Résumé

Développer une relation avec l'ordinateur dans le cadre de la pratique infirmière : une théorie de terrain

Barbara L. Cross, Marjorie MacDonald

En dépit des preuves d'améliorations que les technologies de l'information peuvent apporter à la pratique clinique, le personnel infirmier a été lent à adopter l'informatique et les systèmes d'information. L'objet de la présente étude a été d'élaborer une théorie de fond sur la manière dont le personnel infirmier intègre les ordinateurs à sa pratique clinique, de même que de recenser les facteurs déterminants. Recourant à une théorie de terrain, les chercheuses ont réalisé des entrevues avec 12 infirmières et infirmiers exerçant dans deux hôpitaux de soins de courte durée, dans la province canadienne de la Colombie-Britannique. Tous les participants se sont engagés à établir une relation avec l'ordinateur dans leur pratique. Ils ont intégré les ordinateurs à leur pratique à des rythmes et des degrés d'adoption variés, en fonction de leurs caractéristiques personnelles, de leur expérience en matière d'ordinateurs, du degré auquel l'informatisation s'accorde avec leurs valeurs, de leur capacité à percevoir les avantages de la technologie et de leur aptitude à appréhender et surmonter les obstacles à l'utilisation de l'ordinateur. Le personnel infirmier a besoin de soutiens organisationnels pour faciliter l'intégration des technologies ainsi que d'une formation à l'informatique dans les programmes d'enseignement de base des sciences infirmières.

Mots-clés : ordinateurs, technologies de l'information, soutiens organisationnels, formation à l'informatique

Developing a Relationship With the Computer in Nursing Practice: A Grounded Theory

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While there is evidence that information technology can improve clinical practice, nurses have been slow to adopt computers and information systems. The purpose of this study was to develop substantive theory on how nurses integrate computers into their clinical practice and to identify influencing factors. Using grounded theory, the researchers conducted interviews with 12 nurses practising in two acute-care hospitals in the Canadian province of British Columbia. All participants engaged in developing a relationship with the computer in their practice. They integrated computers into their practice at varying speeds and degrees of adoption, depending on personal characteristics, prior experience with computers, the extent to which computerization was congruent with their values, whether they were able to see the benefits of the technology, and their ability to manage and overcome the barriers to computer use. Nurses require both organizational supports to facilitate technology integration and computer education in their basic nursing programs.

Keywords: computerization, information technology, implementation, nursing

Introduction

Worldwide, information technology (IT), specifically computers and health information systems, are being integrated into many clinical arenas. There is evidence that, when successfully implemented, this technology can significantly improve clinical practice and care delivery (Buus-Frank, 1999; Hebda & Czar, 2009; Lorence, Spink, & Richards, 2002; Mihailidis, Krones, & Boger, 2006; Saba & Westra, 2011). Buus-Frank (1999) suggests that the survival of nursing depends on its embracing of technology, arguing that "as the volume of information increases, the half-life of knowledge is decreasing" (p. 433). Nurses have been slow to adopt computer technology (Simpson, 2003) despite their recognition that technologies are essential tools for both practitioners and administrators (Nagle & Ryan, 1996). When computer technology and information systems are not integrated into nursing practice, patients can be placed at risk, as nurses do not have access to timely information to guide their decision-making. Appropriate use of technology also enables nurses and other care providers to achieve the high output demanded by the

public and governments (Borycki, Lemieux-Charles, Nagle, & Eysen-bach, 2009; Hebda & Czar, 2009; Nagle & Ryan, 1996; Simpson, 2003).

Historical Perspective

In 1958 Blumberg suggested that computers could facilitate the automation and streamlining of selected nursing activities to free nurses up for other important tasks (cited in Hannah, Ball, & Edwards, 2006). In the late 1950s there was very little uptake of computers by nurses (Hannah et al., 2006); nursing leaders were not knowledgeable about this "cumbersome technology" (p. 29) and computer companies therefore focused on the business and financial sectors.

In the 1960s and 1970s, however, health-care leaders began to investigate the use of computer technology and software applications in health care. It was during this period that an early version of the electronic health record (EHR) was developed (Staggers, Thompson, & Snyder-Halpern, 2001). Decision-support tools (e.g., online references, communication and messaging solutions) arrived in the 1980s. By the 1990s computer technology was rapidly proliferating (Buus-Frank, 1999). The burgeoning information age was accelerated by the introduction of Web-based functionality, client/server architecture, and advancements in the World Wide Web (Hannah et al., 2006). New and ever-changing information about patients and their care was available to nurses in real time, potentially giving all clinicians the most current and relevant information to support their practice.

Computer technology in clinical settings created opportunities for nurse leaders to use disparate clinical information systems and electronic spreadsheets for purposes such as reporting client-related data, compiling population-based databases, abstracting statistical information, and using electronic mailing and communications applications (Hannah et al., 2006; Hebda & Czar, 2009; McBride, 2006; Staggers et al., 2001). In the setting chosen for the present study, however, few direct-care nurses accessed computer technologies and related clinical information systems. Many factors might explain this phenomenon. One factor could be a lack of understanding by IT departments and nurse leaders of the potential for positive impacts of computer technology and clinical information systems on clinical practice (Hannah et al., 2006; Hebda & Czar, 2009).

Nurses' Attitudes Towards and Perceptions of Computer Technology

When computers were introduced in the field of health care, quantitative methods dominated the research world and were used to measure nurses' attitudes towards computer technology and their computer literacy. Predetermined attributes of nurses were hypothesized to predict acceptance or adoption of computer technology in their practice (e.g., Hillan,

McGuire, & Cooper, 1998; Hobbs, 2002; Jayasuriya & Caputi, 1996; McBride & Nagle, 1996; Scarpa, Smeltzer, & Jasion, 1992; Schwirian, Malone, Stone, Nunley, & Francisco, 1989; Stronge & Brodt, 1985). Many of the early studies suggested that nursing's reluctance to adopt technology was related to negative attitudes towards computers and a lack of understanding of the technology. In other words, the "problem" was the nurses themselves. Using Burke's (1991) Nurses' Computer-Aided Use Questionnaire, Marasovic, Kenney, Elliott, and Sindhusake (1997) found that age, education, previous use, and years of experience influenced nurses' attitudes towards computers and found a strong positive correlation between nurses' adoption of technology and their satisfaction with, beliefs about, and motivation to use technology. Marasovic and colleagues concluded that education should be focused on optimizing nurses' beliefs and motivations. By contrast, studies on the implementation of biomedical technology (Fulton, 1996; Maxwell, 1995) showed that organizational context, implementation design, and diffusion strategies contributed to nurses' adoption of/resistance to biomedical technology. These findings broaden our understanding of influences on the integration of computer technology, from intrapersonal factors to organizational and environmental context, and suggest that organizational strategies might be at least as important as educational strategies.

None of the published studies on nurses' use of computers and IT has qualitatively explored nurses' understandings of and experiences with computer technology; thus we know little about the perceived value of computerization in nursing practice. Although several of the studies described above identify predefined factors that influence computer use by nurses, we were interested in a more nuanced and in-depth understanding of these influences. Almost no research has been done to theorize the process by which nurses manage challenges to the integration of computer technology and the EHR in their practice; we believe that a qualitative study to develop such a theory will make an important and unique contribution to the literature.

The Study

Computerization Initiative

In 2001 a regional health authority (HA) in the Canadian province of British Columbia began phased-in implementation of IT systems in one of its three geographic regions. Computerization initiatives in the HA evolved between 2001 and 2010. At the time of data collection for this study (November 2009 and January 2010), stationary and mobile computers had been incorporated into the clinical setting at both participating tertiary hospitals. The HA had also adopted an EHR comprising an

integrated suite of electronic solutions in a single platform with several applications (e.g., laboratory and radiology results, clinical documentation/transcribed documents, patient demographics). Although computerization and the EHR were later extended to the HA's two other regions, this study focuses on the computer-implementation experiences of nurses in its southern region.

Despite the HA's staged approach to implementation, the uptake of the technology by nurses in particular may have been limited by a variety of factors. First, in the early days of computerization, IT departments were responsible for deployment strategies in clinical areas. Typically, IT specialists engaged minimally with clinical leaders and did not consider the workflow relationships and information needs of clinicians. It appeared that IT staff, mainly computer technicians, had little understanding of the physical space impacts of computers in clinical settings, staff requirements for education in computer and information systems, and the effects on staff of introducing such technologies in terms of their practice and workflow. IT staff appeared not to be aware of the adverse impacts and safety risks associated with the dynamic nature of clinical practice and of the fact that stationary or "fixed" technologies (e.g., desktop computers) might negatively affect information access. Consequently, desktop rather than point-of-care computers were deployed during most of the early computerization initiatives in the HA.

Second, clinical data available in the EHR were also accessible to staff in print format, providing a "parallel" health record. Consequently, many practitioners and staff members continued to rely on paper-based, manual processes to access patient and clinical information. A 2009 internal audit of nurse-user statistics confirmed that fewer than 30% of nurses accessed patient information via the EHR.

Third, despite recommendations to the contrary (Kushniruk, Borycki, Kuwata, & Kannry, 2006; Mihailidis et al., 2006), there were no clearly mandated organizational requirements for nurses to use computers in their practice. In the absence of an organizational mandate, and with the availability of the familiar paper record, nurses had no incentives to use computer technology.

Given this reality, the HA moved to eliminate the parallel paper system, a process that was achieved in early 2010. This change would render the use of computers and the EHR no longer optional. Consequently, the pre-implementation stage provided a unique opportunity to study how nurses integrate computers and IT into their practice. A situation of mandatory computer use could obscure other important factors in the process of adopting the technologies and could limit opportunities to develop and tailor strategies for supporting technology integration by different groups of nurses.

Purpose

The purpose of the study was to develop a theory of how nurses understand and manage the integration of computers and the EHR into their practice and to explore the influences on this process. Our objective was to identify the barriers to and enablers of computer integration with a view to developing strategies to help nurses incorporate this change into their practice. We anticipate that the results of the study will help to improve and automate nurses' clinical care processes, which in turn will facilitate more accurate, informed, and timely patient-care decisions and result in quality-based efficiencies in care delivery.

Methodology

We used grounded theory (GT) methodology (Glaser & Strauss, 1967), a qualitative, inductive approach, to construct substantive theory about the process by which nurses manage the integration of computers into their practice. Grounded theorists do not set out to test a preconceived theory; rather, they start with an area of inquiry or a research aim and allow whatever is theoretically relevant to emerge from analysis of the data (Strauss & Corbin, 1998). Ultimately, a theory or conceptual framework is generated that explains the actions under study as well as the social and/or structural conditions that influence these (MacDonald, 2001).

Ethics approval for the study was obtained from the joint Research Ethics Board of the HA and the university.

Sample

In GT, sampling is purposive, to identify participants who have experience with the phenomenon under study (Schreiber, 2001). The selection criteria were as follows: (1) practising registered nurse, (2) 6 months' nursing experience, (3) currently providing direct care to patients and families, (4) have access to computers and use biomedical technology, and (5) work in clinical areas in one of the two major acute-care facilities in the southern region of the HA. A total of 12 registered nurses participated — 11 female, one male — from a variety of clinical settings that had moderate to high technology use (e.g., renal, cardiac, medical-surgical). Their ages ranged from 26 to 60 years ($M = 45.9$) and their nursing experience ranged from 1 to 40 years. One held the position of clinical nurse educator and the remaining 11 provided direct acute care.

Nurses were recruited using posters in the clinical areas being targeted. Because the first author was the regional manager of clinical informatics in the HA, there was potential for nurses to perceive a power-over relationship and feel some coercion to participate. To mitigate this risk,

we used a third-party recruiter to receive expressions of interest, meet face-to-face with prospective participants, describe the study, assure the nurses that participation was voluntary, and obtain informed consent. Once a nurse agreed to participate, she or he was referred to the principal investigator (PI), who arranged and conducted all the interviews.

Data Collection

Data collection in GT is conducted concurrently and in tandem with analysis, which involves coding, memoing, theoretical sampling, and sorting (Charmaz, 2006; Glaser, 1998; Schreiber, 2001; Strauss & Corbin, 1998). All 12 interviews were audiorecorded, transcribed verbatim, and uploaded into NVIVO 8 for analysis. After each interview, the interviewer wrote field notes, memoed her observations and interpretations of the interview, and identified opportunities to explore emergent themes during subsequent interviews.

The PI conducted semi-structured, 1-hour, face-to-face interviews with participants. She asked six open-ended questions, adding probes as necessary to obtain more depth or clarification. Questions focused on participants' experiences of using computers and biomedical technology in their practice, the value computers that added to their practice, challenges of integrating computer technology, how they learned about using new technology, and beliefs about the relevance and utility of computers and technology in their practice.

Data Analysis

The database consisted of the audiorecordings, transcriptions, field notes, and interviewer memos. We used standard grounded theory analytic techniques (Charmaz, 2006; Glaser, 1978; Strauss & Corbin, 1990, 1998). Analysis began immediately after the first interview with open or line-by-line coding in which labels or codes, primarily derived from participants' own words, were applied to chunks of data.

Using the constant comparative method (Glaser, 1978), we proceeded with coding by comparing incident to incident, incident to concept, and concept to concept, moving the analysis to higher levels of conceptualization. As concepts accumulated, they were grouped into categories based on their shared properties or dimensions. Thus analysis proceeded by building on early categories to create higher-order categories until saturation of each category was reached — that is, until no new codes emerged from the data.

Between the third interview and the sixth, after considerable line-by-line coding, more focused or selective coding was used to flesh out the concepts and categories. The process of selective coding goes beyond line-by-line coding to create more "directed, selective, and conceptual

codes" (Charmaz, 2006, p. 57). Through theoretical sampling (Glaser & Strauss, 1967), emerging conceptualizations informed the direction of the remaining interviews and comparisons. Then we began the sorting, a process that involves "sorting, diagramming and integrating materials" (Charmaz, 2006, p. 115). This moved the analysis to the level of theorizing, and attention shifted to exploring the data for relationships among the concepts.

We used Strauss and Corbin's (1998) conditional/consequential matrix to help identify the conditions at various levels that influenced particular actions and their consequences. The above analytic processes resulted in a diagram of the emerging categories and the relationships among them (not included here). At this stage in the analysis, we recognized the importance of nurses finding meaning through the use of computers in their practice. Other categories that emerged at this point were barriers to and benefits of computer integration as well as similarities and differences in participants' use of biomedical and computer technology. The analysis also revealed the existence of two distinct groups of nurses in terms of computer-integration experiences.

Additional theoretical sampling and more selective coding were used to flesh out and revise these early categories and develop the relationships among them. We identified the importance of nurses' prior experiences with computers, biomedical technology, learning, and organizational and professional discourses in relation to computer integration. The category of Contextualizing Values emerged to demonstrate that successful adoption of computer technology was influenced by the extent to which nurses perceived that the technology conformed to their values with respect to their nursing practice. The categories of Managing the Barriers and Realizing the Benefits evolved beyond barriers and benefits to a richer understanding of how these processes were handled by participants and the relationship of these categories to whether and how they adopted the technology. The relationships among all of the categories depended on the extent of the nurses' practice experience. The above analysis resulted in a diagram and a preliminary theoretical framework (Figure 1), which outlined the process by which nurses managed the integration of computers and the EHR into their practice and led to the development of the final conceptual framework, as described below.

Findings

A fundamental assumption of grounded theory is that participants share a problem or concern and that they engage in a social–psychological process to resolve it (Schreiber, 2001). The main concern of the participants in this study was the change to their way of managing and provid-

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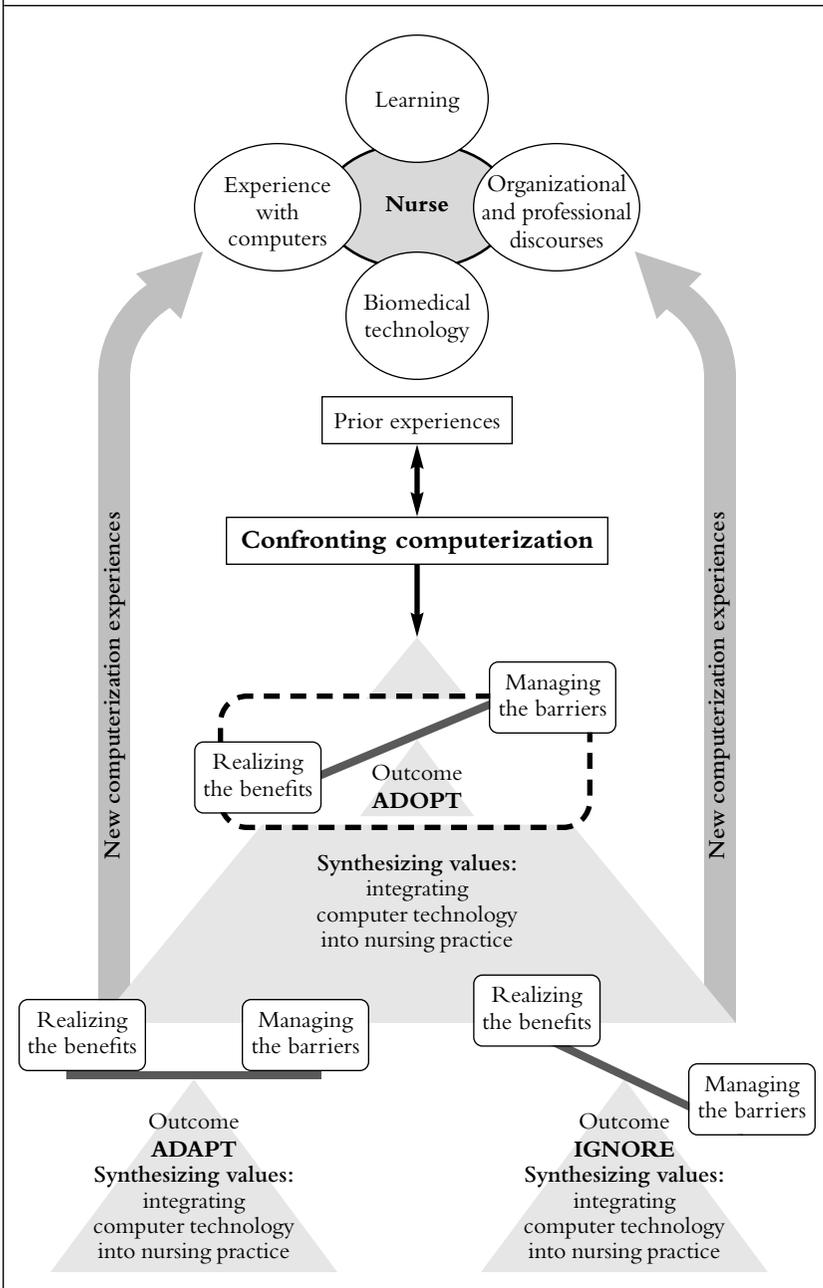Figure 1 *Early Depiction of Grounded Theory*
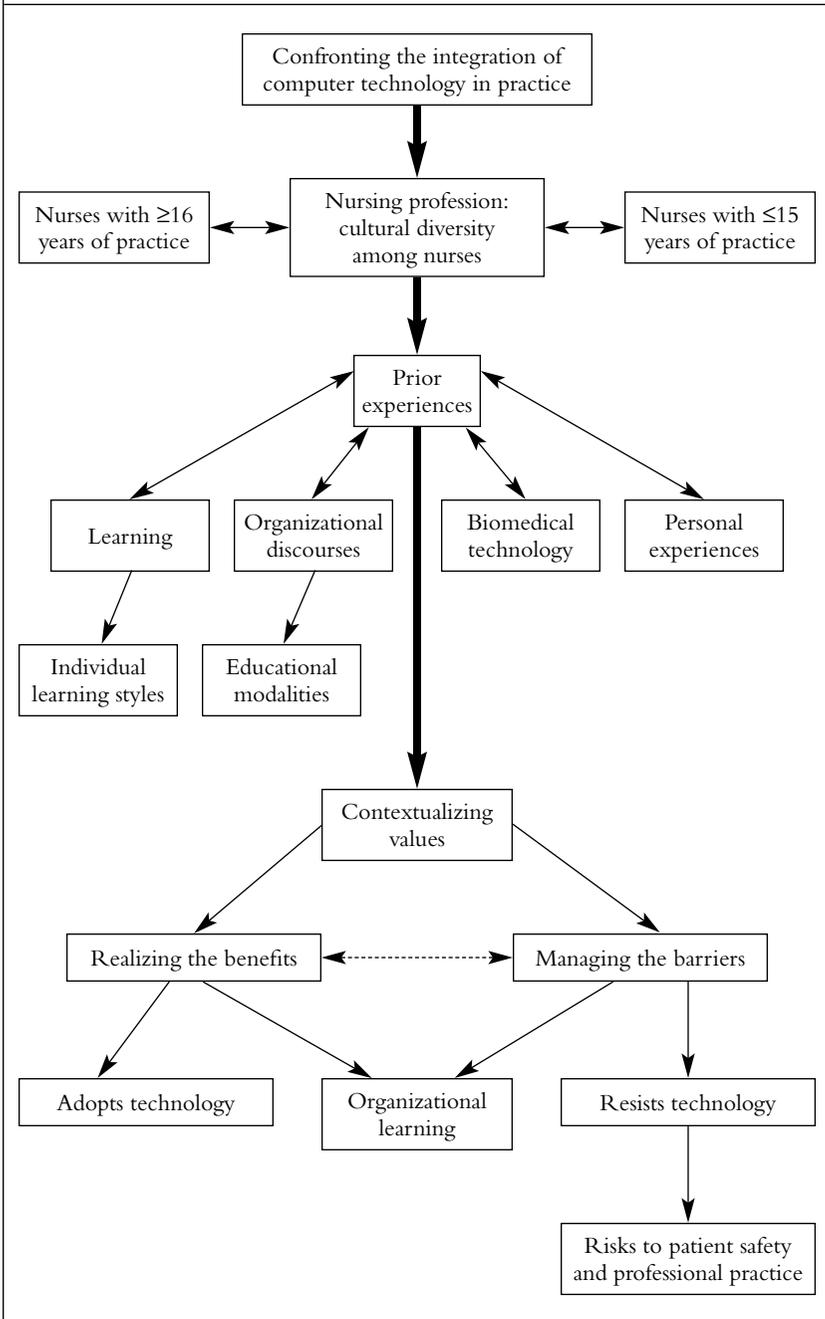
ing patient care as a result of computerization and the introduction of the EHR. To manage this change, nurses needed to develop a relationship with the computer. Thus, the core category that emerged in the analysis was the basic social process of Developing a Relationship With the Computer in Nursing Practice (see Figure 2). To avoid confusion about the level of the concepts and categories in the description below, a different font is used to identify each concept level in the theory. The six higher-order categories are written in bold. Level two codes are written in bold italics. Level three codes are italicized.

The process of Developing a Relationship With the Computer in Nursing Practice consists of six categories: **confronting computerization; reflecting on prior experiences; synthesizing values; realizing the benefits; managing the barriers;** and **adopting, adapting to, or ignoring the computer.** In standard grounded-theory fashion, each of these categories has several subcategories, which, in turn, have other subcategories. These concepts and categories are interrelated and represent a linked set of stages through which participants progress to develop a relationship with the computer such that they are able or unable to integrate the computer into their practice with the goal of providing timely, high-quality nursing care.

How nurses moved through this process was generally dependent on which of two distinct groups they belonged to. The first group (G1) had considerably more years of practice experience. They valued staying in close proximity to their patients, hesitating to leave the patient in order to access a computer. They relied more on the patient than on technology to obtain information for decision-making. They had less trust in technology and had difficulty making the transition to new and different technologies. The second group (G2) had less practice experience and were more likely to have grown up with or used computers extensively. They viewed computers and information systems as important to their practice. They saw computerization as providing timely, accurate patient data and as a clinical tool they could not live without. They trusted technology and were more reliant on it.

Confronting computerization represents the initializing event when computers were introduced into the clinical areas at the HA. The intention was that computers be used for a variety of purposes, including tracking laboratory and diagnostic test results, reviewing patient records and various reports, obtaining electronically generated information about conditions and treatments and policies and standards, and reviewing other clinical documentation. At the time of the study, there was no capability for data entry by the participants. Computerization evoked different responses that, as a rule, depended on the nurses' group membership. The nature of the response influenced the nurses' ultimate use or non-use of

Figure 2   *Developing a Relationship With the Computer in Nursing Practice: A Grounded Theory*

Learning

Experience with computers

Nurse

Organizational and professional discourses

Biomedical technology

Prior experiences

Confronting computerization

Managing the barriers

Realizing the benefits

Outcome
ADOPT

Synthesizing values:
integrating
computer technology
into nursing practice

New computerization experiences

New computerization experiences

Realizing the benefits

Managing the barriers

Outcome
ADAPT
Synthesizing values:
integrating
computer technology
into nursing practice

Realizing the benefits

Managing the barriers

Outcome
IGNORE
Synthesizing values:
integrating
computer technology
into nursing practice

computers and the EHR. Responses included ***reacting to the technology, getting on with it,*** and ***getting stuck.*** In ***reacting to the technology,*** participants expressed a range of negative and positive feelings about computerization. On the negative side, they reported *feeling intimidated* because they had never used a computer before or because they were unfamiliar with information systems in general and thus did not feel confident about seeking the information they needed (G1); *feeling frustrated* by their lack of choice about when to use the computer (G1), how they learned about the computer (G1 and G2), or because the HA was so far behind other organizations with respect to IT (G2); and *feeling overwhelmed* by the workload, which involved "taking on one more piece of unfamiliar technology" (G1).

On the positive side, some participants reported *feeling enthusiastic* about using computers in their practice (G2) and were eager to get on with it. In ***getting on with it,*** the enthusiasts (G2) moved swiftly to incorporate computers and the EHR into their practice and were more likely to make full use of the range of resources offered by the EHR and HA systems. G1 nurses tended to take longer to move beyond the initial confrontation with the computer and instead of ***getting on with it*** often reported ***feeling stuck.*** Those who felt stuck wanted to use the computer but lacked the confidence or skills to log on and/or to access the information in a timely manner. As a result, they would revert back to the paper record for patient/clinical information and, if they used the computer at all, tended not to make full use of the EHR capabilities. These G1 nurses felt intimidated by the computer, frustrated in their attempts to use the computer, and overwhelmed by the demands of learning about computers while attempting to do their work.

The confrontation with computerization also triggered **reflecting on prior experiences** with computers, learning, biomedical technology, and organizational–professional discourses. These experiences influenced how the nurses confronted computerization in their practice. Participants who had had positive experiences with computers, biomedical technology, or learning about computers were more likely to embrace computers, accept new computerization initiatives at the HA, and express motivation and willingness to try new experiences with computer technology (G2). A prior experience was positive for participants when the new technology enhanced rather than impeded their practice and when it was consistent with their values about nursing practice; it was negative when the opposite was true.

Those who reported negative prior experiences were more likely to resent having to use computers, be intimidated by computers, see no need to learn more about computers, or be less motivated to try new computer experiences (G1). In addition, they reported *ignoring the com-*

puter as a coping response to control the pace of learning about or incorporating the computer into their practice or to have some control over the "change" requirements in their practice.

Education and training experiences in biomedical or computer technologies strongly influenced how nurses confronted computerization. Nurses who perceived a need to learn and had the time to learn were more likely to report that their prior learning experiences helped them become knowledgeable and comfortable with the technology (G1 and G2). Some G1 participants felt intimidated learning with their more computer-literate colleagues, while others found it difficult to "absorb" the education provided away from the clinical area because it was not as "familiar" or as "hands on" (G1). Overall, positive learning experiences with computers and technology were likely to contribute to nurses' motivation and willingness to incorporate the computer into their workflow (G1 and G2).

Finally, participants' prior experiences with organizational and professional discourses could positively or negatively impact their ability to engage with the technology and obtain the desired education and support (G1 and G2). ***Organizational discourses*** refers to policies and procedures, implementation strategies for computer and biomedical technology, and related organizational structures and processes. For some participants, the organization's discursive structures and processes, which were intended to facilitate and support computerization, had the opposite effect, resulting in feelings of frustration, mistrust, and concern. Reconnecting with these earlier experiences and feelings affected participants' perceptions of new or upcoming computerization initiatives, raising new questions, concerns, or doubts in their minds (G1 and G2). On the other hand, some participants declared that the organizational processes helped them to use computers and that this enhanced their willingness to embrace the new technology.

Professional discourses refers to participants' experiences with the relationships and tensions between themselves and the "other" group of nurses (i.e., G1 vs. G2). Participants indicated that there was sometimes tension between the two groups. G2 nurses perceived that G1 nurses placed demands on them to help, support, and mentor G1 nurses when they had their own work to do; G2 nurses found this frustrating and unnecessary. G1 nurses perceived that G2 nurses were too trusting of the technology and that they should be willing to provide computer support for their G1 colleagues. At the same time, all participants reported some positive support and mentoring experiences. These experiences influenced how nurses moved through the rest of the basic social process of Developing a Relationship With the Computer.

Synthesizing values is the third stage in the process of Developing a Relationship With the Computer in which nurses connect with their practice values. This process was triggered by **confrontation with computerization.** In managing the requirement for computerization, nurses consciously recalled a particular value underlying their nursing practice: to provide safe patient care. The more that participants felt connected to and aware of their core nursing values, the more they were able to make meaning of and comprehend the relevance of computerization in their practice. Thus *finding relevance* and *finding meaning* were the processes nurses explored in which their core values were expressed as the imperative to preserve the nurse-patient relationship when providing care (G1 and G2).

In *finding meaning* in computerization, participants' identified the conditions for safe and appropriate patient care that must be in place for them to adopt or adapt to computers in their practice — that is, a commitment to using computers in practice requires certain conditions grounded in nurses' values about practice: (1) relevance — all patient and decision-support information must be clinically relevant based on the needs of patients/families and must contribute to patient care; (2) ease of access — accurate information and computer technology must be readily accessible at or near the point of care, with easy processes for logging on and off, and the type of computer technology must be easily incorporated into their practice and workflow; (3) education and support — there must be adequate *time to learn* in a way that is congruent with their learning style; *time to synthesize; time to "take it all in";* and *time to know* where and how to find human, technological, and informational resources; (4) enhanced nursing knowledge/practice — any automation of processes must be perceived by nurses as contributing to nursing practice, reducing duplication of effort, providing best practice/decision supports, augmenting knowledge, defining practice process redesign, ensuring patient safety, and allowing for entry of clinically relevant patient information; (5) clear vision of impending change — nurses accept change as inevitable in their everyday work but want to be part of the vision, to have opportunities to express opinions/ideas/concerns, and to have assurance that workflow and practice nuances will be acknowledged and incorporated into the change.

If participants perceived that all of these conditions were in place during the computerization initiative, they were more likely to *find meaning* in the initiative. They were more receptive to the change and motivated to **realize the benefits** of computerization and more able to **manage the barriers** to seamless integration of the computer in their practice. Although both G1 and G2 participants went through the process of **synthesizing values,** those who had more prior computer experi-

ence (G2) were able to engage with their practice values immediately and at a faster rate; those who had less prior computer experience (G1) needed more time to synthesize the values and *find relevance and meaning* in the computerization initiative.

Realizing the benefits and **managing the barriers** are the fourth and fifth stages in developing a relationship with the computer. These two processes occur concurrently and interactively. Whether participants were open to the benefits of computerization depended on both their prior experiences and their process of synthesizing values. Benefits included having timely, point-of-care access to clinically relevant information and knowing how to search for information that added to their knowledge about patient care needs. This in turn enhanced their ability to make safe, appropriate care decisions.

While nurses were realizing the benefits, they were also struggling to overcome the barriers impeding the integration of computers in their practice. Once they identified the barriers, they began to seek ways to eliminate or work around them. Participants who realized the benefits early in the implementation period were able to be more strategic about managing the barriers (G2). Those who were more adept at managing the barriers (G2) became early adopters and peer champions in their respective clinical areas.

Realizing the benefits involved two processes: *experiencing the value of computers in practice* and *gaining computer proficiency.* As they began to use computers, participants discovered that computers improved their nursing practice and their patient care. They were able to explore new knowledge, practice, and workflow realities associated with computer technology, with resultant enhanced ability to provide safe, timely, and informed care. They discovered efficiencies offered by automation and readily accessible evidence-based data in their point-of-care computers and thus the value of computers. The more they were able to connect with their core values about practice in relation to patient care, the more they appreciated the positive contributions of computerization to the nurse–patient–technology relationship. The more participants used computers to resolve practice problems and answer their questions, the more computer–proficient they became. Both G1 and G2 nurses went through this process, but G2 nurses experienced the value of using computers and gained proficiency at a faster rate.

In **managing the barriers,** participants navigated the myriad obstructions that adversely impacted their ability to use the computer. These included particular organizational processes, knowledge gaps, aspects of care that made it difficult for them to use the computer, lack of computer skills, and not having timely access to computer technology. These barriers ultimately made it difficult for participants to realize the

benefits of the computer in the nurse–patient–technology relationship. Participants went through two processes in managing the barriers: ***confronting the challenges*** and ***succumbing to the barriers.***

In ***confronting the challenges,*** participants tried to overcome the barriers by exploring a variety of options. These included *dealing with it*, *minimizing the fear,* and *feeling motivated to confront the barriers*. In exploring the options, they described *finding new ways, finding work-arounds,* and *practising with the computer*. These strategies for managing the barriers to computer integration were more likely to be reported by G2 nurses.

G1 participants were less able to confront the challenges and some found themselves ***succumbing to the barriers,*** which they described as *losing the battle, feeling no choice, unable to find meaning, retaining old ways,* and *making practice decisions based on outdated information*. These experiences reflect participants' emotional connection to situations of feeling pressured or being forced to use the computer, irrespective of whether they felt confident or able to appreciate the value and meaning of the technology. *Retaining old ways* and *making practice decisions based on outdated information* were strategies used by G1 nurses to control the pace of change associated with the introduction of computers in their practice, despite the risks associated with relying on outdated information.

The process of Developing a Relationship With the Computer concludes with the nurses' decision to **adopt, adapt to,** or **ignore** the computer in their practice. These outcomes are distinctive for each of the participants and are dynamic, meaning that the outcomes could change with the introduction of any ***new computerization experiences*** and the cycle would begin all over again with potentially different outcomes. In fact, many participants did transition from a state of ignoring to a state of adapting to or adopting.

At the time the computerization initiative was introduced in the HA, none of the 12 participants ignored the computer altogether, although some reported having done so previously. Two nurses had just begun to synthesize the value of integrating the computer into their practice toolkit and had not yet reached a definitive outcome. Three had made significant advances with computerization in their practice, reflecting various stages of adaptation. The remaining seven had adopted the computer in all aspects of their practice. Interestingly, the adopters included G1 as well as G2 nurses. The cyclical and ongoing process of developing a relationship with the computer is what explains what might appear to be an anomaly in the findings. In fact, one of the oldest and most experienced nurses in the sample was one of the best clinical resources for nurses in her area. She had fully adopted computerization in her practice and saw herself as a true advocate and mentor for automation.

Table 1 *Adopt, Adapt, or Ignore*		
Adopt	**Adapt**	**Ignore**
Embraces computer technology; goes online whenever information is needed	Realizes some of the benefits of computer technology by accessing selected resources online	Continues to rely on paper and automated printing of information
Accesses all patient/clinical information that is available online	Is selective about when to use the computer for information; paper continues to be first choice	Depends on others to look up information online and print it out
Retrieves patient information from the computer first rather than from the paper record	Verbally supports computer technology at the point of care or in the clinical area	Rationalizes reliance on paper by pointing to lack of accessible and functioning computers
Searches online for decision-support information and adds to Favourites	When not overwhelmed with care demands, seeks assistance from peers with accessing information online and learning about clinical information systems	Continues to access information, policies, and procedures from outdated print manuals and textbooks
Ensures that computer is functioning at all times; participates in technological quality control and views the computer as integral to care delivery	Is inconsistent in ensuring that computers are functioning at all times; depending on prioritization of patient care needs, will use print or telephone resources to augment care delivery	Does not advocate for or express support for computer technology at the point of care or in the clinical area
Engages with others to learn from or to mentor clinical colleagues and others; takes the time to demonstrate new personal learning about computers/clinical resources/electronic health record	Selects mentoring opportunities based on knowledge of and confidence in computer technology and/or clinical information systems	Does not seek new learning opportunities related to computer technology or clinical information systems

The extent to which nurses would adopt, adapt, or ignore varied according to their perceptions of computer technology and/or their personal experiences with incorporating computer technology into their practice. Table 1 presents behavioural examples of these three attitudes towards technology. To **adopt** is "to take by choice in a relationship, to take up and practice or use."[1] This is the most straightforward outcome, with no sub-processes. To **adapt** is "to make fit," to strike a balance between traditional paper-based practices and new computer-based practices. Participants embraced the nurse–patient–technology relationship at selected times during their practice, when they felt confident and comfortable using the computer to access information. When they did not feel comfortable and confident, or when they needed to focus exclusively on the patient, they chose to ignore the computer or wait for a colleague to access online resources. To **ignore** is "to refuse to take notice of; to reject." Participants tended to ignore the computer at times of increased stress, heavy workloads, or complex or competing priorities in the provision of direct care. Some ignored the computer when they were questioning its value or were not yet able to give *relevance* and *meaning* to the nurse–patient–technology relationship (G1). The process of ignoring therefore is a transitional or intermittent experience while nurses continue to incorporate ***new computerization experiences.***

Discussion

This study presents the first grounded theory in the literature that describes the experiences of nurses integrating computer technology into their practice. Although several studies identify the key factors influencing computer adoption (Alquraini, Majeed, Shah, & Chowdhury, 2007; Nkosi, Asah, & Pillay, 2011), which are supported by our findings, there are no studies exploring these factors in the context of the personal experiences of nurses confronting computers in their practice. This study, therefore, contributes some unique insights to the literature.

Distinct Groups With Different Experiences

No other study identifies two unique groups of nurses, each with distinct experiences in developing a relationship with the computer, and thus with distinct learning needs and requirements for support. Organizations tend to put "one size fits all" training and resources into place to support computerization initiatives. Our findings suggest that strategies tailored

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[1] Our definitions for "adopt," "adapt," and "ignore" are taken from *Merriam-Webster online: Dictionary and thesaurus* (http://www.merriam-webster.com/dictionary).

to the unique needs and experiences of distinct groups of nurses might ensure a more successful implementation process.

Expert nurses (Benner, 1984; Benner & Tanner, 1987), with years of tacit, intuitive knowledge and first-hand clinical experience with patients, families, and biomedical technologies, have an opportunity to share their expertise with their less experienced colleagues. At the same time, today's nurses enter the profession with an abundance of computer experience, and even informatics competencies, and thus with knowledge and expertise to share (Courtney, Alexander, & Demiris, 2008; Saranto & Leino-Kilpi, 1997; Smedley, 2005). Frontline mentoring is an ideal way to address just–in–time clinical tasks such as searching online for clinical resources, accessing and navigating the EHR, or determining how best to incorporate computer technology. However, organizations also need to consider strategies for building capacity and rewards for mentoring, not only to capitalize on the skills and abilities of each group in order to facilitate technology integration, but also to address the demand for peer support imposed by one group of nurses (G1) on their more computer-savvy peers (G2).

The Age–Experience Chasm

The two cohorts of nurses were quite different with respect to their years of practice experience and their computer experience. Both groups went through the same stages in Developing a Relationship With the Computer. Although they varied with respect to how each stage played out, the focus of their actions, and the factors influencing those actions, the final outcomes were not determined exclusively by group membership. It is tempting to reduce the years of practice experience to age, assuming that older nurses will have more years of practice experience and less computer experience, since they did not grow up using computers. In fact, much of the early research on nursing uptake of computers reports age as an important predictor (Hillan et al., 1998; Hobbs, 2002; Jayasuriya & Caputi, 1996; Marasovic et al., 1997; McBride & Nagle, 1996; Murphy, Maynard, & Morgan, 1994; Scarpa et al., 1992; Schwirian et al., 1989).

However, the relationship between age and experience is not universal. Data from the Canadian Institute for Health Information (2010) show that more individuals are entering nursing as a second career or as part of a late career path. The average age of entry into the workforce has risen, and regulated nurses today are often 30 or older when they graduate and embark on their nursing career (Fessele, 2009; Hatcher et al., 2006; Letvak, 2003; Med-Emerg Inc., 2005; Sherman, 2006). Thus, we cannot assume that age is a reliable predictor of computer adoption.

Challenging the Critique of Technology

Some authors have suggested that technology disrupts the nurse-patient relationship and threatens to diminish the meaning of the patient experience (Locsin, 2001; Malone, 2003; Sandelowski, 1999, 2002). We believe that this is an outdated perspective. It perpetuates the unrealistic view that a bedside vigil alone is sufficient in today's high-acuity and complex care environments. Even the participants in the present study, who tended to rely more on the patient than on technology for their information (G1), acknowledged that without timely access to vital patient and supporting clinical information, patient care may be compromised.

Conditions Essential for Nurses to Adopt Computer Technology

This study makes an important contribution to the literature by identifying the set of value-based conditions necessary for nurses to integrate computerization into their practice. Some of these conditions are not new to us; what is new is the finding that the conditions are closely tied to the values that nurses hold with respect to their practice. It is not sufficient that technology and information be easily accessible, or that adequate education and support be in place. For computers and information systems to be embraced by nurses, their deployment must be congruent with nurses' practice values with regard to the needs of patients and their families — wherever they may be — while contributing to safe and effective practice and improved patient outcomes.

All of this means that health authorities must ensure that "nursing intelligence" is embedded in their EHRs — that clinical data are not only representative of the patient but also reflective of the nurse's "role in relation to the patient" (Alpay & Russell, 2002, p. 137). Nursing intelligence is realized when data reflect nursing knowledge and nursing's purpose in engaging with the patient; data elements support nurses' ability to conduct patient assessments effectively; there are opportunities for more collaborative (i.e., interprofessional) care planning and coordination; nurses have a say in patient assignments and workloads; and nurses have easy access to clinical decision-support tools that augment nursing knowledge. Only then, argue Goorman and Berg (2000), will nurses value the clinical and professional relevance of computer technology and, ultimately, adopt it in their practice.

Implications for Nursing Education

Computerization in the clinical practice arena calls for 21st-century nurses to be knowledgeable about computers and ready to use their computer skills in a fast-paced, knowledge-intensive, patient-centred environment. This is not a new imperative. However, it will not be met

unless nurses acquire computer skills and computer-integration experience in their basic nursing programs and are offered ongoing support and education in the workplace (Chang & Daly, 2001; Randall, Mitchell, Thompson, McCaughan, & Dowding, 2009; Saranto & Leino-Kilpi, 1997; Smedley, 2005). If nurses are exposed to computer technology prior to entering the practice environment, they will feel more at ease in the workplace searching for online information, using clinical information systems, and incorporating this technology into their everyday practice (Fetter, 2008; McNeil, Elfrink, Beyea, Pierce, & Bickford, 2005).

References

Alpay, L., & Russell, A. (2002). Information technology training in primary care: The nurse's voice. *Computers, Informatics, Nursing, 20*(4), 136–142.

Alquraini, H., Majeed A., Shah, M., & Chowdhury R. (2007). Factors influencing nurses' attitudes towards the use of computerized health information systems in Kuwaiti hospitals. *Journal of Advanced Nursing, 57*(4), 375–381.

Benner, P. (1984). *From novice to expert: Excellence and power in clinical nursing practice.* Menlo Park, CA: Addison-Wesley.

Benner, P., & Tanner, C. (1987). Clinical judgment: How expert nurses use intuition. *American Journal of Nursing, 87*(1), 23–31.

Borycki, E. M., Lemieux-Charles, L., Nagle, L., & Eysenbach, G. (2009). Novice nurse information needs in paper and hybrid electronic-paper environments: A qualitative analysis. In K.–P. Adlassnig, B. Blobel, J. Mantas, & I. Masic (Eds.), *Medical informatics in a united and healthy Europe: Proceedings of MIC 2009* (pp. 913–917). Amsterdam: IOS Press.

Buus-Frank, M. (1999). Nurse versus machine: Slaves or masters of technology? *Journal of Obstetric, Gynecologic, and Neonatal Nursing, 28*(4), 433–441.

Canadian Institute for Health Information. (2010). *Registered nurses: Canadian trends 2004–2008.* Ottawa: Author. Retrieved March 31, 2010, from https://secure.cihi.ca/free_products/regulated_nurses_2004_2008_en.pdf.

Chang, E., & Daly, J. (2001). *Transition in nursing: Preparing for professional practice.* Sydney: MacLennan & Petty.

Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis.* London: Sage.

Courtney, K. L., Alexander, G. I., & Demiris, G. (2008). Information technology from novice to expert: Implementation implications. *Journal of Nursing Management, 16,* 692–699.

Fessele, K. L. (2009). Nursing through the ages: Benefits of a generationally diverse staff mix. *Oncology Nursing Society Connect,* May, 8–12.

Fetter, M. S. (2008). Graduating nurses' self-evaluation of information technology competencies. *Journal of Nursing Education, 48*(2), 86–90.

Fulton, T. R. (1996). Nurses' adoption of a patient-controlled analgesia approach. *Western Journal of Nursing Research, 18*(4), 383–396.

Glaser, B. (1978). *Theoretical sensitivity: Advances in the methodology of grounded theory.* Mill Valley, CA: Sociology Press.

Glaser, B. G. 1998. *Doing grounded theory: Issues and discussions.* Mill Valley, CA: Sociology Press.

Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. New York: Aldine De Gruyter.

Goorman, E., & Berg, M. (2000). Modelling nursing activities: Electronic patient records and their discontents. *Nursing Inquiry, 7,* 3–9.

Hannah, K. J., Ball, M. J., & Edwards, M. J. A. (2006). History of health care computing. In K. J. Hannah, M. J. Ball, & M. J. A. Edwards (Eds.), *Introduction to nursing informatics* (3rd ed.) (pp. 27–40). New York: Springer.

Hatcher, B. J., Bleich, M. R., Connoly, C., Davis, K., Hewlett, P. O., & Hill, K.S. (2006). *Wisdom at work: The importance of the older and experienced nurse in the workplace.* Princeton, NJ: Robert Wood Johnson Foundation.

Hebda, T. L., & Czar, P. (2009). *Handbook of informatics for nurses and healthcare professionals* (4th ed.). Upper Saddle River, NJ: Prentice Hall.

Hillan, E. M., McGuire, M. M., & Cooper, M. (1998). Computers in midwifery practice: A view from the labour ward. *Journal of Advanced Nursing, 27*(1), 24–29.

Hobbs, S. D. (2002). Measuring nurses "computer competency": An analysis of published instruments. *Computers, Informatics, Nursing, 20*(2), 63–73.

Jayasuriya, R., & Caputi, P. (1996). Computer attitude and computer anxiety in nursing: Validation of an instrument using an Australian sample. *Computers in Nursing, 14*(6), 340–345.

Kushniruk, A., Borycki, E., Kuwata, S., & Kannry, J. (2006). Predicting changes in workflow resulting from healthcare information systems: Ensuring the safety of healthcare. *Healthcare Quarterly, 9*(Special Issue), 114–118.

Letvak, S. (2003). The experience of being an older staff nurse. *Western Journal of Nursing Research, 25*(1), 45–56.

Locsin, R. (2001). The culture of technology: Defining transformation in nursing, from "the lady with a lamp" to "robonurse"? *Holistic Nursing Practice, 16*(1), 1–4.

Lorence, D. P., Spink, A., & Richards, M. C. (2002). EPR adoption and dual record maintenance in the US: Assessing variation in medical systems infrastructure. *Journal of Medical Systems, 26*(5), 357–367.

MacDonald, M. (2001). Finding a critical perspective in grounded theory. In R. Schreiber & P. N. Stern (Eds.), *Using grounded theory in nursing* (pp. 113–158). New York: Springer.

Malone, R. E. (2003). Distal nursing. *Social Science and Medicine, 56*(11), 2317–2326.

Marasovic, C., Kenney, C., Elliott, D., & Sindhusake, D. (1997). Attitudes of Australian nurses toward the implementation of a clinical information system. *Computers in Nursing, 15*(2), 91–98.

Maxwell, L. E. (1995). Innovation adoption: Introducing IV patient controlled analgesia to the nursing workplace. *Canadian Journal of Nursing Administration, 8*(4), 59–75.

McBride, A. B. (2006). Informatics and the future of nursing practice. In C. A. Weaver, C. W. Delaney, P. Weber, & R. L. Carr (Eds.), *Nursing and informatics for the 21st century* (pp. 5–12). Chicago: HIMSS Press.

McBride, S. H., & Nagle, L. M. (1996). Attitudes toward computers: A test of construct validity. *Computers in Nursing, 14*(3), 164–170.

McNeil, B. J., Elfrink, V., Beyea, S. C., Pierce, S. T., & Bickford, C. J. (2006). Computer literacy study: Report of qualitative findings. *Journal of Professional Nursing, 22*(1), 52–59.

Med-Emerg Inc. (2005). *Building the future: An integrated strategy for nursing human resources in Canada. Discussion paper – British Columbia.* Ottawa: Nursing Sector Study Corporation.

Mihailidis, A., Krones, L., & Boger, J. (2006). Assistive computing devices. *Computers, Informatics, Nursing, 24*(6), 328–336.

Murphy, C. A., Maynard, M., & Morgan, G. (1994). Pretest and post-test attitudes of nursing personnel toward a patient care information system. *Computers in Nursing, 12*(5), 239–244.

Nagle, L. M., & Ryan, S. A. (1996). The superhighway to nursing science and practice. *Holistic Nursing Practice, 11*(1), 25–30.

Nkosi, Z. Z., Asah, F., & Pillay, P. (2011). Post-basic nursing students' access to and attitudes toward the use of information technology in practice: A descriptive analysis. *Journal of Nursing Management, 19,* 876–882.

Randall, R., Mitchell, N., Thompson, C., McCaughan, D., & Dowding, D. (2009). From pull to push: Understanding nurses' information needs. *Health Informatics Journal, 15*(2), 75–85.

Saba, V. K., & Westra, B. L. (2011). Historical perspectives of nursing informatics. In V. K. Saba & K. A. McCormick (Eds.), *Essentials of nursing informatics* (5th ed.) (pp. 11–30). New York: McGraw-Hill.

Sandelowski, M. (1999). Venous envy: The post–World War II debate over IV nursing. *Advanced Nursing Science, 22*(1), 52–62.

Sandelowski, M. (2002). Visible humans, vanishing bodies, and virtual nursing: Complications of life, presence, place, and identity. *Advanced Journal of Nursing Science, 24*(3), 58–70.

Saranto, K., & Leino-Kilpi, H. (1997). Computer literacy in nursing: Developing the information technology syllabus in nursing education. *Journal of Advanced Nursing, 25,* 377–385.

Scarpa, R., Smeltzer, S. C., & Jasion, B. (1992). Attitudes of nurses toward computerization: A replication. *Computers in Nursing, 10*(2), 72–80.

Schreiber, R. (2001). The "how to" of grounded theory: Avoiding the pitfalls. In R. Schreiber & P. N. Stern (Eds.), *Using grounded theory in nursing* (pp. 55–83). New York: Springer.

Schwirian, P. M., Malone, J. A., Stone, V. J., Nunley, B., & Francisco, T. (1989). Computers in nursing practice: A comparison of the attitudes of nurses and nursing students. *Computers in Nursing, 7*(4), 168–177.

Sherman, R. O. (2006). Leading a multigenerational workforce: Issues, challenges and strategies. *Online Journal of Issues in Nursing, 11*(12).

Simpson, R. L. (2003). Got technology? How IT can — and can't — make a difference in the nursing shortage. *Policy, Politics and Nursing Practice, 4*(2), 114–119.

Smedley, A. (2005). The importance of informatics competencies in nursing: An Australian perspective. *Computers, Informatics, Nursing, 23*(2), 106–110.

Staggers, N., Thompson, C. B., & Snyder-Halpern, R. (2001). History and trends in clinical information systems in the United States. *Journal of Nursing Scholarship, 33*(1), 75–81.

Strauss, A. L., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques.* Newbury Park, CA: Sage.

Strauss, A. L., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (2nd ed.). Thousand Oaks, CA: Sage.

Stronge, J. H., & Brodt, A. (1985). Assessment of nurses' attitudes toward computerization. *Computers in Nursing, 3*(4), 154–158.

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