

**CLINICAL NURSES' PERCEPTIONS OF NURSING INFORMATICS
COMPETENCIES**

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Abstract

This is a descriptive study undertaken to identify competencies and supporting knowledge and skills in informatics perceived to be necessary by nurses for nurses engaged in clinical practice. This study applied a non-experimental, descriptive research design to a quantitative survey performed through web-based technology

Based upon the foundational work of Staggers, Gassert, and Curran (2001, 2002), the goal was to substantiate with clinical nurses and their direct nurse supervisors the clinical competencies that Staggers' identified for Beginning and Experienced clinical nurses through a Delphi methodology of nursing experts. All study facility Registered Nurses received an e-mail inviting their participation. Respondents logged on to a website and completed sections applicable to their situation; that is Beginning Nurse, Experienced Nurse, or Nurse Supervisor. Reminder emails were sent at two and four weeks after the initial invitation. Respondents who accessed and completed the survey received a \$5.00 food coupon redeemable at the hospital facilities.

All of the knowledge, attitudes and skills identified were supported as valuable, that is, a mean score greater than neutral. Value ranged from just above neutral to strongly agree. Factor analysis generally supported categorization; however, many items did not load into the anticipated categories. Categorization is one area which deserves further study

CHAPTER 1

A NEW AGE FOR NURSING

For us who Nurse, our Nursing is a thing, which, unless in it we are making progress every year, every month, every week, take my word for it, we are going back. (Florence Nightingale, 1872)

Nursing's visionary leaders of the 19th and early 20th century could not foresee that nurses in the 21st century would come to rely on something that nursing now takes completely for granted - computer technology. The rapid expansion of such technology into every aspect of modern nursing practice implies that the 21st century nurse must establish and maintain a great number of general and specific computer competencies. In addition to such common applications such as word processing and electronic mail, nurses frequently use computers to enter and review physician orders and other patient care information, to access laboratory and imaging results, and to locate resources. Medical equipment such as electronic thermometers, intravenous pumps and cardiac monitors all incorporate increasing degrees of computerization. Weiser (1991, 1993) termed this "ubiquitous computing." In their professional practices, as in their personal lives, many nurses use computers to collect and interpret data, access and organize information, implement actions, and record responses. Computerization provides an increased level of safety in practice. Small portable computers, such as PDAs, have become as essential to modern nurses as their stethoscope. Nursing leaders in both

education and employment believe that computer competencies are now indispensable for nurses (American Association of Colleges of Nursing [AACN], 1993; American Nurses Association [ANA], 1995, 2001; Anders, Douglas, & Harrigan, 1995; McDaniel, Matlin, Elmer, Paul, & Monastiere, 1998; Smedley, 2005). Skiba, Carty, and Nelson (2006) state that "Nurses must take individual responsibility to promote their knowledge and skills in the use of IT [Information Technology] in order to consider themselves minimally competent to practice in an information-intensive profession." Wilkinson as gone so far as to state that those who can not use computers will be as disadvantaged as those who can not read and write (Wilkinson, 1996).

Statement of the Problem

The registered nurse gathers data associated with the patient or with the process at hand. They then take that interpreted data and apply it against a body of knowledge from nursing and other disciplines. These resulting conclusions and the application of decisions at the clinical, managerial or policy level leads to an outcome, which becomes now another item of data.

Informatics can assist the nurse at every level of this process. Data collection can be automated, elements identified and made widely available. For example, much of nurse's information processing is completing paperwork. As early as 1966, Jydstrup and Gross (1966) estimated that nurses spent 36-64 percent of their time handling information. In 1999 at Parkview Episcopal Medical Center, Parkview, Colorado, it was estimated that nurses spent 50% of their time on paperwork (NIST, 1999). A 2003 study

found that New York state nurses providing direct care spent approximately one third of their time on paperwork.

The syntactic process of turning data into information and subsequently into knowledge can be supported. (Duncan-Poitier, 2003). Cox, Harsanyi, and Dean (1987) maintain that the “very core of nursing practice, regardless of the area of practice, is the management of information. With the exponential increase in the information available, computers offer hope in the nurse’s attempt to sift, process, and utilize information. Kaminski (2007, p. 24) states that “nurses must have the dexterity, competency, and knowledge to seamlessly incorporate the computer or other apparatus into their care.” The need for nurses to be competent in computer technology and information management is greater now than at any previous time.

All of this begs the question of what exactly does it mean to be a “computer competent” nurse? The available literature within both nursing and informatics offers few useful specifics. Many are either statements of opinion or a presentation of some selected “laundry list” of chosen knowledge or skills with little justification as to why these were selected (Hobbs, 2002). What is needed are research-based investigations using valid and reliable instruments examining what knowledge and skills make a nurse computer competent in the clinical setting.

Background

Nursing Informatics

The American Nurses Association in 2001 defined Nursing Informatics as

a specialty that integrates nursing science, computer science, and information science to manage and communicate data, information, and knowledge in nursing practice. Nursing informatics facilitates the integration of data, information, and

knowledge to support patients, nurses, and other providers in their decision-making in all roles and settings. This support is accomplished through the use of information structures, information processes, and information technology. (American Nurses Association, 2001)

While the art of nursing may lay in the interactions among individuals, one aspect of the science of nursing lies in the gathering of data and its collation into information, and ultimately knowledge. This processing of information is central to nursing practice and a novel change in direction for nursing (Staggers and Thompson, 2001, p. 257). Computers can automatically acquire much data. A nurse is required for the interpretation of content. Informatics is a tool, one concerned with the actual process and the impact that information has upon practice.

Competence

Given that informatics has become a fundamental feature of professional nursing, there is a need for research to provide for evidenced-based practice in this area. There has been considerable work towards establishing guidelines for core informatics competencies for nurses from the educational perspective; there has been little similar research from a strictly clinical practice point of view. It has been assumed that those competencies required for new graduates were the same as those for clinical practitioners. This may or may not be the case.

Certainly, for the most part, the core competencies required of clinical practitioners should be included within the competencies in the academic arena. Such clinical competencies provide the foundation for curricula in undergraduate and graduate programs. In practice, however, this does not always occur. Many, if not most, clinical facilities spend a considerable amount of time and money providing additional training to

recently hired new graduates to ensure successful clinical practice. Computer- and system-specific informatics education is but one example of additional training frequently felt to be necessary.

Purpose of the Study

The purpose of this study is to identify the nursing informatics knowledge and skill competencies felt necessary by clinical nurses for clinical nurses at the Beginning and Experienced levels of practice. Computer competent nurses are better able to utilize the vast information now available to them to make better decisions and provide improved patient care. This study builds upon the work of Staggers, Gassert, & Curran, (2001; 2002).who have previously used expert opinion in determining broad categories and then subsequently codified into specific knowledge and skill competencies.

In their work Staggers et al. (2001, 2002) sought to identify a foundation of informatics competencies for nurses at four levels of practice: Beginning, Experienced, Informatics Specialist, and Informatics Innovator. This current study focuses on the first two of Staggers' levels of practice, the Beginning and Experienced nurses. It examines which of the competencies suggested from Staggers' published perspective carries over to the clinical setting and looks for additional informatics competencies that should be considered for inclusion. Such knowledge allows health care providers, schools, graduate programs, nursing informatics experts, professional organizations, and governmental/regulatory agencies to plan and evaluate both formal and continuing education programs.

Theoretical Framework

Model of Skill Acquisition

Stuart and Hubert Dreyfus (1980) developed and published a model of skill acquisition based upon their observations of chess players and airline pilots. The Dreyfus brothers' model was applied to nursing by Patricia Benner in the landmark work *From Novice to Expert: Excellence and Power in Clinical Nursing Practice* (1984). In her work, Benner (p.13) "...posits that in the acquisition and development of a skill, a student passes through five levels of proficiency: novice, advanced beginning, competent, proficient, and expert." Benner's is a humanistic model, itself based upon Heidegger's phenomenological theory that people are defined by their concerns, practices, and life experiences.

According to the Dreyfus model, the novice is overwhelmingly governed by rules and, as such, is unable to rely on previous experience to recognize relevant aspects within a situation. In the next stage, advanced beginning, the learner is still rule-focused, but now has also begun to rely on previous experience to make decisions. This person still needs guidelines in order to perform at an acceptable level.

Competent performers are more organized; they have a plan and have become more efficient. Proficient performers are able to learn and synthesize from previous experiences, and modify their responses to the specifics of almost any given situation.

Experts, with their extensive experience and ability to see the significance and meaning within a contextual whole, are fluid and flexible in performing their skills. Dreyfus describes the expert as the chess player who develops a sixth sense for strategy, the athlete who develops a feel for the ball, the older child who rides as if his bicycle is

an extension of himself, or the airline pilot who self-corrects during a difficult landing without having to think through each step of the process (Dreyfus, 1997).

Given the nature of the modern nursing educational experience with its strong incorporation of computerization into curriculum and clinical exposure, the novice level is assumed to occur during the student's clinical experience. For the purposes of this study, upon graduation the individual is understood to be at the Advanced Beginning level. The four levels of Advanced Beginning, Competent, Proficient, and Expert correspond to Staggers' stated informatics levels of Beginning Nurse, Experienced Nurse, Informatics Nurse Specialist, and Informatics Innovator, which are shown in Table 1-1.

Table 1-1

Definitions of Each of the Four Levels of Computer Skills and Knowledge of Practicing Nurses Applied to the Dreyfus/Benner Model (in parentheses; adapted from Staggers, Gassert, & Curran, 2001).

| Level of Skill | • Knowledge |
|---|--|
| Beginning Nurse (Advanced Beginning) | |
| | <ul style="list-style-type: none"> • Have fundamental information management and computer technology skills. • Uses existing information systems and available information to manage practice. |
| Experienced Nurse (Competent) | |
| | <ul style="list-style-type: none"> • Has proficiency in a domain of interest (for example, public health, education, administration). • Highly skilled in using information management and computer technology skills to support their major area of practice. • Sees relationships among data elements and makes judgments based upon trends and patterns within these data. • Uses current information systems but collaborates with the informatics nurses' specialist to suggest improvement to systems. |
| Informatics Nurse Specialist (Proficient) | |
| | <ul style="list-style-type: none"> • An RN with advanced preparation possessing additional knowledge and skills specific to information management and computer technology. • Focuses on information needs for the practice of nursing, which includes education, administration, research, and clinical practice. |

Table 1-1: Continued.

Definitions of Each of the Four Levels of Computer Skills and Knowledge of Practicing Nurses Applied to the Dreyfus/Benner Model (in parentheses; adapted from Staggers, Gassert, & Curran, 2001).

Informatics Nurse Specialist (Proficient)

- Practice is built on the integration and application of information science, computer science, and nursing science.
- Uses the tools of critical thinking, process skills, data management skills (including identifying, acquiring, preserving, retrieving, aggregating, analyzing, and transmitting data), systems development life cycle, and computer skills.

Informatics Innovator (Expert)

- Educationally prepared to conduct informatics research and generate informatics theory.
 - Has a vision of what is possible and a keen sense of timing to make things happen.
 - Functions with an ongoing, healthy skepticism of existing data management practices and is creative in developing solutions.
 - Possesses a sophisticated level of understanding and skills in information management and computer technology.
Understands the interdependence of systems, disciplines, and outcomes, and can finesse situations to maximize outcomes.
-

Research Questions

This study sought to answer the following questions:

1. What computer knowledge and skill competencies do clinical nurses perceive are required for a nurse to practice at the Beginning level?
2. What computer knowledge and skill competencies do clinical nurses perceive are required for a nurse to practice at the Experienced level?
3. Are certain computer knowledge and skill competencies common to both the Beginning and Experienced practice levels?
4. Do clinical nurses and their direct supervisors share similar perceptions of what are essential computer knowledge and skill competencies?

5. Are these computer knowledge and skill competencies the same or similar to those deemed essential in the published literature?

In essence, this study asks: “What does it mean to be a competent nurse in relation to informatics?”

Summary

Informatics and the computerization of the healthcare environment have now become integral to modern nursing. Competency in this area is now a fundamental expectation, rather than an unusual skill. What is not yet clear is exactly what is meant by the term “computer-competent nurse” and how to implement it in practical terms. The literature review of the following chapter will illustrate how far the profession has come to date in understanding this concept. It will also point out how far we have yet to go.

Chapter 2

LEARNING FROM THE PAST:

A REVIEW OF THE CURRENT LITERATURE

Were there none who were discontented with what they have, the world would never reach anything better. (Florence Nightingale, 1852)

The previous chapter identified how important informatics and computerization has become to the practice of modern nursing. This chapter will summarize the research that nursing has undertaken in this area to date and set up the basis for the current investigation.

Determining Competencies

Several methodologies have been identified to determine the skills and knowledge competencies an individual should possess. Richards, in her 2000 doctoral dissertation, identified four commonly used approaches: evolutionary, committee review, expert panel, and the Delphi method. The oldest and most commonly used is the evolutionary method. One or more individuals with proficiency simply develop criteria based upon their expertise. Committee review is a larger scale, group oriented and more formal application of this approach.

An expert panel is a group with a broad range of education and expertise who apply a systematic method of consensus to the identification of the required competencies. The Delphi technique is an expert panel utilizing a feedback method to

reduce inter-observer variability by confronting each member with the independent judgments of the other members and then giving each member the possibility to adapt his or her judgment. The Delphi technique was the methodology utilized by Staggers et al. in their work on determining and codifying the specific knowledge and skill competencies required for nurses.

Methods

An extensive search and analysis of the healthcare literature was conducted on the concept of “computer competency.” English language publications for 1988 through 2006 were sampled, utilizing PubMed, CINAHL and the Health & Psychosocial Instruments (HaPI) databases. Major search terms were “nursing” and “computer(s)” and then each of the following: “competency (ies),” “skill(s),” and “outcome(s)” as well as their various synonyms. A search was also made for the same years using the Medical Subject Headings (MeSH) term “computer literacy.” This second search identified an additional ten to fifteen articles. The initial literature review was performed in 2003. It was rerun again in late 2006 with the result of only a single additional study.

Procedure and Analysis

In a search of the applicable published literature for inclusion in this review, over 180 possible references were identified by the CINAHL, 150 by PubMed, and 46 by the HaPI databases. Only references describing the use of a specific instrument or another formal research mechanism was included in the review. Each identified instrument, or its applicable subsection, was assigned to a category of knowledge, attitudes, or skill. These three domains have been used in other studies of competency (Birx, Castleberry, & Perry, 1996; Liu, Pothiban, Lu, & Khamphonsiri, 2000; Saranto & Leino-Kilpi, 1997b) and are

supported as appropriate in that they are congruent with Bloom's *Taxonomy of Educational Domains* (cognitive, affective and psychomotor), which is used frequently within the realm of nursing education (Bloom & Krathwohl, 1956; Waltz, Strickland, & Lenz, 1991). Knowledge is necessary to develop skills; a positive attitude fosters interest or motivation to acquire knowledge and skills; and knowledge and skills are increased with practice (Liu et al., 2000). Studies were also analyzed based on the instrument used to measure or identify computer competencies.

Literature Summary

A descriptive summary of the literature findings is provided in Appendixes A (Knowledge/Cognitive), B (Attitudes/Affective) and C (Skills/Psycho-motor) and are discussed below. The author(s), publication date, sample, instrument name (if given), instrument description, identified competencies, and findings are provided. These studies are organized according to the major categories of knowledge (cognitive), attitudes (affective) and skills (psychomotor).

Computer Knowledge (Cognitive)

Cognitive knowledge is an understanding of the terminology and facts to allow one to comprehend, apply, analyze, synthesize and evaluate (Norton, 1998). In the reviewed literature, four instruments that measured cognitive computer knowledge with published psychometrics were identified and are summarized in Appendix A. (E. Birx et al., 1996; Liu et al., 2000; Marini, 2000; Staggers, 1994). The first instrument was *The Staggers Nursing Computer Experience Questionnaire (SNCEQ)* (Staggers, 1994). This 32-item, five-point, multiple-step, self-report instrument measured the nurse's knowledge regarding general computer use, health information systems applications, and the nurse's

role and participation with computers. This instrument also asked subjects to rate themselves on a novice-to-expert scale. For each indicator, subjects score both their past or present computer use and their past or present computer knowledge. The pilot study for this instrument consisted of 24 American graduate nursing students. Overall test-retest reliability was good (Pearson's $r = 0.94$) and both content and construct validity were assessed as adequate (overall coefficient alpha was 0.93). Staggers intentionally excluded males in the SNCEQ's initial development, with the rationale that most nurses were female. Although published in 1994, the instrument was initially validated in 1991 with 110 clinical nurses and again in 1998 with 98 clinical nurses (Staggers, 2001).

Birx, Castleberry and Perry conducted the next study in the United States in 1996. This study sought to measure computer knowledge through a self-developed, ten-item multiple-choice scale, focusing on students' understanding of selected basic computer terminology. This peer-reviewed article offered no specific information about the instrument or its development. The instrument was administered to 38 nursing students, with half participating in nine hours of laptop computer education and half not. This inquiry identified no significant difference in student computer knowledge scores ($t = 1.97, p > 0.05$) dependent upon the use of laptop computers. As the authors note, this may be a reflection of the limited sensitivity of the instrument. No attempt was made to restrict or measure computer access by the non-laptop peer controls.

In 2000, faculty at the American University of Beirut (Lebanon) published their results of an attempt to assess the efficacy of a nursing informatics course. Computer literacy was evaluated with a subset of three questions (of 21 questions overall) in a course evaluation questionnaire (Marini, 2000). Students self-rated their general

knowledge in word processing, presentation graphics and use of the Internet. Marini found a significant increase ($t = -16.32$, $p < 0.05$) in post-test over pre-test knowledge score means. However, the broad simplification of the three-subset questions, their use within a course evaluation format and the small study sample size (a total of 36 students over three consecutive terms) limits the appeal of generalizing these findings outside of this particular setting.

Also published in 2000 was the *Nurses' Computer Knowledge Questionnaire (NCKQ)*. Developed in the People's Republic of China, this instrument consisted of 20 self-rated, true-false items used to measure the computer knowledge of 169 clinical nurses one-year post implementation of a health information system at a Beijing hospital (Liu et al., 2000). The instrument examined nurses' understanding of basic knowledge (that is, system components/actions), health information systems (HIS) use (that is, order entry, data retrieval) and system security (that is, passwords, virus protection). In this study, the nurses' basic computer knowledge scores were low. The authors state that the instrument was designed for Chinese nurses who "had no experience with computer applications, either in the hospital or at home. Most were computer novices" (Liu et al., 2000, p. 198). After training, the nurses' HIS and security scores were higher. This outcome probably reflects the effects of specific computer training. As in the Beirut study, the use of this instrument in settings where nurses are already familiar with computers may be of limited value.

Potential reliability and validity problems exist with all the above instruments in that they rely on nurses' self-report of their own perceived computer knowledge. As Waltz, Strickland, and Lenz (1991) have warned, "self-reports are subject to error due to

a tendency to respond in a socially approved manner, the tendency to acquiesce or agree with a statement without careful consideration, and varying ability to engage in self-focused attention and accurate self-appraisal” (pp. 326-27). While co-measures of the same knowledge or duplicate questions seeking inconsistencies in response might have reduced these problems, none of the reviewed studies appeared to use such an approach. Nor did any identified instrument attempt to measure computer knowledge directly, such as by written examination.

Five surveys were identified that attempted to define and classify the computer knowledge needed by nurses (Arnold, 1998; Carter & Axford, 1993; Saranto & Leino-Kilpi, 1997b; Staggers et al., 2001; Thede, 1998). A 1993 Delphi study by Carter and Axford (1993) had ten Australian experts identify the computer knowledge they thought would be necessary for clinical nurses. This formed the basis of a 75-item questionnaire that was given back to the experts, as well as 150 computer novice RNs. Both expert and novice groups identified knowledge related to the computer’s contribution to nursing information as a concept or the collection of nursing data as important. These investigators reported that word processing or knowledge related to the operation of computers (that is define bit, identify components, and so forth) was unnecessary computer knowledge at the Beginning level. Outside of this, there was little agreement between expert and novice groups.

In 1997, Saranto and Leino-Kilpi’s Delphi study of 15 Finnish experts reported opposite findings; they found that nurses must know how to use the computer for word processing, for accessing and using the hospital information system, and for e-mail.(Saranto & Leino-Kilpi, 1997a, 1997b, 1997c) In this study the authors concluded

that nurses must be aware of basic operations and of system security. They suggested that hospital information systems and informatics education should be integrated into nurses' training. The "experts" selected for the study included clinical nurse managers, nurse educators, student nurses and patients.

At a Rutgers University informatics conference in 1998, Thede delivered a paper in which she reported on 315 respondents to a 1997 Internet survey regarding what should be included in an undergraduate informatics curriculum. Respondents thought that knowledge of 1) computer history, 2) computer hardware, 3) general and specific applications, 4) word processing, 5) databases, 6) bibliographic search, 7) e-mail and 8) Internet searching were important for nurses. Respondents were split as to whether knowledge of nursing taxonomic language and data sets were of value. This was a convenience sample with respondents logging on to a Website over a three-week period to complete the survey. Thede did not explain how respondents learned of the survey's existence; hence, a potential sampling error cannot be disregarded.

Arnold published the results of a survey sent to non-clinical nurses from a 1998 computer conference mailing list. Subjects completed the *Educational Needs Survey*, a 73-item, multi-step scale-type questionnaire regarding their computer usage, educational interests, and the extent of their computer knowledge. While all 497 respondents (33% return rate) wanted more information about presentation software, there was no agreement regarding what other knowledge was necessary, that is whether there was a need to know basic concepts or specific software applications. The top five computer applications subjects used were word processing (73.4%), e-mail (49.6%), database (46%), and spreadsheet (44.1%), and hospital information systems (43.4%). Only word

processing was used by more than half of respondents. The reported reliability coefficient was 0.96. While the stated purpose of the study was to "identify the current informatics educational needs of professional nurses," this was, in fact, a survey of informatics nurses regarding their computer use, educational plans, and expectations for certification content.

In 2001 and 2002 Staggers, Gassert, and Curran published the most definitive research-based work to date in competency identification. From the available literature the authors created a database of possible nursing informatics competencies. Using the Delphi technique a panel of six, primarily scholarly, nursing informatics "experts" honed these competencies and divided them into four distinct skill levels. The end result was a master list of 304 identified competencies: 43 for the Beginning nurse, 35 for the Experienced nurse, 186 for the Informatics Specialist and 40 for the Informatics Innovator.

As noted above, the work of Staggers, Gassert, and Curran was derived primarily through consultation with scholastic nursing experts. In 2003 Christine Curran reported on the efforts of the informatics faculty of the Columbia University School of Nursing to adapt these competencies to Nurse Practitioners (NP). From the original list of 32 experienced-level competencies the faculty added 14 evidenced-based practice competencies and deleted 14 competencies as "... related to non-clinical functions and thus were not deemed essential to NP practice" (p. 324). Perhaps their most significant deduction was that the basic competencies for students and the more comprehensive competencies for the practicing NPs were more or less identical. "The difference between

settings (i.e, [sic] practice and education) was not in the number or type [sic] of competencies itself, but rather in the degree of knowledge and skill mastered” (p. 324).

In 2003 Jiang, Chen, and Chen undertook a Delphi study similar to Staggers’ group, however, their study sought to identify those computer competencies important for Taiwanese nurses. Their end result was 94 competency items sorted into seven domains. Reflective of Taiwan’s unique nursing educational track, the panelists also determined when a specific competency should be cultivated, that is, at the high school, the college, or graduate level.

The singular commonality among all of the survey studies, as with the research studies, is the conflicting findings over what constitutes important computer nursing knowledge. If nurses cannot agree on what constitutes important knowledge, how can nurses ever develop appropriate education programs or measure essential competencies?

Computer Attitudes (Affective)

The affective domain encompasses attitudes, beliefs, values, feelings, and emotions (Norton, 1998). Nurses’ attitudes are an area of research interest, and ten studies involving six specific instruments were identified and summarized in Appendix B (E. Birx et al., 1996; Jayasuriya & Caput, 1996; Liu et al., 2000; Marasovic, Kenny, Elliott, & Sindhusake, 1997; McBride & Nagle, 1996; Murphy, Maynard, & Morgan, 1994; Schwirian, Malone, Stone, Nunley, & Francisco, 1989; Stronge & Brodt, 1985; B. Thomas, 1990; Simpson & Kenrick, 1997).

The earliest and most often utilized instrument is Stronge and Brodt’s 1985 *Nurse’s Attitudes Toward Computers Questionnaire (NATC)* that focused on nurses’ broad beliefs, concerns, and willingness regarding computers in general. The authors feel

that nurses' complex internal states affect their attitudes toward computer use and that "Nurses, as a group, generally have been found to be resistant to computerization, particularly regarding patient care responsibilities that historically have been reserved for personalized attention." (Stronge & Brodt, 1985). Their 20-item multi-step scale questionnaire was developed with 48 Iowa nursing students and faculty. The instrument measured six nursing attitudes: job security, legal ramifications, quality of patient care, capabilities of computers, employee willingness to use computers and institutional benefit. Factor analysis was not performed; rather, the authors relied on index of discrimination scores to select items and then categorized these items according to the previously selected six attitudes.

In a follow-up study four years later, Schwirian et al. (1989) gave the Stronge and Brodt *NATC* to 711 student and clinical nurses. They produced a refined 17-item attitude *NATC* scale with three identifiable factors: computers and patient care, computers and personal security, and general attitude. Stockton and Verhey (1995) in association with the introduction of a patient care information system, also performed a large sample (before, $n = 391$, and after, $n = 265$) psychometric examination of Stronge and Brodt's instrument. They reported an overall instrument reliability of 0.92 and their results reinforced the three factor scale reported by Schwirian, et al. in 1989.

In 1996, McBride and Nagle described their findings related to Stronge and Brodt's original 20 questions *Nurses' Attitudes Toward Computerization (NATC)* questionnaire. Their analysis of data from a convenience sample of 299 baccalaureate nursing students identified three and possibly four factors that influenced the positive attitude of nurses towards computers: nurses' work, barriers, organizational issues, and

perhaps efficiency. Their data analysis of a corresponding sample of 394 RNs supported only the first three factors, with very different item loading assignment than with the student group. In both analyses, the selected factors explained only 50% of variance. McBride and Nagle's results were inconsistent with the previously mentioned studies in finding a lack of support for the construct validity of the Stronge and Brodt instrument.

Simpson and Kendrick (1997) administered the Stronge and Brodt questionnaire to 208 British nurses in 1996. Their study differed from the previously cited studies in that a significant number (45.7%) of nurses expressed a negative attitude towards computerization in clinical practice. The authors felt the issue was one of actual practice not meeting nurse's expectations.

The second instrument identified to measure the affective domain was the 1996 *Nurses' Computer Attitudes Inventory (NCATT)* developed in Australia by Jayasuriya and Caputi. Following administration to 170 nurses and nursing students, a 22-item instrument was developed in which ninety percent of the variance was related to three factors: computers and nursing care, computer anxiety, and patient confidentiality and computers. The instrument demonstrated acceptable internal consistency (Cronbach's alpha coefficients ranging from 0.70 to 0.92) and satisfactory concurrent validity (Pearson's correlations = 0.51, $p < 0.0001$ for the total score) between the Revised NCATT and its predecessor, the CATT. Internal reliabilities suggested each factor contained some unique variance.

Beliefs, feelings and the willingness to change one's attitude towards computers in nursing was the focus of the *Attitudes toward Computing in Nursing Questionnaire* developed in 1990 by Thomas. Thomas developed two 30-item parallel forms of her

instrument and administered both to 109 baccalaureate/master's students in four nursing programs. Internal consistency and reliability were high (Cronbach's alpha greater than 0.89). Birx, Castleberry and Perry (1996) also used Thomas' instrument, which they called *Opinionnaire: Computing in Nursing*. As in their study regarding computer knowledge, Birx et al. found no significant difference between students who were dependent upon the use of a laptop computer in an undergraduate nursing course ($t = 1.13$, $P > 0.05$). The authors concluded that this was related to both groups possessing high attitude scores going into the study. They suggested this may be due to a maturation of students' computer attitudes in the six years since the instrument was developed in 1990.

Nurses' attitudes about satisfaction, beliefs, and motivation regarding computers were examined in 1991 by Burkes in her *Nurses' Computer-Use Attitude Questionnaire*. The instrument was based on an adaptation of Vroom's (1964) Expectancy Theory in which an individual's satisfaction times expectancy (belief) equals motivation, which leads to a choice. Burkes' descriptive, correlational survey of 133 clinical nurses in a single Intensive Care Unit setting supported Vroom's theory by the finding of significant relationships between satisfaction, belief, and motivation. Computer knowledge was positively correlated with beliefs, and computer experience was negatively correlated with satisfaction. Conceptually, Burkes selected three attitudes based upon theory and then sought to identify relating variables. An alternative approach would have been simply exploring the nurses' attitudes.

Conceptualization was also an issue in a 1997 follow-up survey by Marasovic et al. using a modification of Burkes' instrument with 37 Australian intensive care nurses. The purpose of the study was to identify "factors resulting in negative attitudes [which]

then could be targeted through training and support for users.” Factors that influence nursing attitudes towards computers explored were age, years of nursing experience, years of intensive care nursing experience and educational degree. Unfortunately, only the later of these factors is amenable to influence by either training or support.

Burkes’ choice of attitudes was supported in 2000 by Liu, Pothiban, Lu, and Khamphonsiri who found that motivation, beliefs and satisfaction scores (in rank order) were how 169 Chinese nurses viewed computers in relation to a health information system implementation project. As with the earlier discussion on knowledge, while most of the Chinese nurses had positive attitudes towards computers, this may have been impacted by a significant lack of experience with computers.

Murphy, Maynard and Morgan (1994) developed their 12-item general attitude scale for a three-year study of 224 nurses pre- and post-implementation of a Clinical Information System (CIS). The reported alpha reliability value was 0.92. An important finding of their study was that while respondents indicated positive attitudes prior to implementation of a CIS, their attitudes became less positive during startup. This study did not follow through to examine nurses’ attitudes months and years post-implementation. As the post-test mean was lower compared to the pre-test mean in every area, the influence of the CIS implementation may have played a role.

Computer Skills (Psychomotor)

The psychomotor domain consists of the manual, gross and fine motor skills necessary to complete a task (Norton, 1998). Three instruments (E. Birx et al., 1996; Liu et al., 2000; Marini, 2000) and two surveys/studies (Graveley, Lust, & Fullerton, 1999;

Saranto & Leino-Kilpi, 1997a, 1997c) that attempted to measure this domain were identified and are summarized in Appendix C. All five studies were published after 1995.

Birx, Castleberry and Perry in 1996 used a combination of three computer skill checklists (consisting of 10-12 tasks each) measuring students' self-reported skills in using e-mail, word processing, and conducting "library searches." With more than forty elements, this was a large instrument with a heavy response burden on the user. Computer skill scores significantly ($t = 2.78$ to 5.49 , $p < 0.05$) improved over time for students using laptop computers in a nursing class as opposed to students who were not provided computers to use. Experience improved performance. As previously noted, a design problem existed as no attempt was made to either restrict or measure the computer access of the non-laptop peer controls.

Marini (2000), as part of a nursing informatics course evaluation, developed a similar six-item self-reported questionnaire in 1996-1997 to assess skill levels for several common general software applications. Regrettably, she did not identify these applications. However, lab session competencies for the course being evaluated were for Windows'98, Microsoft Word, Microsoft PowerPoint, Microsoft Excel, electronic mail, and library database use. For the 36 students involved, the pre-course to post-course skill scores were statistically different ($t = 11.71$, $p < 0.05$). However, results are not generalizable from this convenience sample.

Published in 2000 the *Nurses' Computer Skills Scale (NCSS)* is a 16-item, four-point multi-step scale developed by Liu, et al (2000) to measure the computer skills of Chinese nurses in a Beijing hospital. Questions were for basic operations (seven items), Health Information Systems (HIS) skills (seven items), and skills for "system security"

(two items). The reported content validity (index = 0.95) and reliability (Cronbach's alpha coefficient = 0.83) were good. Nurses' mean scores were highest for HIS, followed by basic operations and lowest for system security. Significant positive correlation of computer skills with both computer knowledge ($r = 0.18, p < 0.05$) and computer $r = 0.26, p < 0.01$) were found. The authors noted the positive relationship between computer skill level with frequency and length of computer use. In their study situation "most nurses could not conveniently access computers". As noted in the Birx, et al. study, experience improved performance.

The previously described 1997 Saranto and Leino-Kilpi (1997a, 1997c) Delphi study asked a panel of 15 Finnish experts to describe not only computer knowledge, but the computer skills required in nursing. Replies to open-ended questions such as "What do you think a nurse should know about --" were used to develop first a 58-item and then a refined 69-item multi-step scale questionnaire. After the third round, there was 100% consensus that nurses needed to be skilled in 1) the use of system security, 2) word processing, 3) e-mail, 4) the hospital information system, and 5) computerized patient equipment. There was no agreement on skills related to operation of basic components of the computer system. Several content areas had very different scores between rounds two and three, perhaps indicating some ambiguity on the part of the experts.

Graveley, Lust & Fullerton (1999) reported on a self-assessment survey they used in 1997-98 to quantify computer skills before and after a six-session coaching intervention with low scoring nursing students. While 299 students took the pre-intervention questionnaire, only 17 students met the inclusion criteria for final analysis (that is, low initial score, attended intervention, advanced in program, and so forth). Mean

post-intervention scores for these 17 students were dramatically greater than the mean pre-intervention scores in overall use of computers, word processing, use of the Internet, spreadsheets and PowerPoint (*t*-scores between 8.4 and 10.4, $p < 0.05$). Database use and the ability to program “macros” were also deemed important.

Discussion/Findings

A summary of the discussed studies and the competencies each seemed to identify are listed in the Appendixes A, B and C. At least two measurement instruments were found for each domain. It is apparent that disparity exists in the methodological quality of these studies. Most of the studies would have benefited from a sample with adequate power to generate generalizable conclusions. More than half of the studies employed inadequate psychometric analysis or had serious methodological problems.

The computer competencies revealed by the analysis are summarized in Appendix D. At least two or more instruments indicated:

1. Knowledge competencies include: basic operations, word processing, system security, and knowledge of the health information system used by the nurse.
2. Attitude competencies include: satisfaction with the system being used and a belief that the system is better than the alternatives. These motivate the user and lead to a positive mind-set.
3. Skill competencies include: basic operation tasks, word processing, the use of tables and graphs, security, e-mail, the ability to browse the Internet and to accomplish necessary tasks on the users’ specific health information system.

Conclusions and Recommendations from the Literature

Numerous conceptual, methodological and measurement problems exist with the present literature. While nurse researchers in informatics have begun the work on a conceptual base, the ability to generalize from these studies is limited. Individually the studies show a wide range of beliefs and little agreement as to what specific knowledge, attitude, and skills are deemed necessary (or unnecessary) for nurses. Surveyed together as a whole, however, some consensus does emerge. Computer-competent nurses have a general knowledge and understanding of computer technology, a positive attitude toward computers and software and how they benefit nursing, and are skillful in the equipment and software used in their environment. Principally, computer competence is a nurse's ability to effectively use the computer systems available and adapt their use to a variety of particular settings.

The findings above are congruent with the most recently published recommendations by an expert panel of the American Nurses Association (ANA) and published as the *Scope and Standards of Nursing Informatics Practice* (2001). The panel made recommendations for the computer and information literacy skills (that is, competencies) of Beginning and Experienced nurses as well as the Informatics Nurse Specialist. Beginning nurses are able to use computer technology to accomplish tasks. They possess basic computer technology skills in the use of a word processor, database, and spreadsheet, in using applications to give and document patient care, or communicate by e-mail. Experienced nurses have the knowledge, attitude, and skills to support their major area of practice. They are able to see relationships among data elements and make judgments based upon data trends and patterns.

Identification and measurement enhance understanding. Further investigation of competencies will provide educators, employers, and nurses with a beginning framework of the conceptual and technical skills needed for nurses to succeed in today's computerized healthcare environment. Educators and employers should use this information to structure basic and continuing educational programs. Knowing what is necessary the 21st century nurse can develop and maintain computer competencies to the benefit of themselves, their patients and their profession.

Responsible provider and professional organizations should make the sponsorship and funding of additional research to identify the specific computer competencies required in nursing and to develop appropriate instruments to measure these competencies an urgent priority. These organizations need to sponsor and secure funding to conduct well-designed studies generalizable to the practice of nursing.

Summary

The foundational work to date in relation to computer competencies for nurses has occurred primarily in the academic setting or at least from the "expert opinion" perspective. Most of the studies described asked what competencies were necessary for nursing students. Few involved asking practicing clinical nurses and the direct supervisors what computer competencies were necessary for clinical nursing practice. Chapter Three describes research which attempted to narrow that latter knowledge gap.

CHAPTER III

RESEARCH METHODOLOGY

The most important practical lesson than can be given to nurses is to teach them what to observe. (Florence Nightingale, 1860)

The purpose of this study is to identify the nursing informatics knowledge and skill competencies necessary for clinical nurses at the Beginning and Experienced levels of practice. It builds upon the work of Staggers, et al, who have previously used expert opinion in determining broad categories and then subsequently codifying into specific knowledge and skill competencies (Staggers, 2001; Staggers et al., 2001; Staggers et al., 2002). This chapter describes the study's general approach and its methodological rationale.

Research Design

This research applied a non-experimental, descriptive study design. It is non-experimental in that while there is assignment of subjects to specific conditions or groups, the subjects are non-random and self selected for their knowledge or experience within the area under study. No manipulative techniques are used. The focus is descriptive in that it seeks to observe, describe, and document what are the attributes of nurses' informatics competencies (Polit & Hungler, 1995).

Assumptions

In all studies there are underlying basic assumptions implicit in the research process and the researches paradigm (Polit & Hungler, 1995). In this study, the following underlying basic assumptions are identified:

1. That the knowledge and skills making up nurses' competencies can be ascertained.
2. That the informatics competencies identified can be confirmed and evaluated by clinical practitioners and their direct supervisors through a Web-based survey, and that these are representative of those competencies needed by clinical practitioners.
3. That the clinical nurses and direct supervisors responding in this study can critically evaluate practice needs and respond conscientiously to the questions in the survey.
4. That the study variables are not normally distributed, that is, that most respondents will have decided directional preferences in response.

Sample

The population of interest is all practicing clinical nurses and their immediate clinical nurse supervisors. For the purposes of this study a clinical nurse is defined as a Registered Nurse who is involved in direct observation or treatment of patients and their significant others at least 50 percent of their practice time. Full-time, part-time, and call-in nurses were invited to participate. Supervisory nurses are defined as nurses who in their employment position have hiring, firing and performance evaluation accountability

over clinical nurses. The study sample was a convenience sample of all nurses identified through their employment at the study facility, located in Hawai'i.

The study facility is located in Honolulu, Hawai'i and is a large, private, non-profit, acute medical care facility licensed to operate with 526 acute care beds and 28 sub-acute beds. The medical center has more than 3,000 employees; with over 1,000 Registered Nurses and 1,200 physicians are on the active and courtesy medical staff. At the time of the study, every nurse had undergone between eight and 22 hours of orientation training specific to the computer systems they used in their official capacity. This training included security, the use of passwords, order entry, results retrieval, and basic keyboard, mouse, and printer usage, and operational problem solving.

As a leading medical referral center in the mid-Pacific Basin, the study facility offers a comprehensive range of primary and specialized care services including oncology, maternity, trauma, orthopedics, neurology/neurosurgery and behavioral health. It is accredited by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) and is affiliated with the Voluntary Hospitals of America (VHA). The medical center has a strong association with the University of Hawai'i and is approved to participate in physician, nursing, and allied healthcare residency training for students from across the state, as well as nationally and internationally.

The study facility has had house-wide computerized order entry--results reporting capability since 1994. In addition, a large number of stand-alone computer systems exist among the various departments. In January of 2006, several months after this survey was completed, the medical center commenced the first phase of a program of transition to an

electronic medical record with 100 percent computerized admission, billing and patient management, and nursing documentation with sophisticated decision support capabilities. This was a highly customized designed application based upon the family of products from the EPIC Systems Corporation (Madison, Wisconsin). Interestingly, five other inpatient medical facilities across the state are also switching to the EPIC system over the next few years. These planned expansions of information management systems across the state further highlight the importance and relevance of this proposed study to both nursing practice and education. Modern healthcare is beginning to demand a degree of universality, compatibility, and transfer of skills that nurses in Hawai'i will need to meet.

Instruments

In 2001 and 2002, Staggers, Gassert and Curran published the results of their efforts in creating a database of nursing informatics (NI) competencies. They reviewed the published literature for suggested competencies. The resultant database was then submitted to a larger panel of nursing informatics experts (Delphi technique) who affirmed, modified, added, or deleted competencies over a series of at least three reviews. The end result was 304 competencies thought to be necessary for nurses at each of four successive levels of practice: 43 for the Beginning nurse, 35 for the Experienced nurse, 186 for the Informatics Specialist and 40 for the Informatics Innovator. As the competencies originated from the published literature and were then subject to repeated reevaluation by a number of recognized experts in nursing informatics, this database presents a high level of content validity. It should be noted that this is a database listing of necessary knowledge and skills and has never been offered as an "evaluation tool."

Thus, the reliability, validity, and other statistical criteria for assessing measuring tools have never been done.

Staggers, Gassert, and Curran's 2001 article lists by category those specific competencies felt necessary for each of the above levels of nurse. These have been summarized in Table 3-1. This matrix identifies three major concepts or domains (Computer Skills, Informatics Knowledge, and Informatics Skills) and 39 categories necessary for nurses. Only 20 of these categories are applicable for nurses at the Beginning or Experienced level. Staggers et al. never use the term "domain," rather they use categories and sub-categories. The term domain is used for the purposes of this research as it more correctly reflects hierarchical order.

Of the 43 essential computer competencies for the Beginning nurse and 35 for the Experienced nurse which were to be used in this survey, nine questions (5 Beginning, 4 Experienced) were inadvertently eliminated in transcription to the final Website. The eliminated questions are listed in Table 3-2.

This study presented 37 competencies for the Beginning and 31 competencies for the Experienced nurse. Competencies were presented in a Likert scale format; respondents were asked to rank their agreement or disagreement that the item represented a necessary computer knowledge or skill competency for a clinical nurse at their respective level. Beginning nurses were asked to rate the 37 competencies identified for Beginning nurses. Experienced nurses were asked to rate both the 37 competencies identified for Beginning and the 31 competencies for Experienced nurses. For accurate measurement, a five-point ordinal response option was deemed to be required in order to

Table 3-1

*Domains (centered) and Categories (align left) of Informatics Competencies for Nurses
(adapted from Staggers et al. 2001)*

| Categories | Level 1 Beginning Nurse | Level 2 Experienced Nurse | Level 3 Informatics Specialist | Level 4 Informatics Innovator |
|--|-------------------------------|---------------------------------|--------------------------------------|-------------------------------------|
| <u>Computer Skills</u> | | | | |
| Administration | √ | √ | | |
| Communication | √ | | | |
| Data Access | √ | √ | | |
| Decision Support | √ | | | |
| Documentation | √ | | | |
| Education | √ | √ | | |
| Monitoring | √ | √ | | |
| Basic Desktop Software | √ | √ | √ | |
| Systems | √ | √ | √ | |
| Quality Improvement | | √ | √ | √ |
| Research | | √ | | |
| CASE# Tools | | | √ | |
| Project Management | | | √ | |
| Simulation | | | √ | √ |
| <u>Informatics Knowledge</u> | | | | |
| Data | √ | √ | √ | |
| Impact | √ | √ | √ | √ |
| Privacy / Security | √ | √ | | |
| Systems | √ | √ | √ | |
| Education | √ | √ | √ | √ |
| Research | | √ | | |
| Usability / Ergonomics | | | √ | |
| Regulations | | | √ | |
| <u>Informatics Skills</u> | | | | |
| Evaluation | | √ | √ | √ |
| Role | | √ | √ | |
| Analysis | | | √ | √ |
| Data Structures | | | | √ |
| Design Development | | | √ | √ |
| Fiscal Management | | | √ | |
| Implementation | | | √ | |
| Management | | | √ | √ |
| Privacy / Security | | | √ | |
| Programming | | | √ | |
| Requirements | | | √ | |
| Systems Maintenance | | √ | √ | |
| System Selection | | | √ | |
| Testing | | | √ | |
| Research | | | | √ |
| Training | | | √ | |
| Education | | | | √ |
| * Computer Assisted Instruction | | | | |
| # Computer Assisted Software Engineering Tools | | | | |

Table 3-2

Nine Questions from Staggers Original Survey Instrument Accidentally Eliminated from Study

| <u>Question</u> | |
|-----------------|---|
| 5 | Locates and evaluates patient support groups or chat rooms on the Internet. |
| 9 | Uses a database management program to develop a simple database or table. |
| 12 | Uses decision support systems, expert systems, and aids for clinical decision making or differential diagnosis. |
| 16 | Uses computer-assisted instruction (CAI). |
| 19 | Uses presentation graphics (for example, PowerPoint) to create slides, displays. |
| 23 | Uses spreadsheets. |
| 49 | Uses applications for diagnostic coding. |
| 52 | Uses authoring tools to develop CAI for students, nurses, and patients. |
| 58 | Uses data and statistical analysis to evaluate practice and perform quality improvement. |

yield interval level dependent measures which would allow analysis by parametric procedures (Polit & Hungler, 1995).

For each sub-section of competencies in the study, the respondent was given the opportunity to suggest in a free text dialogue box any competency felt to be missing and to suggest how any presented competency should be altered. These suggestions would be analyzed for frequencies, clustered into themes, and reported in the results.

Procedures

All registered nurses employed by the study facility received an initial e-mail at work inviting their study participation. A copy of this e-mail is Appendix J. During the first week of the study an article about the study was published in the weekly staff newsletter. A reminder notice in the newsletter was published each additional week of the study. Wall posters were placed in the general hallways and in nursing staff break rooms during the study. Each nursing manager received an invitational e-mail regarding the study. Study participation reminder e-mails were sent to all facility nurses at two and four weeks.

Using a Web-based investigation technique, respondents logged onto the facility intra-net website and into the study website. For security reasons, the facility IRB required that the study website be confined within the facility firewalls and completed by respondents while they were at work.

Three groups were surveyed: Beginning clinical nurses, Experienced clinical nurses, and Supervisory nurses. After viewing a description of the Beginning, Experienced, and Supervisory roles, respondents then self-identified their membership in a particular group as defined below.

Beginning and Experienced Clinical Nurses

Clinical nurses are defined as Registered Nurses licensed to practice in their area of employment and engaged in the provision of direct patient care at least 50 percent of the time. These may include clinical nurses, unit charge nurses, clinical nurse specialists, case managers, and others who practice in inpatient, outpatient, or other practice locales.

The respondent self-determined their level of practice as “Beginning,” “Experienced,” or “Supervisory.” For the purposes of this study, the amount of time in their current position was utilized as the determining factor. From the Principle Investigator’s thirty plus years of clinical and managerial experience, it was felt appropriate that less than six months experience in the position be designated as a Beginning nurse and six months or more experience as an Experienced nurse. Six months of experience was chosen as twice the typical three month orientation period for most clinical nursing positions at the study facility.

Supervisory Nurses

Supervisory nurses are those nurses who have hiring, firing, and performance evaluation accountability over Beginning or Experienced clinical nurses. Supervisory nurses were asked to complete all 68 questions in both the Beginning and Experienced clinical nurse areas. This supervisory group is being surveyed in addition to those identified by Staggers et al., in order to explore whether managers and staff share common perceptions of what are necessary competencies.

Remuneration for Participation

The last page of the Websurvey contained a link that, upon reaching that page of the survey, initiated an automatic e-mail to the Principal Investigator containing the respondent’s name, work location, and the date and time of survey completion only. No other direct or indirect link with any survey response information existed. An option was present for the respondent to not have this e-mail generated. However, it was made clear that this meant the respondent was unknown to the Principal Investigator and, in effect,

was declining the \$5.00 gift certificate. Upon receipt of the e-mail the Principal Investigator forwarded to the respondent a five dollar (\$5.00) coupon good at any facility cafeteria/gift shop. This was by intercampus mail to the respondents work location. A log of respondents and payment was maintained for grant accounting purposes and to assure that respondents received only one such payment. Such remuneration was made possible by a grant through the Queen Emma Research Foundation.

Demographics

Respondents were asked to complete a basic demographic response section asking for gender, ethnicity, age, highest nursing and non-nursing educational degree(s), year of first RN licensure, and specialty certifications obtained. The items included in the demographic section are found in Appendix K.

The respondents were next asked to specify which of the three survey groups (Beginning, Experienced, or Supervisory) they most closely identified. Based upon their survey group selection, participants were directed to respond to those questions related to their practice (Beginning or Experienced) or the practice of those which they employ/supervise (Supervisory nurses). This is illustrated in Table 3-3.

Table 3-3

Survey Items to be Answered by Respondents by Position and Practice Level

| | Beginning | Experienced |
|--------------------|--------------|--------------|
| Clinical Nurses | Items 1 - 37 | Items 1 - 68 |
| Supervisory Nurses | Items 1- 68 | Items 1- 68 |

Clinical nurses, depending on whether they felt they were Beginning or Experienced, would respond to either 37 or 68 questions. Supervisory nurses would respond to all 68 questions if they supervised both Beginning and Experienced nurses. Otherwise, Supervisory nurses respond to only those questions relating to that level of nurses which they supervised (felt to be an improbable occurrence).

Data Collection

Data collection was automatic by way of commercial survey software called Quask FormArtist - Standard. (2004). FormArtist is a relatively easy-to-use tool for the WYSIWYG creation of Web and e-mail based forms, surveys, polls, and so forth. The software incorporates a large degree of assisted decision support into the form; for example validating entries between similar fields and allowing the respondent to seamlessly skip pages, that is to not present any section that is not relevant to specific respondents. Forms are deployed to a Web server and easily accessed through either the internet or by e-mail by the intended audience. Most importantly, data management and analysis is immediate and easily made with internal report features or by export for more advanced statistical reporting.

Appendix K is a static demonstration for all the content of the study Website. It includes the introduction page, consent, demographics, items presented for response, the final thank you, and the reporting e-mail to the Principal Investigator.

Data Analysis

The data collection/entry was automatic as the subjects entered their responses on-line. Manual data transcription not being required eliminated that source of data entry errors. Basic analysis (that is, frequencies, correlations, cross-tabulations, and ANOVA) and more advanced data analysis (that is, factor analysis) were undertaken using Statistical Package for the Social Sciences (SPSS; Chicago, IL) software, version 13.0 for Windows. Data analysis was performed by the Principal Investigator, with recommendations and review by a professional statistician.

The collected data was reviewed for quality and consistency. One participant indicated they were Beginning, but answered all 68 questions. Their responses for the Experienced nurse questions were excluded from the study. Any missing data was simply excluded from calculations. Study responses were reversed scored (1 = Strongly Disagree, 3 = Neutral, 5 = Strongly Agree) to allow for higher scores to correspond to stronger agreement and ease interpretation.

Question responses were analyzed individually, in domains and category scale sections and as both actual raw and transformed scores. There were 37 Beginning and 31 Experienced nurse questions. As noted previously and illustrated in Table 3-1, these questions are grouped into three major domains with corresponding categories.

As the total possible scores for each domain and category sub-scale can be different for Beginning/Experienced/Supervisor nurse groups, upon the advice of the Statistician, scores were transformed to a 1-100 point scale for ease of comparison. This was accomplished by the formula: Transformed score = [(actual raw score – lowest

possible raw score) / possible raw score range] X 100. Taking the “Computer Skills: Administration” category as an example, the category has two items scored on a 1-5 Likert scale. The lowest possible score was 2, the highest possible score was 10; resulting in a possible raw score range of 8. An individual question raw score of 7 was thus transformed $((7-2)/8) \times 100$ into a new score of 62.5.

The standard descriptive statistical measures were performed, such as averages, frequency counts, and percentages. While averages are generally meaningless with ordinal measures (Polit & Hungler, 1995, p. 441), in this case they are useful as the values can be reduced to a summated rating score.

The inferential statistical analysis was primarily non-parametric. Parametric tests allow more powerful analysis; however, they require three attributes: 1) estimation of at least one parameter, 2) measurements are at least at an interval scale, and 3) considered variables are subject to certain assumptions, such as that the variables are normally distributed in the population. It is this third attribute which precludes parametric tests in this endeavor. It is assumed in this study that the variables were not normally distributed, that is, that most respondents will have decided directional preferences in response. While both parametric and non-parametric statistical tests were performed, the non-parametric values were deemed more reliable.

Principal Component Analysis (PCA) is a statistical procedure similar to Exploratory Factor Analysis [EFA] (DeCoster, 1998). In PCA the principal components are based upon the measured responses. Applied to this study, the domains and categories are based upon the questions. There is good rationale for using this Exploratory Factor

Analysis (EFA) technique. As Staggers et al. did not develop their listing as an investigatory “tool,” they never performed exploratory factor analysis in their determination of domains or categories. No published or unpublished factor analysis is known to exist for this data set.

The study research questions provided the framework or guide by which data analysis was undertaken. The focus was to answer these questions from the information provided.

Validity

The research environment places great value on the concept of the validity of the research findings. Cook and Campbell (1979) described validity as the best available approximation to the truth or falsity of propositions. By this definition, of course, a post-positivist assumption is necessary; that is, there is an assumption that a specific “truth” is out there from which to judge (Ferguson, 2004).

The competencies reported by Staggers, Gassert and Curran originated from the published literature. The authors subjected the identified competencies to repeated reevaluation by a group of recognized informatics in nursing experts. This resulting database then presents with a high level of face and content validity at the time of its inception. One of the aims of this research was to confirm whether this validity continues today.

Consent and Compliance

An application for research was submitted to the Institutional Review Boards (IRB) and scientific review panels of both the University of Hawai'i at Manoa and the study facility. Such review is required for all research involving human subjects.

Both IRBs agreed that this research meet the criteria to waive the requirement to obtain a signed consent form. The only record linking the subject and their research responses would be the consent document and record of payment to the subject. The risk would be potential harm resulting from a breach of confidentiality related to the signed consent form itself. The research presented no more than minimal risk of harm to subjects, and involves no procedures, for which written consent is normally required outside of the research context.

The simple act of the respondent choosing to respond to the research request solicitation and complete the tool is seen as a voluntary consent. Nevertheless, each respondent was asked to specifically select a statement that they agree or disagree to participate in the research after reading the informed consent statement. If "agree" was selected, the respondent continued on. If "disagree" was selected, a thank you statement appeared and the respondent was not able to progress further. Appendix K shows the consent language the respondent saw on the Website; a statement of Informed Consent. This consent followed the suggested language and format of the study facility. Regrettably, the following of this format results in a Flesch-Kincaid Reading Grade Level of 11.8. This concern is somewhat compensated for, however, given that all respondents

have a minimum of two or more years of college or other higher education beyond high school and are practicing professional nurses.

This research also fell under the Federal Guidelines that allows for some research to qualify for expedited Investigational Review Board (IRB) review. That is Subpart A: Federal Policy for the Protection of Human Subjects (Basic DHHS Policy for Protection of Human Research Subjects) of Title 45: Code of Federal Regulations, Part 46: Protection of Human Subjects.

This research study used a survey/interview procedural methodology. All information gathered was utilized in a collective and summary manner. A respondent's e-mail address was linked briefly to their response, only for that time period while they were actively on-line with the survey. The Website was protected with multiple passwords, standard encryption, and accessible on-line only during the time of actual research gathering; a period of approximately 12 weeks. Any possible identifiers linked to the subject and their responses ceased to exist once the period of active on-line connection was broken. Finally, if a subject's responses should be inadvertently disclosed outside of the research, the possible risk to the participant is deemed to be extremely low.

The Principal Investigator has maintained a list of respondents by name, department and date of survey completion only. Once the respondent broke their connection, no identifying connection exists with their responses other than that they participated in a survey. Such a record was required by the grant provider and to assure that respondents are paid and paid only once. This record was kept secured by the Principal Investigator and destroyed at the end of the study.

CHAPTER IV

RESULTS

Statistics...is the most important science in the whole world, for upon it depends the practical application of every other (science) ... To understand God's thoughts we must study statistics, for these are the measure of His purpose. (Florence Nightingale, 1858)

Previous chapters have discussed the problem, offered a review of the literature, and presented the methodology of this study. This chapter presents the results of the study's survey of Beginning, Experienced, and Supervisory clinical nurses as to what computer/informatics knowledge and skills they believe are important for clinical nurses.

Profile of Respondents

A total of 163 of the 1,042 registered nurses employed (full-time = 409, part-time = 541, call-in = 92) by the study facility completed on-line surveys. The overall response rate was 15.6%. At the time of the survey, there were approximately 35 nurse managers at the facility. Twelve responded to the survey resulting in a supervisory response rate of 34.3%. As respondents self-selected their level, it was not possible to determine categorically the number of Beginning or Experienced nurses employed.

Table 4-1 contains descriptions of the actual results and the mean age, percentage by gender, mean years of experience as a nurse, percentage with professional

certification, percentage of nurses with a nursing baccalaureate or master's degree, and the percentage of nurses possessing a non-nursing degree.

Table 4.1

Respondent Sample Description

| Variable | N = 163 | All Respondents |
|----------------------------|------------------------|----------------------------|
| Mean Age | Range: 23 – 65 yrs. | 41.8 years (SD = 10.1 yrs) |
| Male | 21 | 12.9 % |
| Female | 142 | 87.1 % |
| Mean Nursing Experience | Range: 0 – 41 yrs. | 15.5 years (SD = 10.5 yrs) |
| Professional Certification | 53 | 32.5 % |
| Nursing Education | Associate/Diploma - 48 | Associate/Diploma - 29.3 % |
| | Baccalaureate - 100 | Baccalaureate - 61.3 % |
| | Masters - 15 | Masters - 9.4 % |
| | Doctoral - 0 | Doctoral - 0 |
| Non-nursing degree | 67 | 41.4 % |
| Self-rated Clinical Level | Beginning - 11 | Beginning - 6.7 % |
| | Experienced - 140 | Experienced - 85.9 % |
| | Supervisory - 12 | Supervisory - 7.4 % |

Ethnicity. The ethnic distribution of respondents, shown in Table 4-2, demonstrated that two groups (Asian/Pacific Islander and White, Not Hispanic) were in the overwhelming majority. Black - Not Hispanic and Hispanic were tied for the least representation at 1.2 % each.

Table 4-2

Ethnic Distribution of Respondents

| | Frequency | Percent |
|------------------------|-----------|---------|
| Native American | 6 | 3.7% |
| Asian/Pacific Islander | 71 | 44.1% |
| Black, Not Hispanic | 2 | 1.2% |
| Hispanic | 2 | 1.2% |
| White, Not Hispanic | 71 | 44.1% |
| Other | 9 | 5.6% |
| Total | 161 | 100% |
| Missing | 2 | 1.2% |
| Total | 163 | -- |

Registered Nurse Role

As is apparent from Table 4-3, clinical staff nurses (Staff, Charge, Clinical Nurse III/IV, Clinical Nurse Specialists, Case Managers, and Advanced Practice Registered Nurses) were the majority of respondents. These direct clinical care nurses made up 89.2% of respondents, compared with 94.4% of the facility R.N. staff. Administration and management nurses were 10.8% of the sample, compared with 5.6% of facility R.N. personnel. Five individuals (3.1% of respondents) failed to identify their role in the organization.

Table 4.3

Respondent Distribution by Nurse Role compared with Distribution within Study Facility.

| | Frequency | Percent | Study Facility |
|-------------------|-----------|---------|----------------|
| Staff Nurse* | 102 | 64.6% | |
| Charge/CN III/IV* | 24 | 15.2% | 984* |
| CNS/CM/APRN* | 15 | 9.5% | |
| Administration | 9 | 5.7% | ~ 23 |
| Manager/Director, | 8 | 5.1% | 35 |
| Total | 158 | 100% | 1,042 |
| Missing | 5 | 3.1% | N/A |
| Total | 163 | | 1,042 |

* Institutional data with a breakdown by these categories is not available.

Question Responses

Respondents were asked to indicate on a five-point Likert scale of from One (Strongly Disagree), Three (Neutral) to Five (Strongly Agree) as to whether they felt the listed Knowledge, Attitude, or Skill was important for nurses at the indicated level. One respondent appeared to have difficulty in that almost all responses were similar (that is, all responses were “3”). This submission was excluded from analysis. Another respondent indicated an experience level as Beginning and then responded to all questions. Their responses related to Experienced questions were eliminated.

The mean participant responses for each question (grouped first for Beginning and then for Experienced questions) is found in Appendix E. This summary table lists the

mean and standard deviation results for each question asked by respondent experience level and then in total.

Following a five point Likert scale distribution of 1 = Strongly Disagree, 3 = Neutral, and 5 = Strongly Agree, at worst respondents were neutral on each of the questions asked. No question on either a total or a respective level had a mean score in the Strongly Disagree or Disagree level. The lowest scoring question was *Beg_15: Uses multimedia presentations* with a total mean of 3.23; just above neutrality. No Experienced and six Beginning questions scored a mean of less than 3.50. Nine Beginning and seventeen Experienced questions had a total mean below 4.00, representing respectively 24% and 55 % of all questions asked.

Appendix F and G present the questions ranked according to their combined total mean score for Beginning and Experienced level questions respectively. Six of the Beginning questions had total means greater than 4.50. Twenty-eight Beginning and fourteen Experienced questions had total means scored greater than 4.00. This would represent 76 % of Beginning and 45% of Experienced questions asked.

The highest Beginning question was *Beg_30: Recognizes that the computer is only a tool to provide better nursing care and that there are human functions that cannot be performed by computer* (mean = 4.58) and the highest Experienced question was *Exp_16: Provides for efficient data collection* (mean = 4.37). The lowest Beginning questions involved multimedia (*Beg_15: mean = 3.23*) and external peripheral devices (*Beg_21: mean = 3.46*). No Experienced questions were in this same low score grouping (means of 3.00 to 3.49).

Correlation analysis showed that every question had a Pearson Correlation (2-tailed) significant at the 0.05 level, with many at the 0.01 level. As such, any in depth analysis along this line was felt to have a low probability of being meaningful.

Differences between Groups

The mean scores of Experienced and the Supervisory nurses quite often converged in their responses. In only one instance, #Exp_2: *“Uses administrative applications/software programs for budget”* did the two groups of veteran nurses differ significantly ($F = 3.95$, $p = .049$; Mean: Experienced = 3.48, Supervisor = 4.08). Beginning nurses compared to Experienced and Supervisory nurses showed significant disagreement on six items. These seven questions of disagreement are listed in Table 4-4.

In almost every category the Supervisors mean was higher than that of the Beginning or Experienced Nurses. In general, the Experienced Nurse Mean was greater than the Beginning Nurse. One-way ANOVA (comparing the three groups) post hoc pairwise testing (with Bonferroni adjustment for multiple comparisons) was performed to see which pairs were significantly different (that is Beginning vs. Experienced, Beginning vs. Supervisory or Experienced vs. Supervisor). Only one category Computer Skills – Systems had a significant difference ($F = 3.859$, $p = 0.023$) between the three groups. The Beginning nurses' transformed score mean was 65.3, Experienced mean was 74.1, and Supervisory mean was 80.5.

Table 4-4

Computer Knowledge, Attitude, Skill Questions in which Beginning, Experienced, and Supervisory Nurses Disagreed. (Bar denotes cells of comparison)

| | Beginning Mean (N = 11) | Experienced Mean (N = 140) | Supervisory Mean (N = 12) | F | P Value |
|---|-------------------------------|-----------------------------------|---------------------------------|------|---------|
| Exp_2: "Uses administrative applications/ software programs for budget | N/A | 4.08 | 3.53 | 3.95 | 0.049 |
| Beg_14: Uses computerized patient monitoring systems | 3.91 | 4.39 | 4.58 | 3.52 | 0.032 |
| Beg_17: Demonstrates keyboarding (typing) skills | 3.45 | 4.15 | 4 | 4.08 | 0.019 |
| Beg_19: Operates peripheral devices (for example, bedside terminal, hand-held) | 3.36 | 3.79 | 4.25 | 3.18 | 0.044 |
| Beg_22: Uses computer technology safely | 4.18 | 4.52 | 4.83 | 4.04 | 0.019 |
| Beg_24: Identifies the appropriate technology to capture the required patient data (for example, fetal monitoring device). | 3.55 | 4.27 | 4.5 | 6.64 | 0.002 |
| Beg_30: Recognizes that the computer is only a tool to provide better nursing care and that there are human functions that cannot be performed by computer. | 4.09 | 4.6 | 4.83 | 5.1 | 0.007 |

Domain and Category Responses

Using consensus among their expert panel members, Staggers et al. (1994) grouped their list of individual competencies into specific domains (although Staggers never used that term) each containing a number of respective categories. The resulting three domains, their included categories and the specific questions falling into each, as used by Staggers and for this study, can be discerned by an examination of the questions component of Appendix K.

Following this framework, the responses of the nurses involved in this study were evaluated not only on an individual question basis, but on the domain and category basis as described previously in relation to Table 3.1. A summary of nurses' response mean scores by these domains and categories is found on Table 4-5. In order to facilitate comparison, the raw group scores were recalculated into transformed scores of 0 to 100, a process described previously in Chapter III, page 38. Roughly, it can be thought that a transformed score of 0-19 equates to Strongly Disagree, 20-39 to Disagree, 40-59 to Neutral, 60-79 to Agree, and 80-100 to Strongly Agree.

Table 4-5.
Response Combined Group Transformed Score Means by Domains (in Bold) and Categories.

| Domains (Bold) & Categories (Related Question Number) | Beginning Nurses (N = 11) <i>Mean [Std. Dev.]</i> | Experienced Nurses (N = 139) <i>Mean [Std. Dev.]</i> | Supervisory Nurses (N = 12) <i>Mean [Std. Dev.]</i> | All Nurses (N = 162) <i>Mean [Std. Dev.]</i> |
|--|---|--|---|--|
| Computer Skills | | | | |
| (Beg_ 1-25; Exp_1-13) | 72.6 [15.7] | 77.1 [10.4] | 80.9 [12.0] | 77.1 [11] |
| *Administration (Beg_ 1, 2; Exp_1-5) | 72.7 [21.5] | 72.9 [15.3] | 83.0 [16.2] | 73.6 [16] |
| *Communication (Beg_ 3-5; Exp_6-8) | 81.1 [16.7] | 82.9 [12.9] | 83.3 [12.3] | 82.8 [13.1] |
| *Data Access (Beg_ 6-9; Exp_9-11) | 81.8 [15.4] | 79.9 [11.0] | 85.1 [12.4] | 80.4 [11.5] |
| *Documentation (Beg_ 10-12) | 79.5 [20.9] | 87.3 [12.9] | 91.7 [10.7] | 87.1 [13.5] |
| *Education (Beg_ #13; Exp_6-8) | 77.3 [20.8] | 71.2 [15.7] | 76.0 [21.3] | 72 [16.6] |
| *Monitoring (Beg_ 14; Exp_12) | 72.7 [17.5] | 81.2 [12.7] | 84.1 [14.9] | 80.8 [13.3] |
| *Basic Desktop Software (Beg_ 15-17) | 62.9 [16.4] | 70.3 [15.9] | 68.8 [18.2] | 69.7 [16.1] |
| *Systems (Beg_ 18-25) | 65.3 [16.4] | 74.1 [12.9] | 80.5 [12.9] | 74 [13.3] |

Table 4-5. (Continued): Response Combined Group Transformed Score Means by Domains (in Bold) and Categories.

| Domains (Bold) & Categories (Related Question Number) | Beginning Nurses (N = 11) Mean [Std. Dev.] | Experienced Nurses (N = 139) Mean [Std. Dev.] | Supervisory Nurses (N = 12) Mean [Std. Dev.] | All Nurses (N = 162) Mean [Std. Dev.] |
|---|---|--|---|--|
| * Research (Exper_13) | N/A | 70.5 [22.7] | 79.2 [17.9] | 71.2 [22.4] |
| Informatics Knowledge (Beg_26-37; Exper_14-25) | 77.3 [12.6] | 78.3 [9.8] | 82.2 [11.9] | 78.6 [10.2] |
| *Data (Beg_26; Exper_14-16) | 79.5 [15.1] | 82.2 [11.1] | 85.2 [10.2] | 82.2 [11.3] |
| *Impact (Beg_27-31 & 35-37; Exper_18) | 79.1 [15.6] | 82.3 [9.6] | 87.8 [10.0] | 82.5 [10.2] |
| Privacy/Security (Beg_32-33; Exper_19-24) | 75.0 [9.7] | 80.8 [12.7] | 83.9 [13.4] | 80.6 [12.6] |
| Domains (Bold) & Categories (Related Question Number) | Beginning Nurses (N = 11) | Experienced Nurses (N = 139) | Supervisory Nurses (N = 12) | All Nurses (N = 162) [SD] |
| *Systems (Beg_34) | 75.0 [15.3] | 72.7 [12.9] | 79.9 [15.2] | 73.4 [13.3] |
| * Research (Exper_17) | N/A | 68.0 [19.7] | 75.0 [21.3] | 68.5 [19.9] |
| Informatics Skills (Exp_25-31) | N/A | 75.2 [12.4] | 81.5 [15.5] | 75.8 [12.7] |
| *Evaluation (Exp_25-26) | N/A | 76.0 [15.6] | 84.4 [14.2] | 76.7 [15.7] |
| *Role (Exp_27-30) | N/A | 74.9 [13.9] | 81.8 [18.9] | 75.4 [14.4] |
| *Systems Maintenance (Exp_31) | N/A | 74.1 [20.4] | 75.0 [10.7] | 74.2 [19.8] |

In every category except one (*Computer Skills: Systems*) the Supervisors' mean was higher than that of the Beginning or Experienced Nurses. In general, the Experienced Nurse means were greater than those of the Beginning Nurse. *Computer Skills: Basic*

Desktop Software (a Beginning skill) and *Informatics Knowledge: Research* (an Experienced knowledge) were the two categories with the lowest means.

Factor Analysis

Using the Kaiser criterion for factor analysis, which states that the number of factors is equal to the number of Eigen values of the correlation matrix that is greater than one (DeCoster, 1998), then the individual questions fell into sixteen factors. These accounted for 70% of the variance. Two of the factors consisted of only one question each. Many of the questions were found to cross-load on more than one factor. Conceptually, the factors did not seem to correspond to the 17 expected categories or three expected domains in any meaningful sense

Another common factor analysis methodology is to select the number of factors for inclusion by the “Scree Test” (DeCoster, 1998). By this method, plotting the Eigen values of the correlation matrix in descending order, the number of factors is equal to the number of Eigen values that occur prior to the last major drop in Eigen value magnitude. As seen in Figure 4-1, the Scree Plot for the data in this study suggests the number of factors to be between 3 and 5. Forced factor analysis was then undertaken using three factors (explaining 44% of variance), four factors (explaining 47% of variance), and five factors (explaining 50% of variance). Exploratory Factor Analysis was also run on the Beginning and Experienced questions independently. By this method 63% of Beginning and 68% of the Experienced observed variance could be explained.

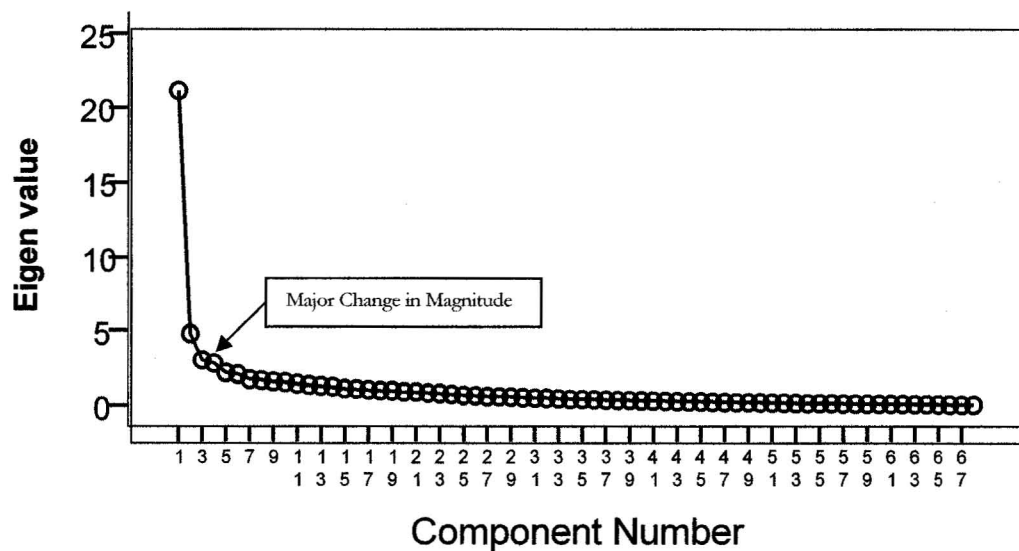


Figure 4-1. *Scree plot of Eigen values in Descending order for all questions.*

By using a forced three factor rotated analysis with a priori set criterion of 0.40 as the minimum for consideration, twelve of the questions were found to not load into any factor and five of the questions cross-loaded onto more than one factor. These seventeen questions were excluded. The remaining fifty-one questions and the three factors into which they fell are listed in Appendix H. The three listed factors were labeled 1) General Software Applications, 2) Clinical Applications, and 3) Networking Systems.

Respondents Comments

At the end of each section Respondents were given the opportunity to make comments or to suggest any competency that they felt was missing or not addressed. Only 16 nurses chose to make any comment. The majority of those comments were a

reiteration of their support for or against a particular question or the importance of informatics in nursing in general. Three respondents felt informatics knowledge and skill should be assessed upon hire and evaluated annually. One nurse wished to see “... *more skills related to our assisting of clients.*” Another observed that “*The knowledge for the Beginner nurse will happen over time and use of computers.*” No respondent suggested a knowledge or skill that should be added.

Summary

The respondent data reported in this chapter provides a listing of specific computer knowledge, attitudes, and skills that the nurses felt were important in their clinical practice. As clinical experts, the nurses rated questions from this context as to what they felt was important and what they felt was not. Taken together, this listing provides an initial working catalog of current nursing computer competence, at least as expected by clinical nurses and their managers.

This chapter has provided a detailed reporting of the results of this study. The next chapter takes this data and attempts to draw meaning and implications from among data elements.

CHAPTER V

DISCUSSION

So never lose an opportunity of urging a practical beginning, however small, for it is wonderful how often in such matters the mustard-seed germinates and roots itself. (Florence Nightingale)

The previous chapter reported the findings of this study. Following that chapter's format and presentation, this chapter presents discussion on what these findings can tell us about computer competency in the clinical nursing setting. The study questions are reviewed and recommendations for future studies are made.

Response Rate and Bias

As stated in chapter four, the survey response rate was 15.6%. Babbie (1990) states that a response rate for self administered mail questionnaires of at least 50% is generally adequate for analysis and reporting (p. 182). Waltz, Strickland, and Lenz (1991) note that with mailed questionnaires a 30% response rate is not unusual.. Sax, Gilmartin, Lee and Hagedorn (2003) in an analysis of response rates and response bias of community college students found response rates of about 31% with e-mail surveys. Importantly, Sax, et al. and Nguyen (2007) found that e-mail surveys were less prone to respondent bias than paper surveys. The process of electronic as opposed to regular mail questionnaire surveys in research is still too new to have an adequate historical research basis to determine acceptable response rates as yet.

Several factors may have played a role in limiting nurse's participation in this study. First, the study immediately followed a hospital-wide nursing satisfaction survey as well as several unit specific surveys. Several staff indicated to the investigator that they were "tired of filling out surveys." Second, the survey was relatively long, which may have caused some nurses to fail to complete their participation to the survey's end due to interruptions or weariness. Study software and methodology did not allow for the identification of such cases. Third, the remuneration offered participants was \$5.00. Increasing it to \$10.00 or more may have improved the response rate. However, six (3.7%) respondents did chose to decline remuneration

Profile of Respondents

Gender profile. The majority (85.9%) of respondents were female. Men were 12.9% of the sample. This is more than double the 5.5% of men engaged in nursing established in an unpublished survey of Hawai'i Registered Nurses (Kooker, Winters-Moorhead, Hobbs, & Acosta, 2005) and the 5.5% of nurses reported nationally (Health Resources and Services Administration, 2005). A previous study by the investigator has shown that men employed in nursing tend to be attracted to large, metropolitan, teaching institutions (Hobbs, 1992), such as the study facility.

Age. The mean age of responding nurses was 41.8 years; with a Standard Deviation of 10.1 years and ranged from 23 to 65 years of age. In a 2005 survey of all Hawai'i Registered Nurses the mean age was 49.3 years [SD: 11.1; Range: 22-83] (Kooker et al., 2005). It would be expected that the mean age for this present research

would be significantly younger than the statewide survey as retired or other nurses no longer employed in acute care would not be included in the sample.

Years of experience. The mean number of years of nursing experience was 15.5 years (SD: 10.5; Range: 0-41 years). This corresponds to the respondent age data and with level of experience.

Professional certification. Approximately one-third (32.5%) of respondents possessed professional certification which were in a variety of clinical areas. This corresponds with a 2005 study sponsored by the site facility on Registered Nurse Satisfaction which found that 36% of facility nurses and 35% of nurses nationally possessed national certification. (Personal communication, M. Harris, Fall 2006). No one certification area was overly represented in this survey. Critical Care (CCRN) certification was the largest single certification group with 4.2% of respondents followed by Certified Nurse Operating Room (CNOR) with 2.5% and Certified Emergency Nurse (CEN) and Medical-Surgical nurse certification with 1.8% each. The study facility strongly supports certification. The facility Collective Bargaining Contract (HNA-Facility Collective Bargaining Agreement, 2005-07) provides for a single five hundred dollar bonus to be provided each four year contract period for any requesting R.N. possessing certification in their specialty area.

Nursing degree. A majority (61.3%) of responding nurses held a Bachelor's degree in Nursing. Only 21.8% of respondents were Associate and Diploma program graduates. Those with a Masters in Nursing were 9.4% and there was no Doctoral nursing degree respondent. This is expected given the emphasis and support the study facility has

placed over the years in the support of professional nursing education. These results also match well with the previously mentioned 2005 Registered Nurse Satisfaction survey which showed that 63% of facility nurses and 45% of nurses nationally reported a bachelor's degree in nursing (M. Harris, Personal communication. December 12, 2006).

Profile summary. The study nurses were about ten years younger than national and state reported profiles. There are more men in this sample than in the nursing workforce at large. However, large community teaching facilities tend to have a disproportionately higher male representation (Hobbs, 1992). The respondent population has a higher nursing educational background than reported for nurses statewide, however, the study facility is well known for its emphasis on certification and higher education.

Question Responses

As noted in the previous chapter, the mean response for all questions was either neutral or above neutral. Only five respondents in seven items ever selected "Strongly Disagreed." This represents a 0.06% or a six out of 10,000 occurrence. This supports that the knowledge, attitude or skill represented by each of the questions was well selected by the Staggers Delphi Group and that each of the questions are seen to possess some degree of value to the study respondents. However, the caution of Polit and Hungler (1995) regarding a tendency of respondents to answer in the positive on self-reported surveys should also be kept in mind.

Less Essential Knowledge or Skills

The items seen as less essential would seem to be those un-related to the direct delivery of care (that is, *multimedia presentation, budget, testing, curriculum planning*)

or those concerned with specific operational systems (*that is, navigate Windows, administrative applications, and so forth*). The item *Beg_33: Describes patients' rights as they pertain to computerized information management* is related to direct patient care, but had a mean of only 3.67. This is surprising given the focus on confidentiality and patient rights in today's healthcare environment.

Following the Staggers' studies criteria (Staggers et al., 2001, p. 307) that an 80% threshold for agreement that any particular knowledge or skill was required to be deemed essential, then 28 (76%) of the Beginning and 14 (45%) of Experienced questions were validated as such. The stronger the relationship to direct patient care, the higher the mean score response.

Thus, 24% of Beginning and 55% of Experienced questions fell below 80%. As such, these would be questions that the respondents may have felt less essential for the Beginning or Experienced clinical nurse.

Five of the Beginning questions (*Beg_18, 23, 33, 15, 21*) and five of the Experienced questions (*Exp_2, 6, 7, 17, 21, 30*) had total mean scores less than 3.75. This would seem to represent a tendency towards neutrality. With the exception of item *Beg_33: (Describes patients' rights as they pertain to computerized information management)* these are questions outside of the realm of direct patient care.

Four Beginning questions (*Beg_1, 19, 20, 34*) and eleven Experienced questions (*Exp_1, 3, 5, 8, 11, 13, 18, 24, 26, 27, 31*) had mean scores between 3.75 and 3.99. The means represent a tendency towards agreement, but fall short of the set 80% essential threshold. These questions appear to be involved in system operations or teaching.

Disagreement Between Levels

Among the three levels of nurses (Beginning, Experienced, and Supervisory) there was significant disagreement ($p \leq 0.05$) on seven questions, which are listed in Table 4-4. Experienced nurses and Supervisory nurses significantly disagreed in their responses in only item # *Exp_2*: “*Uses administrative applications/software programs for budget*” ($F = 3.95$, $p = .049$; Mean: Experienced = 4.08, Supervisor = 3.53). This may be a bias reflecting different role responsibility; that is, Experienced nurses may be placing a perceived greater value on budget software than the Supervisory nurses, who are more likely to have actually used such software in the budgeting process.

The disagreement between Beginning nurses and the Experienced/Supervisory nurses (combined as a single group of experienced nurses) was greater in that they disagreed on six items, which is shown in Table 4-4 as the lower six items. A theme of this disagreement would seem to be in the perceived value of selected core technology knowledge and skills.

Category Responses

Following Staggers’ et al. (2001, p. 307) lead, an 80% level was utilized as the threshold for consensus as to whether a grouping contained important or necessary competencies. By this criterion and looking at total transformed score means, only four computer skills (*Communication, Data Access, Documentation, and Monitoring*) and three knowledge (*DataMean, Impact, and Privacy/Security*) categories were deemed necessary for nurses to possess at their respective levels. All three of the domains of

Computer Skills, Informatics Knowledge, and Informatics Skills failed to meet the 80% threshold as a necessary competency.

In almost every category, The Supervisor mean was higher than that of the Beginning or Experienced nurse. In general, the mean for the Experienced nurse was greater than the Beginning nurse. This higher mean in relation to experience level (Supervisory > Experienced > Beginning) is consistent with the published literature, Chan (2007), Lieu et al (2000) and Stronge and Brodt (1985) all found that experienced nurses had more positive attitudes toward computerization than those with less experience.

Factor Analysis

As recommended by the statistical consultant, the principal component analysis extraction method with varimax rotation (a variance maximizing rotation) was initially utilized for data reduction and analysis. A forced three factor analysis provided the best fit, as discussed on page 54. A comparison of these factor groupings showed no discernable intuitive relationship with either Dr. Staggers' domains or categories. A large percentage of questions fall outside of the Staggers groups and many questions map to more than one factor. This would seem to not support the Staggers identified groups for these questions.

Recently, June Kaminski (2007) of Kwantlen University College, British Columbia has a suggested taxonomy of nursing informatics categorization. These are:

- Technical Competencies: The use of information and communication technology

- Utility Competencies: The use of automated information in a professional context
- Leadership Competencies: decision-making with respect to planning for and using both the technology and information

Conceptually, the questions asked in this study may be easily placed into one of these three taxonomies, which the investigator has demonstrated in Appendix I. The degree of association between this three taxonomic classes and the forced three factor analysis would appear to be only slightly stronger than with the Staggers' categories and domains. Regretfully, Kaminski provides no information as to how she arrived at these taxonomic classes. Not knowing how these three groupings were derived makes any further comparison difficult.

Respondent Comments

It was hoped that the responding nurses would suggest additional knowledge, attitudes, or skills not present within the survey. In the more than a decade since the Staggers group conducted their Delphi study, healthcare, nursing, and informatics has grown and matured. Unfortunately, this did not occur. The comments offered were generally statements for or against some item responded to (that is, "*I don't believe a RN needs to know how to change the toner cartridge*") or else a global comment about the importance of informatics and informatics education (that is, "*Have computer classes on site for nursing staff*" and "*Basic knowledge and troubleshooting is the key.*"). No new or missing knowledge or skill was suggested by any respondent.

This was a long survey and it may be that the respondents became “fatigued” and many chose not to expend the extra energy in writing comments. Informatics knowledge and skills also tends to be a difficult conceptual construct and respondents may have found the survey format unwieldy to respond. One to one interview or focus groups would be a more appropriate methodology to collect such data.

Research Questions

In Chapter One, it was stated that this study sought to answer five specific research questions. A response to each of these questions in turn provides a fitting format for overview and an indication of the significance for the findings of this work.

- *What essential computer knowledge and skill competencies are required for a nurse to practice at the Beginning level?*

Beginning nurses come into their nursing practice with more than a minimal degree of competence. They possess at least that fundamental knowledge and skills obtained as a novice in their basic nursing education. Upon starting in their first professional practice position, the Beginning nurse must quickly gain additional fundamental knowledge and skills. This seems to be both of a global nature, such as internet searching and basic system operations, and of a specific system nature, such as order entry and data retrieval on their specific work systems. Increasingly this is provided as part of the orientation process of many facilities.

The nurses surveyed seem to state that for the Beginning nurse, skills related directly to care (that is, documentation, data entry, communications, impact) were

deemed the most important. Ancillary skills, those tangential to the direct delivery of care (that is, budgeting, multimedia), were deemed less important.

- *What essential computer knowledge and skill competencies are required for a nurse to practice at the Experienced level?*

The Experienced Nurse possesses all the knowledge and skills required for the Beginning practitioner. The Experienced Nurse also possesses the “experience” to allow them to “think outside the box” and the confidence to apply these attributes in their care delivery. Moving beyond simple communication and data access abilities, the Experienced Nurse is also able to more adequately document, monitor and use the computer to positively impact their patient care delivery.

The respondents responses would indicate that the elements deemed most important for Experienced nurses were data integrity, forecasting, clinical support, access to information, and medical-legal support. Elements deemed least important were research, administrative (that is, budget), and education (that is, curriculum and testing).

- *Are certain computer knowledge and skill competencies common to both the Beginning and Experienced practice levels?*

There appeared to be no specific knowledge or skill that the professional nurse “outgrew” as they progressed in experience. Over time, nurses continue to build upon their foundational knowledge and skills. With experience, certain knowledge and skills vary in importance, given the particulars of the specific practice situation. However, no identified knowledge or skill ever seemed to be “discarded” in one’s practice development. As Curran noted in 2003 “The difference between settings (that is, practice

and education) was not in the number or type (sic) of competencies itself, but rather in the degree of knowledge and skill mastered.” (Curran, 2003)

- *Do clinical nurses and their direct supervisors share similar perceptions of what are essential computer knowledge and skill competencies?*

Experienced and Supervisory Nurses shared a high degree of mutual expectations for what are the critical computer knowledge and skills required of clinical nurses. They almost always agreed on what knowledge or skills were important. They only disagreed as to the degree of that necessity. Supervisory Nurses represent a specialized subset of Experienced Nurses. They are Experienced Nurses in a specific administrative role.

Interestingly, it was Beginning Nurses and Experienced Nurses/Supervisory Nurses who differed in some respects upon their perceptions of necessary knowledge and skills. In several areas Beginning Nurses simply did not recognize that a particular knowledge or skill was important. Often, these tended to be what might be considered “higher level” knowledge and skills. For example, Beginning Nurses gave a lower emphasis to *Beginning Question 30: “Recognizing that the computer is only a tool to provide better nursing care and that there are human functions that cannot be performed by computer.”*

- *Are these computer knowledge and skill competencies the same or similar as those deemed essential in the published literature?*

The published literature and clinical staff and management expectations from this study seem to have a high degree of agreement and content validity. Lynn (1986), as described by Devon, Block, et al. (2007) has proposed a two-step method for determining

content validity. The first stage is developmental, identification and evaluation by content experts. This is akin to the work of Staggers, et al. The second stage is judgmental; a Content Validity Index (CVI) is computed on the identified items. The summary CVI is the “proportion of experts whose endorsement is required ... beyond the 0.5 level of significance.” The eighty percentage threshold previously described for this study can be directly related to this methodology.

Overall, in this study those knowledge and skills deemed important by academia generally were also deemed important by practicing clinical nurses. This was contrary to the expectation held by this author going into this study. It speaks well that Nursing’s educational institutions are so well in tune with clinical needs.

Computer competencies associated with the education for patients was highly valued. Somewhat distressing, however, was the low value that Experienced nurses seemed to place on competencies associated with the education of Nurses. Nursing and nurses need to place a greater emphasis on the mentoring of their own.

Limitations

This study is based upon work by Staggers et al. (2001; 2002). Their work was from research conducted over an 18 month period prior to 2002 (Staggers, 2004). In the subsequent five or six years since the actual research was undertaken, informatics and nursing knowledge and technology have continued to expand and mature. It is reasonable to expect that the skills and competencies required by nurses, as compared to those listed by Dr. Staggers et al., have likewise matured and some aspects are no longer relevant and additional skills and competencies have arisen. Respondents in this study were asked to

validate the current applicability of the listed knowledge and skills and to suggest any that they felt to be missing.

Self-reported data has the considerable strength of directness and versatility. Self reports also have at least one inherent weakness; the respondents are by nature biased and “have a tendency to want to present (themselves) in the best light, and this may conflict with the truth’ (Polit & Hungler, 1995, p. 312-13). This has led to concern regarding the validity and accuracy of self-reported data. Lynn (1986) notes that “establishing ... content validity is a challenge because many reviewers are needed to avoid an inflated estimate of validity that often results when experts endorse most items.”

A Web-based survey is a relatively new technology. However, based upon the large number of tools available for purchase this is a technology that is growing and becoming increasingly popular. Any new technology, including Web-based surveys, will have unknown intricacies that may affect the data and the results obtained. As this technology is used and published more in the professional literature, these intricacies will become apparent. In addition, the adequacy of response rates for web based survey research still needs to be determined.

The practicalities of conducting research and the availability of resources played a role in the design and implementation plan for this study. The confinement of the sample population to one specific healthcare system in a specific geographical locale limits the generalizability of the study results to a greater nursing population. The lack of random selection of participants, a small sample size, and that the respondents had to complete the survey while at work also had an effect.

Perhaps the greatest limitation of this particular study, however, was the inadvertent elimination of nine of Staggars et al.'s original questions. These items were lost in the course of the final cut and pasting of the questions into the actual website. Their absence is felt to have minimal effect upon a question by question analysis and comparison with the published work. Additionally, it is felt that each of these nine questions (listed in Table 3-7) were redundant in that the subject content of the question was duplicated by other questions. However, the loss of these nine questions makes any comparison of domains, categories or other groups complicated and possibly suspect since the original listing has now changed.

Implications

The following implications are based on the findings of this study:

Research. Replication of this study with the inclusion of the nine items missing from Staggars' original listing would be useful. Such replication would not only provide data on the missing items, but resolve validity concerns created by the absence of certain questions in this study. The competencies identified should be tested and validated against non-institutional nursing staff; that is nurses other than educational and hospital facilities. For example, it is not known what computer knowledge and skills are required of community case managers, home health, insurance based, clinic and pre-hospital based Registered Nurses.

Clinical nurses should be further consulted regarding new knowledge, attitudes, and skills that they feel necessary in their practice. The use of focus groups rather than surveys may provide a more productive approach to gaining insight and understanding

about the necessary knowledge, attitudes and skills. Pierce, Pravikoff and Tanner (2003) have begun to develop a tool specifically to identify gaps in the Computer and Information Literacy (CIL) skills, competencies, and knowledge in nurses working as educators, administrators and clinicians.

Practice. Having an evidenced based list of the knowledge and skills necessary to practice clinical nursing allows both the practitioner and their employer to continuously measure their competency to practice. As professionals, nurses have a contract in which they provide specific knowledge and skills deemed necessary and valuable by society.

Nursing practice has been defined as both an art and a science (Donahue, 1985). The science of nursing in the form of the equipment and processes which nurses' use in their clinical practice will continue to become increasingly computerized. Additional knowledge and skills will be identified and must be integrated into clinical nursing practice and society's expectations. These practice changes allow the clinical nurse to more efficiently collect data, integrate it into information and produce knowledge by which to improve outcomes and increase satisfaction on the part of nurses, patients, employers and regulatory agencies.

While increasing the challenge and skills necessary to practice the science of nursing, computerization also offers an unprecedented opportunity to enhance the art of nursing. In the automation of many of the physical and data collection tasks associated with nursing care, computerization can free the nurse to personally interact with the patient and their family and to seek to address their needs and their response to their

injury or disease process. This person-to-person contact and interaction, at the very heart of nursing, is fundamentally impossible to computerize.

Education. The identified competencies should be applied against the recommendations such as the American Nurses Association's *The Scope of Practice* standards. Educators and administrators, both within Schools of Nursing and for individual institutions, should then apply these identified standards in the development of educational programs and in the setting of minimal competencies for clinical practice.. While in the past younger nurses have been felt to be more comfortable with computers and to more easily adapt, this is a distinction that seem less and less true.

Summary

The data from this study supports the following four conclusions:

- Nurses' perceptions of the importance of specific knowledge and skills changes with experience
- Nurses agreed that the listing represented important and necessary individual computer competencies for the clinical nurse
- The compilation of the questions within groups aligned under Staggers' or Kaminski's categories was not felt to be credible.
- Respondents in this study could not identify new or additional competencies from within this survey method

This study like all studies is subject to its strengths and limitations. As suggested by Ferguson (2004), a careful analysis of the results and openly acknowledging the

limitations can allow one to make informed decisions about generalizing findings to new settings and populations. Such limitations do not negate the value of reporting such research.

This study's purpose was to identify the nursing informatics knowledge and skill competencies clinical nurses felt necessary for clinical nurses at the Beginning and Experienced levels of practice. The motivation to undertake this study was the work by Staggers, Gassert, and Curran seeking to categorize what knowledge and skills were required by nurses at all levels of informatics practice. Their research contributed to efforts of the American Nurses Association to establish the Scope and Standards of Nursing Informatics Practice (ANA, 1995; ANA, 2001).

The overwhelming majority of published work in the area of nursing computer competencies had an educational institution or an informatics specialist perspective. This study attempted to take a more practice orientated point of view. Seeking the opinion of *clinical* nurses about what is necessary in the *clinical* nursing role. The study's results are a report of one facility's clinical nurses as to what computer knowledge and skills they felt was needed by nurses in their clinical facility practice.

Final Comments

The planned expansions of information management systems in multiple facilities across the state of Hawai'i, across the county, and in many developed countries highlight the importance and relevance of informatics to both nursing practice and education. Even in facilities with no such systems, one has only to stand and observe medical and nursing

staff using digital cameras, laptop computers, and PDAs to understand the inevitability of expansion. Modern healthcare is beginning to demand a degree of universality, compatibility, and transfer of skills that nurses in Hawai'i, in the country and in the world will need to meet.

*Appendix A: Summary Review of Instruments and Studies Reporting Important Computer Knowledge (Cognitive) Computer Competencies for Nurses **

| Author(s) / Year published | Sample | Design (All non- experimental) | Variables/ Identified Important Nurse Competencies | Findings/Comments |
|----------------------------------|---|--|--|--|
| Computer Knowledge (Cognitive) | | | | |
| Staggers / 1994(2001) | <ul style="list-style-type: none"> • Pilot: 24 graduate nursing course volunteers. Males were excluded • 1991 - 110 clinical nurses • 1998 - 98 nurses | Self-developed, 32-item, 5-point multi-step scale: <i>The Staggers Nursing Computer Experience Questionnaire (SNCEQ)</i> | <ul style="list-style-type: none"> • General computer applications • Knowledge of General computer applications • Use of Health Information System (HIS) • Knowledge of use of HIS • Role Participation • Role Knowledge | Measures nurses' self-perceived knowledge regarding general and Health Information Systems applications and asks subjects to rate themselves on a novice-to-expert scale. A background table lists 20 previously published self- |

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| | | | | designed instruments. Reported internal consistency reliability ranged from 0.86 to 0.95. |
| Birx, Castleberry and Perry / 1996 | 38 senior nursing students (20 experimental, 18 control) enrolled in a mental health class | Self-developed, 10-item, multiple-choice tool used in combination with three 10 to 12 task checklists. | <ul style="list-style-type: none"> • Basic computer terminology • E-mail • Word processing • Library searches | No statistically significant difference between students' computer knowledge scores for students given laptop computers in a nursing course and those who were not. |
| Marini / 2000 | 30 BSN and 6 RN nursing students enrolled in a Nursing | Self-developed 21-item course evaluation questionnaire with 3 | <ul style="list-style-type: none"> • Word processing • Presentation graphics • Internet | Study measured the effect of an elective Nursing Informatics course on |

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| | Informatics course in Beirut, Lebanon | subscales: <ul style="list-style-type: none"> • Computer literacy • Software skill • Computer attitudes | | nursing students using a pre/post comparative study design. |
| Liu, Pothiban, Lu and Khamphonsiri / 2000 | 169 clinical nurses in the People's Republic of China | Evaluation. Self-developed, 20-item true-false questionnaire: <i>The Nurses' Computer Knowledge Questionnaire (NCKQ)</i> | <ul style="list-style-type: none"> • Basic computer knowledge (that is, components, on-off, and so forth) 8 items. • HIS Knowledge (that is, operation sequences, order entry, error correction, and so forth) 8 items. • System Security (that is changing password, | This tool was developed to measure the computer knowledge of Chinese nurses in a Beijing hospital one-year post HIS implementation. |

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| | | | virus protection, and so forth) 4 items. | |
| Carter & Axford / 1993 | 10 Australian nursing experts 150 randomly selected clinical nurses | Delphi Survey: 75-item questionnaire | <ul style="list-style-type: none"> • System specific items • Analyze nursing information needs • Communicate needs to IS personnel • Security | <p>Skills the groups specifically felt were unnecessary for nurses:</p> <ul style="list-style-type: none"> • Word processing at Beginning level • Basic computer terminology • Knowledge of hardware configurations |
| Saranto & Leino-Kilpi | 15 "experts:" 5 clinical nurse | Delphi Survey | <ul style="list-style-type: none"> • Knowledge of basic components | |

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| /1997 (1997a, 1997b, 1997c) | managers, 5 nurse educators, 3 student nurses, and 2 patients | | <ul style="list-style-type: none"> • Able to use Windows • Word Processor • Database • Spreadsheet • E-mail • Virus • Use computerized patient equipment • System security | |
| Thede / 1998 | 315 respondents to an Internet survey | Internet survey | <ul style="list-style-type: none"> • Knowledge of computer history • Hardware • General and specific | |

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| | | | applications <ul style="list-style-type: none"> • Word processing • Databases • Bibliographic search • Email and • Internet search | |
| Arnold / 1998 | 497 respondents to a mailing of listees on a continuing computer conference mailing list | Self-developed, 73-item mail survey: <i>Educational Needs Survey (EDS)</i> | <ul style="list-style-type: none"> • Word processing (73.4%) • E-mail (49.6%) • Database (46%) • Spreadsheet (44.1%) • Hospital information systems (43.4%) | This was primarily of survey of informatics nurses regarding their computer use, educational plans and expectations for certification content. |
| Jiang, Chen and Chen | 29 Experts in Taiwan | Delphi Survey using Bryson's (1991) 7 | <ul style="list-style-type: none"> • "Attitudes toward computer" deemed most | This study also sought to identify at which |

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| 2004 | | computer literacy domains. | important <ul style="list-style-type: none"> • Concepts of hardware, software, network” and “program design” deemed less important. | educational level (high school, college, graduate) each competency should be cultivated. |
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*The articles represented in these tables were evaluated and classified in relation to a construal of Bloom's *Taxonomy of Educational Domains* (cognitive - knowledge, affective – attitudes, and psychomotor-skill) as described in the text.

Appendix B: *Summary Review of Instruments and Studies Reporting Important Computer Attitudes (Affective) Computer Competencies for Nurses **

| Author(s) / Year published | Sample | Design (All non- experimental) | Variables/ Identified Important Nurse Competencies | Findings/Comments |
|----------------------------------|--|---|---|---|
| Computer Attitudes (Affective) | | | | |
| Stronge and Brodt / 1985 | 48 Junior/Senior nursing students and faculty at a private, Iowa college. | Self-developed, 20 item, self-reported, 5- point multi-step scale questionnaire: <i>Nurses Attitudes Toward Computers Questionnaire (NATC)</i> | <ul style="list-style-type: none"> • Job security • Legal ramifications • Quality of patient care • Capabilities of computers • Willingness to use • Benefit to institution | Focused on nurses' broad beliefs, concerns, and willingness regarding computers in general. They felt that nurses' complex internal states affect their attitudes toward computer use. In 1995, Stockton and Verhey (Stockton & Verhey, 1995) performed a 656-nurse |

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| | | | | sample psychometric examination of this tool and found an overall instrument reliability of 0.92. |
| Schwiriam, et al. / 1989 | 353 sophomore nursing students and 358 clinical nurses | 17-item adaptation of Stronge & Brodt's tool.: <i>Refined Nurses' Attitudes Toward Computerization (NATC) Questionnaire</i> | Three factors: <ul style="list-style-type: none"> • Computers and patient care • Computers and personal security • General attitude | Students' attitudes toward computer use in nursing were positive, and the more computer experience students had, the more positive their attitudes. The attitudes of the practicing nurses also were generally positive, but differences between students and nurses were observed. |
| McBride and Nagle / 1966 | 394 hospital RNs and 299 BSN students. | Published 20 item, self-reported, 5-point | Four factors influence positive attitude of | A report of the psychometric findings related to Stronge and |

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| | | <p>multi-step scale</p> <p>questionnaire: Stronge & Brodt's <i>Nurses' Attitudes Toward Computerization (NATC) Questionnaire</i></p> | <p>nurses:</p> <ul style="list-style-type: none"> • Nurse's Work • Barriers • Organizational issues • Perhaps efficiency | <p>Brodt's Nurses' Attitudes Toward Computerization questionnaire.</p> <p>Convenience sample of 394 RNs and 299 BSN students. Findings were inconsistent with previous studies in finding a lack of support for construct validity of the S & B instrument.</p> |
| Simpson & Kendrick, 1997. | 208 British Subjects at one hospital. | <p>Stronge & Brodt's tool.: <i>Refined Nurses' Attitudes Toward Computerization (NATC) Questionnaire</i></p> | <ul style="list-style-type: none"> • Length of Service • Employment setting | <ul style="list-style-type: none"> • Nurse's Computer related attitudes only 54.3% positive. • Authors often reported findings as significant with small sample sizes (i.e., N = 3). |

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| Joyasuriya & Caputi / 1996 | 170 Australian subjects: 71 1 st yr. nursing students, 99 hospital nurses. | Self-developed, 22-item. multi-step scale: <i>Nurses' Computer Attitudes Inventory (NCATT)</i> | <ul style="list-style-type: none"> • Computers & patient care • Computer anxiety • Patient confidentiality & computers | This was a revision of the author's previous tool, which was refined and then compared to Stronge & Brodt's NATC. |
| Thomas / 1990 | 109 Baccalaureate/ Master's nursing students in 4 programs. | Two parallel self-developed, 30-item, self-report questionnaires using a 5-point multi-step scale: <i>Attitudes Toward Computing in Nursing Questionnaire</i> | <ul style="list-style-type: none"> • Effectiveness • Comprehensibility • Flexibility • Dependability • Pleasantness/ comfortability • Appropriateness | In 5 areas: General, Research, Administration, Practice and Education. Instrument available in two forms. Cronbach's alpha for Form A = 0.91, Form B = '0.92. |
| Thomas, Delaney & | Convenience sample of 38 third year | Previously published two parallel, 30 item, | Not Applicable | Not Applicable |

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| Weiler / 1992. | nursing students at the University of Iowa | self-report questionnaires using a 5-point multi-step scale | | |
| Birx, Castleberry and Perry / 1996 | 38 senior nursing students (20 experimental, 18 control) enrolled in a mental health class. | <i>Opinionnaire: Computing in Nursing</i> ²³ | Not Applicable | No statistically significant difference between students attitudes towards computers between students given laptop computers in a nursing course and those who were not. |
| Burkes / 1991 | A previously published two parallel, 30 item, self-report questionnaires using | Self-developed, multi- step scale based upon Vroom's expectancy theory: <i>Nurses' Computer-Use</i> | <ul style="list-style-type: none"> • Satisfaction • Beliefs • Motivation | Examined four sections of Satisfaction, Beliefs, Motivation and Knowledge. Alpha coefficients were 0.89, 0.53- 0.66, 0.91 and 0.36, respectively. |

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| | a 5-point Multi-step scale | <i>Attitude Questionnaire (NCUAQ)</i> | | Age & education were non-contributors to attitude, computer experience was negatively and knowledge was positively associated with positive attitude. |
| Liu, Pothiban, Lu and Khamphonsiri / 2000. | 300 clinical nurses in the People's Republic of China | Evaluation. 18-item, 5-point multi-step scale variation of Burkes' adaptation of Vroom's expectancy theory: <i>Nurses' Computer Attitude Scale (NCAS)</i> | <ul style="list-style-type: none"> • Beliefs (6 items) • Satisfaction (6 items) • Motivation (6 items) | This tool was developed to measure the computer attitudes of Chinese nurses in a Beijing hospital one-year post HIS implementation. Half of the items were positive and half negative in each section. |

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| Murphy, Maynard and Morgan / 1994. | Three-year study of 224 RNs, LPNs, NAs & US, pre- and post- implementation of a Clinical Information System | Evaluation. Self- developed, 12 items, 5-point multi-step scale questionnaire. | <ul style="list-style-type: none"> • Satisfaction • Beliefs • Motivation • Collaboration | No statistical difference between pre- and post-test attitudinal scores |
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Appendix C: *Summary Review of Instruments and Studies Reporting Important Computer Skills (Psychomotor) Computer Competencies for Nurses**

| Author(s) / Year published | Sample | Design (All non- experimental) | Variables/ Identified Important Nurse Competencies | Findings/Comments |
|--|--|--|--|---|
| Computer Skills (Psychomotor) | | | | |
| Birx, Castleberry and Perry / 1996. | 38 senior nursing students (20 experimental, 18 control) enrolled in a mental health class | Self-developed, self- reported computer skills checklist | <ul style="list-style-type: none"> • E-mail • Word processing • Library searches | Significant greater computer skill scores in students given laptop computers in a nursing course compared to those who were not. |
| Marini / 2000. | Pilot by 6 nursing faculty then a convenience sample of 30 BSN and 6 RN | Lab Assignment sessions during class | <ul style="list-style-type: none"> • Windows '98 • Microsoft Word • Microsoft PowerPoint • Microsoft Excel | Authors also used a six-item self- reported skill questionnaire to assess skill levels for several common general software applications. |

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| | nursing students enrolled in a Nursing Informatics course in Beirut, Lebanon | | <ul style="list-style-type: none"> • Electronic Mail • Internet/WWW • Library database • CAI evaluation | |
| Liu, et al / 2000. | 300 clinical nurses in the People's Republic of China | Evaluation. 16-item, four-point multi-step scale: <i>Nurses' Computer Skills Scale (NCSS)</i> | <ul style="list-style-type: none"> • Windows operation (7 items) • Health Information Systems skills (7 items) • System security (2 items) | This tool was developed to measure the computer skills of Chinese nurses in a Beijing hospital one-year post HIS implementation. |
| Saranto & Leino-Kilpi / 1997a, b, c. | 15 experts: 5 clinical nurse managers, 5 nurse educators, 3 student | 3-round Delphi postal survey. | <ul style="list-style-type: none"> • Basic components • Word processing • Hospital Information System | |

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| | nurses, and 2 patients | | <ul style="list-style-type: none"> • E-mail • System security • Ergonomics | |
| Graveley, Lust & Fullerton / 1999. | 299 generic and RN to BSN students | Self-developed survey tool. Adaptation using Clements | <ul style="list-style-type: none"> • Word processing • E-mail • Spreadsheets • Databases • Graphics/presentations • Programming “macros” • Internet | |

Appendix D: Common Themes Revealed as More Essential Computer Competencies for Nurses as identified by Hobbs

| Domain | Competency for Nurses |
|--------------------------------|--|
| Computer Knowledge (Cognitive) | <ul style="list-style-type: none"> • Basic Computer Knowledge • Word Processing • System Security • Health Information Systems (Patient data, order entry, results retrieval, and so forth) |
| Computer Attitudes (Affective) | <ul style="list-style-type: none"> • Satisfaction • Beliefs • Motivation |
| Computer Skills (Psychomotor) | <ul style="list-style-type: none"> • Basic operation system tasks (open, close, copy, file sharing, and so forth) • Word processing • Electronic mail • Spreadsheets (including tables and graphs) • Internet • Security • Health Information Systems |

Appendix E:

Summary of Mean Responses by Respective Level and Combined Total

| Question | Beginning N = 11 | Experienced N = 140 | Supervisory N = 12 | Total N = 163 |
|---|---------------------|------------------------|-----------------------|-------------------|
| | (Mean/Std Dev) | (Mean/Std Dev) | (Mean/Std Dev) | (Mean/Std Dev) |
| <i>Beg_1: Uses administrative applications for practice management</i> | 3.64 / 1.03 | 3.93 / .979 | 4.42 / .669 | 3.94 / .970 |
| <i>Beg_2: Uses applications for structured data entry</i> | 4.18 / .874 | 4.33 / .665 | 4.58 / .515 | 4.34 / .672 |
| <i>Beg_3: Uses telecommunication devices</i> | 3.82 / .982 | 4.02 / .803 | 4.00 / .853 | 4.01 / .815 |
| <i>Beg_4: Uses e-mail</i> | 4.36 / .674 | 4.50 / .606 | 4.50 / .522 | 4.49 / .603 |
| <i>Beg_5: Uses the Internet to locate, download items of interest</i> | 4.55 / .688 | 4.42 / .658 | 4.50 / .674 | 4.44 / .658 |
| <i>Beg_6: Uses sources of data that relate to practice and care.</i> | 4.45 / .522 | 4.55 / .541 | 4.83 / .389 | 4.56 / .534 |
| <i>Beg_7: Accesses, enters, and retrieves data used locally for patient care</i> | 4.27 / .647 | 4.51 / .606 | 4.67 / .651 | 4.51 / .612 |
| <i>Beg_8: Uses database applications to enter and retrieve information</i> | 4.27 / .647 | 4.31 / .656 | 4.17 / .718 | 4.29 / .657 |
| <i>Beg_9: Conducts on-line literature searches</i> | 4.09 / .831 | 4.06 / .849 | 4.42 / .793 | 4.09 / .844 |
| <i>Beg_10: Uses an application/software program to document patient care</i> | 4.18 / .874 | 4.51 / .594 | 4.75 / .452 | 4.51 / .613 |
| <i>Beg_11: Uses an application/software program to plan care for patients to include discharge planning</i> | 4.00 / .894 | 4.40 / .634 | 4.58 / .669 | 4.39 / .662 |
| <i>Beg_12: Uses an application/software program to enter patient data</i> | 4.36 / .924 | 4.55 / .555 | 4.67 / .651 | 4.54 / .591 |
| <i>Beg_13: Uses information management technologies for patient education</i> | 4.09 / .831 | 4.14 / .674 | 4.25 / 1.138 | 4.15 / .722 |

Appendix E (Continued)
Summary of Mean Responses by Respective Level and Combined Total

| Question | Beginning N = 11 | Experienced N = 140 | Supervisory N = 12 | Total N = 163 |
|--|---------------------|------------------------|-----------------------|-------------------|
| | (Mean/Std Dev) | (Mean/Std Dev) | (Mean/Std Dev) | (Mean/Std Dev) |
| <i>Beg_14: Uses computerized patient monitoring systems</i> | 3.91 / .701 | 4.39 / .643 | 4.58 / .669 | 4.37 / .658 |
| <i>Beg_15: Uses multimedia presentations</i> | 3.27 / .786 | 3.24 / .920 | 3.08 / .900 | 3.23 / .907 |
| <i>Beg_16: Uses word processing</i> | 3.82 / .874 | 4.03 / .795 | 4.17 / .718 | 4.02 / .793 |
| <i>Beg_17: Demonstrates keyboarding (typing) skills</i> | 3.45 / .820 | 4.15 / .770 | 4.00 / .953 | 4.09 / .802 |
| <i>Beg_18: Uses networks to navigate systems</i> | 3.09 / .701 | 3.72 / .868 | 3.83 / .835 | 3.69 / .867 |
| <i>Beg_19: Operates peripheral devices</i> | 3.36 / .924 | 3.79 / .846 | 4.25 / .754 | 3.79 / .857 |
| <i>Beg_20: Uses operating systems</i> | 3.55 / .934 | 3.84 / .789 | 3.92 / .900 | 3.83 / .806 |
| <i>Beg_21: Uses existing external peripheral devices</i> | 3.27 / 1.01 | 3.44 / .800 | 3.83 / .937 | 3.46 / .827 |
| <i>Beg_22: Uses computer technology safely</i> | 4.18 / .874 | 4.52 / .529 | 4.83 / .389 | 4.52 / .559 |
| <i>Beg_23: Is able to navigate Windows</i> | 3.45 / .688 | 3.67 / .869 | 3.75 / .965 | 3.66 / .862 |
| <i>Beg_24: Identifies the appropriate technology to capture the required patient data</i> | 3.55 / .934 | 4.27 / .677 | 4.50 / .522 | 4.24 / .710 |
| <i>Beg_25: Demonstrates basic technology skills</i> | 4.45 / .688 | 4.39 / .764 | 4.83 / .577 | 4.42 / .753 |
| <i>Beg_26: Recognizes the use and/or importance of nursing data for improving practice</i> | 4.18 / .603 | 4.38 / .595 | 4.58 / .900 | 4.38 / .622 |
| <i>Beg_27: Recognizes that a computer program has limitations due to its design and capacity of the computer</i> | 4.00 / .775 | 4.10 / .652 | 4.33 / .888 | 4.11 / .67 |

Appendix E : (Continued)
Summary of Mean Responses by Respective Level and Combined Total

| Question | Beginning N = 11 | Experienced N = 140 | Supervisory N = 12 | Total N = 163 |
|---|---------------------|------------------------|-----------------------|-------------------|
| | (Mean/Std Dev) | (Mean/Std Dev) | (Mean/Std Dev) | (Mean/Std Dev) |
| <i>Beg_28: Recognizes that it takes time, persistent effort, and skill for computers to become an effective tool.</i> | 4.09 / .831 | 4.26 / .606 | 4.33 / .651 | 4.25 / .624 |
| <i>Beg_29: Recognizes that health computing will become more common</i> | 4.27 / .647 | 4.42 / .551 | 4.75 / .452 | 4.44 / .556 |
| <i>Beg_30: Recognizes that the computer is only a tool to provide better nursing care and that there are human functions that cannot be performed by computer</i> | 4.09 / .831 | 4.60 / .573 | 4.83 / .389 | 4.58 / .596 |
| <i>Beg_31: Recognizes that one does not have to be a computer programmer to make effective use of the computer in nursing</i> | 4.36 / .505 | 4.38 / .529 | 4.58 / .515 | 4.39 / .526 |
| <i>Beg_32: Seeks available resources to help formulate ethical decisions in computing</i> | 4.00 / .775 | 4.01 / .673 | 4.42 / .669 | 4.04 / .684 |
| <i>Beg_33: Describes patients' rights as they pertain to computerized information management</i> | 3.91 / .539 | 3.63 / .744 | 3.92 / .515 | 3.67 / .721 |
| <i>Beg_34: Recognizes the value of clinicians' involvement in the design, selection, implementation, and evaluation of applications, systems in health care</i> | 3.82 / .874 | 3.84 / .629 | 3.83 / .835 | 3.84 / .659 |
| <i>Beg_35: Describes the computerized or manual paper system that is present.</i> | 3.91 / .539 | 4.21 / .662 | 4.08 / .996 | 4.18 / .684 |

Appendix E: (Continued)

Summary of Mean Responses by Respective Level and Combined Total

| Question | Beginning N = 11 | Experienced N = 140 | Supervisory N = 12 | Total N = 163 |
|---|---------------------|------------------------|-----------------------|-------------------|
| | (Mean/Std Dev) | (Mean/Std Dev) | (Mean/Std Dev) | (Mean/Std Dev) |
| <i>Beg_36: Explains the use of networks for electronic communication</i> | 4.09 / .302 | 4.31 / .622 | 4.67 / .492 | 4.32 / .606 |
| <i>Beg_37: Identifies the basic components of the current computer system</i> | 4.30 / .675 | 4.14 / .704 | 4.33 / .888 | 4.16 / .715 |

| Question | Beginning N = 11 | Experienced N = 140 | Supervisory N = 12 | Total N = 163 |
|---|---------------------|------------------------|-----------------------|-------------------|
| | (Mean/Std Dev) | (Mean/Std Dev) | (Mean/Std Dev) | (Mean/Std Dev) |
| <i>Exp_1: Uses administrative applications/software programs for forecasting</i> | N/A | 3.86 / .809 | 4.33 / .888 | 3.90 / .823 |
| <i>Exp_2: Uses administrative applications/software programs for budget</i> | N/A | 3.48 / 1.01 | 4.08 / .996 | 3.53 / 1.02 |
| <i>Exp_3: Uses applications/software programs to manage aggregated data</i> | N/A | 3.77 / .845 | 4.17 / 1.030 | 3.80 / .864 |
| <i>Exp_4: Uses administrative applications/software programs for staff scheduling</i> | N/A | 4.08 / .771 | 4.33 / .651 | 4.10 / .764 |
| <i>Exp_5: Uses administrative applications/software programs for maintaining employee records</i> | N/A | 3.88 / .858 | 4.33 / .778 | 3.91 / .859 |
| <i>Exp_6: Uses applications/software programs to develop testing materials</i> | N/A | 3.70 / .917 | 3.92 / 1.084 | 3.71 / .929 |
| <i>Exp_7: Uses applications/software programs for curriculum planning</i> | N/A | 3.69 / .833 | 4.00 / .739 | 3.72 / .828 |

Appendix E: (Continued)

Summary of Mean Responses by Respective Level and Combined Total

| Question | Beginning N = 11 | Experienced N = 140 | Supervisory N = 12 | Total N = 163 |
|---|---------------------|------------------------|-----------------------|-------------------|
| | (Mean/Std Dev) | (Mean/Std Dev) | (Mean/Std Dev) | (Mean/Std Dev) |
| <i>Exp_8: Evaluates Computer Assisted Instruction (CAI) as a teaching tool</i> | N/A | 3.86 / .707 | 4.00 / .953 | 3.87 / .726 |
| <i>Exp_9: Accesses shared data sets</i> | N/A | 4.01 / .670 | 4.08 / .669 | 4.02 / .668 |
| <i>Exp_10: Extracts data from clinical data sets</i> | N/A | 4.05 / .641 | 4.33 / .651 | 4.07 / .644 |
| <i>Exp_11: Extracts selected literature resources and integrates them to a personally usable file</i> | N/A | 3.91 / .727 | 4.33 / .651 | 3.95 / .728 |
| <i>Exp_12: Applies monitoring system appropriately according to the data needed</i> | N/A | 4.11 / .656 | 4.18 / .751 | 4.11 / .661 |
| <i>Exp_13: Uses computer applications/software programs for statistical analysis and nursing research</i> | N/A | 3.82 / .906 | 4.17 / .718 | 3.85 / .895 |
| <i>Exp_14: Supports efforts toward development and use of a unified nursing language</i> | N/A | 4.14 / .616 | 4.27 / .467 | 4.15 / .606 |
| <i>Exp_15: Promotes the integrity of nursing information and access necessary for patient care within an integrated computer-based patient record</i> | N/A | 4.27 / .600 | 4.50 / .522 | 4.29 / .595 |
| <i>Exp_16: Provides for efficient data collection</i> | N/A | 4.37 / .592 | 4.42 / .515 | 4.37 / .584 |
| <i>Exp_17: Describes general applications available for research</i> | N/A | 3.72 / .790 | 4.00 / .853 | 3.74 / .796 |
| <i>Exp_18: Defines the impact of computerized information management on the role of the nurse</i> | N/A | 3.96 / .675 | 4.25 / .622 | 3.99 / .673 |

Appendix E: (Continued)

Summary of Mean Responses by Respective Level and Combined Total

| Question | Beginning N = 11 | Experienced N = 140 | Supervisory N = 12 | Total N = 163 |
|---|---------------------|------------------------|-----------------------|-------------------|
| | (Mean/Std Dev) | (Mean/Std Dev) | (Mean/Std Dev) | (Mean/Std Dev) |
| <i>Exp_19: Discusses the principles of data integrity, professional ethics and legal requirements</i> | N/A | 4.12 / .660 | 4.33 / .492 | 4.13 / .650 |
| <i>Exp_20: Describes ways to protect data</i> | N/A | 4.29 / .704 | 4.33 / .651 | 4.29 / .698 |
| <i>Exp_21: Describes general applications/software programs to support administration</i> | N/A | 3.65 / .899 | 4.17 / .835 | 3.70 / .902 |
| <i>Exp_22: Describes general applications/software programs, systems to support clinical care</i> | N/A | 4.04 / .713 | 4.33 / .651 | 4.07 / .711 |
| <i>Exp_23: Describes general applications/software programs to support nursing education</i> | N/A | 3.99 / .704 | 4.33 / .651 | 4.02 / .704 |
| <i>Exp_24: Discusses Computerized Assisted Instruction (CAI) as a teaching and learning tool</i> | N/A | 3.86 / .700 | 4.25 / .754 | 3.89 / .710 |
| <i>Exp_25: Assesses the accuracy of health information on the Internet</i> | N/A | 4.13 / .769 | 4.42 / .515 | 4.15 / .755 |
| <i>Exp_26: Assists patients use databases to make informed decisions</i> | N/A | 3.95 / .705 | 4.33 / .651 | 3.98 / .707 |
| <i>Exp_27: Participates in influencing the attitudes of other nurses toward computer use for nursing practice</i> | N/A | 3.96 / .719 | 4.25 / .866 | 3.99 / .733 |
| <i>Exp_28: As a clinician (nurse), participates in the selection process, design, implementation, and evaluation of systems</i> | N/A | 4.30 / .666 | 4.50 / .674 | 4.31 / .667 |

Appendix E: (Continued)

Summary of Mean Responses by Respective Level and Combined Total

| Question | Beginning N = 11 | Experienced N = 140 | Supervisory N = 12 | Total N = 163 |
|--|---------------------|------------------------|-----------------------|-------------------|
| | (Mean/Std Dev) | (Mean/Std Dev) | (Mean/Std Dev) | (Mean/Std Dev) |
| <i>Exp_29: Acts as an advocate of system users including patients or clients</i> | N/A | 4.17 / .672 | 4.33 / .888 | 4.19 / .689 |
| <i>Exp_30: Markets self, system or application to others</i> | N/A | 3.54 / .845 | 4.00 / .853 | 3.58 / .852 |
| <i>Exp_31: Performs basic trouble-shooting in applications/software programs</i> | N/A | 3.96 / .817 | 4.00 / .426 | 3.97 / .792 |

Appendix F: Rank Listing for Beginning Level Responses Based Upon Total Mean

| Response Range | Beginning Level Questions (Combined Total Mean) |
|----------------|--|
| 4.50 – 5.00 | <p>Beg_6: Uses sources of data that relate to practice and care. (4.56)</p> <p>Beg_7: Accesses, enters, and retrieves data used locally for patient care (4.51)</p> <p>Beg_10: Uses an application/software program to document patient care (4.51)</p> <p>Beg_12: Uses an application/software program to enter patient data (4.54)</p> <p>Beg_22: Uses computer technology safely (4.52)</p> <p>Beg_30: Recognizes that the computer is only a tool to provide better nursing care and that there are human functions that cannot be performed by computer (4.58)</p> |
| 4.00 – 4.49 | <p>Beg_2: Uses applications for structured data entry (4.34)</p> <p>Beg_3: Uses telecommunication devices (4.01)</p> <p>Beg_4: Use e-mail (4.49)</p> <p>Beg_5: Uses the Internet to locate, download items of interest (4.44)</p> <p>Beg_8: Uses database applications to enter and retrieve information (4.29)</p> <p>Beg_9: Conducts on-line literature searches (4.09)</p> <p>Beg_11: Uses an application/software program to plan care for patients to include discharge planning (4.39)</p> <p>Beg_13: Uses information management technologies for patient education (4.15)</p> <p>Beg_14: Uses computerized patient monitoring systems (4.37)</p> <p>Beg_16: Uses word processing (4.02)</p> <p>Beg_17: Demonstrates keyboarding (typing) skills (4.09)</p> <p>Beg_24: Identifies the appropriate technology to capture the required patient data (4.24)</p> <p>Beg_25: Demonstrates basic technology skills (4.42)</p> <p>Beg_26: Recognizes the use and/or importance of nursing data for improving practice (4.38)</p> <p>Beg_27: Recognizes that a computer program has limitations due to its design and capacity of the computer (4.11)</p> <p>Beg_28: Recognizes that it takes time, persistent effort, and skill for computers to become an effective tool. (4.25)</p> <p>Beg_29: Recognizes that health computing will become more common (4.44)</p> <p>Beg_31: Recognizes that one does not have to be a computer programmer to make effective use of the computer in nursing (4.39)</p> <p>Beg_32: Seeks available resources to help formulate ethical decisions in computing (4.04)</p> <p>Beg_35: Describes the computerized or manual paper system that is present. (4.18)</p> <p>Beg_36: Explains the use of networks for electronic communication (4.32)</p> <p>Beg_37: Identifies the basic components of the current computer system (4.16)</p> |
| 3.50 – 3.99 | <p>Beg_1: Uses administrative applications for practice management (3.94)</p> <p>Beg_19: Operates peripheral devices (3.79)</p> <p>Beg_20: Uses operating systems (3.83)</p> <p>Beg_34: Recognizes the value of clinicians' involvement in the design, selection, implementation, and evaluation of applications, systems in health care (3.84)</p> <p>Beg_18: Uses networks to navigate systems (3.69)</p> <p>Beg_23: Is able to navigate Windows (3.66)</p> <p>Beg_33: Describes patients' rights as they pertain to computerized information management (3.67)</p> |
| 3.00 – 3.49 | <p>Beg_15: Uses multimedia presentations (3.23)</p> <p>Beg_21: Uses existing external peripheral devices (3.46)</p> |

Appendix G:

Rank Listing for Experienced Level Responses based upon Total Mean.

| Response Range | Experienced Level Questions (Combined Total Mean) |
|----------------|---|
| 4.50 – 5.00 | None |
| 4.00 – 4.49 | <p><i>Exp_4: Uses administrative applications/ software programs for staff scheduling (4.10)</i></p> <p><i>Exp_9: Accesses shared data sets (4.02)</i></p> <p><i>Exp_10: Extracts data from clinical data sets (4.07)</i></p> <p><i>Exp_12: Applies monitoring system appropriately according to the data needed (4.11)</i></p> <p><i>Exp_14: Supports efforts toward development and use of a unified nursing language (4.15)</i></p> <p><i>Exp_15: Promotes the integrity of nursing information and access necessary for patient care within an integrated computer-based patient record (4.29)</i></p> <p><i>Exp_16: Provides for efficient data collection (4.37)</i></p> <p><i>Exp_19: Discusses the principles of data integrity, professional ethics and legal requirements (4.13)</i></p> <p><i>Exp_20: Describes ways to protect data (4.29)</i></p> <p><i>Exp_22: Describes general applications/ software programs, systems to support clinical care (4.07)</i></p> <p><i>Exp_23: Describes general applications/ software programs to support nursing education (4.02)</i></p> <p><i>Exp_25: Assesses the accuracy of health information on the Internet (4.15)</i></p> <p><i>Exp_28: As a clinician (nurse), participates in the selection process, design, implementation, and evaluation of systems (4.31)</i></p> <p><i>Exp_29: Acts as an advocate of system users including patients or clients (4.19)</i></p> |
| 3.50 – 3.99 | <p><i>Exp_1: Uses administrative applications/ software programs for forecasting (3.90)</i></p> <p><i>Exp_3: Uses applications/ software programs to manage aggregated data (3.80)</i></p> <p><i>Exp_5: Uses administrative applications/ software programs for maintaining employee records (3.91)</i></p> <p><i>Exp_8: Evaluates Computer Assisted Instruction (CAI) as a teaching tool (3.87)</i></p> <p><i>Exp_11: Extracts selected literature resources and integrates them to a personally usable file (3.95)</i></p> <p><i>Exp_13: Uses computer applications/ software programs for statistical analysis and nursing research (3.85)</i></p> <p><i>Exp_18: Defines the impact of computerized information management on the role of the nurse (3.99)</i></p> <p><i>Exp_24: Discusses Computerized Assisted Instruction (CAI) as a teaching and learning tool (3.89)</i></p> <p><i>Exp_26: Assists patients to use databases to make informed decisions (3.98)</i></p> <p><i>Exp_27: Participates in influencing the attitudes of other nurses toward computer use for nursing practice (3.99)</i></p> <p><i>Exp_31: Performs basic trouble-shooting in applications/ software programs (3.97)</i></p> <p><i>Exp_2: Uses administrative applications/ software programs for budget (3.53)</i></p> <p><i>Exp_6: Uses applications/ software programs to develop testing materials (3.71)</i></p> <p><i>Exp_7: Uses applications/ software programs for curriculum planning (3.72)</i></p> <p><i>Exp_17: Describes general applications available for research (3.74)</i></p> <p><i>Exp_21: Describes general applications/ software programs to support administration (3.70)</i></p> <p><i>Exp_30: Markets self, system or application to others (3.58)</i></p> |
| 3.00 – 3.49 | None |

Appendix H:

Question Groupings into Three Factors with their Corresponding Staggers' Grouping.

| <u>Factor</u> | <u>Survey Question</u> | <u>Staggers' Grouping</u> |
|---------------|---|---------------------------|
| One: | B-4: Uses e-mail | CS: Communication |
| General | B-6: Uses sources of data that relate to practice and care. | CS: Data Access |
| Software | B-7: Accesses, enters, and retrieves data used locally for patient care. | CS: Data Access |
| Applications | B-8: Uses database applications to enter and retrieve information. | IK: Privacy/Security |
| | B-32: Seeks available resources to help formulate ethical decisions in computing. | CS: Administration |
| | E-1: Uses admin application/software programs for forecasting | CS: Administration |
| | E2: Uses application/software programs for budget | CS: Administration |
| | E-3: Uses applications/software programs to manage aggregated data. | CS: Administration |
| | E-4: Uses applications/software programs for staff scheduling | CS: Administration |
| | E-5: Uses applications/software programs for maintaining employee records. | CS: Education |
| | E-6: Uses applications/software programs to develop testing materials. . | CS: Education |
| | E-7: Uses applications/software programs for curriculum planning | CS: Education |
| | E-8: Evaluates Computer Assisted Instruction (CAI) as a teaching tool. | CS: Data Access |
| | E-9: Accesses shared data sets | CS: Data Access |
| | E-10: Extracts data from clinical data sets. | CS: Data Access |
| | E-11: Extracts selected literature resources and integrates them to a personally usable file. | CS: Monitoring |
| | E-12: Applies monitoring system appropriately to the data needed. | CS: Research |
| | E-13: Uses computer applications/software programs for statistical analysis and nursing research. | IK: Data |
| | E-14: Supports efforts toward development and use of a unified nursing language. | IK: Impact |
| | E-18: Defines the impact of computerized information management on the role of the nurse. | IK: Privacy/Security |
| | E-21: Describes general applications/software programs to support administration. | IK: Privacy/Security |
| | E-22: Describes general applications/software programs/systems to support clinical care. | IK: Privacy/Security |
| | E-23: Describes general applications/software programs to support nursing education. | IK: Privacy/Security |
| | E-24: Discusses Computerized Assisted Instruction (CAI) as a teaching and learning tool. | IS: Role |
| | E-27: Participates in influencing the attitudes of other nurses toward computer use for nursing practice. | |

Appendix H: (Continued)

Question Groupings into Three Factors with their Corresponding Stagers' Grouping.

| <u>Factor</u> | <u>Survey Question</u> | <u>Stagers' Grouping</u> |
|----------------------------------|---|----------------------------|
| Two: Clinical Applications | B-10: Uses an application/software program to document patient care. | CS: Documentation |
| | B-11: Uses an application / software program to plan care for patients to include discharge planning. | CS: Documentation |
| | B-12: Uses an application / software program to enter patient data | CS: Documentation |
| | B-13: Uses information management technologies for patient education. | CS: Education |
| | B-14: Uses computerized patient monitoring systems | CS: Monitoring |
| | B-22: Uses computer technology safely. | CS: Systems |
| | B-24 Identifies the appropriate technology to capture the required patient data. | CS: Systems |
| | B-26: Recognizes the use and/or importance of nursing data for improving practice. | IK: Data |
| | B-28: Recognizes that it takes time, persistent effort, and skill for computers to become an effective tool. | IK: Impact |
| | B-29: Recognizes that health computing will become more common. | IK: Impact |
| | B-30: Recognizes that the computer is only a tool to provide better nursing care and that there are human functions that cannot be performed by a computer. | IK: Impact |
| | B-31: Recognizes that one does not have to be a computer programmer to make effective use of the computer in nursing. | IK: Impact |
| | B-35: Describes the computerized or manual paper system that is present. | IK: Impact |
| | B-36: Explains the use of networks for electronic communication. | IK: Impact |
| | E-16: Uses word processing. | IK: Data |
| | E-29: Acts as an advocate of system users including patients or clients. | IS: Role |
| | E-30: Markets self, system or application to others. | IS: Role |
| Three: Networking Systems | B-9: Conducts on-line literature searches. | CS: Data Access |
| | B-15: Uses multimedia presentations. | CS: Basic Desktop Software |
| | B-16: Uses word processing | CS: Basic Desktop Software |
| | B-18: Uses networks to navigate systems. | CS: Systems |
| | B-20: Uses operating systems | CS: Systems |
| | B-21: Uses existing external peripheral devices. | CS: Systems |
| | B-23: Is able to navigate Windows. | CS: Systems |
| | B-33: Describes patient's rights as they pertain to computerized information management. | CS: Systems |
| | E-31: Performs basic trouble-shooting in applications/software programs. | IK: Privacy/Security |
| | | IS: Systems Maintenance |

Appendix I:

Study Questions Assignment into Kaminski Competency Categories.

Kaminski Competency Category

Beginning Questions

Beg_2: Uses applications for structured data entry

Beg_3: Uses telecommunication devices

Beg_4: Uses e-mail

Beg_5: Uses the Internet to locate, download items of interest

Beg_7: Accesses, enters, and retrieves data used locally for patient care

Beg_8: Uses database applications to enter and retrieve information

Beg_10: Uses an application/software program to document patient care

Beg_12: Uses an application/software program to enter patient data

Beg_14: Uses computerized patient monitoring systems

Beg_15: Uses multimedia presentations

Beg_16: Uses word processing

Beg_17: Demonstrates keyboarding (typing) skills

Beg_18: Uses networks to navigate systems

Beg_19: Operates peripheral devices

Beg_20: Uses operating systems

Beg_21: Uses existing external peripheral devices

Beg_22: Uses computer technology safely

Beg_23: Is able to navigate Windows

Beg_25: Demonstrates basic technology skills

Beg_35: Describes the computerized or manual paper system that is present.

Beg_6: Uses sources of data that relate to practice and care.

Beg_26: Recognizes the use and/or importance of nursing data for improving practice

Beg_27: Recognizes that a computer program has limitations due to its design and capacity of the computer

Beg_28: Recognizes that it takes time, persistent effort, and skill for computers to become an effective tool.

Beg_30: Recognizes that the computer is only a tool to provide better nursing care and that there are human functions that cannot be performed by computer

Beg_31: Recognizes that one does not have to be a computer programmer to make effective use of the computer in nursing

Beg_36: Explains the use of networks for electronic communication

Beg_37: Identifies the basic components of the current computer system

Technical

Utility

Appendix I: (Continued)

Study Questions Assignment into Kaminski Competency Categories.

Kaminski Competency
Category

Beginning Questions

Beg_1:

Uses administrative applications for practice management

Beg_9: Conducts on-line literature searches

Beg_11: Uses an application/software program to plan care for patients to include discharge planning

Beg_13: Uses information management technologies for patient education

Beg_24: Identifies the appropriate technology to capture the required patient data

Beg_29: Recognizes that health computing will become more common

Beg_32: Seeks available resources to help formulate ethical decisions in computing

Beg_33: Describes patients' rights as they pertain to computerized information management

Beg_34: Recognizes the value of clinicians' involvement in the design, selection, implementation, and evaluation of applications, systems in health care

Leadership

Kaminski Competency
Category

Experienced Questions

Exp_9: Accesses shared data sets

Exp_10: Extracts data from clinical data sets

Exp_25: Assesses the accuracy of health information on the Internet

Exp_26: Assists patients to use databases to make informed decisions

Exp_31: Performs basic trouble-shooting in applications/software programs

Exp_20: Describes ways to protect data

Exp_22: Describes general applications/software programs, systems to support clinical care

Exp_30: Markets self, system or application to others

Exp_1: Uses administrative applications/software programs for forecasting

Exp_2: Uses administrative applications/software programs for budget

Exp_3: Uses applications/software programs to manage aggregated data

Exp_4: Uses administrative applications/software programs for staff scheduling

Exp_5: Uses administrative applications/software programs for maintaining employee records

Exp_6: Uses applications/software programs to develop testing materials

Exp_7: Uses applications/software programs for curriculum planning

Technical

Utility

Leadership

Appendix I: (Continued)

Study Questions Assignment into Kaminski Competency Categories.

Kaminski Competency
Category

Beginning Questions

Exp_7: Uses applications/software programs for curriculum planning

Exp_8: Evaluates Computer Assisted Instruction (CAI) as a teaching tool

Exp_11: Extracts selected literature resources and integrates them to a personally usable file

Exp_12: Applies monitoring system appropriately according to the data needed

Exp_13: Uses computer applications/software programs for statistical analysis and nursing research

Exp_14: Supports efforts toward development and use of a unified nursing language

Exp_15: Promotes the integrity of nursing information and access necessary for patient care within an integrated computer-based patient record

Exp_16: Provides for efficient data collection

Exp_17: Describes general applications available for research

Exp_18: Defines the impact of computerized information management on the role of the nurse

Exp_19: Discusses the principles of data integrity, professional ethics and legal requirements

Exp_21: Describes general applications/software programs to support administration

Exp_23: Describes general applications/software programs to support nursing education

Exp_24: Discusses Computerized Assisted Instruction (CAI) as a teaching and learning tool

Exp_27: Participates in influencing the attitudes of other nurses toward computer use for nursing practice

Exp_28: As a clinician (nurse), participates in the selection process, design, implementation, and evaluation of systems

Exp_29: Acts as an advocate of system users including patients or clients

Leadership

Appendix J:

(Initial Contact E-mail to Potential Respondent)

Your Participation in Nursing Computer Competency Research

Dear (Facility) Nursing Colleague:

Informatics and the use of computers has become a fundamental aspect of modern nursing practice. The rapid expansion of such technology into every aspect of modern nursing implies that the 21st century nurse must establish and maintain computer competency. This is certainly seems to be true for the (facility) nurses. In addition to such common applications as word processing and electronic mail, we use computers to enter and review physician orders and other patient care information, to access laboratory and imaging results, locate resources and do much of our charting. Medical equipment such as electronic thermometers, intravenous pumps and cardiac monitors all incorporate some degree of computerization. In our professional practice, as in our personal lives, we use computers to collect data, access information, implement actions and record responses. (The facility) believes that computer competencies are now essential for nurses. This will be even more so in January 2006 when (facility) converts to CARE*Link, the EPIC health information systems.

I am a Ph.D. in nursing student at the University of Hawai'i at Manoa. My doctoral focus is an investigation as to what is the essential computer competencies required for clinical nursing practice. I am asking your assistance in this endeavor by completing an on-line survey related to how you feel about a number of pre-identified nursing computer competencies. You are encouraged to also make comments of your

own. I estimate this survey will take between 20 and 60 minutes to complete. Your responses are strictly confidential. A summary of results will be made available to all (facility) nurses. The survey is accessed by going to [http: \www.hobbssurvey.\(facility\).com](http://www.hobbssurvey.(facility).com). (You may either type this in your browser or simply click the link to be taken there). **For your participation in this survey you will receive a \$5.00 coupon good at any (facility) gift shop/cafeteria.** You may also option to not be identified as having completed a survey. However, it will then be impossible to send you a \$5.00 gift certificate.

Please feel free to contact me at 547-4121 (work), 239-0002 (home) or at [shobbs@ \(facility\).org](mailto:shobbs@.(facility).org) with any questions, concerns, or comments. Your assistance in this endeavor is greatly appreciated. This research is approved by nursing and hospital administration and supported by a grant from the Queen Emma Research Foundation.

Steven D. Hobbs, Ph.D. (c), R.N., BC

Doctoral Nursing Student, The University of Hawai'i at Manoa

Appendix K: *Sample of Website Content*

WELCOME TO:

CLINICAL NURSES' PERCEPTIONS OF ESSENTIAL NURSING INFORMATICS COMPETENCIES

Mahalo for Your Participation in Nursing Computer Competency Research!

Dear QMC Nursing Colleague:

Mahalo for your consideration in participating in this important nursing research.

The following is a brief description of the research and why you have been asked to participate. You will then be asked to review a required consent form. If you agree to participate by completing the survey you will then be taken to a brief demographic information form and then the survey itself. This survey is completely confidential. No one, not even the investigator will be able to link your actual responses specifically to you. Upon reaching the survey's end an e-mail message will appear addressed to the Principle Investigator. If you provide your name and work unit and send this e-mail, a \$5.00 gift certificate will be mailed to you in appreciation for your participating in this study. You may choose to not have the notification e-mail sent, however, you will then not receive the \$5.00 gift certificate.

Informatics and the use of computers has now become a fundamental aspect of modern nursing practice. The rapid expansion of such technology into every aspect of modern nursing implies that the 21st century nurse must establish and maintain computer competency. This is certainly seems to be true for (facility) nurses. In addition to such common applications as word processing and electronic mail, we use computers to enter and review physician orders and other patient care information, to access laboratory and imaging

results, locate resources and do much of our charting. Medical equipment such as electronic thermometers, intravenous pumps and cardiac monitors all incorporate some degree of computerization. In our professional practice, as in our personal lives, we use computers to collect data, access information, implement actions and record responses. (Facility) believes that computer competencies are now essential for nurses. This will be even more so in January 2006 when (facility) converts to CARE*Link, the EPIC health information systems.

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Please feel free to contact me at 547-4121 (work), 239-0002 (home) or at shobbs@queens.org with any questions, concerns, or comments. Your assistance in this endeavor is greatly appreciated. This research is approved by nursing and hospital administration and supported by a grant from the Queen Emma Research Foundation.

Steven D. Hobbs, Ph.D.(c), R.N., BC

Doctoral Nursing Student, The University of Hawai'i at Manoa

(Facility Identification)
HONOLULU, HAWAII
109

INFORMED CONSENT TO TAKE PART IN A
CLINICAL RESEARCH STUDY

Title of Study: Clinical Nurses' Perceptions of Essential Nursing Informatics Competencies

Principal Investigator: Steven D. Hobbs, Ph.D.(c), R.N., BC

Address: (Facility Name)
(Facility Address)
Honolulu, HI 96813
Phone: (808) 547-4121 *Pager:* 578-8884

Sponsor: School of Nursing & Dental Hygiene,
Address: Webster Hall, University of Hawaii,
Honolulu, Hawaii 96822

INFORMED CONSENT

You are asked to take part in this research study as you are a Registered Nurse employed by (Facility name). This is a research study, the culmination of my doctoral studies, is looking at what are the essential computer knowledge and skill competencies expected for beginning and experienced nurses.

Before you decide whether or not to take part in this study, you must understand the purpose, how it may help, any risks, and what you have to do. This process is called informed consent. This consent form gives you this information about the study. Once you understand the study, and agree to take part, you will be asked to "sign" this consent form. You may print a copy to keep or a generic copy of the consent is available from the Principle Investigator at any time. .

Before you learn about the study, it is important that you know the following:

- Taking part in this study is of your own free will.
- You may decide not to take part in the study or stop being in the study at any time prior to submission without it making any difference to your role at (facility) or the University of Hawai'i. No one, excluding the researchers, will ever know specifically if you agreed or declined to participate.

PURPOSE OF THE STUDY

The purpose of this research study is to establish what computer competencies (knowledge and skills) are necessary for beginning and experienced clinical nurses? The study will accomplish this by seeking your opinion as to your agreement or disagreement with a number of competency statements. Such knowledge allows health care providers, schools,

graduate programs, nursing informatics experts, professional organizations, and governmental/regulatory agencies to plan and evaluate both formal and continuing programs. Over 800 Registered Nurses at (facility name) have been asked to participate. You may not be directly helped from this study, but the information obtained will be of value to the nursing profession and the institution. The research will benefit the Principle Investigator in completing his doctoral degree in Nursing. This study is supported by a grant from the Queen Emma Research Foundation.

STUDY PROCEDURES

You were selected as a Registered Nurse who works for (facility name). All (facility name) R.N.s are being asked to participate. If you agree to take part in the study, you need simply to click on the "I agree to participate" box below. You will then be taken to a series of screens asking for your agreement or disagreement regarding a number of competency statements. You will also be asked to provide some basic information on yourself to allow statistical analysis. Once you have signed off the study website, your responses will not be linked to any unique identification to you. Completion of all questions may take about 20 - 60 minutes. You are asked to reply to the survey only once.

If you have completed the study, upon signing off the study website, an automatic e-mail will be sent to the Principle Investigator indicating your name, work unit and that you have completed the study. This e-mail is in no manner connected to your question responses. Upon receipt of the e-mail the Principle Investigator will send to you a five dollar (\$5.00) gift certificate good at any (facility name) store or cafeteria as remuneration for study participation. You may also choose to not have this e-mail sent. Your question replies will still be tabulated. However, without the e-mail it is impossible to know you specifically participated and to send you the \$5.00 gift certificate.

RISKS

Two possible risks from taking part in this study are the loss of privacy and the possibility that you may have some emotional distress in filling out the study forms. Several actions will be taken to decrease these risks: 1) All responses will be marked with a code number, rather than your name. 2) All computerized and printed records will be secured by the principle investigator and only the research team will be able to read them. 3) You may stop completing the survey at any time.

BENEFITS

Knowledge gained from this study may help other people in the future. Such knowledge may allow health care providers, schools, graduate programs, nursing informatics experts, professional organizations, and governmental/regulatory agencies to plan and evaluate both formal and continuing programs.

You will also receive a one time five dollar (\$5.00) gift certificate good at any (facility name) store or cafeteria as compensation for study participation.

CONFIDENTIALITY

Your replies are confidential (private). The usual precautions will be taken to maintain the privacy and confidentiality of your replies. The confidentiality of all study-related records will be kept according to all applicable laws. Although (facility name) will take all measures to maintain the privacy of your records, they cannot be held responsible for or guarantee that other institutions will do the same. There is a possibility that your records, including identifying information may be inspected by authorized representatives of the study sponsor, the study staff, and the staff of (facility name) Center Research & Institutional Review Committee (IRC). The IRC looks at research subjects to make sure that your rights are protected ethically. You will not be identified (known) by name in any reports or publications coming from this study.

COSTS

There is no financial cost to you for participation in this study.

REMOVAL FROM THE STUDY

You take part in this study of your own free will. You may be removed from the study without your consent if you are unable or unwilling to complete all of the study questions.

AGREEMENT TO TAKE PART AND CERTIFICATION

I have read and understand the description of this study such as the purpose and nature of this study, its expected length, the procedures involved, reasonably known risks and discomforts, benefits to expect, release of my replies, and removal of my responses without my consent from this research study.

I am taking part in this study of my own free will. I may withdraw (stop taking part) at any time, even after "accepting" this consent form, by simply closing my computer "browser" and disconnecting. Doing so will not make any difference to my relationships at (facility name) or The University of Hawai'i. I understand that my consent does not take away my legal rights in case of carelessness or negligence of anyone connected with this study. I understand that selecting the "I agree to participate" box below is the same as my signature and means that I have read the information above, my questions have been satisfactorily answered and I wish to participate. If at any time I have questions, I can contact the researcher listed above or the resources listed below.

This research summary has been presented in electronic form to the above subject. To the best of my knowledge, the subject is voluntarily and knowingly giving informed consent and has the legal capacity to give informed consent to take part in this research study.

Steven D. Hobbs, Ph.D.(c), R.N., BC
Investigator's Name (Print)

December 15, 2004
Date/Time

NOTE: If I have any questions about my rights as a volunteer or any other matter relating to this study, I may call **Steven D. Hobbs at (808) 239-0002 or (800) 780-4236** and talk about

any questions that I might have. If I cannot get satisfactory answers to my questions or I have comments or complaints about my participation in this study, I may contact:

Research & Institutional Review Committee
(Facility Name)
(Facility Address)
(Facility Address)
Honolulu, HI 96813
Phone: (808) 547-4512

Committee on Human Studies
University of Hawai'i
2540 Maile Way, Spalding #253
Honolulu, HI 96822
(808) 539-3955

You may print this form for your reference by selecting "File → Print" on your browser.

Select One:

☐ I agree to participate as described above ☐ I decline to participate

=====

If the respondent selects "I Decline to Participate" they will be taken to the following message:

Mahalo for your time. I appreciate you making the effort to visit this studies website and to consider your participation in this research. I regret that you have chosen not to participate at this time. If you have any question or comment regarding this research and your participation, please do not hesitate to contact me at 547-4121 (work) or 239-0002 (home). Should you change your mind and later chose to participate you may simply access the website again and select "I agree" at the end of the consent.

Steven D, Hobbs, Ph.D.(c), R.N., BC

Ph.D. in Nursing Student, Univ. of Hawai'i

If the respondent selects "I agree to participate" they will be taken to the Demographic page below.

Demographic Questions

Please enter or check the appropriate information below. This information is for analysis purposes only and can not be used in identification.

1. Year of Birth: 1 9 _ _
2. Gender ☐ Male ☐ Female
3. Ethnicity ☐ American Indian/Alaskan Native
☐ Asian or Pacific Islander
(Includes Hawaiian & Filipino)
☐ Black, not of Hispanic origin
☐ Hispanic
☐ White, not of Hispanic Origin
☐ Other: _____
4. Principle R.N. role:
☐ Staff Nurse ☐ Charge/ CN III/IV ☐ Clinical Specialist/Case Manager
☐ Administration ☐ Manager/Director/and so forth
5. Year of first R.N. Licensure: _ _ _ _
6. Highest completed Nursing Degree:
☐ Associate. ☐ Diploma ☐ Bachelors
☐ Masters ☐ Doctorate
7. Highest completed Non-Nursing Degree:
☐ Associate ☐ Diploma ☐ Bachelors
☐ Masters ☐ Doctorate
8. National Organization Certification:
(Certification by a national nursing organization)
☐ No ☐ Yes: Specialty: _____
(Type in)

WEB QUESTIONNAIRE

INSTRUCTIONS: FOR EACH QUESTION BELOW, PLEASE INDICATE WHETHER YOU STRONGLY AGREE – AGREE – ARE NEUTRAL – DISAGREE OR -- STRONGLY DISAGREE THAT THE IDENTIFIED SKILL IS NECESSARY FOR BEGINNING NURSES IN THEIR PROFESSIONAL CLINICAL PRACTICE. FOR THE PURPOSES OF THIS STUDY THE AMOUNT OF TIME IN THEIR CURRENT POSITION IS RECOMMENDED AS THE DETERMINING FACTOR OF BEGINNING OR EXPERIENCED. THAT IS, LESS THAN SIX MONTHS EXPERIENCE EQUALS A BEGINNING NURSE AND SIX MONTHS OR MORE EXPERIENCE EQUALS AN EXPERIENCED NURSE.

LEVEL ONE: BEGINNING NURSE

COMPUTER SKILLS: ADMINISTRATION

1. Uses administrative applications for practice management (for example, searches for patient, retrieves demographics, billing data)

- ☐ Strongly Agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly Disagree

2. Uses applications for structured data entry (for example, patient acuity or classification applications)

- ☐ Strongly Agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly Disagree

COMPUTER SKILLS: COMMUNICATION (e-mail, internet, telecommunications)

3. Uses telecommunication devices (for example, modems or other devices) to communicate with other systems (for example, access data, upload, download)

- ☐ Strongly Agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly Disagree

4. Use e-mail (for example, create, send, respond, use attachments)
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
5. Uses the Internet to locate, download items of interest (for example, patient, nursing resources)
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

COMPUTER SKILLS: DATA ACCESS

6. Uses sources of data that relate to practice and care.
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
7. Accesses, enters, and retrieves data used locally for patient care (for example, uses HIS, CIS for plans of care, assessments, interventions, notes, discharge planning)
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
8. Uses database applications to enter and retrieve information
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
9. Conducts on-line literature searches
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

COMPUTER SKILLS: DOCUMENTATION

- 10.** Uses an application/software program to document patient care
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
- 11.** Uses an application/software program to plan care for patients to include discharge planning
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
- 12.** Uses an application/software program to enter patient data (for example, vital signs)
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

COMPUTER SKILLS: EDUCATION

- 13.** Uses information management technologies for patient education (for example, identifies areas for instruction, conducts education, evaluates outcomes, resources)
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

COMPUTER SKILLS: MONITORING

- 14.** Uses computerized patient monitoring systems
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

COMPUTER SKILLS: BASIC DESKTOP SOFTWARE

15. Uses multimedia presentations
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
16. Uses word processing
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
17. Demonstrates keyboarding (typing) skills
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

COMPUTER SKILLS: SYSTEMS

18. Uses networks to navigate systems (for example, file servers, www)
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
19. Operates peripheral devices (for example, bedside terminal, hand-held)
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
20. Uses operating systems (for example, copy, delete, change directories)
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

21. Uses existing external peripheral devices (for example, CD-ROMs, zip/jazz drives)
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
22. Uses computer technology safely
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
23. Is able to navigate Windows (for example, manipulate files using file manager, determine active printer, access installed applications, create & delete directories)
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
24. Identifies the appropriate technology to capture the required patient data (for example, fetal monitoring device)
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
25. Demonstrates basic technology skills (for example, turn computer off & on, load paper, change toner, remove paper jams, print documents)
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

INFORMATICS KNOWLEDGE: DATA

26. Recognizes the use and/or importance of nursing data for improving practice
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

INFORMATICS KNOWLEDGE: IMPACT

27. Recognizes that a computer program has limitations due to its design and capacity of the computer

- ☐ Strongly Agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly Disagree

28. Recognizes that it takes time, persistent effort, and skill for computers to become an effective tool.

- ☐ Strongly Agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly Disagree

29. Recognizes that health computing will become more common

- ☐ Strongly Agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly Disagree

30. Recognizes that the computer is only a tool to provide better nursing care and that there are human functions that cannot be performed by computer

- ☐ Strongly Agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly Disagree

31. Recognizes that one does not have to be a computer programmer to make effective use of the computer in nursing

- ☐ Strongly Agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly Disagree

INFORMATICS KNOWLEDGE: PRIVACY/SECURITY

- 32.** Seeks available resources to help formulate ethical decisions in computing
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
- 33.** Describes patients' rights as they pertain to computerized information management
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

INFORMATICS KNOWLEDGE: SYSTEMS

- 34.** Recognizes the value of clinicians' involvement in the design, selection, implementation, and evaluation of applications, systems in health care
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
- 35.** Describes the computerized or manual paper system that is present.
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
- 36.** Explains the use of networks for electronic communication (for example, Internet)
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
- 37.** Identifies the basic components of the current computer system (for example, features of a PC, workstation)
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

IF YOU IDENTIFIED YOURSELF AS A BEGINNING NURSE, YOU ARE NOW FINISHED. CLICK THE BUTTON BELOW. IF YOU IDENTIFIED YOURSELF AS AN EXPERIENCED OR SUPERVISOR NURSE, PLEASE CONTINUE.

INSTRUCTIONS: FOR EACH QUESTION BELOW, PLEASE INDICATE WHETHER YOU STRONGLY AGREE – AGREE – ARE NEUTRAL – DISAGREE OR -- STRONGLY DISAGREE THAT THE IDENTIFIED SKILL IS NECESSARY FOR EXPERIENCED NURSES IN THEIR PROFESSIONAL CLINICAL PRACTICE. FOR THE PURPOSES OF THIS STUDY THE AMOUNT OF TIME IN THEIR CURRENT POSITION IS RECOMMENDED AS THE DETERMINING FACTOR OF BEGINNING OR EXPERIENCED. THAT IS, LESS THAN SIX MONTHS EXPERIENCE EQUALS A BEGINNING NURSE AND SIX MONTHS OR MORE EXPERIENCE EQUALS AN EXPERIENCED NURSE.

Level Two: Experienced Nurse

COMPUTER SKILLS: ADMINISTRATION

1. Uses administrative applications/software programs for forecasting
 - ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
2. Uses administrative applications/software programs for budget
 - ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
3. Uses applications/software programs to manage aggregated data
 - ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
4. Uses administrative applications/software programs for staff scheduling
 - ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

5. Uses administrative applications/software programs for maintaining employee records
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

COMPUTER SKILLS: EDUCATION

6. Uses applications/software programs to develop testing materials
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
7. Uses applications/software programs for curriculum planning
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
8. Evaluates Computer Assisted Instruction (CAI) as a teaching tool
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

COMPUTER SKILLS: DATA ACCESS

9. Accesses shared data sets
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
10. Extracts data from clinical data sets
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

- 11.** Extracts selected literature resources and integrates them to a personally usable file
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

COMPUTER SKILLS: MONITORING

- 12.** Applies monitoring system appropriately according to the data needed
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

COMPUTER SKILLS: RESEARCH

- 13.** Uses computer applications/software programs for statistical analysis and nursing research
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

INFORMATICS KNOWLEDGE: DATA

- 14.** Supports efforts toward development and use of a unified nursing language
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
- 15.** Promotes the integrity of nursing information and access necessary for patient care within an integrated computer-based patient record
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
- 16.** Provides for efficient data collection
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

INFORMATICS KNOWLEDGE: RESEARCH

17. Describes general applications available for research
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

INFORMATICS KNOWLEDGE: IMPACT

18. Defines the impact of computerized information management on the role of the nurse
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

INFORMATICS KNOWLEDGE: PRIVACY/SECURITY

19. Discusses the principles of data integrity, professional ethics and legal requirements
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
20. Describes ways to protect data
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

Informatics Knowledge –Systems

21. Describes general applications/software programs to support administration (for example, staffing, budget)
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

22. Describes general applications/software programs, systems to support clinical care
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
23. Describes general applications/software programs to support nursing education
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
24. Discusses Computerized Assisted Instruction (CAI) as a teaching and learning tool
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

INFORMATICS SKILLS: EVALUATION

25. Assesses the accuracy of health information on the Internet
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree
26. Assists patients to use databases to make informed decisions
- ☐ Strongly Agree
 - ☐ Agree
 - ☐ Neutral
 - ☐ Disagree
 - ☐ Strongly Disagree

INFORMATICS SKILLS: ROLE

27. Participates in influencing the attitudes of other nurses toward computer use for nursing practice

- ☐ Strongly Agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly Disagree

28. As a clinician (nurse), participates in the selection process, design, implementation, and evaluation of systems

- ☐ Strongly Agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly Disagree

29. Acts as an advocate of system users including patients or clients

- ☐ Strongly Agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly Disagree

30. Markets self, system or application to others

- ☐ Strongly Agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly Disagree

INFORMATICS SKILLS: SYSTEMS MAINTENANCE

31. Performs basic trouble-shooting in applications/software programs

- ☐ Strongly Agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly Disagree

Final Screen

Mahalo for taking this important survey on how your beliefs and use of informatics in nursing practice. Your responses have now been recorded. These results are the central component of my doctoral dissertation research and will be reported as part of that effort. I also hope to publish this information in the professional nursing literature. The information will be shared with the (Facility) CARE*Link team who may find it useful in creating a more useful Health Information System for nursing at (Facility).

Please enter your name and home unit in the two spaces below. Then hit "SEND." This will generate an e-mail to me indicating that you have concluded your access of this survey. I will know only that you have accessed the survey. It is impossible to identify which survey results were yours.

This e-mail allows me to send you a \$5.00 certificate of appreciation for taking the time to contribute to this effort. This coupon is good at any (Facility) cafeteria, dining room, food cart or gift shop.

If you desire to NOT be identified to the Principle Investigator as having participated in this study or wish to decline the \$5.00 gift certificate, simply do not hit the "Send" button and simply close your browser to exit the website.

Again, mahalo nui loa for assisting in my dissertation and towards advancing our knowledge base in this important area of Nursing's practice.

Steven D. Hobbs

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Name: _____

Work Unit: _____

Glossary

Advanced Beginning Nurse A nurse who is still rule-focused, but now has also begun to rely on previous experience to make decisions. This person still needs guidelines in order to perform at an acceptable level, but is beginning to see relationships.

Algorithm: A set of unambiguously defined rules describing how to obtain the solution to a problem.

Attitude A state of mind or a feeling; disposition.

Beginning Nurse A nurse preparing for initial entry into nursing practice or who has just begun a nursing career.

Clinical Nurse A nurse who is involved in direct observation and treatment of patients and their significant others. * For the purposes of this study, an additional condition was made that this be equal to or greater than 50% of the time.

Computer A device capable of acquiring, storing and outputting data and processing these data under the control of programs that is also stored in the computer.

Competency. A determination of an individual's capability to perform up to defined expectations.

Competent Nurse A Registered Nurse who has been identified (by observation, testing, and so forth) as capable to performing up to defined expectations for a selected area.

Data Representation of observations or concepts suitable for communication, interpretation, and processing by humans or machines. Interpretive data form information.

Delphi Technique A feedback method to reduce inter-observer variability by confronting each member of a panel of experts with the independent judgments of the other members and giving each member the possibility to adapt his or her judgment.

Descriptive Research Research studies that have as their main objective the accurate portrayal of the characteristics of persons, situations, or groups and the frequency with which certain phenomena occur.

Experienced Nurse A nurse with proficiency in one or more domains of interest.

Expert Nurse A nurse with the extensive experience and ability to see the significance and meaning within a contextual whole; one who is fluid and flexible in performing their skills.

Informatics A term from the French *informatique*, which includes all aspects of the computer milieu, from the theoretical to the applied.

Informatics Innovator An R.N. who is educationally prepared to conduct informatics research and generate informatics theory.

Informatics Nurse Specialist An RN with advanced preparation possessing additional knowledge and skills specific to information management and computer technology.

Information Data that is interpreted, organized, or structured.

Knowledge The objects, concepts and relationships that are assumed to exist in some area of interest. A collection of knowledge, represented using some knowledge representation language is known as a knowledge base and a program for extending or querying a knowledge base is a knowledge-based system. Knowledge differs from data or information in that new knowledge may be created from existing knowledge using logical inference. If information is data plus meaning then knowledge is information plus processing.

Novice Nurse A nurse who primarily governed by rules and, as such, is unable to rely on previous experience to recognize relevant aspects within a situation.

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

Proficient Nurse A nurse who has been judged to meet minimal required competencies.

Skill A proficiency, facility, or dexterity that is acquired or developed through training or experience.

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