the care of patients such as interpreting patient and nurse information, using informatics applications for nursing and addressing privacy, confidentiality and security of information in nursing practice.

A complete review of the last 15 years of empirical studies addressing the integration of information technology competencies and the progression of information technology in nursing education can be found in the article by Staggers, Gassert and Curran [7]. They concluded that the integration of information technology knowledge and skills into nursing education curricula has been a slow process and that no consistent curricula for nursing information technology exist in nursing education programs. The work of Staggers, Gassert, and Curran has been the most recent work in promoting information technology in nursing education. Using a review of the literature from 1986 to 1998, and

input from a panel of NI experts, these authors have developed 304 nursing informatics competencies for four levels of practicing nurses: beginning nurse, experienced nurse, informatics nurse specialist and informatics innovator. The broad categories of competencies and accompanying specific competencies should guide nurse educators in designing curricula to prepare nurses for all levels of professional practice.

Materials and Methods

Research Questions

This article reports findings of a study examining perceived informatics competencies of nurse faculty, practicing nurses and baccalaureate and masters prepared student nurses in the U.S. The major research questions were:

1. What specific informatics knowledge and skills currently are being taught in nursing education programs across the United States?
2. To what extent are faculty members prepared to teach this knowledge and these skills?
3. What are the perceived current and future uses of informatics tools used by practicing nurses?

Instrument

The principal investigator secured a small faculty development grant from a regional college in Idaho to partially fund the development of an online survey. The Information Technology (IT) Education in Nursing Curricula Survey was developed on paper and then refined for submission to an on-line service that reformatted the survey and managed survey responses. Survey questions were developed from the literature and content validity was established through review by Nursing Informatics experts serving on the American Nurses Association's Committee on Nursing Practice Information Infrastructure and the ANA's Information and Data Set Evaluation Center (NIDSEC). The initial paper survey contained 11 broad categories of questions that resulted in the online survey version containing a total of 37 discrete questions

Sample and Procedure

The American Association of Colleges of Nursing (AACN) was contacted to first rent mailing lists of applicable individuals and to later purchase a file of e-mail addresses of deans/directors of baccalaureate and higher nursing programs in the United States. After obtaining human subject approval from the college Institutional Review Board (IRB), the primary investigator created mailing labels from the AACN for all 672 member and non-member baccalaureate and higher nursing programs in the United States, including the territory of Puerto Rico. A letter was mailed to each dean/director of the nursing program outlining the purpose of the research, assigning a pass code for the online survey, indicating a deadline for submittal and contact information for further questions. A statement was also included explaining that completing the survey constituted consent to participate. Program deans and directors were encouraged to complete the survey or to assign the task to an appropriate member of their program. Data, including date and pass code number for each participating program, were tracked on a weekly and then monthly basis by an online service. This service, blinded to respondents, managed the data collection. E-mail reminders about the deadline for participating were sent for those who had not responded after the first six weeks of the study. A second e-mail was sent notifying programs that data collection was extended for two months until the end of July, 2001. Additionally, the reminder emails included a link to the survey. A Web search was made to obtain names and e-mail addresses for programs whose e-mail returned (n= 33). Twelve of 33 email addresses were not found. Some respondents indicated reasons for not submitting the survey: no longer in director position (n=10); on vacation/sabbatical leave or out of the country (n=9); not knowledgeable about the content (n=8), unable to access the survey (n=10). Attempts were then made to identify the appropriate person to complete the survey at programs that did not initially respond. Seven schools reported difficulty with link activation. Support from the online survey vendor was solicited to help participants who reported that they were "unable" to access the survey. In most cases, investigation revealed the inability to access the survey was due to configuration of the school's computer system. Seven requests for a faxed version of the survey were filled.

The survey collected quantitative and qualitative data. Data analysis included frequencies and cross tabulations using the Statistical Package for the Social Sciences (SPSS). Spradley's [8] ethnographic method was used to analyze data for the survey questions with a qualitative component. In those instances, subjects were asked to explain a rationale for their quantitative response or provide illustrative examples using free-text answers. The submitted responses were examined in their native form. Specifically, each open-ended question was treated as a separate organizing framework and the answers were transcribed verbatim and compared with the other open-ended responses for that question. The responses were grouped in larger taxonomic domains by virtue of some similarity. The first element of the structure of a domain is a "cover term". For example, using an example from the survey, the cover term "mobile computing" was identified as a symbol of a larger unit of knowledge, representing the views of the population of nurse faculty for the semantic relationship of "the types of technology tool competencies used in the future".

Results

A total of 266 programs out of 672 (return rate = 40%) submitted the survey. Of this sample, 65% (n= 172) were nursing program administrators, directors, managers or deans and less than 28% (n= 74) were nurse educators. Respondents represented programs from all states within the U.S. and the territory of Puerto Rico with the largest regional responses from the South Atlantic area (District of Columbia, Delaware, Florida, Georgia, Maryland, North/South Carolina, Virginia, and West Virginia.) and the Eastern North Central Region (Illinois, Indiana, Ohio, Michigan, and Wisconsin). Almost half of the respondents served urban settings, less than a third served rural areas, and one-fifth reported serving a combination of urban and rural constituencies.

Undergraduate Nursing Programs

Informatics Knowledge and Skills

For 50% of the sample (n=132), the informatics content reported most frequently was "Accessing electronic resources". Slightly less than half of responding programs reported the ethical use of information systems and the computer based patient record were taught in undergraduate nursing programs. Slightly greater than one-third of programs (37%, n= 98) reported "evidence-based practice" was a component of the undergraduate curriculum. Less than half of the respondents (40%, n=105) selected "Information Technology nurse competencies" as content within undergraduate programs. Specific informatics content areas determined to be the least visible were data/information system standards such as the American Society for Testing and Materials (ASTM), Health Level 7, and the American National Standards Institute (ANSI); and the Nursing Information and Data Set Evaluation Center (NIDSEC) criteria.

Informatics Skills Required for Program Entrance and Exit

It is remarkable that only about half of U.S. baccalaureate nursing programs require undergraduate nursing students to enter with basic word processing and e-mail skills. Only 25% (n=67) of those responding expected students to enter with information literacy skills such as bibliographic retrieval skills via the library and/or the Internet. About 40% (n=98) of programs required students to be proficient in accessing the Internet/WWW upon entering the undergraduate nursing programs.

As expected, almost 80% of nursing undergraduate programs expected students exiting from their programs to demonstrate computer literacy skills (word processing and e-mail) and information literacy skills (bibliographic retrieval and use of the Internet/WWW). Prior to graduation, competency in using databases and spreadsheets was expected in only one third of undergraduate programs. A majority of programs reported that validation of computer literacy skills occurs indirectly through integrated course assignments. Others reported central validation strategies for students upon exit from the program that included demonstration of competencies, completion of a computer course or computer literacy exam.

Graduate Nursing Programs

Informatics Knowledge and Skills

The two informatics content areas reportedly taught most frequently in graduate nursing programs in the U.S. were:

- Accessing electronic resources and
- Ethical use of information systems" (privacy, confidentiality and security of information).

It was disappointing that only 34% (n=91) of programs reported including "evidence-based practice" in the graduate nursing curriculum. The lowest reported informatics content areas taught in graduate programs are identical to those reported as lowest in undergraduate programs:

- The Unified Medical Language System
- Data/information system standards
- Ergonomics
- NIDSEC criteria for information systems
- The life cycle of an information system

Informatics Skills Required for Program Entrance and Exit

Less than half of the respondents required graduate students to enter with skill in using email and word-processing. A lower percentage of respondents required information literacy skills (bibliographic retrieval skills and accessing the Internet/WWW). The lowest reported informatics expectations for nurses entering graduate programs were in spreadsheet applications, databases, and presentation graphics software.

Faculty

Informatics Skills Taught

Approximately one-third of programs reported that nurse faculty members are teaching computer literacy skills: e-mail, spreadsheets and databases. Over half of nursing programs surveyed indicated nurse faculty is teaching information literacy skills (bibliographic retrieval from both the Internet/WWW and library sources) and use of presentation graphics software.

Average Level of Nurse Faculty

Using Benner's from Novice to Expert framework [9], only two programs rated their nurse faculty as "experts" in teaching and using information technology. The greatest percentage of nursing programs (39%, n=103) rated faculty at the "advanced beginner level". A combined percentage of 86% (n= 229) of programs rated faculty as "novice", "advanced beginner", or "competent". Significantly, 18% (n= 48) of programs reported faculty as "novices" in this area. Less than one third (29%, n= 78) of nursing programs reported faculty members at the "competent level". Nearly half (46%, n=122) of programs reported either no future plans or did not know of any plans to offer informatics education or training in their region

Evidence of a Champion of Nursing Informatics

Over three fourths of nursing programs indicated there was a champion informatics user in their nursing program. This finding reflects support for informatics education in the nursing curriculum.

Practicing Nurses

Informatics Tools Used by Practicing Nurses

Respondents indicated the most frequent use of informatics tools used by practicing nurses included remote monitoring devices, online consumer health tools, and handheld computers. When asked to predict five years into the future, respondents identified similar informatics tools will be used predominantly by nurses.

Need for Informatics-Prepared Nurses

Almost three quarters (n=194) of respondents indicated that nurses in their regions were currently performing informatics work. Over half of those surveyed reported a moderate to high need for nurses prepared for informatics positions in healthcare. In the next three years, 81% (n=213) of nursing programs projected that the need for informatics nurses will increase greatly (41%, n=108) or increase somewhat (40%, n=105). Reflecting a common theme among many regions, the greatest percentage of programs per region perceiving a moderate to high need for informatics nurses currently were from the East South Central, East North Central, Pacific, or South Atlantic regions of the United States. Compared to other regions, the East South Central

and Pacific region respondents most frequently projected the need for informatics-prepared nurses will "increase greatly" in the future. Representing a rural location, nursing programs from the Mountain region represented the lowest percentile in planning for informatics training or education for practicing nurses, faculty or students in the next year. As shown in Table 1, respondents projected that within the next 3 years there will be an increased need for system analysts for nursing informatics positions.

Discussion

Research Question 1

In examining findings that answer the first research question, the data indicate that current baccalaureate nursing programs have greater emphasis on "computer literacy skills" rather than "information literacy skills". Expectations for informatics skills are low for students entering both undergraduate and graduate nursing programs. There are many gaps in informatics content taught at both levels of nursing preparation.

Table 1: NI Positions Most Needed in the Future (N= 134 responses)

Cover Terms	Native Terms (role description by respondent)
Systems Analyst (n=23)	Involved in the planning, design, selecting, implementation, and evaluation of computer systems; CIO; Process improvement; Mediators between staff and technology.
Clinical Use (n=10)	Engage in Telehealth; Use of computers at bedside; Electronic health record; Management.
On-Site Educators (n=6)	Trainers; Software troubleshooters, Upgrade/Implementation designers.
Quality Improvement Nurses (n=11)	Nurses who work with insurance; Database developers; Quality assurance people; Data mining and outcomes evaluation workers.
Specific Positions Needed or Already in Place (n=13)	We need 3 people at our hospital; Local hospital hires one informatics nurse for every 6 units; At the local hospital, we have 21 positions; Vendors hire locally.
Don't Know (n=48)	I don't understand the question; Are far behind; Don't have the background to answer this.

Research Question 2

The findings regarding research question #2, the extent of faculty preparation for teaching informatics knowledge and skills, are unclear with respect to the breadth and depth of the informatics skills possessed by nurse faculty. Many respondents noted that information technology experiences such as the use of databases and spreadsheets were included in the nursing curriculum, but did not tie the use of these applications to clinical practice. Although informatics content and skills may be present in nursing curricula, it is not evident if it is the nurse faculty who were teaching informatics content and computer skills. The data indicate that there is a gap in the knowledge needed by faculty to prepare nurses to be skilled in information technology and its' use to manage clinical information in daily clinical practice. According to Connors et al. [10], educators who teach with advanced technologies need to "develop new skill sets and reengineer their pedagogical approach so that technology itself remains transparent to the learning process" (p. 233).

Research Question 3

The findings from research question #3 describe the program directors' perceptions about the current and future uses of informatics tools by practicing nurses and underscore the need for nurse generalists and specialists to be knowledgeable and skillful in using informatics tools. The findings provide further support for more nurse informatics specialists and faculty with informatics expertise. Thus despite the fact that current baccalaureate education efforts are focused on basic computer literacy, the faculty do perceive the need for including technology skills and information literacy skills for data management and data and information processing in the nursing curricula.

Conclusion

This study provides the empirical evidence of the critical need to include informatics concepts, informatics skills and the use of informatics tools in professional nursing practice within nursing curricula across the United States. The schools of nursing deans/directors perceive a growing need for informatics specialists and nurse educators who are prepared to lead change related to informatics. Noticeably, the data indicate that informatics competencies and tools used most by practicing nurses (e.g., remote monitoring devices, handheld computers, and accessing on-line health care resources) are not currently identified as expected outcomes from graduates within the U.S. It would be useful to know how these tools that were indicated by respondents as being utilized by practicing nurses are being incorporated into present curricula to prepare students for practice. The majority of nurse educators are primarily at the novice or advanced beginner level with use of informatics tools and skills such as word processing, bibliographic retrieval, and graphics presentation software and perhaps have had few opportunities to gain expertise with informatics tools used in daily nursing practice. Yet the need for information management in daily nursing practice is increasing and thus, the need for faculty to be knowledgeable and skilled in informatics is paramount. From the data it is apparent that faculty development opportunities in informatics are critically needed to ensure faculty achieve a level of competency needed to prepare nurses for professional practice. The finding that 75% of programs reported a champion informatics person is very positive and reflects a pool of faculty who are interested in promoting the integration of informatics concepts and skills in nursing program curricula. When considering the competency levels of faculty in this study, it may be that nursing programs should select these informatics champions for further faculty development opportunities in this arena. Although the majority of programs reported a champion, it may still be a challenge for

nursing programs to find and fund sufficient informatics continuing education to assist faculty to the necessary level of competency. It was interesting to find that the programs indicating that there were no current opportunities for informatics training also indicated they were unaware of or there were no future plans to offer nursing informatics education/training in their region. This finding underscores the need for further education of nursing directors and faculty that specifically addresses the importance of informatics for supporting evidence-based health care. How can graduates of nursing programs be prepared to deliver evidence-based best practice within the ever-changing world of informatics as it relates to nursing if nurse educators have a knowledge gap and the programs do not include basic informatics content? Nursing programs should examine the outcomes of the project entitled E-Health Delivery System (SEEDS) created by a partnership between the University of Kansas School of Nursing and Cerner Corporation [10]. In this project, curriculum content includes virtual case studies that assist students to "think in a data-driven mode that, in turn, provides the foundation for evidence-based practice" [10, p. 230]. The nursing program utilizes Cerner's clinical information system software for order entry, data repository, clinical documentation and clinical decision support tools in a "live-production" environment. The challenge to nursing programs will be to close the ever-widening gap between education and practice.

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