The Frequency, Variability And Barriers Of Use Associated With A Character-Based Software Application Prototype By Nurses In A Pre-Anesthesia Testing Clinic.

By

Allyson Wallace-Scroggs, RN, BSN

A Master's Research Project

Presented to
Oregon Health Sciences University
School of Nursing
in partial fulfillment of
the requirements for the degree of
Master of Science
September 6, 1996

Approved:

[redacted]

Leslie N. Ray. RN, Ph.D., Assistant Professor, Research Advisor

[redacted]

Darlene A. McKenzie, RN, Ph.D., Professor, Committee Member

[redacted]

Kent A. Spackman, MD, Ph.D., Associate Professor Pathology and Medical Informatics, Committee Member

[redacted]

Beverly Hoeffer, RN, D.N.Sc., F.A.A.N., Interim Associate Dean for Graduate Studies

Acknowledgments

The author would like to acknowledge and express her profound gratitude to the following individuals who made completion of this research project possible:

Leslie N. Ray, RN, Ph.D., Darlene A. McKenzie, RN, Ph.D., and Kent A. Spackman, MD, Ph.D., my committee members, for their unstinting encouragement, support and guidance.

Kitty Caton, RN, Ph.D. and Kate Shaver, RN, M.Sc., my colleagues and friends, for sharing their time, expertise and energy throughout the duration of this project.

Peggy Dahms, RN, Manager of Clinical/Nursing systems ITG Healthcare Systems, for her valuable suggestions and assistance in obtaining the study sample.

Donna Rohde, Management Analyst 3, ITG Healthcare Systems, for her willingness to share her knowledge regarding the prototype application CareChart, and her cooperation during the data collection period.

Cleon Smith, Systems Analyst 2, ITG Application Support Systems, for his technical expertise in expeditiously generating the necessary system reports during data collection.

E. Scott Scroggs, my husband, for his unwavering support, encouragement, endurance and faith.

Lorraine K. Bosely, my friend, for her adaptability, mathematical assistance and moral support.

Laura Wallace-Dickson, my sister, for her tolerance, hospitality and sense of humor.

Garth Dickson, my nephew, for his vitality and never ending enthusiasm.

Kelsey Dickson, my niece, for her computer expertise and technical support.

Madison and Cleo, my cocker spaniels, for their devotion and late night vigilance.

To all of my family members and friends, for their patience, support and encouragement throughout the duration of this process.

Finally, in memory of Cedric S. Wallace, my father, for his historical perspective, sense of humor and character, and Florence M. Bosely, my fairy godmother, for her unique perspective on the world, zest for life and unending faith.

Abstract

Title: The Frequency, Variability And Barriers Of Use Associated With A Character-Based Software Application Prototype By Nurses In An Pre-Anesthesia Testing Clinic.

Author: Allyson Wallace-Scroggs, RN, BSN

Approved: [redacted]
Leslie N. Ray, RN, Ph.D., Assistant Professor

In anticipation of fully automated patient medical records systems, implementation of information technology continues in health care organizations. New types clinical software applications are impacting how nurses retrieve patient information. Investigating how nurses use a clinical information systems application, while providing patient care, has the potential for providing significant insight into the information needs and system uses of nurses. The purpose of this descriptive study was to investigate how frequently nurses use a prototype application, CareChart, to retrieve data from the patient information database and what information they retrieve, while generating a list of their reasons for not using the application. The study sample was a convenience sample of ten ambulatory care nurses from the pre-anesthesia testing clinic of a tertiary-level hospital associated with a health sciences university. Across a three month period, two system generated reports collected the quantitative data for the variables CareChart Use, Nurse, and Type of Data Retrieved. The qualitative data for the fourth variable, Reasons for Not Using the CareChart Application, was collected using semi-structured interview schedule

designed specifically for this study. This study found that the nurses rarely used the CareChart application to retrieve patient data. When the nurses did use CareChart, Lab data was accessed most frequently. The nurses gave 217 reasons for not using the CareChart application, with Time and Training Concerns mentioned most frequently. Study limitations include those inherent to the study design and methodology, as well as problems associated with using computer generated system reports. This study indicates that nurses will not use a new computer application which does not save them time and for which they have not been trained. The time constraints nurses' experience in their work environment are determined by the patient care demands specific to that clinical specialty area. Nurses continue to be the knowledge experts regarding what constitutes nursing practice in their clinical areas, reinforcing the importance of having nurses involved in the design and implementation of the clinical systems intended as nursing practice tools. In addition, as computer literacy becomes an expectation of nursing practice, adequate training will be essential for the acceptance and use of a clinical system; whether it is introducing new users to the system, or teaching current users new applications.

Table Of Contents

List of Tables

List of Figures

Appendices

Chapter I

Introduction

Patient specific data and related health information are necessary components of any health care delivery system. The growth in information technology has affected how this information is collected, organized, stored, retrieved and used (Gellman, 1986; Hammond, Johnson, Varas, & Ward, 1991). The benefits associated with informational systems are numerous for the health care delivery institutions, the patients, as well as for health care professionals (Chan & Schonfeld, 1993; Ritchie, Taylor, Milne, & Duncan, 1991; Murphy, Maynard, & Morgan, 1994; Ngin, Simms, & Erbin-Roesemann, 1993; Skolniek, 1996).

The introduction of informational systems technology into the health care industry has only occurred within the last 10 -15 years, even though these applications have been used successfully for many years in the fields of defense, communication, finance and electronics. Implementation of these systems was relatively uneventful, necessitating few adaptations due to usability problems, as the health care institutions used these systems primarily to automated their management and financial functions (Simpson, 1995). However, the creation of the automated patient medical record generates completely new uses for these informational systems. These automated patient medical records systems require new types of software applications, aimed at the clinical practice arenas of health care. As the clinical practice aspects of health care delivery differ greatly from those of business, these new applications will not be based on these existing software applications. Because the usability of any software application corresponds with the designers' abilities to match the applications features with the users' needs, producing automated patient medical record systems creates new design challenges. Designers must accurately create representations of all

the user's tasks, as they are manifested in all the possible health care delivery settings; inpatient, outpatient, as well as home health care. (Henderson, 1991; McCormick, 1991; Moran, 1994; Spitzer, 1993).

Creating informational systems software applications involves an iterative process, where the design evolves over several cycles or iterative stages. Initially, the designer creates a conceptual representation of the intended users' work environment and task requirements. Then prototype applications are tested by both designers and users, allowing for interactive communication between these two groups. Changes or adjustments to the prototype based on the users validation or critical feedback, are then incorporated into the prototypes' design. This process can continue through the iterative cycle of testing and adjusting until the users accept and support the application.

Most health care institutions purchase the necessary software systems for developing and maintaining health care data base systems. Some heath care institutions are forming collaborative relationships with computer software companies to increase the usability and fit of these computer software systems with their institutions' unique requirements (Dahms, personal communication, 1990; Hoffman, personal communication, 1990) and to accelerate their institution's acquisition of the "competitive edge" associated with automation (Carroll, Kellogg, & Rosson, 1991; Wakerly, 1993). Computer software companies are equally interested in forming these alliances, seeking input from the primary system users during the research and development of the new applications (Council of Scientific Affairs, 1993; Coyne, 1995; Faaoso, 1992; Gould & Lewis, 1987; Graves & Corcoran, 1988b; Harrell, 1994; Nielsen, 1993; Norman, 1988; Simpson, 1995; Zielstorff, Hudgings, Grobe, & NCNIP, 1993).

Historically, nurses have played a significant role in the maintenance and management of patient's clinical information and medical records; a role they

continue to occupy using both manual and automated systems. Nurses occupy several roles within health care delivery systems; functioning as patient case managers, primary care providers in multiple settings with a variety of clinical responsibilities, as well as researchers and administrators. While the specific information needs of each nursing position may vary, nurses continue as the primary collector of patient information in health care (Brooks, Semenuk & Vaughan, 1988; Brown, 1988; Chan & Schonfeld, 1993; Chute, Cesnik & van Bemmel, 1994; Council of Scientific Affairs, 1993; Faaoso, 1992; McCormick, 1991; Melia, 1989; Schmaus, 1991; Simpson & Kenrick, 1997), generating over fifty percent of patient information (Chu, S., 1993). Therefore, when software designers create automated medical record systems to accommodate the specific idiosyncrasies of the health care delivery settings, they need to include nursing's perspective in their end-users' conceptual model.

Investigating how nurses use a clinical information systems application while they are providing patient care has the potential for providing significant insight into the information needs and system uses of nurses. This knowledge will allow: (a) software applications to contain features necessary and useful for the nurses' job tasks and environment; (b) the identification of the information needs and uses of nurses in ambulatory care settings; and (c) health care organizations to plan and expand their informational systems to keep pace with ambulatory care settings. Therefore, identifying how frequently nurses use the system, if this system use varies by nurse, the data they retrieve, and the problems they associate with using the application, will provide meaningful information to nursing at the clinical, as well as the professional, practice level.

This study address two questions: the amount nurses use the system and their reasons for not using it. Specifically, one asks: How frequently do nurses use the CareChart application to obtain patient data from the Lifetime Clinical

Record (LCR), and do these data retrievals vary by nurse or by type of data retrieved? The second research question asks: what are the reasons nurses give for not using the CareChart application, and to what extent do these reasons fall into the conceptual categories of Technical, Resource or Data Management issues?

Chapter II

Growth of Information Systems Use in Health Care

The significant growth and changes associated with the application of informational system technology to the health care industry have not gone unnoticed. According to Faaoso (1992), 57.5% of community hospitals with more than 100 beds use some type of computerized patient information system. The American Medical Association, the American Nurses Association, the Agency for Health Policy Research (Council of Academic Affairs, 1993; Zielstorff, et al., 1993), and the Institute of Medicine are but a few of the professional groups and agencies to become involved in the discussions relative to informational systems. Their involvement has produced an array of standards and professional mandates addressing the multiple issues surrounding these new systems (Chan & Schonfeld, 1993; Public Health Service, 1991; Waller & Fulton, 1993). Experts from the health care and computer industries anticipate that the current implementation of new informational systems will culminate in on-line or fully automated patient medical records systems. As a result of integrating all the various components of health care, these systems are being touted as the answer to many of health care delivery's problems (Council of Scientific Affairs, 1993; McCormick, 1991; Pangalos, 1993; Smith & Jones, 1991; Zielstorff, et al., 1993).

The benefits ascribed to automated medical records systems are numerous. These systems are expected to: provide cost savings, enhance quality of patient care (Faaoso, 1992; Harrell, 1994; NCNR Priority Panel on Nursing Informatics, 1993; Kincaid-Smith, 1991), plan and operate managed care systems (Bergman, 1993; Bialorucki & Blaine, 1992; Bishop, 1991; Chan & Schonfeld, 1993; Lumsdon, 1993; Milholland, 1994), and improve patient outcomes by decreasing the time necessary to diagnosis and treat (Bergman,

1993; Harrell, 1994). Eventually, interconnecting all the various data bases necessary to support these automated patient medical records systems will allow data to be shared between institutional and personal systems (Butzen & Furler, 1986; Gellman, 1986; Hard, 1990; Kincaid-Smith, 1991; Schmaus, 1991), further changing the US health care system and aligning it with the changes associated with the telecommunications revolution (Bergman, 1993; Skolniek, 1996; Wakerly, 1993; Willis, 1992).

However, the installation and use of these informational systems is not without associated risks: high cost (Anderson, 1992; Harrell, 1994; Lumsdon, 1993); and concerns for the protection of data (Amidon, 1992; Barber, 1992) are described, as are the need for heightened security precautions against unauthorized use (Bialorucki & Blaine, 1992); theft, sabotage (Anderson, 1992), and computer virus contamination (Bailey & Reichley, 1992). In addition, the debates over data ownership (Chute, et al., 1994; Gilhooly & McGhee, 1991; Harrell, 1994) and the issue of patients storing their own records have been rekindled (Gilhooly & McGhee, 1991; Pangalos, 1993). While concerns regarding threats to patient record confidentiality continue to raise serious discussion (Bakker, 1993; Barber, 1992; Bialorucki & Blaine, 1992; Brooks, et al., 1988; Butzen & Furler, 1986; Council of Academic Affairs, 1993; Emson, 1988; Fletcher, 1991; Grady, Jacob, & Romano, 1991; Halperin, 1988; Hard, 1990; Hard, 1992; Horan, 1993; McClowy, 1991; Milholland, 1994; Piesse, 1987; Rittman & Gorman, 1992; Romano, 1987; Safran, Rind, Citroen, Bakker, Slack, & Bleich, 1995; Schiedermayer, 1991; Siegler, 1982; Waller & Fulton, 1993; Wolfe, 1990).

Within the health care industry, the transition to automated financial and management systems has been relatively uncomplicated. However, automated patient medical records systems will be composed of new types of software applications, designed specifically for the health care delivery industry (Harrell,

1994). These applications are not built on the tried and proven platforms of other industries' software applications. While greater than one-half of all medium sized, community hospitals have some form of automated systems in place, Simpson (1995), describes how the implementation of clinical systems lags far behind the older, more accepted systems borrowed from other industries.

> A market study by HBO & company shows that of 400 hospitals with more that 100 beds, 99 % had financial management systems in place (general ledger, payroll, and accounts payable) while only 24% had nurse documentation systems; 14 % had point-of-care documentation systems, and 9% had a clinical data repository (pg. 88).

Design of Clinical Information Systems

As these clinical systems are not molded from existing software applications and platforms, they constitute a new group of software applications. Consequently, as such, these new programs need to be designed for new groups of users, with different job tasks, as well as multiple work environments and settings (Graves & Corcoran, 1988a; Graves & Corcoran, 1988b).

As a field of design dedicated to making everyday devices usable, usability engineering has been involved in computer and software design for many years (Coyne, 1995; Karat & Bennet, 1991; Moran, 1994; Nielsen, 1993; Norman, 1988). This field incorporates specific design principles with the iterative process in creating end-user centered design frameworks by: (a) bringing end-user centered views into a design, (b) constructing a shared understanding of an evolving design, and (c) supporting group process in design (Karat & Bennet, 1991). More specifically, Norman (1988) says a design should:

(a) make it easy to determine what actions are possible at that moment (constraints);

(b) make things visible, including the conceptual model of the system,

the alternative actions and the results of action;

(c) make it easy to evaluate the current state of the system;

(d) follow natural mappings between intentions and require actions; between actions and resulting effects; between the information that is visible and the interpretation of the system (pg. 188).

Basically, the user should be able to figure out what to do and tell what is going on. In addition, usability design incorporates the concept of variability of system users based on expertise, into the framework for the software application design. Neilson (1993), emphasizes the importance of including the software application users in the usability engineering process by describing a schematic of the three main dimensions on which user's experience differs. These three dimensions are "knowledge about computers in general, expertise in using the specific system, and understanding the task domain" (Figure 2a). Knowing the variability inherent in the user groups, and including this into the end-user conceptual model, will increase the likelihood of the application's features fulfilling the user's needs.

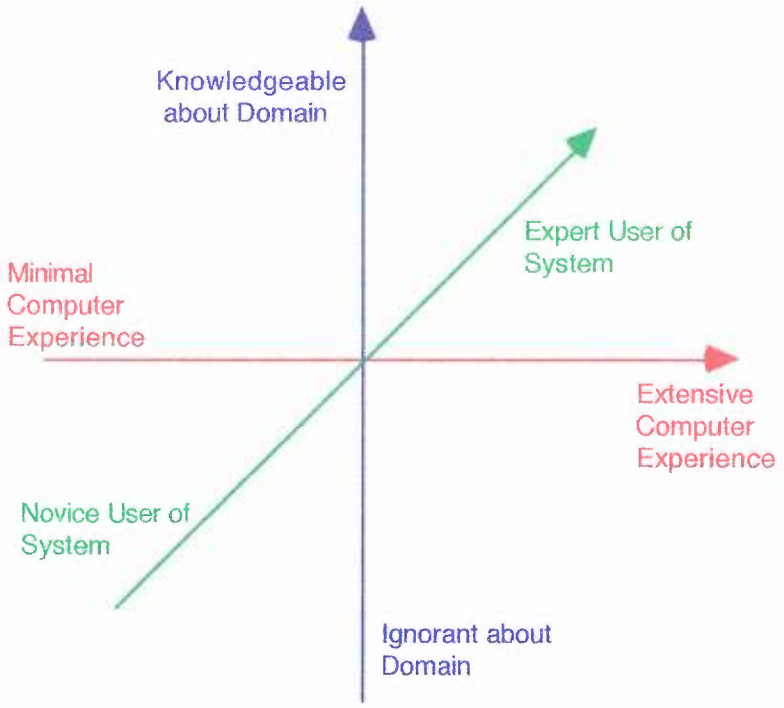

Figure. 2a. Continuum of the three main dimensions of user's experience.

The health care industry has a strong rationale for accepting and following these design principles: cost. While experts agree that the cost to create and implement an automated patient record system is a significant factor in the decision to automate, actual cost estimates for a typical medium sized hospital varied substantially. Experts estimate this cost can range from a low of $2 to $6 million (Anderson, 1992; Harrell, 1994; Lumsdon, 1993), to a high of $15 and $30 million (Harrell, 1994).

Few, if any, health care delivery institutions are able to find, purchase and install systems that meet their informational needs and adapt well to the idiosyncrasies of their institutional environments. Additional software programming or engineering, and ongoing system support is almost always required, accruing additional and sometimes on-going, expense for the institution. Software products frequently overrun cost estimates, primarily due

to: (a) frequent requests for changes by users, (b) overlooked tasks, (c) the users lack of understanding of their own requirements, and (d) insufficient or inadequate user analyst communication and understanding. Even one iteration of a prototype application can produce significant design improvement (Nielsen, 1993).

By collaborating with computer system software development companies, health care delivery institutions are significantly influencing the design of the applications they will use. The ultimate success of automated medical records depends on user acceptance (Dillon, McDowell, Norcio & DeHaemer, 1994; Harrell, 1994); therefore it is imperative for nurses to interact with the system designers to shape their "user interface" (Bishop, 1991; Chute, et al., 1994). Encouraging the nurses' involvement has organizational implications as well, potentially positioning the agency more favorably to weather the social changes engineered by this technological change (Connor, 1993; Beckhard & Pritchard, 1992; Chang, 1984; Rogers, 1983; Romano, 1990; Bridges, 1991; Del Bueno, 1986; Hebert & Benbasat, 1994; Pettigrew, Ferlie, & McKee, 1992; Chin & Benne, 1985; Pettigrew, et al., 1992; Zaltman & Duncan, 1977; Lawrence, 1991; McClellan, Henson, & Schmele, 1994). With the high price tags accompanying the design and implementations of these systems, any avenue to increase usability and fit while diminishing the likelihood of repeated adjustments should be pursued, as this will eventually benefit all of the stakeholders involved (Lumsdon, 1993; McCormick, 1991; Melia, 1989; Spitzer, 1993).

Registered Nurses and Informational Systems

Romano (1990), describes health care as information intensive, with up to thirty-five percent of nurses' time believed to be spent in information related activities, while others, describes patient care as an information dependent business (FitzHenry & Snyder, 1996). Yet, nurses appear to be disinterested

computer users. Nurses are unlikely to own home computers and few express sufficient interest to explore systems on their own to discover the benefits available to them (Norman, 1988). Jones (1991) describes clinical nurses as having limited hands-on experience with computers, even with a prevalence of computers in many clinical areas. Clinical informational system managers and software company representatives have reported that nurses are not familiar with computer technology or what it can do for them (Dahms, personal communication, 1990; Myers, personal communication, Feb. 22, 1996). In a qualitative study Harris (1990), found that when using computer-mediated nursing care plans, nurses reported experience feelings of loss: of autonomy, of individualization of care, and of nursing expertise.

However, Pacey (1983), suggests that this slow acceptance of technology may be gender related as women traditionally engage in non-technological tasks. Popular literature agrees that women have been slow to accept computers as tools, though they associate this with the gender issues associated with our cultural socialization of women (Grobe, 1984; Kantrowitz, 1994; Tannen, 1994). Consequently, female-dominated professions such as nursing, are disposed to value need-oriented work, work which systematically gives precedence to maintenance and nutrition versus construction and engineering. If true, this explains why nurses are more interested in what people need than what professionals (even technological professionals) can supply (Pacey, 1983). In their study on work excitement and nurses, Ngin, et.al., (1993) reiterates Pacey's point, describing nurses' personal enthusiasm and interest in work (work excitement), as being less a function of working in a high tech environment than it is how their work is arranged and their work conditions. Thus, the literature appears to support the perception that while nurses have assumed the important

role as primary user of this technology which is rapidly becoming essential for their practice, they have little or no knowledge of the systems they are using.

Nielson (1993), describes three dimensions upon which a nurse-user could vary with regard to her usage of informational systems (Figure 2a). Yet, surely not all nurses possess the same amount of knowledge with regard to the each dimension. In addition, in the interest of accuracy, the third dimension, "understanding the task domain", require including all of nursing's sub-specialties, as well as their corresponding knowledge base and skill levels. Therefore, on the basis of task domain alone, nurses could vary from other nurses on what type of information they seek from an automated patient medical record system.

Nurses' use of automated informational systems might vary in yet another manner. All of Neilson's dimensions cross through one intersection, and each dimension functions as an experience or knowledge continuum along which users may vary. These continuums each range from the rudimentary level of knowledge and proficiency, novice, to the consummate level of knowledge and proficiency, expert (Nielsen, 1993). Therefore, in the context of automated information systems use, nurses-as-users could be described as novices in the dimensions of "knowledge about computers in general" and "expertise in using the specific system". However, nurses-as-users are experts in the dimension of "understanding the task domain". Exactly where each individual nurse belongs along these three dimensional continuums, will vary by nurse. Therefore, it is essential for nurses to be actively involved in the development of the software applications they will be using, providing insight into the range of possible variations between and across nurses during the applications' development.

The literature describes three areas where the impact of computers on health care organizations may not be beneficial to nurses. These areas include

deskilling, or replacement of nursing skills with technical systems, threats to the nursing role as nurses give up primary caregiving for the role of biomedical technician, and heightened occurrences of burnout related to balancing the responsibilities of caregiving and systems use (Ngin, et.al., 1993).

Research studies involving nursing and computer information systems may be divided into two groups; clinical nursing informatics studies and general nursing studies. Currently, clinical nursing informatics research is investigating three areas; (1) nursing's language; (2) clinical judgment and computer-based systems; and (3) how well-designed systems can transform nursing practice (Ozbolt & Graves, 1993). While in the general nursing research literature, early studies investigated the influence of demographic characteristics (age, education, specialty, experience) and prior computer use on nurses attitudes towards computers in general (Axford & Carter, 1996). More recently, studies are adopting a wider and more varied focus, investigating: whether nurses accept and use computers (Chang, 1984) computer virus occurrences (Bailey & Reichley, 1992), how much data is lost during processing (Chan & Schonfeld, 1993), discussion of users and uses of patient records (Council of Scientific Affairs, 1993), and patient held records (Gilhooly & McGhee, 1991). While others are examining the knowledge, attitude, and practices of health care providers regarding confidentiality of patient information (Curran & Curran, 1991; Grady, et al., 1991; Safran, et al., 1995; Weiss, 1982).

So, while research activity in the area of nursing and informational systems is ongoing, no studies are found which examine the reasons nurses do or do not use automated informational systems. Many studies approach the issues of nurses as computer users from the perspective of nurse's perceptions and attitudes regarding computers (Hebret & Benbasat, 1994; Murphy, et al., 1994; Simpson & Kenrick, 1997; McBride & Nagel, 1996; Stockton & Verhey, 1995).

Hebret and Benbasat (1994), measure the relationship between nurses' attitudes and expectations and information technology adoption. They found that 77% of the variance of intent to use computer technology was explained by three attitude variables. In another perception based study, Murphy, et al. (1994), examine nurses' attitude change related to transition into a computerized clinical information system in a hospital setting. They report that despite a decrease in the pre- and post-computerization attitude scores among their sample, that using the automated clinical information is associated with some good feelings about the technology in their setting. The do go on to suggest, however, that the narrative comments received by respondents suggests that a deeper exploration of the impact of automated clinical information systems on nursing practice is necessary.

None of these perception and attitude based studies include ambulatory care nurses in their samples, nor are they conducted in ambulatory care settings; the market described as one of the fastest growing in health care delivery (Nichols, personal communication, June 12, 1996). In addition, it remains unclear what relationship nurses' perceptions and attitudes have to the reasons they describe for not use a computerized medical record system. Furthermore, while both Hebret and Benbasat (1994), and Murphy, et al., refer to the concepts of usability design as they pertain to nursing informational systems, no studies were found that incorporate the usability design methodology of investigating users system utilization by monitoring by system generated reports, and user interviews (Nielsen, 1993).

Numerous studies investigating nursing care quality and the impact of informational systems on nurses productively have identified time savings in indirect nursing tasks, yet these studies have not documented increases in patient contact time or whether the quality of care improves (Axford & Carter, 1996).

One study using a quality assurance framework compares computerized flow sheets to hand-written flowsheets to demonstrate the values of computerized clinical systems (Hammond, et al., 1991). The authors concluded that the significant improvement in both the volume and accuracy of patient care documentation had the potential for decreasing nurses clerical functions. In another study, Willson (1994) evaluates if nurses value and use the information in the computerized medical record. The research hospital system justified further bedside computer installation based on this study, as her results indicate that the day shift nurses value bedside computers, and believe the hospital system should install them in other facilities. The nurses estimate using the computers 75% of the time, however documentation activities occur for only two types of patient data; vital sign measurement and intake and output documentation (Willson, 1994). None of these studies investigate the types of patient data nurses need from a computerized medical record, and no attempt was made to ascertain if the information the nurses' deem useful is available to them through the automated medical record systems.

However, research studies have investigated clinical information systems from the perspective of nurses' information needs (Graves & Corcoran, 1988a; Graves & Corcoran, 1888b). In particular, the investigation of the supplemental-information-seeking behavior of cardiovascular nurses by Corcoran-Perry and Graves (1990), a systems design classic, provides insight with significant ramifications for the design of nursing information systems. The authors found that nurses need a surprisingly large portion of information to complete their job related tasks, that nurses seek patient-specific data most frequently, and this data could be made available by computer.

Conceptual Framework

Overlapping the stages of the iterative design process, which supports computer software design principles, and Continuous Quality Improvement (CQI), the principles which support the quality management paradigm of the research setting, creates the conceptual framework for this study (Figure 2b). Creating an agency atmosphere of proactive or preventive quality, where the continuous improvement process is carried out by individual "production" workers, instead of specialized "quality assurance" personnel is the CQI quality goal of an agency. Within this study's setting agency, the CareChart application pilot program carries two CQI enhancement goals: (1) ease of use; and (2) users' acceptance. As described by Hunt (1992), the continuous improvement process incorporates the works of Deming, Crosby, Juran and Costello, and may be described using the planning, control and improvements' tenets of a quality trilogy. The process begins at "Plan," and circles through the stages of "Do," "Check," and "Act," before returning to the stage one, all part of a continuous process (Hunt, 1992). This study's conceptual framework, uses the iterative design process to refine Deming's circle; the CareChart prototype to circles through the stages of *Testing, Validation, Adjustment & Improvement* as necessary, until no problems are detected (Figure 2b).

The iterative design process as used in the design of software applications and by usability engineers, believes use is the end of the design, and the user the final designer (Nielsen, 1993; Norman, 1988). Within the Plan stage, the iterative computer application designer develops an understanding of the user's context by deploying prototypes during design stages or iterations. A clear understanding of the user's context and tasks can open up new approaches and ways of thinking for the designers (Gould & Lewis, 1987; Jacobsen & Fennell, 1989; Moran, 1994; Nielsen, 1993).

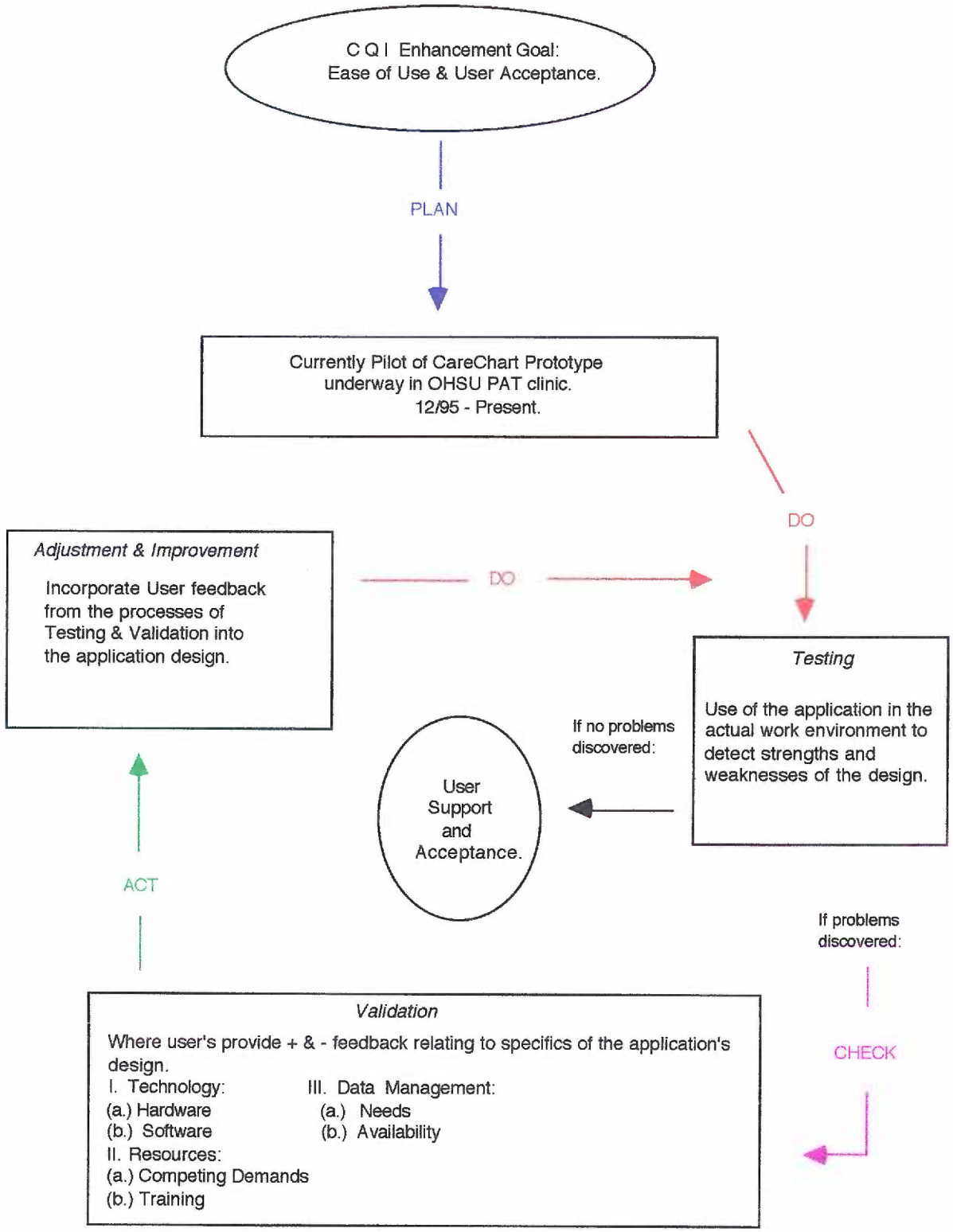

Figure 2b. Conceptual framework.

The second stage, "Do," involves the iterative process of *Testing*, which allows the users to actually use the prototype application in their normal environment to detect strengths and weakness of the design (McCormick, 1991; Melia, 1989). Following this stage, the framework requires a choice. If no problems are detected within the prototype application, the process moves directly to the User Support and Acceptance position. However, if problems are detected, the application progresses to the *Validation* stage (Moran, 1994).

In the next stage, "Check", *Validation* allows users an opportunity to provide positive and negative feedback relating to specifics of the prototype application's design (McCormick, 1991; Melia, 1989; Perreault & Wiederhold, 1990; Spitzer, 1993). The user's concerns are grouped into three conceptual categories of Technological, Resource and Data Management Issues. Technological issues encompass the hardware, or the actual computer workstation equipment, and software, defined as the set of programs or commands which operate and direct the use of the system hardware (Wallace-Scroggs, Pool, & Lee, 1989). Resource issues pertain to users' concerns in relationship to competing demands specific to their job tasks and work environment, as well as training matters associated with informational systems. The data management issues are divided into the categories of user's data needs and data availability (Faaoso, 1992; Graves & Corcoran, 1988a; McCormick, 1991; Melia, 1989; Schmaus, 1991; Smith & Jones, 1991).

Next, the prototype is returned to the designers, for *Adjustment And Improvement.* Here, the designers incorporate the feedback from the processes of *Testing* and *Validation*, in the "Act" stage. Alterations, adjustments and design changes based on the feedback from the "Do" and "Check" stages are incorporated into the prototype application (Carroll, et al., 1991; Gould & Lewis, 1987; Graves & Corcoran, 1988a; Henderson, 1991; Jacobsen & Fennell, 1989;

Melia, 1989; Moran, 1994; Nielsen, 1993; Norman, 1988; Perreault & Wiederhold, 1990; Schmaus, 1991; Smith & Jones, 1991; Spitzer, 1993).

Again, the framework pathway requires a choice; a result of no problem allows the prototype application to progress directly to the User Support and Acceptance position. However, the "If problems persist" pathway requires the CareChart prototype to continue circling through the stages of *Testing, Validation, Adjustment and Improvement* as necessary, until no problems are detected (Figure 2b), (Carroll, et al., 1991; Gould & Lewis, 1987; Graves & Corcoran, 1988a; Henderson, 1991; Jacobsen & Fennell, 1989; Moran, 1994; Nielsen, 1993; Norman, 1988; Perreault & Wiederhold, 1990; Spitzer, 1993).

The two goals of ease of use and user acceptance are inherent in the iterative design process, and are appropriate for the framework of CQI as well. To achieve these two goals, the CareChart prototype application circles through the four stages of the iterative process until adjustment of the design problems is successfully enough for the CareChart application users to accept and support CareChart. As these goals are part of the ongoing CQI process, the CareChart application may circle through the "Plan", "Do", "Check" and "Act" stages several times, resulting in iterative adjustments of large or small proportions.

Information System Background

The information system setting for this study, like most others, consists of independent databases run on a mainframe computer, interconnected to individual PC workstations by several local-area networks (LAN). The components of interest to this study are two databases and their interconnecting software application pathways. The first database, the Lifetime Clinical Record (LCR) stores clinical and patient-related service information (procedures, tests' results, medications, etc.). The second database, the Proprietary database, contains financial information. These two databases are connected to allow

clinical system users to deliver patient care, while concurrently providing the necessary billing information for those patient services. For example, the clinical user activity of ordering a laboratory test for a patient requires activity in both databases: the test is ordered using the Proprietary database, while the results of these laboratory tests are stored in and retrieved from the LCR database. To simplify this process for the clinical user, the clinician enters a software access pathway through the existing workstation interface, and selects the activity they want to accomplish (ordering of test, or procedure), from the appropriate ancillary department (Laboratory, ECG, X-ray). The information system selects the software access pathway, and chooses the appropriate database (Figure 2c).

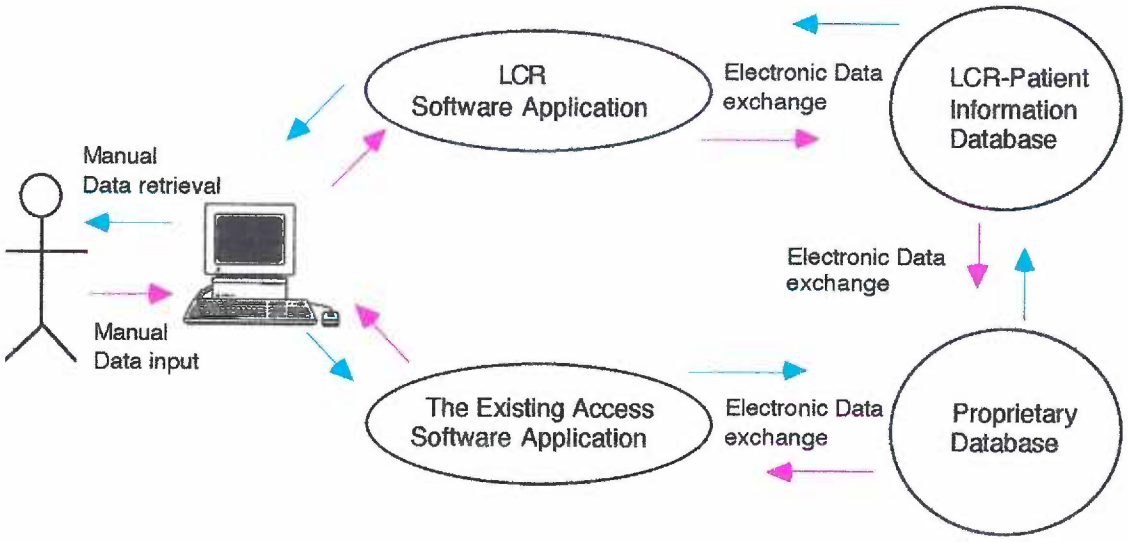

Figure 2c. Agency information system and the existing access pathway.

The acceptance of the character based format, Windows, as the industry standard for user interfaces requires the development of a new software access pathway, or application, for accessing the LCR (Myers, personal communication Feb. 22, 1996). This application, CareChart, is currently being pilot tested in this study's agency. As a result, selected ambulatory care clinic nurses are actively participating in the user pilot-testing of CareChart.

As a prototype, the CareChart application is "added on" to the current software access pathway configuration (Figure 2d). Pilot clinic users select either the CareChart application or the existing Patient Services icon from their agency workstation menu, whenever they want to enter the automated patient medical record to retrieve patient information. CareChart takes the user directly into the LCR-patient information database, (pathway A), and displays the patient information in the Windows format. The current user access pathway remains in place (pathway B), displaying information on an workstation monitor in a modified, semi-windows format created using an emulator program called a Graphic User Interface (GUI).

Once in the CareChart application, the user may select a third pathway to access the LCR-patient information database. An icon labeled OAS-GUI on the CareChart desktop takes the user out of the prototype application, back to the existing software access pathway and into the automated patient medical record (pathway C). This third pathway (C), allows the user to leave the CareChart application, enter the existing pathway application where the user interfaces with the familiar semi-Windows display format (Spackman, 1996).

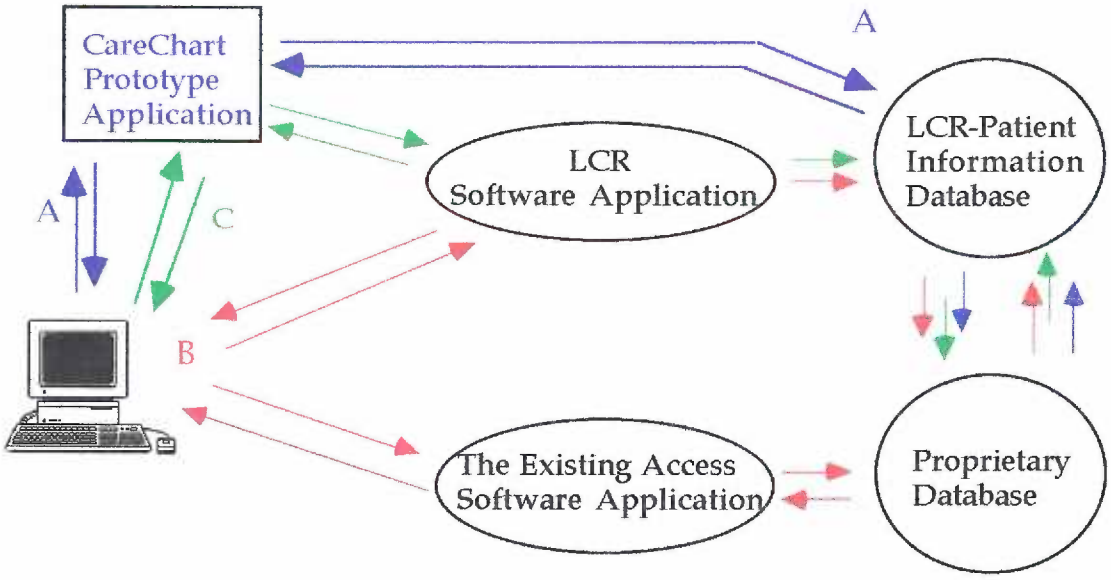

Figure 2d. The agency information system with the CareChart prototype application.

Once in the CareChart application, if the user wishes to use the existing software application pathway they must choose one of two options: select the interim access pathway (C), or sign-off the CareChart application and sign-on to the existing access application, designated as B. This Graphic User Interface (pathway C), facilitates the user leaving the CareChart application, and entering the existing access application pathway by requiring no effort on the part of the user. The computer system actually signs the user onto the existing access pathway using the sign-on identification code from the CareChart application, and presents the user with a computer work screen similar to the format used on the workstation. If the user chooses to exit CareChart and sign-on to existing access pathway (pathway B), the computer presents them with the familiar work screen currently displayed on the workstation used to enter the existing access application pathway (Spackman, 1996). However, while this optional pathway into the patient information database does exist, as the PAT clinic nurses report

not using pathway C, its presence will not be considered for the purposes of this study.

Chapter III

Methods

Study Design

The research design is descriptive.

Research Questions

Research question number one is: How frequently do nurses use the CareChart application to obtain patient data from the patient information database, and do these data retrievals vary by nurse or by type of data retrieved? Research question number two is: What are the reasons' nurses give for not using the CareChart application, and to what extent do these reasons fall into the conceptual categories of Technical, Resource or Data Management Issues?

Setting

The setting for this study was the Pre-Admission Testing Clinic (PAT), an ambulatory care clinic associated with a large, tertiary-level trauma center and a health sciences university. This institution was deliberately selected as it is a beta test site for the SMS software company, vendor for the CareChart application.

Sample

The target population represents all nurses who use the prototype application CareChart to access a patient information database within the automated medical record. As the CareChart application is being piloted in the PAT clinic, the accessible population and the sample population consist of all ten nurses working in the PAT clinic during June 1996 to August 1996. The sampling strategy was purposive, as this group possesses unique knowledge relative to the CareChart application. Because of the unique position of the PAT clinic as a pilot software testing site, this sample population provides insights regarding how frequently the application is used, what data is obtained using it, as well as the

reasons for not using the application, all from the unique standpoint of the practicing clinical nurse.

Due to organizational restructuring and consequent staffing changes, the participants vary slightly between the two research questions. The sample for research question number one, is all the regularly scheduled PAT clinic nurses for the study time period. This produces a sample population of eight nurses, subject's #1-#8. The sample for research question number two includes all of the nurses working in the PAT clinic who were available to be interviewed during the data collection time period. Thus regularly scheduled nurses, rotating PAR department nurses, as well as on-call and temporary nurses are included in this sample. This adds two nurses, increasing the number of nurses in the sample for research question number two, to nine nurses, subject's #1-#5, and #7-#10. Interviewing all available PAT clinic nurses using the prototype CareChart application increases the range of possible responses, thus producing the most complete assortment of interview responses possible.

Within this sample are three distinct clusters of nurses. These groups consist of; clinic nurses (N = four; three RN's & one LPN), RN case managers (N = three RN's), and Adult Nurse Practitioners (N = two ANP's). While members of all three groups are regularly scheduled PAT clinic nurses, the roles and job descriptions of the three groups are distinctly different. The clinic nurse interacts with each patient by initiating a medical history and nursing assessment, providing individualized patient teaching, and coordinating the completion of necessary pre-operative screening exams. The ANP interviews patients, completing the history and physical exam pertaining to anesthesia needs, and writes pre-operative anesthesia instructions. The role of the RN case manager (RNCM), is to interview patients regarding their living situation, support systems and home care needs, from the perspective of discharge coordinator.

Protection Of Human Subjects

Permission to access the record generated by the patient information database's system record tracking mechanisms was granted by the Director of Health Information Services. Access to the PAT clinic nurses was coordinated through the efforts of the ITG Clinical System Manager, the PAT Department Director and the PAT Clinical Staff Liaison. In keeping with Health Information Services departmental policy, confidentiality for the PAT clinic Nurses with regard to the system generated reports was provided by replacing their identifying names and user id's (fields: user id, first, last name) with a number. These numerical indicators were used during the interview data collection process as well. In the interest of protecting patient data anonymity, during data analysis all references to patient names were replaced with numerical identifiers as well. In addition, as required by this institution's research review board, individual consent forms for each nurse were completed prior to the onset of interviews (Appendix A). This study data is not available for viewing or use by anyone other than the research committee, whose viewing and use is limited to data analysis activities.

Data Collection Methods

Two different data collection methods are used to answer the two research questions of this study. For the system usage data, an automated tracking mechanism which produces two standard reports, The CareChart Daily Use Report and the Quarterly Use System Tracking Report for the PAT clinic are used. These two measures collect the quantitative data for the three study variables (CareChart Use, Nurse and Type of Data Retrieved), necessary to answer research question number one. For the qualitative data needed to answer research question number two, a semi-structured interview uses a third

measure, an interview schedule, (Appendix B) designed to collect the data for the fourth study variable, Reasons for Not Using The CareChart Application.

The presence of the automatic tracking mechanism programmed into the sign-on identification pathway for this automated medical record provides the opportunity to quantify the frequency of system use. Also, these system generated reports allow investigation of whether the use of the CareChart application differs between individual nurses, and across three naturally occurring groups found within the sample of PAT clinic nurses. Finally, these reports provide a list of what data nurses obtain when they enter the patient information database. Based on the premise that the PAT clinic nurses are not in fact using the new prototype application, the second research question seeks to compile all the possible reasons the nurses might have for not using CareChart.

Research Variables

CareChart Use. The variable CareChart Use is defined as the total numbers of times clinic nurses access the patient information database to obtain patient related data using the CareChart application pathway (Pathway A, Figure 2d). CareChart Use is operationally defined as all of the times the PAT clinic nurses use this pathway to enter the patient information database to retrieve any type of patient data. CareChart Use is calculated by summing all the PAT clinic nurses' sign-on identification codes attributed to CareChart for the three month study time period.

Nurse. The variable Nurse is defined as all of the regularly scheduled nurses working in the PAT clinic during the three month study time period. For operationalization, the PAT clinic nurses are identified as those who use their unique sign-on identification code to access the patient information database employing either the CareChart pathway or the existing access pathway (Pathway B, Figure 2d).

The Nurse variable is determined by the presence of any PAT clinic nurse's unique sign-on identification code on measure one, The CareChart Daily Use Report and/or measure two, The Quarterly System Use Tracking Report. Summing the number of times each nurse's unique sign-on identification code appears during the study time period, produces this variable's data.

Type of Data Retrieved. The variable Type of Data Retrieved, is defined as all types of patient data nurses obtain from the patient information database during the three month study time period. These include patient testing results from the ancillary departments of Lab, Radiology, Radiation Oncology, and Adult Pulmonary Function, as well as patient care reports and information summaries such as Dictated Reports, Diagnosis and Procedural Summaries, Allergy, Clinical Summaries and Demographic and Insurance. First, an overall listing of all of the different types of data obtained by all PAT clinic nurses during the three month period is created. All data is grouped by type, and the Type Of Data Retrieved variable is calculated by summing the number of entries in each group.

Reasons For Not Using The CareChart Application. The variable, Reasons For Not Using The CareChart Application, is defined as any comment or response given by a nurse to questions which pertained to why that subject did not use the CareChart application to access patient information in the patient information database. Every reason given by a subject is coded with data descriptors and all those responses that pertained to not using CareChart are gathered into a list.

This variable is calculated by summing the responses on this Reasons for Not Using CareChart list. Further calculations include dividing all of the responses listed as Reasons for Not Using the CareChart Application into one of the three conceptual categories based on their data descriptors. All responses for

each conceptual category are summed, producing three figures: a total number of Technical Reasons for Not Using the CareChart Application, a total number of Resource Reasons for Not Using the CareChart Application and a total number of Data Management Reasons for Not Using the CareChart Application.

Measures

A total of three measures are used to answer the research questions. The first measure is a system report generated daily, the CareChart Daily Use Report, and it records access to the patient information database using the CareChart pathway.

The second measure is a system generated quarterly report, the Quarterly System Use Tracking Report. It contains the records of entries into the patient information database using the existing access pathway and the CareChart pathway. In addition, it also contains the data for the variable, Type of Data Accessed, as it tracks the sign-on identification code of all patient information database uses from their point of sign-on to all the database reservoirs they enter, regardless of access pathway.

The third measure is an interview schedule, created specifically for this study (Appendix B). This measure is designed to elicit CareChart use information from the PAT clinic nurses with open-ended questions. This question format was intentionally selected to facilitate capturing the most complete and comprehensive list of barriers, concerns and opinions associated with using the CareChart application that these nurses might express.

Measure one

The CareChart Daily Use Report displays the sign-on identification code of users accessing the patient information database via the CareChart pathway. From this report, the data collected includes: the nurse as user (first name, last

name & user id), the date (date) and the time (time) the CareChart application is accessed.

Reliability & Validity. Two potential threats to the CareChart Daily Use Report's reliability and validity as a measure exists. Both threats occur in the sign-on identification phase, and would introduce the same uncertainty into data collected with this measure. As the first represents a computer error, the possibility of the computer program mechanisms linking the wrong user to the sign-on code entered, the probability of it occurring is low.

The second threat involves the potential for human error. Any nurse can access the patient information database by using another nurse's sign-on identification code. While this may be accomplished several ways, the result is the same. Data for the CareChart Use variable would be attributed to the nurse who's assigned sign-on identification code is collected by the patient information database tracking mechanisms. As a result of either of these two errors, CareChart application use totals for each individual PAT clinic nurse may be skewed, artificially inflated by the application use of another nurse. Any artificial inflation of CareChart application use totals impacts the three nurse role groups data as well. However, the likelihood of nurses from one role group using the sign-on identification code of a nurse from another role group is minimal. Because of this, the reliability and validity of the CareChart Daily Use Report as a measure of CareChart application use behavior of individual nurses, and the three nurse role groups, are somewhat weakened. Any conclusions drawn from this data are weakened as well. In addition, the potential of these errors for this reliability and validity of this data weakens conclusions pertaining to , as well. While the possibility of nurses from one role group using the sign-on identification code of another nurse from another role group is unlikely, the potential does exist.

However, using the CareChart Daily Use Report as a measure for CareChart Use of nurses in the aggregate is unaffected by the potential for this error.

Measure two

The second measure is a standard system generated report; the Quarterly System Use Tracking Report for the PAT clinic. This report displays every PAT clinic user accessing the patient information database and the type of data items they retrieve, regardless of pathway. This report collects: the nurse as user (first name, last name & user id), the patient accessed (accessed patient first name, last name), the type of data item accessed (accessed data item), as well as the access date (date) and time (time).

Reliability and Validity. As the second system generated report being utilized as a study measure, the Quarterly Use System Tracking Report contains the same potential threats to measure reliability and validity as does measure one, the CareChart Daily Use Report. Two additional threats exist as well; (a) the possibility of the computer selecting the wrong item during data collection, and (b) the possibility of data being deleted when reformatting is done to remove the patient names from the reports. While the likelihood that these errors will occur is low, these threats jeopardize the strengths of the individual nurse as user data; therefore conclusions drawn from this data will be made with caution.

Measure three

The third measure, a semi-structured nurse interview schedule designed expressly for this study, gathers each PAT clinic nurse's reasons for not using the CareChart pathway. The interview schedule consists of two separate sections of questions, four questions in a General section, and eight questions in a Specific section (Appendix B) for a total of twelve questions. In the General section, questions gather subject demographic data of age range, gender, personal computer ownership, length of ownership and computer use away from work,

attempting to determine whether any general interest in computer technology exists within this sample population.

In the Specific section, open-ended questions elicit each nurse's computer use activities, in particular, any which relate to their perception of using the CareChart pathway. Expressly, questions asking whether they use the CareChart application and what they use CareChart for determine the nurses' computer use activities from the perspectives of technical and information needs. Then each subject is asked: what are your reasons for not using CareChart to get needed patient information, and how do you usually obtain patient information; addressing all three conceptual categories.

The final three questions are meant to encourage the subjects to describe more of their own experience, and to imagine what pieces of patient information they think a nursing information system application should incorporate. Specifically, these questions refer to their patient care information needs which are not met by the existing automated medical record, how the nurses meet those needs, and what other kinds of information they would like to access on the computer. This approach is included in the measure's design in an attempt too illicit any factors which might indirectly influence the nurses' use of the CareChart pathway. Only by recognizing both the surface and underlying concerns which influence nurses' choices, is it be possible to fully understand their perspective of why they do not use the CareChart application.

Reliability & Validity. As this measure was developed solely for this study, several potential threats to both it's reliability and validity exists. The nurse interview schedule is untested, with no estimate of reliability available. Also, any problems related to inadequate content sampling have not been identified and corrected.

However, this instrument intends to measure each nurse's own perception of her computer use behaviors. Therefore, questions addressing the different components of this concept increase the sampling adequacy of the content area for that concept, heightening this instrument's internal consistency (Caton, personal communication, 1995; Polit & Hungler, 1991). In addition, posing questions about CareChart use or non-use from different component areas of the concept, such as Technical, Resource and Data Management Issues, allow the questions to be repeated. This increases the potential for tapping the whole domain of possible responses, as well as the presenting the possibility for responses which are similar or over-lapping. This also can serve to increase the internal consistency of an instrument.

The semi-structured interview format also produces concern regarding memory recall. Memory difficulties about CareChart use are lessened by interviewing subjects while they are using the software application. Also, each nurse is directly asked whether they use CareChart; an answer of "no" identifies the possibility of memory difficulty due to lack of application use. Inability to recall why they did not use CareChart is also unlikely to occur, as these nurses are members of a pilot testing project. None of the nurses interviewed appeared or responded in a manner to suggest memory recall difficulties; in fact if a nurse was unable to answer accurately, that nurse declined to respond to the question.

Therefore, as this measure is investigating nurses' perception of why they do not use a prototype software application, in a pilot testing area, these threats are to some extent predictable and may be controlled by measure design. Nevertheless, as conclusions drawn from the data collected using such an untested measure may be weakened slightly, this will be done with caution.

Data Analysis

The data analysis discusses each research question separately. The quantitative data from measures' one and two provides averages, and percentages to compare CareChart use to use of the existing access pathway. The comparisons for each nurse subject form a three-way matrix; comparing nurse to nurse, nurse to the aggregate, and nurse to the three nurse role groups. Following content analysis of the qualitative data from measure three, percentages for the conceptual categories and reasons given for not using CareChart, compare nurses' responses regarding the two access pathways.

Research Question Number One

Research question number one asks: (a) how frequently nurses use the CareChart application to obtain patient data from the patient information database, (b) do the patient data retrievals vary by nurse, and (c) do the data retrievals vary by type of data? To answer this question requires determining the numbers of times each nurse signs on to CareChart, the number of worked days and the type of data retrieved. Comparisons may then proceed using the matrix of nurse to nurse, nurse to the aggregate, and nurse to the three role groups, as well as between applications.

Each time the sign-on code for a nurse subject displays, it counts as an entry into a patient information database in the automated medical record and as a data retrieval for that nurse subject. For purposes of this study, the number of days each nurses signed on is calculated based on a nurse's sign-on code. If a sign-on code displays on either of the system generated reports, that nurse counts as signed on that day; conversely, if the nurse sign-on identification code does not display on one of the reports, the nurse is not signed on that day. For this calculation, "days signed on" is the number of days signed-on by each subject, summed across all subjects. Any days nurses worked in the PAT clinic

without signing on to either application are removed from the calculation. This definition is chosen to account for the overlapping of nurses' schedules, which allows between one and four nurses to sign on to either CareChart or the existing access pathway, on any given clinic day. In addition, none of the nurses worked every day of the study time period. Thus, converting the individual nurse data retrieval figures to average data retrieval percentages of Total System use, provides a common basis for comparison for all of the subjects.

The type of patient data the nurses retrieve with each sign-on entry only displays on the Quarterly System Use Tracking Report. Matching the numerical nurse indicator, the date, and time of access from the CareChart Use Report with an entry on the Quarterly System Use Tracking Report, provides the type patient data obtained using the CareChart application. Subtracting these CareChart data retrieval entries, leaves those data retrieval entries obtained using the existing access pathway. For purposes of comparisons between nurses and across pathways, these figures are converted to percentages of the Total System use. Total System use is operationally defined as CareChart use plus existing access pathway use.

Research Question Number Two

Research question number two asks: (a) why don't the nurses use the CareChart application, and (b) to what extent do these reasons fall into the conceptual categories of Technical, Resource, and Data Management Issues? Answering this question requires analyzing the data collected from measure three using standard content analysis procedures and then determining response frequency percentages for the conceptual categories.

Content analysis provides the means of taking nurses' statements regarding the CareChart application and identifying commonalties. The analysis follows the standard content analysis procedures of coding

(descriptions), clustering (linking code descriptions into groups), and categorizing (placing the groups into the á priori content categories). The first analysis step for this interview data is the coding process, and in some instances this coding occurs concurrently with data collection. The initial phase of step two, clustering of the data descriptors, originates here also, taking advantage of the ongoing coding process to uncover potential sources of bias. At this level, coding includes reviewing notes and dividing the interview responses in a meaningful manner, taking care to maintain the individual responses' relationships to each other (Huberman & Miles, 1994).

In the first step, coding of all the interview responses occurs. If possible, the data descriptors are kept semantically close to the text they represent, to assist with capturing distinct response ideas. Every unique response given by a subject, whether it is as a separate thought, or is a phrase in a longer sentence with a larger context, receives an individual code. Dividing responses into their multiple ideas collects the widest and most complete picture possible of why the nurses are not using the CareChart application to obtain patient data from the patient information database.

Each distinct response idea with its data description counts as a separate interview response entry. If a nurse repeats the same idea more than once, each response is weighted as one response. By weighting all responses equally, the data will more accurately reflect the importance these reasons hold for the nurses, presenting the truest picture of the nurse's perception of their concerns. This inclusion criterion is based on the assumption that higher response counts reflect higher concern (Weber, 1985), and helps prevent introducing any outside interpretation biases regarding response importance.

Step two, gathering the data descriptors into clusters, progresses from the raw interview responses, to clusters of responses with similar or like meanings.

These clusters are then given titles such as Lack of Knowledge and Time-negative, reflecting the common thread between all of their responses. For example, the data descriptors which contain the phrase "Doesn't know.....", cluster with other descriptions about knowledge, such as "infrequent exposure". Those with the phrase "too slow" cluster with other negative related time responses into the Negative Time Concerns grouping. Creating the grouping of Other, provide a place to put those data descriptors which don't easily fit into any of the other clusters. See Appendix C for examples of clustered codes.

Categorizing into the á priori categories occurs at the third step to avoid biases in the coding, and to allow for the fullest expression of the interview data ideas. This step ascertains if the topics which connect the responses in each grouping match the definitions and fit into the conceptual framework structure of the three conceptual categories. Sub-categories within Technical Issues include: (a) Hardware, operationally defined as the actual computer workstation equipment, and (b) Software, defined as the set of programs or commands which operate and direct the use of the system hardware (Wallace-Scroggs, et al., 1989). Within Resource Issues are: (c) Competing Demands, defined as resource issues pertaining to users' concerns in relationship to rival claims on their time specific to their job tasks and work environment, and (d) Training, defined as training matters associated with informational systems. And finally, within Data Management Issues are: (e) Data Needs, defined as data users deem necessary to their completing the tasks and requirements of their jobs, and (f) Data Availability, defined as the ability of the user to access data that is stored on-line in what the user describes as an efficient and timely manner. For example, clusters related to the topic of training are combined into the sub-category of Training (Table 1.).

Table 1.

Data descriptors and second step data reduction clusters associated with the Sub-Category of Training.

Descriptors	Clusters	Sub-Category
Lack of knowledge about computers and CareChart interferes with use	Lack of Knowledge	Training
Multiple training concerns need to be addressed	Negative Training Concerns	Training
One to one training helpful	Positive Training Comments	Training

Again, creating the Other sub-category helps avoid forcing relationships between clusters or losing their important study-related meanings. In another example, data descriptors from an Other cluster, all with the common thread of nurses less interested in computers than their patients, becomes the grouping of Disinterest in Computers and fits into the sub-category of Competing Demands (Table 2).

Table 2.

Data descriptors and second step data reduction clusters associated with the Sub-Category of Competing Demands.

Descriptors	Clusters	Sub-Categories
Multiple demands for the Nurses to balance	Human Resources	Competing Demands
Nurses don't express interest in computers	Disinterest in Computers	Competing Demands
Some users are comfortable using computers	Interest	Competing Demands

Following the placing of clusters into the sub-categories described above, the final step of partitioning the sub-categories into the three larger conceptual categories of Technical Issues, Resource Issues and Data Management Issues occurs. Calculating the response frequencies in percentages for the three large conceptual categories, the six sub-categories, and the clusters it is possible to compare between and across categories, between and across the categories by individual nurses, the nurse aggregate and the three nurses' groups.

At this point, it is possible to divide all of the clusters into two sets: those which constitute reasons or support Reasons For Not Using The CareChart Application, and those sub-categories which do not directly address reasons for not using CareChart. This analysis produces twenty-one clusters, fourteen of which relate to the Reasons For Not Using The CareChart Application.

The clusters which do not directly address the topic Reasons For Not Using The CareChart Application, are further divided into two sets. Six clusters sharing the topic Positive Aspects Specifically Related to CareChart, with one cluster describes concerns regarding Nurses' General Information System Wants

& Needs. These clusters contain subject's responses to questions which were asked during the interviews while attempting too illicit all factors which might indirectly influence the nurses use of the CareChart pathway. The comparative analysis using response frequency percentages extends to these clusters, but is limited to investigating their relationship to the Reasons For Not Using the CareChart Application.

Chapter IV

Findings

This chapter presents the study's findings, beginning with the presentation of a brief summary, and a description of the sample. The quantitative data for research question number one will be discussed first, followed by the qualitative data for research question number two.

Summary of Findings

Research question number one asks: (a) how frequently do nurses use the CareChart application to retrieve patient data from the patient information database, (b) do the patient data retrievals vary by nurse, and (c) do the data retrievals vary by type of data? This study found that overall, the nurses in this sample do not use the CareChart application to access patient data in the patient information database, particularly when compared with their use of the existing access pathway. The majority of the times nurses did log on to the CareChart application, they did not proceed into a patient database and retrieve patient data. The CareChart usage figures account for the sign-on activities of four nurses, while usage of the existing access pathway accounts for five. Of interest, is that CareChart use did vary amongst the nurse role groups. In general, each of the individual nurses accessed the same ancillary departments and patient information databases. However, twice as many ancillary departments and patient information databases were accessed using the existing access pathway as were accessed using CareChart. Within the nurse role groups, the types of data retrieved varied. One type of data was accessed much more frequently than all of the others combined.

Research question number two asks: (a) why don't the nurses use the CareChart application, and (b) to what extent do these reasons fall into the conceptual categories of Technical, Resource, and Data Management Issues? The nurses give two hundred seventeen individual reasons for not using the CareChart application, and from these responses fourteen specific reason response clusters emerge. Of these, the nurses most frequently mention Time Concerns and Training Concerns as their reasons for not using CareChart. These reason response patterns are consistent with the CareChart use figures found in research question number one; also varying by role group, with the clinic nurse group giving the most Reason types of responses.

The reasons are fairly evenly divided among the three conceptual categories of Technical, Resource, and Data Management Issues, with response frequencies varying by role group. The number of ANP group responses are highest in Technical and Data Management categories; the number of RNCM group responses are highest in Resources and Data Management categories, and the number of clinic nurses responses are highest in Resource issues category.

The reason response patterns in the two categories, Positive Aspects Specifically Related to CareChart use and Nurses' General Information System Wants & Needs, are consistent with the CareChart use figures found in research question number one and with the role groups CareChart use patterns.

Description of the Sample

The demographic data was collected during the nurse interviews from nine nurses, subjects' one through five, and seven through ten. All of the nurses in this sample are women. Their age ranges are from 30-39 years (N = 3 subjects), 40-49 years (N = five subjects), and 50-59 years (N = 1 subject).

Eight of these nine nurses currently own and use a home computer; seven own Windows-based machines and one owns a Macintosh. The length of

ownership varies between less than a year (four nurses), and longer than one year (three nurses). In addition, two of these nurses operate outside business ventures dependent upon computer use.

Research Question Number One

CareChart Use

During the three month study period, the PAT clinic nurses used the CareChart application one hundred fourteen times, or three percent of the time they access the patient information database (Figure 4a). However, of the one hundred fourteen times they used CareChart, they only retrieved patient data from the patient information database fifty-three times (46%). In sharp contrast, the nurses used the existing access pathway one thousand, seven hundred and twenty-four times, or ninety-seven percent of the time they access the patient information database. On an average, while the nurses use the CareChart application almost three times a week, they use the existing access pathway substantially more frequently, almost eighty-three times a week. This CareChart use rate reflects the activities of four out of the ten nurses in the sample. The remaining six nurses did not use the CareChart application during the study period, with only subject #6 using the existing access pathway. The CareChart use figures are substantiated by the interview data from measure three.

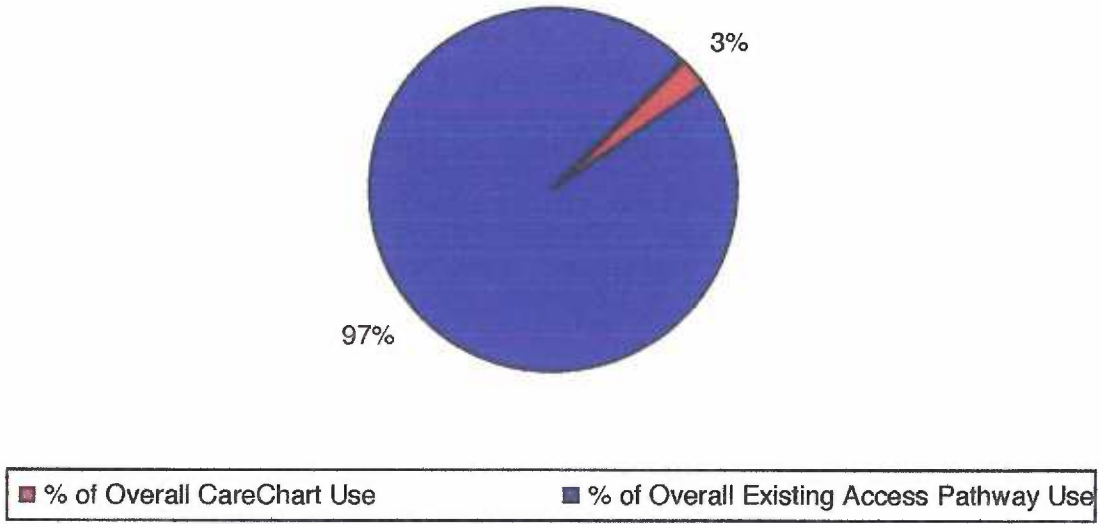

Figure 4a. The percentage of data retrievals using the CareChart application and existing access pathway.

Of the sixty-four days the PAT clinic was open, there were five days (8%) with no use of either the CareChart application or the existing access pathway. During the fifty-nine days when either CareChart or the existing access pathway was used, CareChart was used to access the patient information database twenty-nine percent of the time (N = 17 days).

Data Retrieval Variation

Data Retrievals did vary by the three nurse role groups; all of the subjects who signed on to CareChart to retrieve patient data from the patient information database belong to either the adult nurse practitioner (ANP) or RN case manager (RNCM) role groups, with the RNCM subjects using CareChart most frequently. The RNCM group retrieves patient data using CareChart an average of four times a week, the ANP an average of three times a week, and while the clinic nurse group does not at use CareChart to retrieve patient data at all.

Variation in Type of Data Retrieved

Using CareChart, the nurses access four ancillary departments or patient information databases, with Lab results (N =33) being the most frequent. Second is the patient database Dictated Reports, which nurses access less than half as frequently as Lab (N = 13). Nurses use CareChart to retrieve Diagnosis and Procedural Summaries six times, and Adult Pulmonary Function Lab once.

However, the number of patient information databases the nurses access doubles when they use the existing access pathway. The nurses access those four departments, as well as five others; Allergy (N=16), Radiation Oncology (N = 5), Clinical Summaries (N = 43), Demographic and Insurance (N=7), and Adult Pulmonary Function Lab (N=2). Individually and in role groups, the nurses access more than twice as many types of data using the existing access pathway as they do using the CareChart pathway. When using CareChart, the subjects access the ancillary departments or patient information databases in the same frequency as they do with the existing access pathway, with the exception of two, Dictated Reports and Diagnosis and Procedural Summaries (Figure 4b).

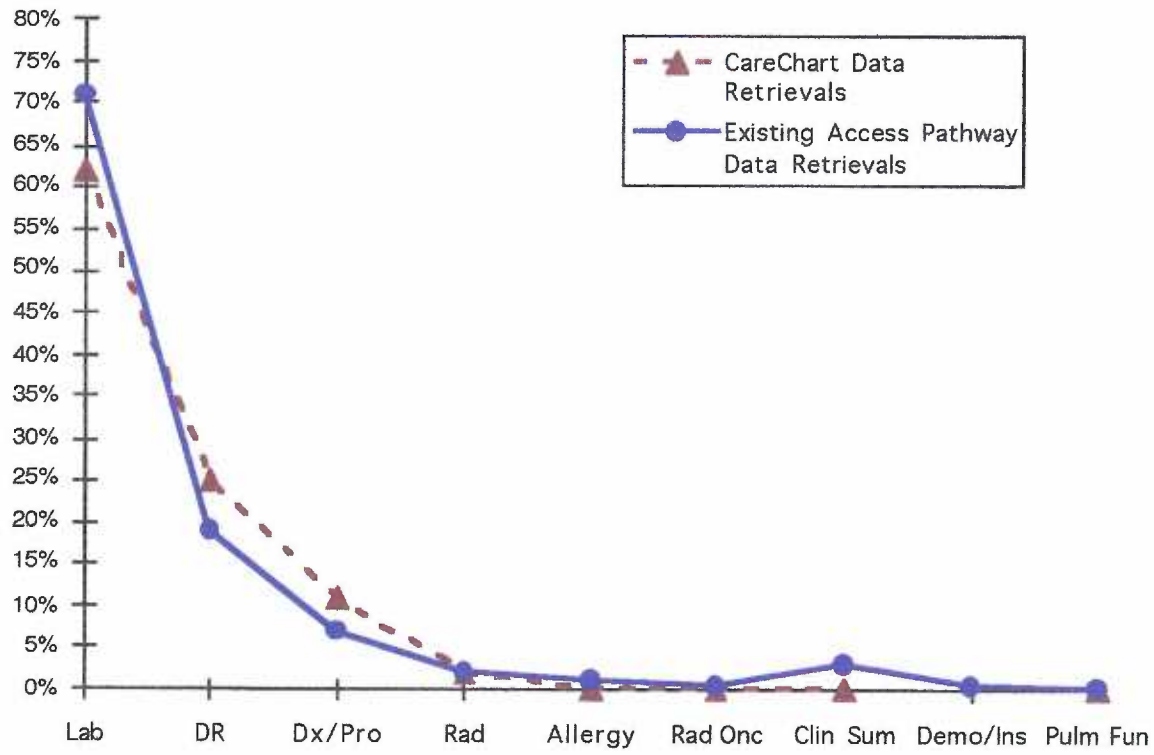

Figure 4b. Percent of data retrievals using CareChart and existing access pathway by types of data retrieved.

Research Question Number Two

Reasons Given for Not Using the CareChart Application

Coding the nurse interview data results in a total of two hundred ninety responses, with two hundred seventeen responses that are Reasons Given for Not Using the CareChart Application. The remaining seventy-three interview responses not directly addressing the reasons' nurses don't use CareChart, are divided into those responses which indicate positive aspects specific to the CareChart application and those which indicate the types of data important to the nurses (Figure 4c).

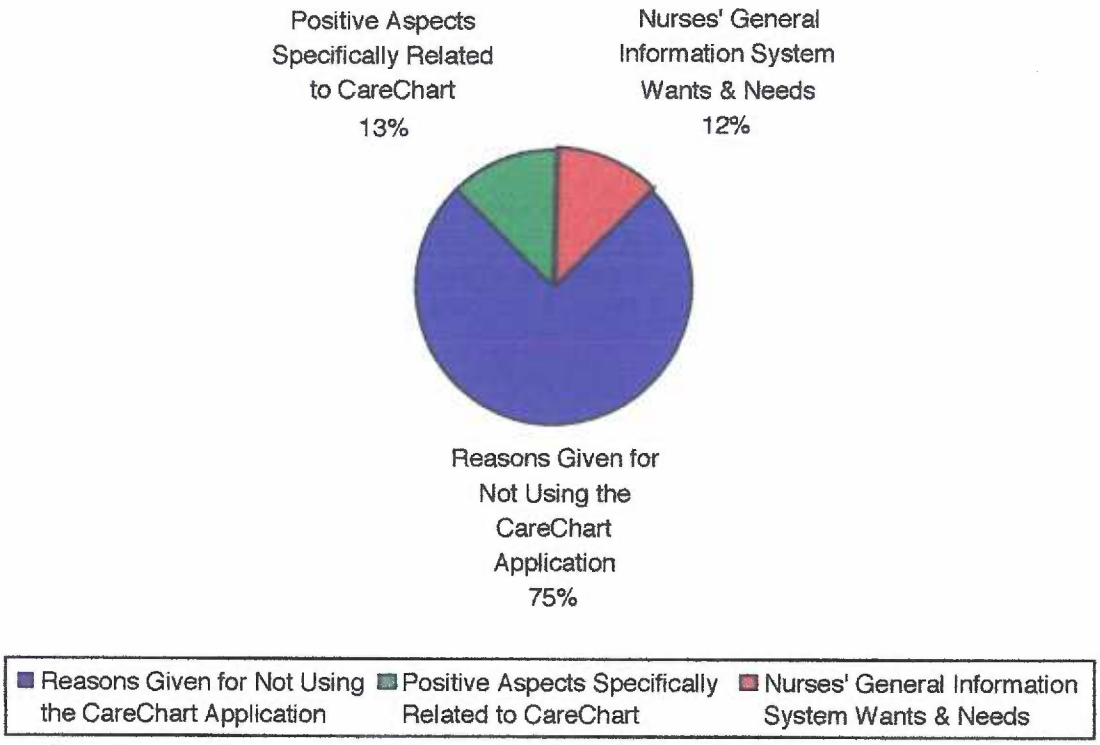

Figure 4c. Percentage of interview responses by type of responses.

Responses within Positive Aspects Specific to CareChart, refer to specifics about the CareChart application which the nurses like or find helpful. The responses within Nurses' General Informational Systems Wants & Needs, refer to types of patient information the nurses need and the types of patient information they would like to have access to, as well as including descriptions of the various role responsibilities which drive their patient information requests. The Reasons Given for Not Using the CareChart Application responses are discussed first (Figure 4d).

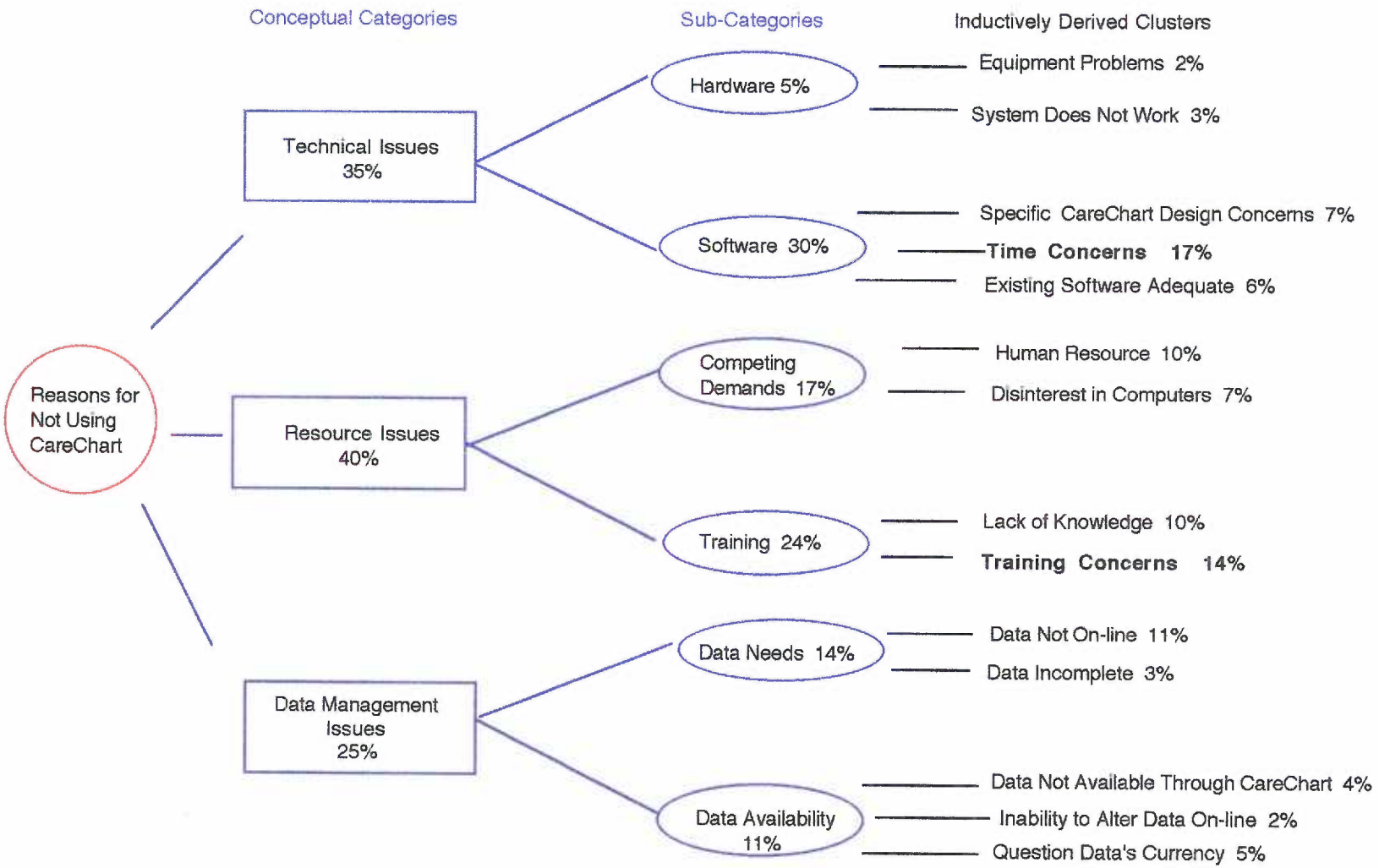

Figure 4c. Categorization of reasons PAT clinic nurses give for not using the CareChart application.

During the interview process, the nurses repeatedly mention two reasons for not using the CareChart application; Time Concerns and Training Concerns. Overall, the Time Concerns cluster, in the Software Sub-category, receives seventeen percent of the responses, and the Training Concerns cluster , in the Training Sub-category, fourteen percent of these responses (Figure 4e).

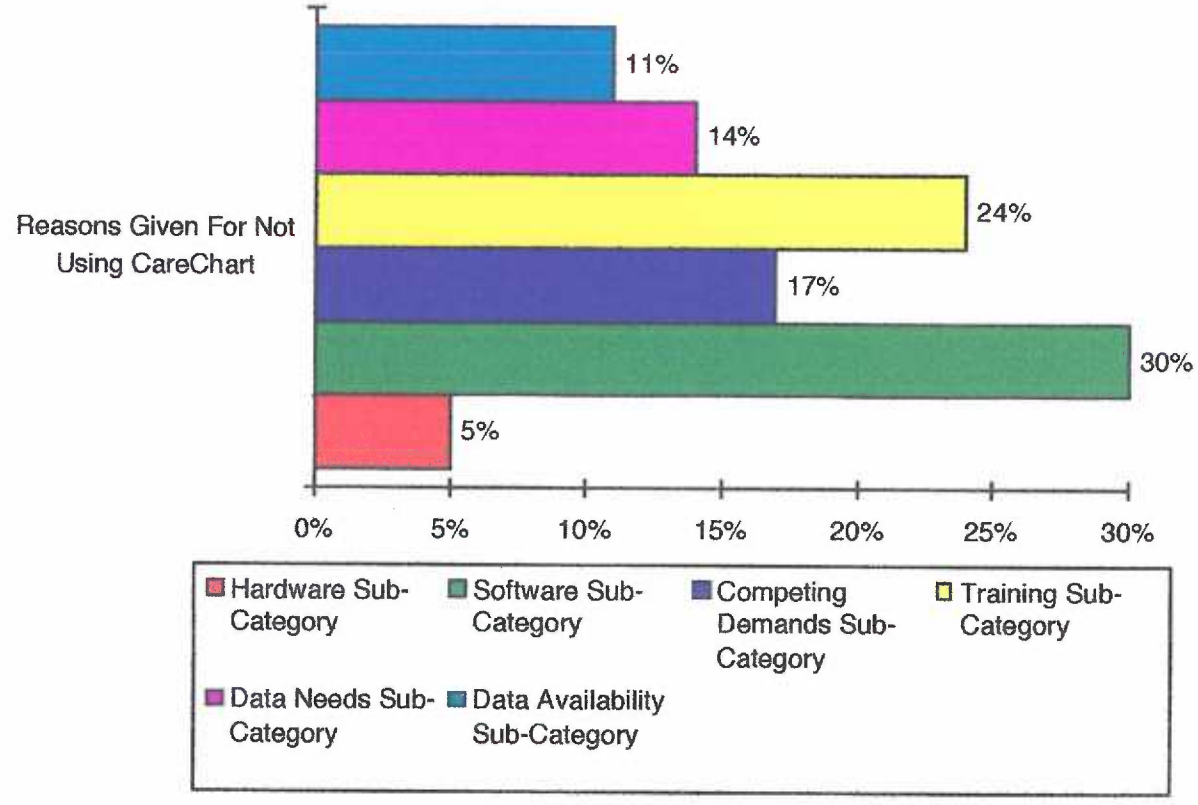

Figure 4e. Reasons given by PAT clinic nurses for not using CareChart.

Time & Training Concerns. The frequency of Time Concern responses do vary among the three nurse role groups; most of the subjects responding in this cluster belong to either the ANP or RNCM role groups, with the exception of two subjects from the clinic nurse group. Thirty different data descriptors in this cluster describe the problem of speed when using CareChart: *"now see this is the part that bothers me too, I just .....I always [use CareChart for] pre-op orders, and it*

takes forever;..... it's too slow." ; by compare it to the existing access pathway or the original lab terminal system: *"what I need it for as RN in this clinic is for lab reports, faster with [existing access pathway], it works great".*; or *"I can access labs quicker, going into the old lab function (old lab terminals), because you just hit PR again ..... instead of the four or five steps it takes in [the existing access pathway] to get the next person."* In addition, the nurses relate to the time it takes to use CareChart in terms of how it impacts their patient responsibility and how they perceive the demands on their time: *" it's too slow.....usually we're in a hurry here and we don't have time to wait".*

Responses from the System Does Not Work cluster, describe other disruptions that affect the nurses time: *"Anyway with the CareChart on there, I can't use the spreadsheet program to make the graphs and what not for the statistics .....It made the other systems I need to use crash. So the end result was that I went home and did my graphs at home on my computer."* which serve to reinforce the nurses' concerns about time urgency and the constraints they experience in their work environment.

All of the participants voiced concerns over the sufficiency of their training for using CareChart, their responses creating the two clusters of Training Concerns and Lack of Knowledge. Combined, the thirty data descriptors from both clusters describe the training the nurses received: *"Little bit of training they've given use is all I've ever had--very minimal". "You learn on the job".* , or *"UM, ten minutes by [Subject 4]"* , and *" no .....trial and error....."*.; or : *"I just started and figured it out...no, they just had signs up on how to get in .....and they gave me a number .."*; the training they would like to receive: *"It would be excellent to have.....something that just explains what it can do for you, what potential it has.....and who set up the software, and what they had in mind when they did.....I personally feel like that nurses have not ever been given adequate training to Windows, to*

.... a lot of miss-information is passed along;" and report concerns they have regarding their knowledge of CareChart: *"I don't know that much about it...I don't utilize the computers as much as I probably should because I don't know that much about them ...I do my basic stuff here and get what I need."* ; and: *"I basically know my little minute piece of the pie, and that's it. . . ..I'm very computer illiterate I feel like...but I can kind of do [the existing access pathway] and that's it, order processing, retrieving lab results, and that's about all I can do, or look up the schedule of the clinic, or stuff like that".*

Despite having home computers and using computers regularly in their work, the nurses describe themselves as a computer illiterate. In fact, forty-four percent of the responses relating to lack of knowledge, four nurses actually use the phrase "computer illiterate" to describe themselves. Furthermore, responses within the Disinterest in Computers cluster reinforce the nurses concerns pertaining to training. For example, responses such as: *"I'm not really interested in what all this computer can do, it meets my needs here at work..... I'm outside gardening, I've no desire to sit in front of a computer. Absolutely not. I think there're great for what they do, believe me, but personally I wouldn't use it outside of work, it's not that important to me."* clearly demonstrate their disinterest.

While the reasons Time Concerns and Training Concerns receive the most mention, the other twelve reasons also add meaningful dimensions to the emerging picture of these PAT clinic nurses as system users (Table C1, Appendix C). The Equipment Problems cluster within the Hardware sub-category, receive the least number of responses (N = 4), while the other cluster in that sub-category, System Does Not Work, receives seven. Within the Software sub-category, the Specific CareChart Design Concerns cluster delineates individual attributes the nurses object to, for example: *"[I have to] get out [of CareChart]....., if I have to order, then you have to get back into CareChart, so that's not good."* and "

Also, dictated reports are all in one single folder, listed as dictated reports, whether or not it's history or physical, a discharge summary, or a progress note.....so I have to look at each and every one of them.....". The cluster Existing Software Adequate illustrates the nurses' disinterest in this new application, CareChart: *"It didn't seem to have any information that wasn't found elsewhere, that I was already comfortable with getting".*

In the Competing Demands sub-category, the Human Resources cluster describes how CareChart has affected their work life: *"nurses just fear 'oh more work', it isn't different work, or more efficient, work it's just more work."* ; and *"In fact I'd better turn it on now; I usually turn this on cause it's so long. .....my other screen is on first....There I just hit it and you just wait, it's going to take a long time. I usually come in here, turn on the computer, then go in there and get my papers, and.....".*

In the Data Management sub-category of Data Needs, the responses describe the patient data the nurses need for patient care: *"usually those records [from another institution] have been sent to the referred MD, that they're referred to, they are usually sitting in a clinic, they're not interfaced with the OHSU system"* ; their problems with incomplete records: *"...so it's not reliable, to go into CareChart and to look and see what lab work have these people had, because it may have already been done, but just not be in there."* ; and how they retrieve it : *" that's our first thing, if we have the chart we'll just look for it there; we would not go into the computer if we have it in the hard chart...".* In the other Data Management sub-category Data Availability, the nurses' responses recite reasons they don't use CareChart that relate to data currency: *"yes, it doesn't necessarily interface right away, I don't know how soon it gets on there"* ; the inability to locate the data using CareChart: *"I guess the other suggestion that would link in with CareChart is that I like the idea of all the folders and the accessibility to go in there and collect the information on a patient, however, if those haven't been entered properly and there're not on that database, they*

could still be entered in the computer somewhere else, and just not be in there,.....I mean not in the CareChart area....." ; and their inability to alter any of the data in CareChart: *"[CareChart is] only for priorly scheduled patients"* .

Identified Themes in Reasons For Given for Not Using CareChart

In analyzing the reasons nurses give for not using CareChart, several themes present themselves, fitting easily into three á priori conceptual categories; Technical, Resource and Data Management Issues (Figure 4c). In doing so, it became obvious that within each of the larger categories, were sub-categories. For example, Technical Issues includes both hardware and software related responses. Thirty-five percent of the Reasons For Not Using the CareChart Application are in the Technical Issues category (N = 75), forty percent are in the category Resource Issues (N = 88), and twenty-five percent are in the conceptual category of Data Management Issues (N = 54).

All nine subjects responded in all three conceptual categories. Across the three role groups, most of the ANP subjects' responses fit within the Technical (33%), and Data Management (37%), categories, with fewer responses fitting into the Resources category (25%). For the RNCM subjects, the majority of their reason responses fit into the Technical (35%), and Data Management categories (41%). The clinic nurses responses fit into the Resource category (49%), with some responses in the Technical category (32%), and still fewer in the Data Management category (22%) (Table 3). However, as a group, the clinic nurses subjects have the highest response percentage (36%), for Reasons Given For Not Using the CareChart Application (Table D1; Appendix D).

Table 3.

Percentage of responses by nurse role group as they fit into the three conceptual categories.

Category	ANP		RNCM		Clinic Nurses		Total
	N	%	N	%	N	%	N
Technical	25	33%	26	35%	24	32%	75
Resource	22	25%	23	26%	43	49%	88
Data Management	20	37%	22	41%	22	22%	54

Positive Aspects Specifically Related to CareChart and Nurses' General Informational Wants & Needs

There are thirty-nine responses in the Positive Aspects Specifically Relatedto CareChart category and thirty-four responses in the Nurses' General Informational Wants & Needs category. These response clusters also fit easily into the three á priori conceptual categories; Positive Aspects Specifically Related to CareChart clusters into the two conceptual categories of Technical and Resource Issues (Figure 4f), and the Nurses' General Informational Wants & Needs cluster into the Data Management category (Figure 4g).

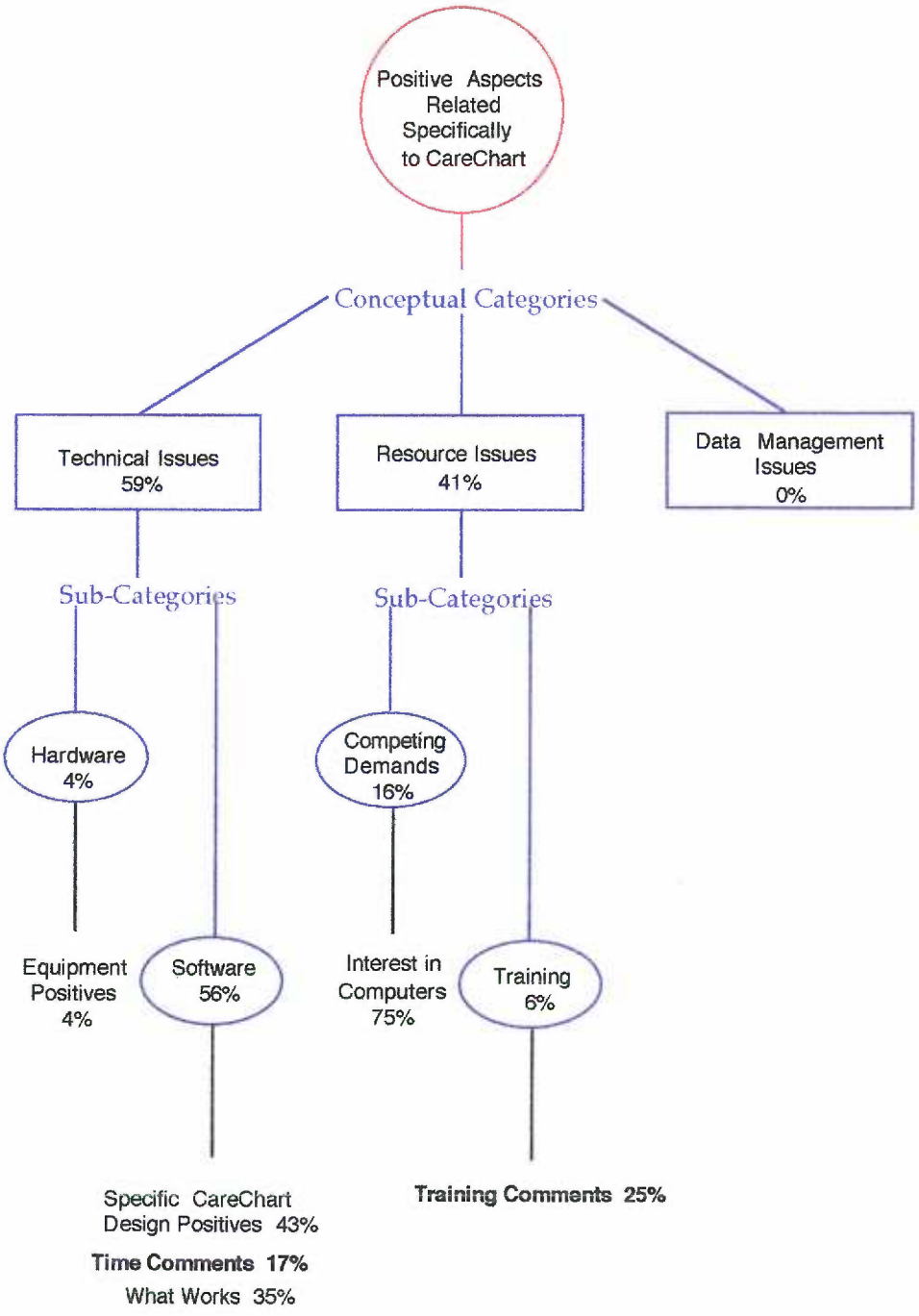

Figure 4f. Categorization of Positive Aspects Specifically Related to CareChart responses.

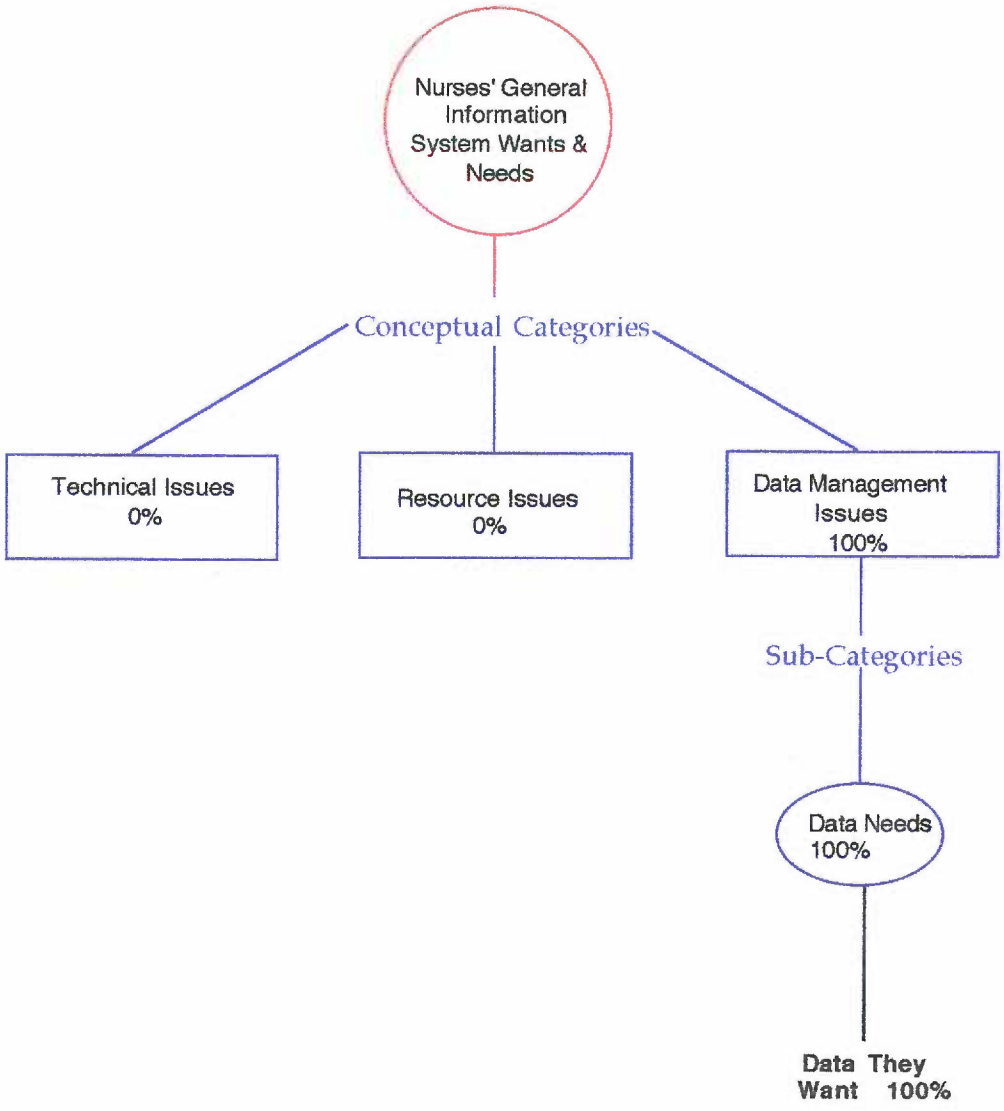

Figure 4g. Categorization of Nurses' General Information System Wants & Needs Responses.

The Positive Aspects Specifically Related to CareChart clusters which receive the fewest responses, correspond with the Reasons types of response clusters receiving the most responses. The Time Comments cluster (17%), appears to be opposite the Time Concerns cluster (17%); as does the Training Comments cluster (25%), opposite the Training Concerns cluster (14%). This

pattern is repeated with the nurses' responses pertaining to patient data; Data They Want (100%) receives thirteen times as many responses as do the two Data Needs clusters of Data Not On-Line (11%) and Data Incomplete (3%).

During the nurse interviews, all nine of the nurse subjects mention at least one concern regarding patient data they want. While the majority of the RNCM group's responses (N = 39%), fit into the Technical Issues category, this group responds as often in the Resource Issues category as do the clinic nurses (44%). Most of the responses for the ANP group fit into the Technical Issues category, however they also have numerous concerns regarding Data Management issues as well (32%). In addition, the clinic nurses responses for the Technical Issues category (13%) are far fewer than either of the other two groups (Table D2; Appendix D).

Chapter V

Discussion

This chapter presents the interpretation and discussion of the study findings presented in chapter four. The implications for the research setting organization, and the software development company are described as well, referencing the informational system needs lists for each, which are included as appendices (Appendices F and G). In conclusion, general implications this research has for the nursing profession, health care delivery institutions and software companies are presented, followed by discussion of the study limitations, as well as suggestions for future research.

PAT Clinic Nurses Acceptance & Use of the CareChart Prototype

One of the more interesting findings of this research is that the CareChart application is rarely used, especially in comparison with the use of the existing access pathway. In addition, there are some days when neither access pathway is used to retrieve patient data from the patient information database. However, more frequently, just one pathway, the existing access pathway, is used by the nurses in the clinic. This samples' computer use behavior resembles Harris's (1990), description of nurses as uninvolved informational systems users, and corroborates Jones' (1991) conclusion that the prevalence of computers in many clinical areas has not altered nurses' levels of hands-on experience.

Acceptance & Use of CareChart by Three Nurse Role Groups

The three naturally occurring role groups within the PAT clinic sample highlight the relationship of knowledge continuums, or dimensions, and levels of expertise Nielson discusses in his descriptions of design user variability. All of the nurses functioning in the roles of clinic nurse, ANP and RNCM may be described as experts in the "understanding the task domain" dimension. In

addition, some of these nurses may also describe themselves, or their co-workers, as "knowledgeable about computers in general" or possessing "expertise in using the specific system" (Nielsen, 1993). Yet, each user's position along the system user and computer experience domain did not appear to impact their use of the CareChart application. All of the nurses in the RNCM group have owned their own computer for at least six months, one operating a separate, computer dependent business for six years. Both of the ANP subjects own and use home computers, one for as long as five years. And while one clinic nurse does not own a computer, all of the remaining clinic nurses have owned and used a computer for a minimum of eight months. Therefore, the variation in data retrievals seen by the differing nurse role groups appears to pertain more to their knowledge of the CareChart application and "expertise in using the specific system" (CareChart), than it pertains to "knowledgeable about computers in general".

Patient Data Retrieved Using CareChart

That twice as many types of data were retrieved using the existing access pathway as were retrieved using CareChart is not unexpected considering the minimal use of the CareChart application. However, two patient information databases, Dictated Reports and Diagnosis and Procedural Summaries, were accessed more frequently using the CareChart application than the existing access pathway. One RNCM retrieved Dictated Reports and Diagnosis and Procedural Summaries more frequently than she did Lab. This raises the possibility that some specific CareChart design feature exists which makes accessing both of these patient information databases using CareChart easier or more efficient. Another possibility, is that as this subject is one of the two labeled as an early majority adopter, her adaptability to the CareChart application makes it easier for her to discover how CareChart's is useful to her in her role.

Lab data was accessed far more frequently than any other type of data. As the purpose of this clinic is pre-admission testing, and lab tests are some of the easiest, least expensive, and least invasive exams which can be conducted to evaluate patients, this finding is expected and easily understood. Virtually every single pre-operative patient has blood studies done prior to their surgical procedure, regardless of age, gender, diagnosis or surgical procedure planned. Therefore, this data retrieval pattern should not be expected to represent data retrieval patterns for other clinical areas. The type of data retrieved relates to the information needs of the users; and user variation may exist within and between clinical environments, as well as between and across users' roles. Software application designs need to reflect the needs of all groups of users, regardless job tasks, in all work environments and settings (Corcoran-Perry & Graves, 1990; Gould & Lewis, 1987; Graves & Corcoran, 1988a; McCormick, 1991; Melia, 1989; Norman, 1988; Romano, 1990).

Obstacles to Nurses' Acceptance of CareChart

The interview schedule was designed to parallel the *Validation* stage of the Conceptual Framework, creating an opportunity for nurses to verbalize complimentary and critical feedback pertaining to the CareChart application (Gould & Lewis, 1987; Jacobsen & Fennell, 1989; McCormick, 1991; Melia, 1989; Perreault & Wiederhold, 1990; Spitzer, 1993).

Interview responses by Three Nurse Role Groups. The clinic nurses group did not use CareChart, and as a group, had the highest response percentage for Reasons Given For Not Using the CareChart Application types of responses. As all of the clinic nurses tried the CareChart application when it was first installed, and some even report having tried it in anticipation of their interviews for this research, is seems reasonable that they would have the most critical and the fewest encouraging things to say about CareChart. The clinic nurses also have a

different practice environment than their RNCM and ANP counterparts; their time at work is more fragmented and less autonomous. Clinic nurses work around the other care providers; consequently time and quickness might be of more importance to them. Their tasking pattern requires them to break tasks into smaller fragments which can be accomplished in between others, or while waiting for others to finish seeing patients. Therefore, it seems reasonable that most of their critical comments are placed in the Resource and Technical Issues categories, and few of their Positive Aspect types of responses are in the Technical Issues category.

The RNCM group responded most often in the Technical and Data Management categories; conceptual categories which appear well matched to their role as patient discharge coordinator. This groups' Positive Aspect types of responses demonstrates this as well, as this group made fewer responses in both of these categories. These subjects have an expanded domain of patient information they are reviewing, increasing their interest in the sub-categories of Data Needs and Availability, describing their search through the available patient data for "old case management notes", and anything which will help them complete and overall summary each patient's condition and circumstances. Yet, they are still interacting with their patients in the ambulatory care clinical environment, and as such, fall under the same time constraints as the ANP and clinic nurse groups; complaining that using CareChart only adds to the often long, fatiguing, and possible frustrating day their patients have spent undergoing their pre-operative evaluations.

The expanded role of primary care provider for the subjects in the ANP group, also appears to match the two conceptual categories their responses were placed in most often. However, this group also had high percentages of Positive Aspect types of responses in these categories as well. The responsibilities of

completing the patient's history and physical, and writing pre-operative orders require that they also review a large portion of each patient's medical record information; using the chart, the computer, the patient, and sometimes information from other institutions. Again, the subjects in this group function under pressure to accomplish all this in a timely fashion; expressing their concern and frustration regarding the time it takes to access CareChart, as well as to sort through the on-line information, all while patients are waiting.

Both the ANP and the RNCM groups made proportionately more positive remarks about CareChart and the information system data needs than did the clinic nurses. As these two groups are the highest users of the system, perhaps those who use the system eventually find out more of what it has to offer them. The positive remarks from these two groups fall into the Technical and Resource Issues categories, with none of these nurses making positive Data Management comments. This is neither unexpected nor unreasonable, as their understanding of the CareChart application and it's design capabilities limited.

In addition, all of the responses describing Nurses' General Information System Wants & Needs cluster into the Data Needs Sub-Category. This is also expected, as the nurses' knowledge of the technical aspects of computer applications is minimal. Also, during the nurse interview, the nurses were only asked to describe what patient information would be available in the "perfect on-line patient record". Follow-up questions pursuing any of the Technical and Resource issues in such a situation, were not asked.

Considering all fourteen reason clusters as a whole provides a comprehensive picture of why the nurses do not use the CareChart application. The nurses responses describe data management issues, such as necessary data incomplete or unavailable, as well as issues relating to the competing demands of their job tasks and problems with the informational systems network.

Furthermore, their responses clearly outline their concerns regarding the usefulness of the system's software designs, their lack of interest in and knowledge about the technology. All of these response concerns combine to create the comprehensive, end-user centered conceptual model deemed essential by both the usability engineering and nursing literature (Corcoran-Perry & Graves, 1990; Coyne, 1995; Gould & Lewis, 1987; Graves & Corcoran, 1988a; Henderson, 1991; Melia, 1989; Moran, 1994; Nielsen, 1993; Norman, 1988; Zielstorff, et al., 1993).

Considering the dearth of responses in the cluster Equipment Problems, the conversion from a light pen driven system to a the Windows format with a mouse was not difficult or problematic for the subjects. The cluster Specific CareChart Design Concerns, describes detailed problems in the software design, such as poorly defined folder labels and the limitations associated with the view-only functionality regarding patient data. Within the software sub-category, the cluster Existing Software Adequate, informs us that this group of subjects believes the CareChart prototype application has no advantages over the existing system.

The nurses' perception that computer use provides no advantages for them, reinforces their responses in the Human Resources cluster. The two reasons "Nurses View Computers As More Work", and "Come In Early To Adjust Work Pattern For Computers", are very illustrative. These nurses believe that they need to lengthen their work days, by coming in to work earlier, to accommodate the CareChart application. In addition, they perceive this tool as wasting resources; as generating more of the same kind of work for them, not more efficient or different work, as well as producing more, instead of less, paper. Organizational leaders, then can begin to understand what has

motivated nurses to resist adopting computer technology in general, and more specifically, CareChart (Bridges, 1991; Connor, 1993).

The reasons in the Disinterest in Computers cluster serve to clarify this developing image of nurses' beliefs about computers further, describing that while nurses think of computers as a work tool, they are not integrating this new tool into their work environment. These nurses do not appear to be interested in this technology, and certainly not any new computer related advances, which they believe will not benefit them, instead causing them more work. Ngin, et.al., reports that the nurses with the least interest in computers find the computer moderately frustrating, while all of the nurses in her sample report mixed feelings regarding computer frustration. Murphy, et al., reports that their sample of nursing personnel attitudes regarding computers became less positive as they began using the clinical information system.

Time And CareChart's Ease of Use. These responses seem to be emphasizing four issues: (a) the importance of time, or speed, (b) comparisons with other pathways or applications, (c) the impact on patients, and (d) nurse's perception of their own time constraints. For a tool to be useful for a nurse, speed is an important consideration, figuring heavily into their estimate of that tool's "ease to use". The nurses describe this value again by comparing the speed of CareChart to the existing access pathway or other computer applications. Three Reasons within this cluster ("Won't make patients wait while uses CareChart", "Time pressure when patients waiting" and "[The existing access pathway] is faster"), amply describe how the issue of quickness and patient interrelate with regard to the CareChart applications (Table C1, Appendix C, and Appendix E). Nurses will not adopt a change or a new technology which does not demonstrate a relative advantage, preferably speed, over the existing system,

just for the sake of change and technological advancement (Chang, 1984; Hebert & Benbasat, 1994; Rogers, 1983; Romano, 1990).

Although time is an important consideration for nurses, patient well being continues to be their primary concern. Inconveniencing the patient is rarely acceptable to them; valuing the patient, is a concept integral to the nursing profession. The expression of these patient-related, interpersonal skill concerns also finds support in the literature (Chang, 1984; Hebert & Benbasat, 1994; McClellan, et al., 1994). In the discussion of narrative comments from her 1994 study, Murphy, et al., reports that out of the eighty-three responses, sixty-two (75%) pertained to time. These nurses are echoing what Harris (1990), found in her qualitative study; nurses feel a loss of autonomy, the loss of individualization of care, and the loss of nursing expertise when using computer-mediated nursing care plans. Unfortunately, it is no longer sufficient for nurses to only develop expertise in the general and specific domains of patient care; they must now begin develop expertise in the general and specific domains of computer informational system (Shaver, 1995).

The frequency of Time Concern responses also indicates how these nurses are delivering nursing care in their clinical environment with a constant sense of urgency, echoing their perceptions of their own time constraints. Within the System Does Not Work cluster, the responses describe disruptions which can take many forms, i.e., other applications not functioning, or locking up, when used or the workstation crashing in the middle of some task. All of these disruptions may appear to the user to be malfunctions caused by CareChart, when they are more likely caused when the hardware and software interactions do not operate smoothly. These deficiencies affect the nurses by interfering with their ability to do their jobs.

Furthermore, a tool is not useful if it interferes with job tasks, instead of expediting them in some fashion. The reason cluster, Inability To Alter Data On-Line, describes a design feature of CareChart that is inherently inconsistent with the delivery of patient care in the outpatient setting. Patients are routinely added or deleted from a clinic's daily schedule, and the CareChart design currently does not accommodate this practice. CareChart only displays the data for patients which are on its patient roster at the beginning of the clinic day. If patients are added to the schedule, none of their patient data is available through CareChart, and their paper medical record is not automatically ordered from the existing medical records department. These findings clearly support Hendrickson and Kovner's (1990), conclusions following their review of informational system effects on nursing resources. More systematic research into the effects of the various components of informational systems is necessary to fully document the effect computers have on nurses' time (Hendrickson & Kovner, 1990).

Training And CareChart's Ease of Use. This cluster, reinforced by the reasons in the Lack of Knowledge cluster, describe how training affected the nurses' use of CareChart. Three elements are involved: (a) the training they received, (b) training they want or need, and (c) remarks concerning learning.

While the training the nurses received appears to have varied significantly from individual to individual, they all agree on one aspect; the nurses describe the training they received as incomplete. Several nurses describe teaching themselves from handouts or exploration, or receiving a few minutes of system orientation from another nurse. Circumscribed training and orientation time engenders the belief that staff members need to learn the application on their own, and some subjects expressed the worry that by learning the application themselves, the nurses perpetuate misinformation. A few described the skills necessary to use CareChart as being established only through repeated

practice or use; adding that while experienced computer users learn quickly, novices do not. If indeed the nurses are learning the system as they go, as they describe, this lack of application knowledge could certainly serve to exacerbate their sense of time urgency and frustrations with CareChart. Their lack of training would surely affect their CareChart use, and their perceptions of it's potential uses. If an individual's adoption of innovations is influenced by their belief in their capacity to perform the specific, necessary tasks (Kim & Kim, 1996), these nurses are describing themselves as non-adopters.

The nurses also mention that they need training on basic computer skills, and instruction on how to navigate in the Windows environment. For those who have received the institution's version of a Windows light course, they cited limit practice opportunities and equipment; they need to practice on the workstations they'll be using in their clinics. If workstations are not available in the class, they need to have access to them on the job, to provide experience back to back with the training. Some would like to have an opportunity for more training, to learn more about CareChart's potential uses, and the purpose behind its design and implementation. The remarks within the Positive Aspects Training cluster serve as reinforcements for the training requests delineated so far. For example, two of the nurses who benefited from the one to one training efforts provided by the ITG staff, had high praise for the experience.

The remarks concerning learning describe how the nurses have used the varying amounts of training they have received to try and accommodate the CareChart application by adapting themselves and their work environment. Several subjects described their adaptations as "knows how to use well enough for now", accepting that they have "no time to learn on her own", or just doing "minimal computer use due to lack of knowledge" (Appendix E). And while there has been a workstation in the PAT clinic for several years, most of these

Lack of Knowledge cluster responses expose the nurse's self-perceived CareChart (and whole computer system) knowledge deficits. Often the situations these responses are describing illustrate software design issues, not lack of computer skills on the part of the nurses. The nurses are far too willing to assume problems they encounter with the CareChart application relate to their knowledge deficits, instead of possible software malfunctions. Perhaps the mind set of the self-taught perpetuates a habit of finding fault with the learner, instead of the tool. Furthermore, regardless of how long they'd owned home computers, or what extracurricular computer-type activities they engage it, these nurses still describe themselves as "computer illiterate".

It is not altogether unreasonable to correlate the unpleasant computer experiences these nurses have related about CareChart, and their limited exposure to user training opportunities, with the reasons gathered into the Disinterest in Computers cluster. The literature suggests that previous computer experience, whatever the setting, may influence nurses expectations (Chang, 1984; Hebert & Benbasat, 1994; Rogers, 1983). Perhaps, basing their expectations on their previous computer experiences, these nurses do not expect computers to be easy to learn and use. If the nurses are not interested in computer technology for its own sake, if they don't receive any incentive to accept the system in organizationally sponsored training sessions, they are certainly less likely to learn through active exploration on their own. At some point, the nurses or users need to be taught enough about the software applications to be able to ascertain their inherent ease of use, as well as their value. Training becomes crucial to the successful implementation of the CareChart application; regardless of what level of change the organizational team considers this change (Chin & Benne, 1985; Tappen, 1989; Zaltman & Duncan, 1977; Faaoso, 1992; Jacobsen & Fennell, 1989; FitzHenry & Snyder, 1996; Nielsen, 1993; Norman, 1988; Spitzer, 1993), even

those limited to software application upgrades, introducing the user-friendly format, Windows (Myers, personal communication, Feb. 22, 1996; Sandrick, 1996). Specifically, Ngin, et.al., suggests that computer training opportunities which allow nurses to improve their skills need to be made available to nurses after the hardware is in place.

Positive Responses and Data Important to Nurses

With the exception of one, all of the nurses responded by saying they didn't know enough about computers to be helpful when they were first approached for the interviews. However, by proceeding with the interview schedule's questions, their responses revealed progressively more information about CareChart. Several of the questions on measure three were specifically designed to encourage the subjects to describe more of their own experience, in an attempt to illicit factors which indirectly influence CareChart use.

The inductive coding process allowed the interview responses to be placed in into three groups; Reasons Given for Not Using the CareChart Application, Positive Aspects Specifically Related to CareChart or Nurses' General Information System Wants & Needs. As the responses were divided based on their meaning for and importance to the nurses, this process diminishes the likelihood that outside interpretations biases were introduced during data analysis. Including both critical and positive responses in the coding also provides a structure for identifying response patterns consistent with response set bias, i.e., socially desirable, acquiescent or nay-saying. Instead, the Positive Aspects Specifically Related to CareChart response clusters appear to enhance, and to some extent balance, their corresponding critical, or Reasons Given For Not Using CareChart, clusters. In particular, the Data They Want cluster provides an involved description of the different types of patient data the nurses believe they need, as well as the uses this data serves; further explaining the

reason clusters Data Not On-Line, Data Incomplete, Data Not Available Through CareChart, and Question Data's Currency.

Implications

PAT Clinic Nurses Acceptance & Use of the CareChart Prototype

Clearly, such low use of either application pathway has repercussions for the automated information system goals of this organization. One purpose for introducing an automated patient informational database is to increase the availability of patient information by improving the collection, organization and retrieval of patients records. The benefits associated with this automation are achieved, while decreasing the institution's dependence on a increasingly strained manual medical records department. The knowledge that the PAT clinic nurses are still seeking their patient data from sources other than the on-line patient information databases indicates several possible, ongoing issues related to this computerized patient medical record. Included in these issues are: Education and computer skill levels, usability and fit of the software applications to the institutions' idiosyncrasies, staffing and resource issues, as well as data needs and availability.

In addition, the institution has chosen to upgrade the existing automated patient information database by adopting a Windows-based access application. As cost alone would prohibit supporting two separate user interfaces, it appears the CareChart application is destined to eventually replace the existing access pathway (Myers, personal communication Feb. 22, 1996). However, the limited use of the existing access pathway suggests that acceptance and use of the current automated patient information base, at least by these nurses, has met with minimal success. Limited system use is a signal for the change leaders and management team to consider reassessing their current innovation implementation strategies. The virtually non-existent CareChart use figures

suggests that wide spread implementation of Care Chart into the ambulatory care clinics will be met with low acceptance and significant use difficulties.

Moreover, in addition to the CareChart implementation concerns, identifying the presence of sign-on misuse by some nurses, exposes problems with the ongoing organizational issues of sign-on policy compliance and system security. Four of the clinic nurses deny using CareChart while describing themselves as users of the existing access pathway. However, their unique, individual sign-on identification codes do not display on the two system generated reports. If these nurses are retrieving patient data from the patient information database using the existing access pathway, data retrieval is occurring under another system user's sign-on identification code, constituting sign-on misuse. Specifically, this finding demonstrates that the use of system generated reports as a monitor of employee system use is problematic, identifies sign-on security problems as well as the lack of staff compliance with institutional computer use policies. In addition, not knowing who is retrieving patient information under each unique sign-on identification code, rekindles the concerns related to patient information confidentiality. While it is probable that the organizational leaders have suspected a certain degree of sign-on policy non-compliance exists within their large population of system users, having this practice acknowledged as a finding of this research may give concerns for the security of confidential patient information a higher profile.

From the user's perspective, the stress associated with the disruption of normal work patterns and the upheaval in the work place experienced due to repeated system adjustments, carries more weight than do the financial concerns. This stress has implications for the organization if it increases resistance among the nurses by creating negative feelings about informational systems. Ultimately,

the successful implementation is dependent on the acceptance of the users (FitzHenry & Snyder, 1996).

For the software design company, this research's results provide an excellent opportunity to design solutions specific to the difficulties users associate with the application; corresponding with the *Adjustment And Improvement* stage of the conceptual framework (Figure 2d). Design changes, if undertaken now, have the potential of preventing, or at least minimizing, cost overruns associated with software application implementation. As some experts believe that the predominate software design cost overruns hinge on a misunderstanding of the user's perspective, these research findings clearly indicate using them to rectify conceptual misconceptions while improving the design (Gould & Lewis, 1987; Henderson, 1991; Jacobsen & Fennell, 1989; Nielsen, 1993).

A second software design implication pertains to the sign-on misuse finding. It is therefore possible, although unlikely given their interview statements, that PAT clinic nurses other than those credited with CareChart use are actually using the CareChart application as well. The results of this sign-on related human error may indicate that the nurses' use of the existing access pathway is lower for individual nurses than is reported. Perhaps obstacles inherent in the pathway design of both CareChart and the existing access pathway are prompting nurses to take short cuts where ever they can find them. Using another nurses sign-on identification code may simply be an easy solution for the nurses. However, two of the clinic nurses who said they did not use CareChart, but did use the existing access pathway also reported in their interview that they access the paper chart first, before they use the automated patient medical record. Therefore, it is possible that two of these nurses with no

sign-on code activity on the system reports could be accessing the paper chart instead, minimizing the presence of this error somewhat.

Acceptance & Use of CareChart by Three Nurse Role Groups

To demonstrate their acceptance of the CareChart application, all three role groups would use CareChart for their patient data retrievals. Instead, only two of the three groups, the RNCM and the ANP groups display data retrieval activity using CareChart. This system use variance by nurse role groups, suggests several implications for this institution in relationship to the CareChart implementation. Adopters of Innovations are described in the literature as belonging to one of five categories: innovators who adopt first (2.5%); early adopters, who adopt next, and are opinion leaders (13.5%); early majority, who are deliberate and cautious (next 34%); late majority skeptical and past-oriented (the mean and next 34%); and laggards, who are traditional (last 16%) (Rogers, 1983). Labeling the ANP subject who has owned a computer for five years, as an early adopter, accounts for ten percent of the sample, and twenty-five percent of the CareChart users. The second ANP who has owned a computer for an unknown amount of time, but uses CareChart, may be labeled as an early adopter. This now accounts for twenty percent of the sample and fifty percent of the CareChart users. The remaining two CareChart users each have owned a computer for about six months, fit nicely into the early majority category; the other five computer owning nurses could then be placed into the late majority category, or into the laggards with the one non-computer owning nurse. Fully sixty percent of the nurse sample involved in the pilot test of this prototype application represent individuals who are only likely to accept an innovation during the second half of the implementation. In the absence of the RNCM and ANP groups, it is possible that the majority of the clinic nurses will continue to be late majority or laggard category adopters of innovation; reinforced by the

homogeneity of their work groups (Rogers, 1983). This variation by nurses' job role and responsibilities, has significance for the management team of this organization. All types of patient data necessary to perform tasks associated with any of these role groups must be readily available through CareChart.

In addition, home computer ownership and use appear to have little impact on computer acceptance and usage in the work place, by this sample of nurses. While one-third of the families in America own computers, the majority are purchased and used by men (Kantrowitz, 1994). The nurses need to know how to use the applications, understanding their potential uses with respect to their role in the work place, as well as mastering the skills of efficient use. While this study only investigated the nurses in one clinic, three nurse role variations were found. In addition, this clinic is fairly specialized, addressing only the pre-anesthesia needs of patients; other clinics will have different patient information needs reflecting their specialties' patient mix, and staff role mix. The personnel in these clinical areas deserve customized training and user support, provided by individuals familiar with the clinical areas, the different staff roles involved in each area, and the CareChart application (FitzHenry & Snyder, 1996; Ngin, et.al., 1993).

The system designers need to be aware that different users have different information needs, and the RNCM, ANP, or clinic nurse role in the PAT clinic may well differ substantially from those roles in other specialty clinical areas. Following the changes engendered by this pilot of CareChart, a second iteration in a different clinical specialty area might be worth consideration (Gould & Lewis, 1987).

Patient Data Retrieved Using CareChart

The variation in the types of patient data retrieved using CareChart as it pertains to the three nurse role groups has meaning for the institution. These

nurses retrieve data from the ancillaries and patient databases in a manner reflecting their practice specialty; the frequency of their interview responses in the conceptual categories matches their role responsibilities as well. For the institution, these data retrieval patterns imply training related concerns for this institution. The ambulatory care clinics, whether general or specialty, will have different patient information needs mirroring their patient mix, and clinic functions. Therefore, all of these clinical areas deserve customized training predicated on their unique patient information needs and data retrieval patterns.

This variability in data retrieval patterns also has meaning for the software designers. The literature supports the necessity of supplying the information nurses need to complete job related tasks using computers (Corcoran-Perry & Graves, 1990; Graves & Corcoran, 1988a; Graves & Corcoran, 1988b; McCormick, 1991; Melia, 1989; Nielsen, 1993; Romano, 1990), as well as the logic that different types of users require different data (Norman, 1988). The type of data users retrieve relates to their information needs; and user variation may exist within and between clinical environments, as well as between and across users' roles. Software application designs need to reflect the needs of all groups of users, regardless job tasks, in all work environments and settings (Corcoran-Perry & Graves, 1990; Gould & Lewis, 1987; Graves & Corcoran, 1988a; McCormick, 1991; Melia, 1989; Norman, 1988; Romano, 1990).

Interview Response Themes

For the organization, the reasons given for not using CareChart in the Training cluster (Resource Issues), highlight the nurses informational systems educational and experiential needs. The Time cluster (Technical Issues), responses address the correctness of CareChart's fit regarding some of the clinical practice idiosyncrasies of this institution. The complimentary responses in the Positive Aspects Specifically Related to CareChart clusters and the data requests

in the Data Nurses Need & Want clusters, supplement and reinforce the critical responses, supplying insight into what portions of the automated patient information database nurses appreciate, accept and use. Therefore, the high frequency of critical responses as well as the presence of corroborating positive responses and responses indicating the data important to the nurses, provides the complete image of why the PAT clinic nurses do not use the CareChart application. This complete image clearly indicates that the two CQI goals for this CareChart pilot test (Ease of Use and User Acceptance), remain unmet at this time. The CareChart application needs to continue to circle through the iterative process outline in the Conceptual Framework (Figure 2b). While this iterative cycling continues, this organization should consider suspending further implementation of the prototype application as the new access pathway to the patient information database.

In addition, having the positive responses about CareChart as well as the responses indicating the types of data important to nurses reinforce and support the critical reasons for not using CareChart suggests that these nurses are capable of providing an unbiased picture of what they think and feel regarding both CareChart and the agency's automated patient information systems. However, even examined together, all of the interview responses can not negate the minimal CareChart use figures nor the probability that the majority of nurses fit Rogers' descriptions of late majority and laggard category adopters of innovation. Even if the CareChart application is altered based on the feedback of their problems and concerns, it is probable that the majority of the nurses will not be more receptive of a second iteration of the CareChart application unless the organization alters it's change strategies and tactics.

These identified themes also re-emphasizing the importance of this organization's position as partner in a collaborative relationship with the SMS

software. While the principle reason a health care delivery institution forms a partnership with a software design company is to accelerate their acquisition of the automation competitive edge (Carroll, et al., 1991; Wakerly, 1993), increasing the usability of the software makes the issues of user support and training assistance relevant as well. As a beta testing site, an institution may be asked to pilot test serial applications, resulting in a constant pattern of change for their system end-users. Often, the software company will supply personnel and expertise in training and user support activities at little or no cost, offsetting some of the organization's financial liabilities associated with these activities.

These themes highlight implications for the software company as it continues to use this institution's clinical practice areas for the iterative development of it's software applications, as well. Specifically, further user testing the CareChart application will refine it's design usabililty, while most likely heightening CareChart's overall marketability prior to it's release onto the health care delivery software market.

Obstacles to Nurses' Acceptance of CareChart

For the organization, specific reason clusters nurses give for not using the CareChart application may signal distinct connotations. For example, Existing Software Adequate, indicates that in addition to other CareChart design concerns, they also may have the public relations problem of inadequate or invisible management level support for the planned system upgrades (Havelock, 1973; Hebert & Benbasat, 1994; McClellan, et al., 1994; Rogers, 1983). In another instance, viewing the two reasons "Nurses View Computers As More Work", and "Come In Early To Adjust Work Pattern For Computers", as the actual sentiments of nurse users, the organizational leaders can begin to understand what has motivated nurses to resist adopting computer technological in general, and more specifically, CareChart (Bridges, 1991; Connor, 1993). According to FitzHenry

and Snyder (1996), process gains do not "sell themselves", and specific organizational change tactics are necessary for successful implementation. In particular, they suggest assigning influential staff to committees, setting improvement objectives, discretely analyzing process for automation, and selling the change: from the bottom-up, top-down and sideways (FitzHenry & Snyder, 1996).

The PAT clinic nurses clearly indicate a lack of interest in this technology, as evidenced by their responses in the Disinterest in Computers cluster. This gives credence to Harris (1990) suggesting that nurses have no interest in this technology, and to others who believe that nurses are simply unfamiliar with benefits associated with computer use. Regardless, nurses' view computers as a change requiring them to alter established, routine work flow patterns; a belief that usually increases resistance to change while it decreases their acceptance of the proposed improvement (Bridges, 1991; Chang, 1984; Connor, 1993; Hebert & Benbasat, 1994; Rogers, 1983; Romano, 1990).

For the software company, in addition to the areas for design improvement, the presence of all these reasons might indicate areas for future marketing efforts, serving as valuable information for their corporate representatives (FitzHenry & Snyder, 1996; Havelock, 1973). While the CareChart application may "sell itself" to other avid computer users, the designers must not forget that designers aren't typical users and there is no substitute for the interaction and the study of actual users of any proposed design. As Norman (1988) aptly remarks:

"There is a big difference between the expertise required to be a designer and that required to be user. In their work, designers often become expert with the *device* they are designing. Users often expert at the *task* they are trying to perform with the device." (pg. 156).

Time And CareChart's Ease of Use. With the insight provided by these Time Concerns and other related reasons, it is understandable why the nurses chose not to use CareChart. The image of the PAT clinic work environment provided just by these reasons reveals; this is a time pressured environment, CareChart does allow for the fluid nature of patient schedules and at times CareChart appears to be unreliability due to the inconsistencies of the network.

The organization is being told that this prototype application: (a) compares unfavorably with the existing access pathway (Relative Advantage), (b) is not perceived as consistent with needs of the users (Compatibility), and (c) does not demonstrate results which are visible to others (Observability). The CareChart application does not meet three characteristics described in the diffusion of innovation literature as necessary for adoption to take place (Rogers, 1983). Progressively, by adding the insights attached to each new research finding, the organization is developing an extensive image of the how their change tactics and strategies, as well as the proposed technological innovation itself, is perceived by the nurses.

Furthermore, the nurses are telling the CareChart designers several things about themselves: (a) time is a highly valued, expensive commodity in today's health care delivery market, (b) technology is not of value in and of itself, it's worth is calculated on the patient related outcomes and efficiency which are associated with its use, and (c) patients are nurses' primary focus, and ultimately, any tool must facilitate nurses' interactions and delivery of care to patients. Ease of use is virtually synonymous with timeliness in the nursing environment.

Training And CareChart's Ease of Use. For the organization, the implications have consistently concerned the ramifications of organizational change. If the upgrade to CareChart is a staged implementation ending with the

removal of the existing access pathway, the three training elements described certainly deserve consideration. The content of these training responses could help the organization decide what material the training should cover, who conducts the training, as well as how and when the implementation schedule proceeds (Hebert & Benbasat, 1994). As Windows-based applications are expected to be easier for users to learn and use, the organization may anticipate limiting implementation costs by decreasing or eliminating user training (Myers, personal communication, Feb. 22, 1996; Sandrick, 1996). The minimal use of CareChart by these nurses, coupled with the volume of Time and Training Concerns responses, suggests that continuing the strategy for implementation of CareChart will meet with user rejection, which will only be intensified if application training is further minimized or eliminated. The nurses are telling their institution that changes introduced without education and practice opportunities are not readily embraced.

For the software design company, sharing this feedback with the CareChart system designers allows them to know what the nurses have been able to learn about the application from their limited training, have learned on their own or through hearsay. In particular, these responses illustrate that while the usability engineering principle of designing the system to encourage user exploration is a good design premise, it should not be relied upon as a replacement for training and system support prior to, during, and after implementation (Gould & Lewis, 1987; Hoffman, personal communication, 1990; Jacobsen & Fennell, 1989; Moran, 1994; Nielsen, 1993; Norman, 1988).

Positive Responses and Data Important to Nurses

This organizations gain an improved awareness of the value and credibility of its nursing personnel, by virtue of the open, honest and unbiased nature of the feedback they provide for the both CareChart application and the

pilot test process itself. By demonstrating their ability to provide constructive criticism, these nurses confirm their worth as effective, invaluable system design partners and the system design engineers benefit as from descriptions of what is workable, or efficient, in their design.

Summary

In summary, the significance and relevance of current, complete and readily accessible patient information to health care providers is well recognized and thoroughly documented. The automated patient medical record system is replacing the manual, paper medical record system which has long served as the backbone of our health care delivery system. The successful union of health care technology and informational systems technology is integral to the success of any health care delivery institution in the health care environments of the future. Innovations in the information technology industries continue to impact, inform and guide the patient information pathway for health care providers. While this growth and development produce significant benefits and improvements, it also requires ongoing adaptation from patients, providers and administrators of the health care industry.

A new type of health care delivery team is developing to keep pace with the rapidly changing world of information systems in health care delivery institutions. Patient care professionals need to work in conjunction with informational systems designers to design, create, produce and manage the automated patient medical records systems necessary to successfully navigate the expanding information highway.

Nurses are uniquely situated to step into this clinician-informatics liaison role. They possess the necessary knowledge base to inform the research, design and production aspects of the software applications; and they have the interpersonal skills necessary to support the implementation and ongoing

adjustments necessary to achieve user acceptance. The Iterative Design Process accepted by both the usability engineering and system design fields as essential to successful software design and development overlaps seamlessly with the Continuous Quality Improvement management paradigm accepted by nursing.

Using this combined process of CQI and iterative design, this study utilized both qualitative and quantitative approaches to investigate if ambulatory care nurses use the automated patient medical record system to obtain patient information, how frequently they were using it, and what information they were retrieving. The two CQI goals of User Acceptance and Ease of Use were not supported; requiring the CareChart application to continue circling through the stages of *Testing, Validation, Adjustment & Improvement,* as necessary. The results suggest that while the nurses enter the automated patient medical record, they do not use the new, character-based prototype application, CareChart. Instead, they prefer to use the current access application pathway they are familiar and comfortable with, which allows them to obtain patient data more quickly when compared with the prototype application. Once in the medical record, the types and amounts of patient data nurses retrieve vary between the three role groups of clinic nurse, Adult Nurse Practitioner, and RN case manager, exhibiting only minor variation in the types of patient data most frequently retrieved by the members in each group. In addition, a descriptive list of reasons' nurses gave for not using the prototype software application were compiled. These reasons were clustered into the three conceptual categories of Technical, Resource and Data Management issues. The largest group of responses were clustered in the Technical Issues category (Time Concerns) and in the Resource Issue category (Training Concerns). The reasons clustered into the Data Needs and Data Availability sub-categories within Data management, ranked closely behind in frequency of responses.

Implications for research

Both nursing practitioners and the nursing profession need to embrace and support the emerging field of nursing informatics; a combination of both the science and art of nursing informational systems. Nurses in the clinical patient care environments must increase their use of computerized information systems; expanding their involvement in the design and implementation of the automated patient medical records systems they use. Nurse managers, need to encourage and administratively support this involvement on the part of their nursing staff. The nursing profession needs to continue to incorporate computer use skills in undergraduate curriculum, while supporting nursing informatics programs at the graduate level, and continuing to lobby nationally for nursing involvement in the informational aspects of national health care reform.

Health care delivery institutions need to re-examine their informational systems departments, and insist on the presence of clinically prepared nursing professionals in the role of clinical systems administrators or liaisons. And finally, computer software companies need to include nurses in all phases of the design, development, production, marketing and maintenance of clinically oriented software applications, destined for the heath care industry.

Limitations of the study. This study did ascertain the frequency with which PAT clinic nurses use the CareChart application to retrieve patient data, and the types of patient data they retrieve. In addition, this research generated a extensive list of reasons these nurses give for not using CareChart, creating a comprehensive end-user conceptual model while demonstrating the advantages associated with interviewing software application end users.

The design of this research was descriptive. Therefore, all comparisons are presented as circumstantial and detailed statements, rather than as conclusions. Other constraints inherent in the chosen design and methodology

for this study include using of computer generated system reports. Customized computer generated reports which include both the sign-on and the sign of date and time would facilitate the combined use of two reports as measurement instruments. Also, such a report format would assist with the following design-related difficulties which impair the strength of the research findings.

One difficulty this research identified, is the presence of a human error weakening the reliability and validity of system generated reports as measures. Data retrievals are attributed to the nurse who's assigned sign-on identification code is collected by the patient information database tracking mechanisms. As a result, system use totals for both the CareChart application and the existing access pathway are skewed, artificially inflated by the use of another nurse. Therefore, the conclusions drawn from this data regarding system application use behaviors in individual nurses are limited, however, the presence of this error does not affected conclusions drawn from the data for application use of nurses in the aggregate.

Future Research

Several areas warranting further research surfaced in this study. The implementation of a second iteration of the CareChart application could be studied using the methodology of this research, allowing comparison of these two research study's results. Would the results of this research study have varied using different research methodological approaches? Further investigation scrutinizing how nurses use automated patient medical records is needed, for instance, the many areas of clinical nursing practice need exploration. A study which examined the system use variations which were found between the Adult Nurse Practitioner and the RN case manager groups of nurses, would be interesting. This study found no variation in the data retrieval patterns of individual nurses, however, is there variation in the data retrieval patterns

between nurses across units? What are nurses' information needs for computerized medical records systems and how does this vary in different clinical settings? What are the information sources nurses use to meet these needs? Would analysis of clinical workplace settings aimed at describing nursing work flow patterns assist in addressing nurses' resource related issues and concerns? Also, to what extent are nurses innovators, early adopters, early majority, late majority or laggard adopters of informational system technological innovations in health care delivery settings? Or, further investigations into the key elements necessary for successfully implementing a clinical application or upgrade, is also warranted. And finally, more systematic research into the effects of the various components of informational systems to document the effect computers have on nurses' time, is needed.

References

Amidon, P. (1992). Widening privacy concerns. ONLINE, 64-67.

Anderson, L. G. (1992). Combating crime in outpatient surgery centers: Monitoring behaviors and practices. Association of Operating Room Nurses, 55(3), 801- 810.

Axford, R. L., & Carter, B. E. L. (1996). Impact of clinical information systems on nursing practice: Nursing perspectives. Computers in Nursing, 14(3), 156-163.

Bailey, T. C., & Reichley, R. M. (1992). Investigation of a computer virus outbreak in the pharmacy of a tertiary care teaching hospital. Infection Control and Hospital Epidemiology, 13(10), 594-8.

Bakker, A. R. (1993). Access to medical databases; Theory and practice response to: Pangalos G.J.: Medical database security policies [Editorial]. Methods of Information In Medicine, 32(5), 357.

Barber, B. (1992). Security screening. Nursing Times, 88(49), 50-52.

Beckhard, R., & Pritchard, W. (1992). Changing the essence: The art of creating and leading fundamental change in organizations. San Francisco, CA: Jossey-Bass.

Bergman, R. (1993). A doctor in the network: Physician links improve access to critical data. Hospitals, 67(9), 24-6.

Bialorucki, B. B. A., & Blaine, M. J. (1992). Protecting patient confidentiality in the pursuit of the ultimate computerized information system. Journal of Nursing Care Quality, 7(1), 53-56.

Bishop, C. W. (1991). A new format for the medical record. MD Computing, 8(4), 208-215.

Bridges, W. (1991). Managing transitions: Making the most of change. Reading, MA: Addison-Wesley.

Brooks, G. M., Semenuk, T., & Vaughan, V. S. (1988). Controlling Information: Who, What, How? Computers in Healthcare, 9(1), 16-18.

Brown, P. (1988). Not to be handled by patients. Nursing Times, 84(22), 44-45.

Butzen, F., & Furler, F. (1986). Computer security: A necessary element of integrated information systems. Bulletin of Medial Library Association, 74(3), 210-216.

Carroll, J. M., Kellogg, W. A., & Rosson, M. B. (1991). The task-artifact cycle. In J.M. Carroll (Ed.), Cambridge series on human-computer interaction designing interaction psychology at the human-computer interface (pp. 74-102). Cambridge, Mass: Cambridge University Press.

Caton, K. A. (1995). personal communication.

Chan, L. S., & Schonfeld, N. (1993). How much information is lost during processing? A case of pediatric emergency department records. Computers and Biomedical Research, 26, 582-591.

Chang, B. L. (1984). Adoptions of innovations: Nursing and computer use. Computers in Nursing, 2(6), 229-235.

Chin, R., & Benne, K. D. (1985). General strategies for effecting changes in human systems. In W.G. Bennis, K.D. Benne, & R. Chin (Eds.), The planning of change (4th ed., pp. 22-45). New York: Holt, Reinhart and Winston.

Chute, C. G., Cesnik, B., & van Bemmel, J. H. (1994). Medical data and knowledge management by integrated medical workstations: summary and recommendations. International Journal of Bio-Medical Computing, 34, 175-183.

Chu, S. (1993). Part II - clinical information systems: The nursing interface. Nursing Management, 24(11), 58-60.

Connor, D. R. (1993). Managing at the speed of change. New York: Villard.

Corcoran-Perry, S., & Graves, J. (1990). Supplemental-information-seeking behavior of cardiovascular nurses. Research in Nursing & Health, 13(2), 119-127.

Council of Academic Affairs, A. M. A. (1993). Feasibility of ensuring confidentiality and security of computer-based patient records. Archives Of Family Medicine, 2(5), 556-560.

Council of Scientific Affairs, A. M. A. (1993). Users and uses of patient records report of the Council on Scientific Affairs. Archives of Family Medicine, 2(6), 678-81.

Coyne, R. (1995). Designing information technology in the postmodern age: From method to metaphor. Cambridge, Mass: The MIT Press.

Curran, M., & Curran, K. (1991). The ethics of information. Journal Of Nursing Administration, 21(1), 47-49.

Dahms, P. (1990). Personal communication.

Del Bueno, D. J. (1986). Power and politics in organizations. Nursing Outlook, 34(3), 124-128.

Dillon, T.W., McDowell, D., Norcio, A.F., & DeHaemer, M.J. (1994). Nursing acceptance of a speech-input interface: a preliminary investigation. Computers in Nursing, 12(6), 264-71.

Emson, H. E. (1988). Confidentiality: A modified value. Journal of Medical Ethics, 14, 87-90.

Faaoso, N. (1992). Automated patient care systems: The ethical impact. Nursing Management, 23(7), 46-48.

FitzHenry, F., & Snyder, J. (1996). Improving organizational processes for gains during implementation. Computers in Nursing, 14(3), 171-180.

Fletcher, J. C. (1991). Ethics is everybody's business especially in regard to confidentiality. The Journal Of Clinical Ethics, 2(1), 30-31.

Gellman, R. M. (1986). Divided loyalties: A physician's responsibilities in an information age. Social Science and Medicine, 23(8), 817-826.

Gilhooly, M. L., & McGhee, S. M. (1991). Medical records: Practicalities and principles of patient possession. Journal Of Medical Ethics, 17(3), 138-143.

Gould, J. D., & Lewis, C. (1987). Designing for usability: Key principles and what designers think. In R.M. Baecker & W.A.S. Buxton (Eds.), Readings in human- computer interaction: A multidisciplinary approach (pp. 528-539). San Mateo, CA: Morgan Kaufman Publishers, Inc.

Grady, C., Jacob, J., & Romano, C. (1991). Confidentiality: A survey in a research hospital. The Journal Of Clinical Ethics, 2(1), 25-30.

Graves, J., & Corcoran, S. (1988a). Design of nursing information systems: Conceptual and practice elements. Journal of Professional Nursing, 4(3), 168-177.

Graves, J. R., & Corcoran, S. (1988b). Identification of data elements categories for clinical nursing information systems via information analysis of nursing practice. Proceedings-Symposium on Computer Applications in Medical Care.

Grobe, S. (1984). Conquering computer cowardice. The Journal of Nursing Education, 23(6), 232-39.

Halperin, E. C. (1988). The right to privacy and the duty to protect. Southern Medical Journal, 81(10), 1286-1289.

Hammond, J., Johnson, H. M., Varas, R., & Ward, C. G. (1991). A qualitative comparison of paper flowsheets vs a computer-based clinical information system. Chest, 99(1), 155-7.

Hard, R. (1990). Computers help keep patient files confidential. Hospitals, 64(16), 49-50.

Hard, R. (1992). Keeping patient data secure within hospitals. Hospitals, 66(20), 50.

Harris, B.L. (1990). Becoming deprofessionalized: One aspect of the staff nurse's perspective on computer-medicated nursing care plans. Advances in Nursing Science, 13(2), 63-74.

Harrell, A. (1994). Building a patient record system. Health Progress, 75(3), 51- 54.

Havelock, R. G. (1973). The strategies and tactics of innovation: The change agent's guide to innovation in education. Englewood Cliffs, NJ: Educational Technology.

Hebert, M., & Benbasat, I. (1994). Adopting information technology in hospitals: The relationship between attitudes/expectations and behavior. Hospital & Health Services Administration, 39(3), 369-83.

Henderson, A. (1991). A development perspective on interface, design, and theory. In J. M. Carroll (Ed.), Cambridge series on human-computer interaction: Designing interaction psychology at the human-computer interface (pp. 254-268). Cambridge, MA: Cambridge University Press.

Hendrickson, G., & Kovner, C. T. (1990). Effects of computers on nursing resource use: Do computers save nurses time? Computers in Nursing, 8(1), 16-22.

Hoffman, K. (1990). Personal communication.

Horan, S. (1993). Absolute confidentiality - myth or reality. Occupational Health: A Journal for Occupational Health Nurses, 45(1), 16-18.

Huberman, A. M., & Miles, M. B. (1994). Qualitative data analysis: An expanded sourcebook (2nd ed.). Thousand Oaks: SAGE Publications.

Hunt, D. V. (1992). Quality in America. How to implement a competitive quality program. Irwin, IL: Business One.

Jacobsen, T. J., & Fennell, S. E. (1989). Systems life cycle: Strategy for managing the impact of information systems on nursing. In V.K. Saba, R.A. Rieder, & D.B. Pocklingtom (Eds.), Nursing and computers: An anthology. (pp. 40-45). New York: Springer-Verlag.

Jones, K. (1991). Computer systems in labor and delivery units. Critical care issues. Journal of Obstetric, Gynecological and Neonatal Nursing, 20(5), 371-75.

Kantrowitz, B. (1994). Men, women and computers. Newsweek, CXXIII(20), 48- 55.

Karat, J., & Bennet, J. C. (1991). Working within the design process: Supporting effective and efficient design. In J. M. Carroll (Eds.), Cambridge series on human- computer interaction designing interaction. Psychology at the human-computer interface (pp. 269-285). Cambridge, Mass.: Cambridge University Press.

Kim, I., & Kim, M. I. (1996). The effects of individual and nursing unit characteristics on willingness to adopt an innovation: A multilevel analysis. Computers in Nursing, 14(3), 183-187.

Kincaid-Smith, P. (1991). Computers in practice. The Medical Journal Of Australia, 154, 80.

Lawrence, P. R. (1991). How to deal with resistance to change. In, Management of change (pp. 77-85). Boston: Harvard Business School Press.

Lumsdon, K. (1993). Holding networks together: Shared information will be glue for reformed health system. Hospitals, 67(4), 26-27.

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

McClellan, M. A., Henson, R. H., & Schmele, J. (1994). Introducing new technology: Confusion or order? Nursing Management, 25(7), 38-41.

McClowy, S. G. (1991). Validity concerns: A commentary in response to "Confidentiality". The Journal Of Clinical Ethics, 2(1), 31-32.

McCormick, K. A. (1991). Future data needs for quality of care monitoring, DRG considerations, reimbursement and outcome measurement. Image, 23(1), 29.

Melia, K. (1989). Computer ethics. Nursing Times, 85(29), 62-63.

Milholland, D. K. (1994). Privacy and confidentiality of patient information challenges for nursing. Journal Of Nursing Administration, 24(2), 19-24.

Moran, T. P. (1994). Introduction to this special issue on context in design. Human-Computer Interaction, 9(1), 1-2.

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), 239-44.

Myers, S. (Feb. 22, 1996). Personal communication.

NCNR Priority Panel on Nursing Informatics. (1993). Nursing Informatics: Enhancing patient care. (NIH Publication No. 93-2419). Washington, DC: National Institute of Nursing Research, National Institutes of Health.

Ngin, P., Simms, L. M., & Erbin-Roesemann, M. (1993). Work excitement among computer users in nursing. Computers in Nursing, 11(3), 127-133.

Nichols, R. (June 12, 1996). Personal communication.

Nielsen, J. (1993). Usablity engineering. Mountain View, CA: Academic Press AP Professional.

Norman, D. A. (1988). The design of everyday things. New York: Doubleday.

Ozbolt, J. G., & Graves, J. R. (1993). Clinical nursing informatics. Developing tools for knowledge workers. Nursing Clinics of North America, 28(2), 407-425.

Pacey, A. (1983). Technology: Practice and culture. Cambridge, MA: The MIT Press.

Pangalos, G. J. (1993). Medical database security policies. Methods of Information In Medicine, 32(5), 349-56.

Perreault, L. E., & Wiederhold, G. (1990). System design and evaluation. In E.H. Shortliffe, L.E. Perreault, G. Wiederhold, & L.M. Fagan (Eds.), Medical informatics: Computer applications in health care (pp. 151-178). Reading, MA: Addison-Wesley Publishing Company.

Pettigrew, A., Ferlie, E., & McKee, L. (1992). Receptive and non-receptive contexts for change. In, Shaping strategic change (pp. 267-299). London: Sage.

Piesse, B. (1987). The importance of confidentiality. The Australian Nurses Journal, 16(8), 48-50.

Polit, D. F., & Hungler, B. P. (1991). Nursing research: Principles and methods (4th ed.). New York: J.B. Lippincott Company.

Public Health Service. (1991). Report to congress: The feasibility of linking research-related data bases to federal and non-federal medical administrative data bases. In Agency for Health Care Policy and Research, AHCPR Publication No. 91-0003. Rockville, MD: U.S. Department of Health and Human Services, Public Health Service.

Ritchie, L. D., Taylor, M. W., Milne, R., & Duncan, R. (1991). Computer virus infection. The Lancet, 338(8782-8783), 1598.

Rittman, M. R., & Gorman, R. H. (1992). Computerized databases: Privacy issues in the development of the nursing minimum data set. Computers in Nursing, 10(1), 14- 18.

Rogers, E. M. (1983). Diffusion of innovations (3rd ed.). New York: The Free Press.

Romano, C. A. (1987). Privacy, confidentiality, and security of computerized systems: The nursing responsibility. Computers in Nursing, 5(3), 99-104.

Romano, C. A. (1990). Diffusion of technology innovation. Advances In Nursing Science, 13(2), 11-21.

Safran, C., Rind, D., Citroen, M., Bakker, A., Slack, W. V., & Bleich, H. L. (1995). Protection of confidentiality in the computer-based patient record. MD Computing, 12(3), 187-192.

Sandrick, K. (1996). Interview: John E. Abele. Hospitals & Health Networks, 70(1), 28-30.

Schiedermayer, D. L. (1991). Guarding secrets and keeping counsel in the computer age. The Journal Of Clinical Ethics, 2(1), 33-34.

Schmaus, D. (1991). Computers in the OR. Association of Operating Room Nurses, 54(4), 885-890.

Shaver, K. S. (1995). The diffusion of computer use in schools of nursing. Unpublished master's thesis. Oregon Health Sciences University, Portland, Oregon.

Siegler, M. (1982). Confidentiality in medicine: A decrepit concept. The New England Journal of Medicine, 307(24), 1518-1521.

Simpson, G., & Kendric, M. (1997). Nurses' attitudes towards computerization in clinical practice in a British general hospital. Computers in Nursing, 15(1), 37-42.

Simpson, R. L. (1995). To retool the workplace, you'd better have the right technology tools. Nursing Administration Quarterly, 20, 87-89.

Skolniek, A. A. (1996). Experts explore emerging information technologies' effect on medicine. Journal of the American Medical Association, 275(9), 669-670.

Smith, A. W., & Jones, A. (1991). Computerizing medical records: Legal and administrative changes necessary. HealthSpan, 8(11), 3-6.

Spackman, K. (1996). Personal communication.

Spitzer, P. G. (1993). A comprehensive framework for I/S strategic planning. Computers in Healthcare, 144(5), 28, 30-33.

Stockton, A. H., & Verbey, M. P. (1995). A psychometric examination of the Stronge-Brodt nurses' attitudes towards computers questionnaire. Computers in Nursing, 13(3), 109-113.

Tannen, D. (1994). Gender gap in cyberspace. Newsweek, CXXIII(20), 52-53.

Tappen, R. M. (1989). Strategies for planned change. Nursing leadership and management: Concepts and practice (2nd ed.). Philadelphia: Davis.

Wakerly, R. (1993). Open systems drive health information networks. Computers in Healthcare, 14(3), 32-35.

Wallace-Scroggs, A., Pool, B., & Lee, K. (1989). SMS Order Processing Glossary. Unpublished document, Oregon Health Sciences University, Portland, Oregon, 1-13.

Waller, A. A., & Fulton, D. K. (1993). The electronic chart: Keeping it confidential and secure. Journal of Health and Hospital Law, 26(4), 104-108.

Weiss, B. D. (1982). Confidentiality expectations of patients, physicians, and medical students. Journal of the American Medical Association, 247(19), 2695-2697.

Weber, R. P. (1985). Basic content analysis. In J.L. Sullivan & R.G. Niemi (Eds.), Quantitative Applications in the Social Sciences. 52(07-049). Beverly Hills: SAGE Publications.

Willis, J. (1992). Networking: seamless care. Nursing Times, 88(49), 52.

Willson, D. (1994). Survey of nurse preceptions regarding the utilization of bedside computers. Proceedings - the Annual Symposium on Computer Applications in Medical Care., 553-557.

Wolfe, K. (1990). Confidentiality and common sense. American Association of Occupational Health Nurses Journal, 38(7), 338-340.

Zaltman, G., & Duncan, R. (1977). Introduction to social change: Strategies for planned change. New York: Wiley.

Zielstorff, R. D., Hudgings, C. I., Grobe, S. J., & The National Commission on Nursing Implementation (NCNIP) Task Force on Nursing Information Systems. (1993). Next-generation nursing information systems: Essential characteristics for professional practice. Washington, DC: American Nurses Publishing.

Appendix A

Study Subject Consent Form

Study Title: The Frequency, Variability And Barriers Of Use Associated With A Windows-Based Software Application Prototype By Nurses In An Pre-Anesthesia Testing Clinic.

Principal Investigator: student: Allyson Wallace-Scroggs; 494-7322

Study Advisors: Darlene McKenzie; 494-3803 and Leslie Ray; 494-3806

You have been invited to participate in this research study because you are a nurse, working in the OHSU Pre-Anesthesia Testing clinic. The purpose of this study is to investigate how ambulatory care nurses use CareChart to access the LCR. We hope as a result of this study, to better describe nurses needs to the system designers and engineers. You may or may not personally benefit from participating in this study. However, by serving as a subject, you may contribute new information which may benefit others in the future. As a nurse working at OHSU, any improvements made to the software applications you will be using, will directly benefit your work environment, as well as the entire OHSU computer user community. The involvement of patient care providers in the design and implementation of the information systems fulfills a mandate of the National League of Nursing.

You will be asked to take part in a 20 minute, semi-structured interview conducted by the principal investigator. This interview will follow a scheduled format, containing closed and open-ended questions, and your responses will be audio taped. You will be asked general questions about owning and using a computer away from work and what you use the computer for. You will be asked specific questions about using or not using

CareChart, what information you use CareChart for, and what reasons you have for not using CareChart. In addition, you will be asked about using or not using the GUI pathway while in CareChart, what other information you 'd like to have on the computer, what information you need for providing patient care that isn't on the computer, and how you currently get that information.

The only discomforts associated with this study will be any inconvenience you may experience due to the time it takes to complete this interview. There are no costs to you for participation in this study. There are no treatments or compensation offered in the event of complication. However, you have not waived your legal rights by signing this form.

No information concerning your name, or user sign-on identification code is to be transmitted outside of OHSU. Neither your name nor you identity will be used for publication or publicity purposes. According to Oregon law, suspected child or elder abuse must be reported to appropriate authorities.

The Oregon Health Sciences University, as an agency of the state, is covered by the State Liability Fund. If you suffer any injury from this research project, compensation would be available to you only if you establish that the injury occurred through the fault of the University, its officers, or employees. If you have further questions, please call the Medical Services Director at (503) 494-8014.

As the principle investigator (Allyson Wallace-Scroggs @ (503) 494-7322), I am willing to answer any other questions you may have about this study. In addition, if you would like to speak with either of my advisors, you may contact them; Darlene McKenzie @ (503) 494-3803 or Leslie Ray @ (503)

Appendix B

Semi-Structured Nurse Interview Schedule

1). General Questions:

a). age range: 20-29; 30-39; 40-49; 50-59; 60-69; 70-79

b). gender: M F

c). Do you use a computer away from work or at home?

d). What do you use the computer for?

2). Specific Questions:

a). Do you use the CareChart application?

b). What do you use the CareChart application for?

c). What are the reasons you don't use CareChart to get the patient information/data you need?

d). How do you usually obtain different types of patient information/data (i.e.: Lab results, ECG, etc.?)

e). Do you use the CareChart or do you use the GUI?

-of the time you access each department, what % of the time do you branch off from CareChart and go through GUI?

f). What information do you need for providing patient care that you don't get from the computer?

g). How do you get that information?

i). What other kind of information would you like to get from the computer system?

Categories	Sub-Categories	Clusters	Descriptors
	Software	Specific CareChart Design Concerns	Error messages were inaccurate
			Getting in and out of CareChart awkward
			Have to leave for some data
			Searching through data in CareChart takes time
			Don't use [Other] icon because of time to load CareChart
			Dictated reports label inadequately defined
		Time Concerns	CareChart slow to start
			Too slow
			Time pressure when patients waiting
			Interferes with patient contact & rapport
			[Other] could go faster
			[Other] is faster
			Would use CareChart if faster
			Original lab terminal system faster
			No time to practice after classes
			Likes CareChart, but ...Too slow
			Learning to wait
			Won't make patient wait while uses CareChart
			Time is a problem
			Doesn't use CareChart if low on time
			[Other] is faster to get started than CareChart
			Would use CareChart if had time

Categories	Sub-Categories	Clusters	Descriptors
		Existing Software Adequate	No advantage
			Prefers others
			Uses [Other]
			Nurses use [Other]
			Uses [Other] for other functions
Resource Issues	Competing Demands	Human Resources	Backtracking to get patient data
			Would decrease workload to get data
			Long wait for requested change to CareChart
			Asks others if can't find data
			No support to fix problems
			Adjusted work pattern to allow for CareChart slowness
			Avoid duplication of data collection efforts
			CareChart takes both time & money for print
			Computer generate more paper
			Come in early to adjust work pattern for computers
			Double effort-computer + paper trail
			Nurses view computers as more work
			Will user support help integrate software?
		Disinterest	Data collection would be difficult
			Doesn't ask for things (data) she doesn't think possible
			Don't know CareChart because don't use it
			Can't complain about system she doesn't use

Categories	Sub-Categories	Clusters	Descriptors
		Disinterest	No interest in computers outside work
			Not interested in learning more
			Nurses afraid to explore
			Nurses don't understand windows format
			Nurses fear damaging patient data and system
			Doesn't know what other data she wants
			Uses Chart first
			Uses LCR if chart unavailable
	Training	Lack Of Knowledge	Computer illiteracy
			Minimal computer use due to lack of knowledge
			Didn't know what [Other] icon for
			Doesn't know all the data available in LCR
			Infrequent exposure
			Doesn't know how to adjust CareChart; printing only one
			Doesn't know how to fit CareChart into work pattern
			Doesn't know overall systems picture
			Limited understanding of applications
			Doesn't know how to add on patients
			Doesn't know what CareChart can do for her
			Doesn't know how to use CareChart efficiently
			New screen-situation, doesn't know what to do
			Needs to find out what to do

Categories	Sub-Categories	Clusters	Descriptors
		Training Concerns	Experienced users learn quickly, novices can't
			Knows how to use well enough for now
			Only learn CareChart by repeated use
			Limited training
			Learn system as you go
			Need training with windows
			Wants training on CareChart potential uses & purpose
			Exploration helped her
			No experience back to back with training
			Nurses need training on basic computer skills
			Word of mouth passes misinformation
			Self taught-no training
			No time to learn on her own
			Part-time, missed training
			Need more training to use it for more
			Trained by another user
Data Management Issues	Data Needs	Data Not On-Line	Gets data from ancillary department
			Gets data from chart
			Gets data from other institutions
			Gets data from referring clinic

Categories	Sub-Categories	Clusters	Descriptors
Data Management Issues	Data Needs	Data Not On-Line	Gets data from referring doctor
			Gets data from other staff
			Gets data from patients
			Long delay until data on-line
			When patient not on schedule, can't find charts & no data on-line
			Handwritten data never available on-line
			Who's data on-line and who's not
		Incomplete Data	Patient data in CareChart incomplete
			If data not in Medical Record/CareChart, assumes data doesn't exist
			Wants all dictated patient data in LCR
			Chart data incomplete, hard to find
	Data Availability	Data Not Available Through CareChart	Wants one system for patient data
			Many people need same data
			LCR has data she needs
			Patient data in separate systems
			Patient data not available through CareChart

Categories	Sub-Categories	Clusters	Descriptors
	Data Availability	Ability To Alter Data On-Line	Doesn't allow add-on patients
			CareChart is view only
	Data Needs	Question Data's Currency	Chart availability unpredictable
			Doesn't know how current patient data is on-line
			Is up-to-date patient data in computer
			Clinic patient population are unreliable historians

Appendix C

Table C2. Categories, Sub-Categories, Clusters & Descriptors From Qualitative Data: Positives Aspects Specifically Related to CareChart and Nurses' General Information System Wants & Needs.

Category	Sub-Category	Clusters	Descriptors
Technical Issues	Hardware	Equipment Problems	Likes mouse vs light pen
	Software	Specific CareChart Design Positives	User support fixed her problem
			Uses CareChart
			Can find data in CareChart
			CareChart easy to use for patients on schedule
			CareChart helpful
			CareChart useful when data complete
			Data she needs now in CareChart
			Uses CareChart first
			Gets data from CareChart
		Time Comments	Seems to speed up with use
			Saves patient time
			Saves prep time
			Not time consuming once in it
		What Works	Uses computer to get data first
			Uses [Other] because has data she needs
			Ortho dictation into LCR very efficiently

Category	Sub-Category	Clusters	Descriptors
		What Works	Radiology gets data in to LCR pretty well
			Radiology reports well defined
			Moving between patients not as big a problem
Resource Issues	Competing Demands	Interest in Computers	Likes windows format
			Comfortable exploring computer applications
			Feels comfortable with computers
			Looks for solutions
			Self-adjusting to working with computers
			Expanding her use of windows
			CareChart not available in PACU
	Training	Training Comments	One -One training helpful
Data Management Issues	Data Needs	Data They Want	Type of patient data needed
			What data she wants on-line
			Wants CareChart on Inpatient side
			Wants to move efficiently around in patient data
			Needs financial screening report
			What she uses patient data on CareChart for

Category	Sub-Category	Clusters	Descriptors
Data Management Issues	Data Needs	Data They Want	Wants social work summary on-line
			Uses on-line data for QA activities
			Wants extra synopsis on CareChart
			Wants data from most recent hospitalization
			Wants discharge summary on-line
			Wants mandated dictation of patient data
			Wants reports labeled by who wrote it

Appendix D

Response Percentage Tables for the Nurse Role Groups for Reasons Given For Not Using CareChart and Positive Aspects Specifically Related to CareChart, As They Fit Into The Three Conceptual Categories.

Table D1. Percentage of responses by nurse role group as they fit into the three conceptual categories.

Category	ANP		RNCM		Clinic Nurses		Total
	N	%	N	%	N	%	N
Technical	25	33%	26	35%	24	32%	75
Resource	22	25%	23	26%	43	49%	88
Data Management	20	37%	22	41%	22	22%	54

Table D2. Conceptual categorization of positive and data related responses by nurse role group, in percent.

Category	ANP		RNCM		Clinic Nurses		Total
	N	%	N	%	N	%	N
Technical	11	48%	9	39%	3	13%	23
Resource	2	13%	7	44%	7	44%	16
Data Management	34	38%	10	29%	11	32%	34

Table D3. Conceptual categorization of reasons given for not using CareChart, Positive, and data related Total responses by nurse role group, in percent.

Responses	ANP		RNCM		Clinic Nurses		Total
Reasons Total	26	36%	26	36%	21	29%	73
Positive Aspects & Data Related Total	26	36%	26	36%	21	29%	73

Appendix E

Table E1: Technical Issues Category, Hardware Sub-Category: Equipment Problems Cluster.

User	N	Descriptors	Example
RN			
#9	1	No computer to use after training	"The windows light class that they gave people when the new workstations came up was really inadequate in reference to that the windows light class you had one temporary workstation, and then no time to work on it, and then by the time we actually got the workstations that were functioning, people just didn't .....they didn't get that experience back-to-back with education. And it was inadequate. The class was about an hour, then it was about six weeks before.....and only one on the unit.....which was off the unit in a separate room....."
RNCM			
#2	1	No computer to use after training	"[names] they'd set up some training, and but I only work part-time, and I'm really not computer literate, ...I did not have a computer at the time , and .....so."
#2	1	Computer didn't work for awhile	"I did not have a computer at the time , and ..... and then mine acted up for a while...."
ANP			
#4	1	Inadequate amount of hardware to access LCR	"If going to have information stored in a computer, you damn well are going to have to have enough screens so that people can then access it...not enough screens in pre-op holding areas, department of anesthesia, in the operating room.....not enough hardware to support that kind of system."
Total	4		

Appendix E

Table E2: Technical Issues Category, Hardware Sub-Category: System Does Not Work Cluster.

User RNCM	N	Descriptors	Example
#7	1	Computer system sometimes down when needed	"I also use the GUI system to enter orders, and referrals" (does that work well for you?) "Yes, when the computer's not down"
#7	1	Crashes other programs	"Anyway with the CareChart on there, I can't use the spreadsheet program to make the graphs and what not for the statistics there's a conflict in there somewhere. It made the other systems I need to use crash.
#7	1	CareChart crash forced taking home work	"Anyway with the CareChart on there, I can't use the spreadsheet program to make the graphs and what not for the statistics there's a conflict in there somewhere. It made the other systems I need to use crash. The ITG folks came over here and messed with it, and they weren't exactly sure what the problem was. So the end result was that I went home and did my graphs at home on my computer and couldn't do them here."
#7	1	Got error messages when tried to use CareChart	"From the beginning when we started testing it, ... you'd try to go into it and ours consistently got error messages that the program was already running....that it was open...."

User	N	Descriptors	Example
ANP			
#4	1	CareChart use fell when no longer automatically opened	"When we first started to use CareChart in this clinic, it was set up so that it would automatically open when turned on the computer in the morning, ...worked out okay for a while, but the workstation would crash because of bugs in CareChart. So, I said time out, we can't do they anymore, pull CareChart out of the boot. So, when we boot up, leave CareChart out of it, because, I have to have the workstation, and that's when CareChart usage starting falling off, when we took it out of the initial boot up."
#4	1	Work station crashed due to CareChart bugs	"When we first started to use CareChart in this clinic, it was set up so that it would automatically open when turned on the computer in the morning, ...it'll take a few minutes to get it up.....worked out okay for a while, but the workstation would crash because of bugs in CareChart."
#4	1	Integrate CareChart data with other software for outcomes research	"well tested on the pre-anesthesia software program ..... can then be used for statistics, generate alot of research and stats off it, correlate patient medical problems with anesthesia, with anesthesia outcomes ....do huge amount of research off of the information that is collected because of the way it is collected.....vendor assures that outside software is compatible with SMS, but is SMS willing to integrate it"
Total	7		

Appendix E

Table E3: Technical Issues Category, Software Sub-Category: Specific CareChart Design Concerns Cluster.

User	N	Descriptors	Example
LPN			
#5	1	Program awkward	"well we've talked about that, and there were some future projects I think that they're working on. in some ways I think it would be good, but I don't know the one that they were working on that I saw was like a million different pages, and you're just the way we gather our information, it's often not chronological, you know, it seems like it would be real difficult, switching back and forth....." (paraphrased) "when you ask the patient one question , sometimes they answer another of your questions and that would be hard to input with a computer. With paper you just write it down in it's spot."
#5	1	Moving from patient to patient is slow	" it's too slow" "to come up, and even then it seems slow, in fact I knew this interview was coming up so used it again last week. I thought, I'll try this again, just because I couldn't even remember, it'd been so long...and it took forever." "Once you get into it even that's real slow, going from patient to patient even just getting to that."
RN			
#8	1	[Other] better than [Other]	".... I like [Other] much better than [the previous system]".
#9	1	Excess printing isn't good	printing all the reports "that's not good"
#9	1	[Other] 4-5 steps longer than original lab system	"..... I need to pull labs up on all those patients we did in the morning, I can access labs quicker, going into the old lab function (old lab terminals), because you just hit PR again and you can stick in another medical record number, and you're right there on top of the labs, instead of the four or five steps it takes in [Other] to get the next person."

User	N	Descriptors	Example
RNCM			
#2	1	Only gives data for patients on daily schedule	(paraphrased) "not on patients that aren't scheduled.....would like to have that information for each patient"
#3	1	Only gives data for patients on daily schedule	"it's easy to use here, because the whole patient roster is here..." do you ever get patients that you are going to see that aren't on the roster? "yea, I had one today.....so I went into [Other] to get information on them"
#7	1	No on-line indicator of patient testing completed & results pending	"another problem is, well for example, I came in for a pre-op work-up, and I went to my clinic first, and then came here, and the clinic had already drawn my blood, but it was all in the same day, and it hasn't been run through the lab yet, and the results aren't in the computer, ...how are we going to know for sure whether or not it got done? That's not necessarily a glitch with the CareChart, but it's a glitch in the system"
#7	1	CareChart wouldn't come up at first	".....from the beginning when we started testing it, it wouldn't come up, if you double click on the icons, nothing would come up....."
#7	1	Error messages were inaccurate	".....from the beginning when we started testing it, it wouldn't come up, if you double click on the icons, nothing would come up, then you'd try to go into it and ours consistently got error messages that the program was already running....that it was open...."

User	N	Descriptors	Example
ANP			
#1	1	Getting in and out of CareChart awkward	"If we were using only one computer, it would be a pain, to have to get out of it each time and get back into it."
#1	1	Have to leave CareChart for some data	"Get out to get other information, if I have to order, then you have to get back into CareChart, so that's not good."
#1	1	Searching through data in CareChart takes time	".....it takes some time to sort through it. It takes a while, too , I'd like an extra synopsis, on CareChart of problems they are seeing, surgeries that they've had, and dates, that kind of stuff, because that would make it more accessible. Otherwise I still have to search through what's on the CareChart to pull out the stuff that I'm need."
#4	2	Dictated reports label inadequately defined	Also, dictated reports are all in one single folder, listed as dictated reports, whether or not it's history or physical, a discharge summary, or a progress note.....so I have to look at each and every one of them.....Wouldn't it be lovely if I could see somewhere on a screen which's a dictated report from ENT, what's a dictated report from Ortho, where is the admit history and physical, and where is that discharge summary? from the most recent hospitalization?" "reports defined better...
#4	1	Don't use GUI icon because of time to load CareChart	"no-one in this clinic does it.....no-body does that here, they go straight into [Other] from the workstation and by-pass CareChart completely. Because it takes CareChart a few minutes to load, & they don't want to tie up the screen that long just to get CareChart to load in the first place."
Total	16		

Appendix E

Table E4: Technical Issues Category, Software Sub-Category: Time Concerns Cluster.

User	N	Descriptors	Example
LPN			
#5	1	CareChart slow to start	" it's too slow to come up, and even then it seems slow, in fact I knew this interview was coming up so used it again last week. I thought, I'll try this again, just because I couldn't even remember, it'd been so long...and it took forever"
#5	2	Too slow	" ...it was so slow, I just kind of quit using it.....".
#5	1	Time pressure when patients waiting	" it's too slow.....usually we're in a hurry here and we don;t have time to wait"
#5	1	Interferes with patient contact & rapport	".....I don't like the idea of typing everything in front of the patient, we have so much information that we have to fill out, and we try to do it, all the paper work that we can, at the desk before we come into the room with a patient so that you're making eye contact instead of writing, writing, writing, and um, with the computer I'd be typing, typing, typing, and uh, not dealing with the patient and I feel that that would be kind of detrimental."
#5	1	[Other] could go faster	" I use [Other]; from the [agency] workstation, yea, I just take it off of that.....it could always probably go faster, but it's faster than the CareChart.
#5	1	[Other] could go faster	".....it [Other] could always probably go faster, but it's faster than the CareChart.

User	N	Descriptors	Example
RN			
#8	1	[Other] is faster	"what I need it for as RN in this clinic is for lab reports, faster with [Other], it works great".
#8	1	Too slow	"not anymore; no, too slow".
#8	1	Would use CareChart if faster	"I'd use CareChart if it were faster."
#9	1	Original lab terminal system faster	"I can access labs quicker, going into the old lab function (old lab terminals), because you just hit PR again and you can stick in another medical record number, and you're right there on top of the labs, instead of the four or five steps it takes in [Other] or [Other] to get the next person" .
#9	1	No time to practice after class	"The windows light class that they gave people when the new workstations came up was really inadequate. In reference to that the windows light class you had one temporary workstation, and then no time to work on it..."
RNCM			
#2	1	Likes CareChart, but...Too slow	"I do like it, it's just too slow"
#2	6	Too slow	"now see this is the part that bothers me too, I just this patient, I always icon onto pre-op orders, and it takes forever; (it takes to long to come up, and it takes to long to go into each patient) it seems to get faster with each patient.....it's crazy--but if I had patients waiting first thing in the morning, there's no way I could do this, it's too slow."
#2	1	Learning to wait	"One of the hardest things for me to learn was to be patient, when it didn't come up, I was clicking again I thought, oh it didn't take it, and that was with windows too."

User	N	Descriptors	Example
RNCM			
#3	2	Too slow	"it takes a terrible amount of time for it to come on..... It's a problem, it needs to come up quicker, I don't know why they can't figure it out. You should be able to hit it, sign-on, and go...."
#3	1	Won't make patients wait while uses CareChart	"it takes a terrible amount of time for it to come on....when I have to sit here and wait for three minutes for it to come on, when I have a patient a waiting....who's been talked to by ten people already, they just want to go home, their tired, and they've been here for 2 hours, and I'm the last person, they don't want me sitting in here for 5 minutes."
ANP			
#1	2	CareChart slow to start	"It takes a while to come up, so that I can use it, ..."
#1	1	Time is a problem	".....I'd probably would do better if I understood more of the system so that I can pull out what I wanted, more readily. Time is always a problem. .....I think there are some things that I don't know that I can do with this...that would kind of be like that inside knowledge like you were saying, you can pull this up by using this icon. That you might find at the time, and I that's alot of what I've done with the SMS system, I've just learn it at the time. .....I don't sit down here and say, I don't usually have the time to just sit down here and say lets see what this is. I don't get to just sit down and play."
#1	1	Too slow	"It's a little slow sometimes getting from patient to patient, but I don't think that's the problem. The major problem is getting into it to begin with. it's slow, and I have to leave it, ..."
#1	1	Time pressure when patients waiting	"It takes a while to come up, so that I can use it, and if I've got, if it's really intense, with a lot of patients waiting, and it takes some time to sort through it. It takes a while, too ,..... I still have to search through what's on the CareChart to pull out the stuff that I'm need."

User	N	Descriptors	Example
ANP			
#4	1	CareChart slow to start	"I don't find it that time consuming once I get into it, it takes a long time to bring it up"
#4	1	Doesn't use CareChart if low on time	"If I don't have time to get into it, otherwards it's not the top priority, it's an adjunct right now."
#4	2	[Other] is faster	"Pt switching is faster, because [Other], I don't know, it just doesn't take as long to load each individual file".
#4	2	[Other] is faster to get started than CareChart	"usually, usually I'll have to get a lab very very quickly while I'm doing patient care review, even when my day starts, and [Other] is faster to initially open up in the morning, and so I open [Other] first.."
#4	1	Won't make patients wait while uses CareChart	"usually, usually I'll have to get a lab very very quickly while I'm doing patient care review, even when my day starts, and [Other] is faster to initially open up in the morning, and so I open [Other] first.."
#4	1	Would use CareChart if had time	".....now if I can have 30-45 minutes before I start seeing patients in the morning, once I get it open and running, that works real well, but, but, [Other] is the faster way to get started, that's all there is too it."
Total	36		

Appendix E

Table E5: Technical Issues Category, Software Sub-Category: Existing Software Adequate Cluster.

User	N	Descriptors	Example
RN			
#8	3	Uses [Other]	" use [Other]---[Other] all the time."
#9	1	No advantage	"It didn't seem to have any information that wasn't found elsewhere, that I was already I comfortable with getting"
#9	1	Prefers others	"because I feel comfortable, using [Other]"
#10	1	Prefers others	"usually I just need to go through [Other], and get everything through [Other]"
RNCM			
#2	1	Uses [Other]	(Do you go into [Other]) "All the time".
#2	1	Prefers others	"I always go over to [Other], and look under LCR ....."
#7	1	uses [Other] for other functions than viewing	"....I also use the [Other] system to enter orders, and referrals"
#7	1	Prefers others	"I use the [Other]"

User	N	Descriptors	Example
ANP			
4#	1	Uses [Other] Uses [Other] for lab work	"chart reviews, today's history and physical--I almost always go into [Other] to pull up lab work; and on my pre-op mode with [Other], (also my pre-op mode in CareChart) that gives me my list of lab results, dictated results, pulmonary function studies; whatever; the stuff I need to review"
#4	1	Nurses use [other]	"in this clinic ....., they go straight into [Other] from the workstation and by-pass CareChart completely."
Total	12		

Appendix E

Table E6: Resource Issues Category, Competing Demands Sub-Category: Human Resources Cluster.

User	N	Descriptors	Example
LPN			
#5	1	Backtracking to get patient data	" one thing that would be real helpful would be if we could to get the EKG's to use from here, in our clinic; pretty much everything else, pretty much we have what we need.....but we are frequently calling to get them faxed over from the department. it would be great we could access them ourselves. .....We have to call up to EKG, give them the patient's unit number, then they can't tell us on the spot, you know, they'll go look it up and fax it if they have it. Sometimes we are just waiting...not knowing what's going to come over or not. Sometimes they call back, sometimes they won't, I think it depends on how busy they are.....sometimes we're planning to do one on a patient, unless we get a copy from them, because it's not in the chart, and um....if we could just get it , we'd know that there is one."
#5	2	Would decrease workload to get data	"Oh, how could it possibly do that? [records from patients that are outside {agency}].....sure if I could have a whole wish list here, that would be great. call long distance, we have to fax long distance, it's a pain "
RN			
#8	1	Long wait for requested change to CareChart	(paraphrased) "it's so long since I tried it, ...but it just took to long...I just remember it ...when I needed to look up labs, it took too long...waiting...for them to put the X's on the folders .....it took to long."
#10	1	Asks others if can't find data	" Yes, I'm pretty adepatient at doing things, so it's not to bad, I fumble my way through the best I can, if I have any questions, I just ask someone else what I do I need to do to get this stuff"

User RNCM	N	Descriptors	Example
#2	1	No support to fix problems	(so you can't get the demographic information on CareChart) "... there's nothing up here (the CareChart desktop) that can give it too me. I mentioned that to them, and they said that because we already have a system to do that..."
#7	1	No support to fix problems	"....um, it conflicts with the spread sheet program that we have .....anyway with the CareChart on there, I can't use the spreadsheet program to make the graphs and what not for the statistics there's a conflict in there somewhere. It made the other systems I need to use crash. The ITG folks came over here and messed with it, and they weren't exactly sure what the problem was. So the end result was that I went home and did my graphs at home on my computer and couldn't do them here."
#2	1	Adjusted work pattern to allow for CareChart slowness	" In fact I'd better turn it on now; I usually turn this on cause it so long. .....my other screen is on first....There I just hit it and you just wait, it's going to take a long time. I usually come in here, turn on the computer, then go in there and get my papers, and....."
#2		Backtracking to get patient data	"I have to call, and try to figure out which financial specialist saw the person and what was the outcome"
#7	1	No support to fix problems	"...um, it conflicts with the spread sheet program that we have .....anyway with the CareChart on there, I can't use the spreadsheet program to make the graphs and what not for the statistics there's a conflict in there somewhere. it made the other systems I need to use crash. The ITG folks came over here and messed with it, and they weren't exactly sure what the problem was. So the end result was that I went home and did my graphs at home on my computer and couldn't do them here."
#7	1	Avoid duplication of data collection efforts	"Boy, that's a tough question.....um, I guess in a general sense I would like to see less duplication in different fields and a more standardized area that all of us are documenting on....."

User	N	Descriptors	Example
ANP			
#4	1	No support to fix problems	"they were supposed to fix that, and they didn't because I tried it on CareChart today"
#4	1	Cc takes both time & money for printing	"time and expense to print. "
#4	1	Computers generate more paper	" I feel very badly that the computer has not saved paper, ...many times it generates more paper....."
#4	1	Adjusted work pattern to allow for CareChart slowness	"if they all came to work five minutes earlier, turned on the computer immediately, and hit CareChart and just walked away for 5 minutes, then they wouldn't be so mad at it"
#4	1	Avoid duplication of data collection efforts	" .yea, so that the information that we start and collect in this hospital is part of that database used on the inpatient side so that we don't have to do it over again and over again and over again."
#4	1	Come in early to adjust work pattern for computers	"if they all came to work five minutes earlier, turned on the computer immediately, and hit CareChart and just walked away for 5 minutes, then they wouldn't be so mad at it"
#4	1	Double effort-computer + paper trail	"....it isn't different work, or more efficient work it's just more work. Because until the computer part is really part of our lives, we still have to have the paper trail....."
#4	1	Nurses view computers as more work	"nurses just fear 'oh more work', it isn't different work, or more efficient work it's just more work. Because until the computer part is really part of our lives, we still have to have the paper trail....."
#4	1	Will user support help integrate software?	"..[outside software vendor with anesthesia package]...vendor assures that outside software is compatible with SMS, but is SMS willing to integrate it"
#4	2	Would decrease workload to get data	I'd like to see ....it would be ideal to have laboratory and x-ray information from other hospitals on the computer to cut down dramatically on workload and faxing. It would be ideal"
Total	21		

Appendix E

Table E7: Resource Issues Category, Competing Demands Sub-Category: Disinterest in Computers Cluster.

User	N	Descriptors	Example
LPN			
#5	1	Data collection would be difficult	"well we've talked about that [about putting your paper work on the computer] , and there were some future projects I think that they're working on. in some ways I think it would be good, but I don't know the one that they were working on that I saw was like a million different pages, and you're just the way we gather our information, it's often not chronological, you know, it seems like it would be real difficult, switching back and forth....." after the interview, she paraphrased: when you ask the patient one question , sometimes they answer another of your questions and that would be hard to input with a computer. with paper you just write it down in it's spot
#5	1	Uses chart first	" that's our first thing, if we have the chart we'll just look for it there; we would not go into the computer if we have it in the hard chart,.. So if we have the chart, and it has everything in it, we don't do the computer until .....later in the day we try to get the results and put them on our paper work"
#5	1	Doesn't ask for things (data) she doesn't think possible	"Oh, how could it possibly do that? [get records from patients that are outside {agency}].....sure if I could have a whole wish list here, that would be great."
#5	1	Don't know CareChart because don't use it	" Um CareChart,.....it was so slow, I just kind of quit using it and now I feel like really don't know it very well"
#5	1	Can't complain about system she doesn't use	"that's true [add on patients not being on CareChart], but cause I don't use it, I can't complain about that"

User RN	N	Descriptors	Example
#8	1	No interest in computers outside work	"I'm outside gardening, I've no desire to sit in front of a computer. Absolutely not. I think there're great for what they do, believe me, but personally I wouldn't use it outside of work, it's not that important to me".
#8	1	Not interested in learning more	"I don't feel that I need it [more training helpful], I'm not really interested in what all this computer can do, it meets my needs here at work, I don't feel like I need to learn anymore".
#8	1	Uses chart first	"Try to get hard chart for all patients first"
#8	1	Uses LCR if chart not available	"..... use LCR if can't get hard chart"
#9	1	Nurses afraid to explore	" ..... and they are afraid to go explore....cause they think they are going to screw something up....."
#9	1	Nurses don't understand windows format	"and, I personally feel like that nurses at [agency] have not ever been given adequate training to windows.....80% of the people are still like, well how'd you do that.....they'll have their windows overlapped.....just to learn how to tile and cascade , they don't understand all these pull down functions..."
#9	1	Nurses fear damaging patient data and system	"they are afraid to go explore....cause they think they are going to screw something up....."
#9	1	Can't complain about system she doesn't use	[doesn't notice that can't add new patients] "I'm not that familiar with it to make a value judgment"
#10	1	Doesn't know what other data she wants	"um, nothing I can I think of...everything I think I use is there"

User	N	Descriptors	Example
RNCM			
#3	1	Doesn't know what other data she wants	"oh, that I'd have to think about [what other data she'd like on-line]...I don't work in here once or twice a month....."
Total	15		

Appendix E

Table E8: Resource Issues Category, Training Sub-Category: Lack of Knowledge Cluster.

User	N	Descriptors	Example
LPN			
#5	1	Computer illiteracy	"No, it [[Other]] seems to work pretty well, I basically know my little minute piece of the pie, and that's it. . . ..I'm very computer illiterate I feel like. .but I can kind of do [Other] and that's it, order processing, retrieving lab results, and that's about all I can do, or look up the schedule of the clinic, or stuff like that."
RN			
#8	1	Minimal computer use due to lack of knowledge	"I don't know that much about it...I don't utilize the computers as much as I probably should because I don't know that much about them I do my basic stuff here and get what I need."
#8	1	Computer illiteracy	"For me to understand it I'm not too computer literate here,....."
#10	1	Didn't know what [Other] icon for	have you ever seen it? "no" "I don't think I'm here enough to use it, I guess. this week I've been here every day, but I'm only here usually I here about once a week"
#10	1	Doesn't know all the data available in LCR	"not that I can think of, again it's so hard, I'm here so sporadically, that it makes it hard to even know what are the things I could get out of it if I needed to "
#10	2	Infrequent exposure	"not that I can think of, again it's so hard, I'm here so sporadically, that it makes it hard to even know what are the things I could get out of it if I needed to "

User	N	Descriptors	Example
RCNM			
#2	1	Doesn't know how to adjust CareChart; printing only one	"and the other thing, I haven't figured out how to print one report, ...some patients, you know, go back , and there's one report in the middle you want, and maybe I'd like to print it and send it over with my referral to the inpatient case manager"
#2	1	Doesn't know how to fit CareChart into work pattern	"I don't print usually, I just read. So sometimes if I could print what I wanted out of there, and take it with me, cause, um, I'm over here and I need to see patients, but maybe I'll have five minutes in between, and it's too hard to keep coming back and it needs time, and it's only going to get busier.
#2	1	Computer illiteracy	"[names] they'd set up some training, and but I only work part-time, and I'm really not computer literate, ..."
#2	1	Didn't know what [Other] icon for	Take me into [Other] through [CareChart]? I didn't know that, I've never used it"
#2	1	Doesn't know overall systems picture	" ...it [CareChart] could maybe be on the patients for that floor.....it's such a complex system....."
#3	1	Computer illiteracy	"I'm not real computer smart but I've figured out how I do it...."
#3	1	Didn't know what [Other] icon for	"I don't know what that [[Other] icon] is specifically, I've never used that ....I guess I need to learn how to use [Other], maybe it would be quicker..."
#3	1	Limited understanding of applications	"I'm not real computer smart but I've figured out how I do it; I go up to the workstation, ...oh I wonder why that gave that to me, that's a patient I had yesterday, and I wonder if I didn't sign off or something.....I guess I need to learn how to use [Other], maybe it would be quicker...I know [Other] so that's what I use....."
#3	1	Infrequent exposure	"I don't work in here once or twice a month....."
#3	1	Doesn't know how to add-on patients	"it maybe possible (to add them to CareChart) I wouldn't know how to do that, and I don't have time to try and learn how to do that right now...."

User	N	Descriptors	Example
ANP			
#1	1	Doesn't know what CareChart can do for her	"I'd probably would do better if I understood more of the system so that I can pull out what I wanted, more readily. ..... I think there are some things that I don't know that I can do with this...that would kind of be like that inside knowledge like you were saying, you can pull this up by using this icon."
#4	1	Doesn't know how to use CareChart efficiently	"I don't know efficiently how to move from that days roster to today's roster, and I should, but I haven't had to do that before...."
#4	1	New screen -situation; doesn't know what to do	I left the CareChart screen active.....actually not a big problem, I need to check it out more....same screen yesterday is there today.....I've got to find out a way to switch dates" .....it doesn't switch dates automatically when the new date comes on.....but I don't think that's a problem, it's more just me not knowing....I don't know efficiently how to move from that days roster to today's roster, and I should, but I haven't had to do that before...."
#4	1	Needs to find out what to do	"I left the CareChart screen active.....I've got to find out a way to switch dates"
Total	21		

Appendix E

Table E9: Resource Issues Category, Training Sub-Category: Training Concerns Cluster.

User	N	Descriptors	Example
LPN			
#5	1	Experienced users learn quickly, novices can't	" ....I mean we were shown everything, it's just that I 'd have to use it, use it, use it to get with it. I feel like I don't have much computer experience just to pick it up (snaps fingers)."
#5	1	Knows how to use well enough for now	"No, it seems to work pretty well, I basically know my little minute piece of the pie, and that's it. . . ..I'm very computer illiterate I feel like.....but I can kind of do [Other] and that's it, order processing, retrieving lab results, and that's about all I can do, or look up the schedule of the clinic, or stuff like that"
#5	1	Only learn CareChart by repeated use	" .... it's just that I 'd have to use it, use it, use it to get with it."
RN			
#8	1	Limited training	"Little bit of training they've given use is all I've ever had--very minimal". "You learn on the job".
#8	1	Knows how to use well enough for now	"I don't know that much about it.....I don't utilize the computers as much as I probably should because I don't know that much about them I do my basic stuff here and get what I need."
#8	1	Learn system as you go	"Little bit of training they've given us is all I've ever had--very minimal". "You learn on the job"
#9	1	Trained by another user	"UM, ten minutes by[Subject 4]"
#	1	Limited training	"UM, ten minutes.....".
#9	1	Need training with windows	"and, I personally feel like that nurses at [agency]have not ever been given adequate training to windows, to ....just basic computer skills....."
#9	1	Wants training on CareChart potential uses & purpose	"It would be excellent to have....whether it's a manual, or a thirty minute video...something that just explains what it can do for you, what potential it has.....and who set up the software, and what they had in mind when they did."

#9	1	No time to learn on her own	"CareChart.... I'm not opposed to it, I just haven't had the time or the motivation to sit down and...."
#9	1	Exploration helped her	"anything in a windows environment, anything with how you think about how the computer gives you information or interfaces makes sense to me, so if I need to find something, I can find it, it doesn't frustrate me to....."
#9	1	No experience back to back with training	"the windows light class that they gave people when the new workstations came up was really inadequate in reference to that you had one temporary workstation, and then no time to work on it, and then by the time we actually got the workstations that were functioning, people just didn't .....they didn't get that experience back-to-back with education. and it was inadequate."
#9	1	Nurses need training on basic computer skills	"and, I personally feel like that nurses at OHSU have not ever been given adequate training to windows, to ....just basic computer skills, there're hit and miss....."
#9	1	Word of mouth training passes misinformation	"and, I personally feel like that nurses at OHSU have not ever been given adequate training to windows, to ....just basic computer skills, there're hit and miss, there're shared on a grass roots level, a lot of miss-information is passed along."
#10	1	Self taught-no training	" no .....trial and error.....".
#10	1	Learn system as you go	[training?] "No , trial and error.....[does trial and error work?]....yes, I'm pretty adepatient at doing things, so it's not to bad, I fumble my way through the best I can...."

User RNCM	N	Descriptors	Example
#2	1	Need training with windows	(some people think with windows, you don't need training) "that's not true, I think you're going to have a lot of problems with computers.....".
#2	1	No time to learn on her own	(paraphrasing) "I'm busy, I don't have time to explore (software of computers)"
#2	1	Part-time, missed training	"[names] they'd set up some training, and but I only work part-time..."
#3	2	Self taught-no training	"I just started and figured it out.... (were you trained on how to use [Other]?) ....no, they just had signs up on how to get in (to Other) and they gave me a number and .....".
#3	1	No time to learn on her own	"I don't have time to try and learn how to do that right now...."
#7	1	Self taught -no training	"I got a hand out from the nursing education department here for [Other] training, and I went through it myself"

User	N	Descriptors	Example
ANP			
#1	1	No time to learn on her own	"I don't sit down here and say, I don't usually have the time to just sit down here and say lets see what this is. I don't get to just sit down and play."
#1	1	Exploration helped her	"It's pretty self explanatory, I mean I've been in here and played, with these things to figure out what they are, an yea you can do that. I think there are some things that I don't know that I can do with this... you might find at the time, and I that's alot of what I've done with the SMS system, I've just learn it at the time."
#1	1	Knows how to use well enough for now	"I think that for what I do immediately no, [I don't need more training]whoever, if I wanted to be able to use more of the system, yes. and I'd probably would do better if I understood more of the system so that I can pull out what I wanted, more readily."
#1	1	Learn system as you go	"...that's alot of what I've done with the SMS system, I've just learn it at the time."
#1	1	Need more training to use it for more	" if I wanted to be able to use more of the system, yes [more training would be necessary]."
#1	1	Trained by another user	"[Subject 4] about 30 minutes"
#4	1	No time to learn on her own	"....I haven't had time to play on CareChart in the last month or so"
Total	31		

Appendix E

Table E10: Data Management Issues Category, Data Needs Sub-Category: Data Not On-Line Cluster.

User	N	Descriptors	Example
LPN			
#5	2	Gets data from ancillary department.	" ....but we are frequently calling to get them faxed over from the department. We have to call up to EKG...."
#5	1	Gets data from chart	" that's our first thing, if we have the chart we'll just look for it there; we would not go into the computer if we have it in the hard chart..."
RN			
#9	1	Gets data from chart	(do you use the hard chart?) "oh, sure, if it's here"
#9	1	Gets data from other institutions	(what about records from another institution?) "usually those records have been sent to the referred MD, that they're referred to, they are usually sitting in a clinic, they're not interfaced with the [agency]system"
#10	1	Gets data from chart	(do you use the chart?) "again, if there's old records from anesthesia or from this clinic, PAT, or any kind of you know recent progress notes that are in there, so we can look back and see what kind of surgeries they've had, and that kind of thing"
RNCM			
#2	1	Gets data from chart	"I read the chart, "
#2	1	Gets data from referring clinic	(what about from the referring clinic?) " yes, we do get information from the referring clinic...."
#2	1	Gets data from referring doctor	"Occasionally I call the doctor if a patient thinks they can drive themselves home, or thinks they can ambulate, and I'm really not sure, cause it hasn't been written anyplace..."
#2	1	Long delay until data on-line	"Eventually you get it [financial specialist reports] under admitting notes, but there can be several days, in there that you don't know if they've seen the patient, and their system isn't connected to ours....."

User	N	Descriptors	Example
RNCM			
#3	1	Gets data from other staff	(How do you get information you need for providing patient care that you don't get from the computer?) "From other staff of clinic.....?
#3	1	Gets data from chart	(How do you get information you need for providing patient care that you don't get from the computer?) "...from hard copy of chart..."
#3	1	Gets data from patients	(How do you get information you need for providing patient care that you don't get from the computer?) ..."from the patient..."
#7	1	Gets data from other staff	"I .....pretty much glean that from other people's assessments."
#7	1	Gets data from chart	"I also go through the charts and look at old case management notes, as far as particular medical information that I need, here in this clinic I just need an overall summary of what is happening, ..."
ANP			
#1	1	Gets data from referring doctor	"Sometimes call the primary provider, and who ever in the clinics, if the patient is sketchy about the history, or not a good historian, then yea I'll go back. and that happens for a good percentage of this population, because they don't know what's happened to them, they don't know what the surgeon did, they don't what medications they've been put on, they don't know why they're on this medication. So, yea for that population I end up spending a lot of time with the primary care provider, whoever that is."
#1	1	Gets data from patients	"....I use the patient, ...".
#1	1	Gets data from chart	"I use the chart,...."
#1	1	Gets data from other institutions	".....and sometimes we go back and find information from past files from other institutions."

User	N	Descriptors	Example
ANP			
#1	1	When patients not on schedule, can't find chart & no data on-line	(patients not on clinic schedule) "Yea, because then we can't get their charts either. Where their charts are, in another clinic, and not available, or they're in between somewhere and not able to be found.
#4	1	Handwritten data never available on-line	"I never know who's putting information into the computer and who is not. There are too many different ways for people to put information into the medical record. Some discharge summaries are hand written and some are not; if it's hand-written it's never going in to LCR.... "
#4	1	Who's data on line & who's not	"I never know who's putting information into the computer and who is not. There are too many different ways for people to put information into the medical record. Some discharge summaries are hand written and some are not; if it's hand-written it's never going in to LCR, I would like to see anesthesia records assessable in the computer system, I look for those alot, I'd love to see old EKG's "
#4	1	Gets data from chart	" I have to look in the printed medical record..."
#4	1	Gets data from referring clinic	(Do you ever call the referring clinic?) "sometimes I do, occasionally patients are moving through the systems faster than the paper trail and for instance, Orthopedics clinic sees a patient and holds onto the medical record. Patient immediately comes over for their pre-op evaluation and I have nothing."
Total	24		

Appendix E

Table E11: Data Management Issues Category, Data Needs Sub-Category: Data Incomplete Cluster.

User	N	Descriptors	Example
RNCM			
#4	1	If data not in Medical Record/CareChart, assumes data doesn't exist	"I have to look in the printed medical record, and if the information isn't in the medical record that I'm looking for, then I go into CareChart, and if it isn't there it probably doesn't exist."
#4	1	Wants all dictated patient data in LCR	"every single discharge summary should be dictated, every single pre-op history & physical should be dictated and in LCR, so many people have to look at that information, so, many people want the same information, were trying to get the nursing database in the computer, moving fairly rapidly towards that end.....so that the information that we start and collect in this hospital is part of that database used on the inpatient side so that we don't have to do it over again and over again and over again."
#7	1	Patient data in CareChart incomplete	"...so it's not reliable, to go into CareChart and to look and see what lab work have these people had, because it may have already been done, but just not be in there."
ANP			
#1	1	Chart data hard to find & incomplete	".....if I use this as a synopsis, it saves a heck of a lot of time going through the chart to try and find things because the charts are often confusing, and things can get misplaced in charts. When you get there,. part of it is missing, or and some of that stuff is pretty difficult to track down."
#1	2	Patient data in CareChart incomplete	Well, it's just not complete. If the information was there and it was there on every patient then it would be much more useful. But, I'll go through my list of patients, and maybe 50% of them have anything in there that's like a dictated summary, or um...recent labs, or anything. Sometimes, I have nothing."
Total	6		

Appendix E

Table E12: Data Management: Issues Category, Data Availability Sub-Category: Data Not Available Through CareChart Cluster.

User	N	Descriptors	Example
LPN			
#5	1	LCR has data she needs	" .....pretty much everything else, pretty much we have what we need....."
RNCM			
#2	1	Wants one system for patient data	paraphrased: she wants the systems to work all together, have all the patient information together under 1 system, instead of all these little systems, which didn't necessarily mean all the icons, but it meant that instead of having to come back out of whatever application you were in to go back into another application to get another piece of information. like going from CareChart to [Other] or CareChart out to [Other].....she doesn't like the wagon-wheel spoke idea, she would like to be able to go from whatever application or screen you are on to be able to jump from social service, to patient results, dictated reports, to financial information and to the high risk assessment screen.
#2	1	Patient data in separate data systems	"Eventually you get it (financial screening reports) under admitting notes, but there can be several days, in there that you don't know if they've seen the patient, and their system isn't connected to ours....."
#2	1	Patient data not available through CareChart	(so you can't get the demographic information on CareChart) "well I may, under [Other] (the newly noted [Other] icon) there's nothing up here (the CareChart desktop) that can give it too me. I really do need it"
#7	2	Wants one system for patient data	"Boy, that's a tough question.....um, I guess in a general sense I would like to see less duplication in different fields and a more standardized area that all of us are documenting on.....there are so many different areas that you have to go into to look at like what, admitting has d1, what case management has d1, what the nurses on the floor have d1, what we've d1 in the PAT clinic" the wagon spoke thing-----separate paths vs central grouped? "right, which is problematic.

User	N	Descriptors	Example
RNCM			
#7	2	Patient data in separate data systems	I guess the other suggestion that would link in with CareChart is that I like the idea of all the folders and the accessibility to go in there and collect the information on a patient, however, if those haven't been entered properly and there're not on that database, they could still be entered in the computer somewhere else, and just not be in there, ...I mean not in the CareChart area....."
ANP			
#4	1	Many people need same data	".....so many people have to look at that information, so, many people want the same information...."
Total	9		

Appendix E

Table E13: Data Management Issues Category, Data Availability Sub-Category: Inability To Alter Data On-Line Cluster.

User	N	Descriptors	Example
LPN			
#5	1	Doesn't allow add-on patients	(add on patients not being on CareChart) "that's true....."
RNCM			
#7	1	CareChart is view only	"I also use [the Other] system to enter orders, and referrals".
#2	1	Doesn't allow add-on patients	"only for priorly scheduled patients"
ANP			
#1	1	CareChart is view only	"If we were using only one computer, it would be a pain, to have to get out of it each time and get back into it. Get out to get other information, if I have to order, then you have to get back into CareChart, so that's not good."
Total	4		

Appendix E

Table E14: Data Management Issues Category, Data Availability Sub-Category: Question Data's Currency Cluster.

User	N	Descriptors	Example
LPN			
#5	1	Chart availability unpredictable	"So, if we have the chart, and it has everything in it, we don't do the computer ....."
RN			
#9	1	Doesn't know how current patient data is on-line	(aren't sure if information is current) "yes, it doesn't necessarily interface right away, I don't know how soon it gets on there"
#8	1	Chart availability unpredictable	"try to get hard chart for all patients first; use LCR if can't get hard chart"
#9	1	Chart availability unpredictable	"oh, sure, [uses the chart], if it's here"
RNCM			
#2	1	Is up-to-date patient data in computer	"you can get it, what you can do, if it's charted (the social service information) and put in the computer, which it may not be, ..."
#7	1	Doesn't know how current patient data is on-line	"another problem is, well for example, I came in for a pre-op work-up, and I went to my clinic first, and then came here, and the clinic had already drawn my blood, but it was all in the same day, and it hasn't been run through the lab yet, and the results aren't in the computer, ...how are we going to know for sure whether or not it got done? That's not necessarily a glitch with the CareChart, but it's a glitch in the system"
#7	1	Clinic patient population are unreliable historians	"if the patient says I don't know what they did" (laughs)

User	N	Descriptors	Example
ANP			
#1	1	Chart availability unpredictable	"often ...we can't get their charts either [when patients are added on to clinic schedule]. Where their charts are in another clinic, and not available, or they're in between somewhere and not able to be found."
#1	1	Clinic patient population are unreliable historians	"I will, sometimes, call the primary provider, and who ever in the clinics, if the patient is sketchy about the history, or not a good historian, then yea I'll go back. and that happens for a good percentage of this population, because they don't know what's happened to them, they don't know what the surgeon did, they don't what medications they've been put on, they don't know why they're on this medication. So, yea for that population I end up spending a lot of time with the primary care provider, whoever that is."
#4	1	Chart availability unpredictable	"... occasionally patients are moving through the systems faster than the paper trail" and for instance, Orthopedics clinic sees a patient and holds onto the medical record. Patient immediately comes over for their pre-op evaluation and I have nothing."
#4	1	Is up-to-date patient data in computer	" I cannot trust that the computer has every single bit of dictation"
Total	11		

Appendix F

The PAT Clinic Nurses' List Of Organizational Information System Needs

Positive Aspects of the On-line Patient Information System

The Existing Access Pathway. In general, the PAT clinic nurses describe the current automated patient information system as adequate, however the do mention that it is slower than the "old lab terminal" system in retrieving lab results. They prefer the existing access pathway to CareChart because: as CareChart offers them no new or valuable features; they are comfortable using current system; and they need access to all of the functions other than data viewing or display.

When trying to locate patient information, some of the nurses prefer to access the computer first, while others use the chart. Those who use the computer, report that they do so because: the on-line medical record has data they need; Orthopedic clinic dictation reaches the patient information database very efficiently; Radiology reports are well defined and reach the patient information database fairly quickly.

Three of the nurses like the new Windows format, with a fourth mentioning that she likes using the mouse instead of the previous system's light pen. Two nurses describe themselves as: (a) comfortable working computers; (b) exploring computer applications; and (c) willing to adjust to working with computers.

The CareChart Application. Specifically, the nurses describe CareChart as displaying some or all of the patient data they need, easy to use for patients on the schedule, helpful, useful when the data is complete, and useful now that user support fixed her problem. While, only one nurse describes CareChart as the

first source she uses for patient data needs, two nurses mention wanting access to CareChart in other departments where they work.

While most of the nurse interview responses regarding time and training were critical, a few nurses made positive remarks. One user describes CareChart as "getting faster with each patient", and another as "not time consuming once in the application". Others believe that accessing all the patient data available in CareChart saves both the nurses' preparation time as well as the time the patient has to spend being evaluated. Regarding training, two of the nurses remarked on how helpful they found one-to-one training, describing it's most helpful aspect as being the "inside tips" about specific functions, jobs tasks and shortcuts they were able to receive.

Concerns Regarding the On-line Patient Information System

The Existing Access Pathway. In general, the nurses describe experiencing equipment related problems (lack of workstations, and non-functional workstations) during the CareChart pilot testing project. They also complain that the whole system is sometimes down during the day when they need it. But most frequently, their complaints center around the time it takes them to use the computer and the resultant impact it has on their abilities to complete their job tasks. In addition, because of their time urgency concerns, they mention that using the computer interferes with patient contact & rapport, that time is always being a problem, as well as mentioning concerns about not having time to practice their new computer skills after training classes.

Their also express their concerns regarding the competing demands they experience for their time in terms of the computer's impact on their workload: if the computer doesn't have the patient data they have to backtrack and utilize other sources to get it, a task they see as increasing their patient care workload. Having to have two separate systems for collecting and storing patient data

appears to them as a duplication of their efforts, doubling their work load or creating more work, and generating more, not less paper. In addition, if they find other software products they would like to use in conjunction with the current system, they have been unable to ascertain that their agency's user support department will be supportive.

While many of the training and lack of knowledge responses these nurses mention specifically address CareChart, they also raise several issues regarding the acceptance and use of the existing access pathway. Computers have been commonplace in all of the ambulatory care clinics for at least five years, yet these nurses still describe themselves as being computer illiterate. Some report they have minimal contact with the computer, using them less than they probably could and not knowing all the patient data available in the patient information database due to lack of knowledge and/or infrequent exposure. Some of the nurses hold definite beliefs pertaining to computer skills: (a) they believe that experienced users learn quickly, while novices do not, (b) that they know how to use the system to get the patient data they need well enough for now, (c) that you only learn systems by repeated use, and (d) that they have to learn the system as they go. These nurses continue, adding that for them to use the system more than they do now, they would need additional training, as they have no time to learn it on their own.

At least one nurse describes the other nurses she interacts with as needing training in basic computer skills, and especially pertaining to the Windows format. But, she adds, this training should include practice experience on the same workstations they train on, preferable occurring back to back with the training. She describes many of the agencies' nurses as self-taught or taught by other users, believing that this increases word of mouth interchanges, which pass misinformation.

The CareChart Application. Specifically, the nurses describe CareChart as interfering with the other programs they use to complete their job tasks and responsibilities. The nurses use the on-line data for statistical reports, and Quality Assurance projects. Once the CareChart pilot began, these other programs crashed, necessitating them taking work home, completing the tasks using their home computers. Other times, when they tried to access CareChart, they received error messages, some of which they nurses believed were incorrect. Also, they describe workstation crashes due to "bugs in CareChart" occurring during the pilot project, leaving them without a workstation to access on-line patient data.

Regarding the design of CareChart application, the nurses describe it as awkward; getting in and out of the application is cumbersome, and moving from patient to patient is slow. For example, searching through the folders of patient data is time consuming, and the dictated reports folders are inadequately labeled, requiring the nurses to search through all of the documents to locate those they are looking for.

There are no on-line indicators to signal when patient's tests are completed or if the results are pending, requiring the nurses to sign-on to CareChart repeatedly, searching for patient's results. Also, CareChart only displays data for patients on the daily schedule, and only allows displaying or viewing data. The nurses have to get out of the application to retrieve data on patients who have been "added on" to the daily schedule, or if they need to use another function, such as ordering patient tests. In addition, the nurses do not utilized the GUI icon on the CareChart desktop to enter the existing access pathway, preferring to sign-on directly to the existing access pathway, and bypassing the wait associated with the workstation to load CareChart.

One of the recurring themes in the nurses concerns regarding CareChart, is time. They feel a strong sense of time urgency, and CareChart only seems to compound this issue. The CareChart application takes a prolonged amount of time for the workstation to load, is time consuming to sign-on to, and is slow moving between patients. If CareChart contains the patient data they are looking for, they often are require to search through all of the available information for that patient to find the specific data they want. In addition, they describe experiencing long waits for requested changes to be made to CareChart, as well as having no support to fix the problems they report.

The other major theme evident in the nurses CareChart concerns pertains to their knowledge of, and interest in, the application. Almost all of the nurses describe themselves using the term "computer illiterate", regardless of their home computer ownership, use and skill level. They have a limited understanding of the overall local area network system their agency has installed, and therefore an even smaller understanding of how CareChart and the PAT clinic fits into this information systems picture. The do not feel they know how to use CareChart efficiently, what it can do for them , or even the extent of the patient data it contains. Many of the nurses describe their CareChart training as minimal and/or inadequate, perhaps fueling an already developing disinterest in computer technology. Only one nurse reports that individual, unguided exploration of the CareChart application was helpful to her knowledge of CareChart. Most of the nurses describe their knowledge of CareChart as incomplete due to their infrequent exposure to it or their lack of use, their fear of exploring computers in general, their fear of damaging the system or patient data, their lack of understanding of the Windows format, and their minimal interest in learning more. When asked why they do not tell the system coordinators about their problems with CareChart, they respond by saying they

can't complain about an application they won't use, or that they do not ask for what they want, unless they know it is possible to accomplish.

Concerns Specific To CareChart And The Available Patient Data

Many of the nurses' responses pertain to the data they retrieve from the system, data that is not available on-line or through CareChart, whether the data is complete or current, data they want, and what their uses are for all of this patient data.

They currently use the existing access pathway to retrieve Lab results, order tests, check their clinic schedule, as well as the schedules for individual patients, retrieve patient demographic and financial information and check on surgery dates. However, they would like the capability of retrieving patient assessments, i.e.: medical history with dates of admissions, illnesses, and injuries and treatments; surgical history with dates and procedures, anesthesia records, and treatments; and physical examinations or as synopses of patients' medical and surgical histories. In addition, they want to retrieve patient information in the form of dictated summaries (admitting and discharge notes, procedures), new and old test results (Labs, Pulmonary Function studies, Chest X-rays, ECGs, CT scans), any other diagnostic work-up or consultations, outside physician records, current medication information, drug allergies, patient demographic information (financial data, financial screening reports, insurance coverage, addresses), and social work consultation reports (referrals, case management notes, histories and summaries). Furthermore, they would like this information on all patients; those currently in this agency's patient information database system, and those newly referred to the system.

While the majority of this data is for delivering direct patient care, the nurses visualize other possible for this data. They would like to generate patient care notices regarding post-operative care and discharge instructions, and

produce resource use reports from their patient care data. Currently, patient care notices are generated by hand, and the resource use reports require the labor intensive practice of entering the data by hand into other database programs.

When they are unable to retrieve the data they need from the patient information database, these nurses get their data from numerous sources: the ancillary service departments, the chart, other institutions, the referring clinic, the referring doctor, from other staff, and from the patients. They also describe: (a) long delays waiting for patient data to become available on-line; (b) how handwritten data is never available on-line, prompting their concerns regarding incomplete patient data and data currency; and (c) they question how they are to know who's data is on-line and who's is not, as well as if the on-line data is current. In response to these concerns, at least two of the nurses mention accessing the chart first, before ever signing on to access the on-line patient information database.

Indeed, the nurses may consequently search all of these various sources for patient information, simply because they do not know if they data they need is available on-line and where on-line it is stored. Which types of patient data are dictated, and hence likely to reach the on-line patient information database, remains uncertain, raising another system use concern for these nurses. Several separate and distinct patient information database systems exist. With many different people needing access to patient data, the nurses would like all of the patient data they need stored and accessible through one on-line database system.

Having ready access to all of this patient information allows the Adult Nurse Practitioners to prioritize patients' problem lists and health concerns, and to plan the types of tests patients will need to undergo in completing their pre-anesthesia evaluations. The clinic nurses use the extensive medical history,

surgical history, and patient testing information to plan the patient teaching necessary, and to help guide the patient through their, sometimes complex, pre-anesthesia evaluations. Furthermore, this patient information provides the necessary demographic and financial background history to allow the RN case managers to plan adequate home health care and support for patients post discharge. While these requests for patient data may seem extensive, the purpose of this information is to allow these nurses to provide a thorough and complete pre-anesthesia evaluation and teaching experience for every patient.

Appendix G

The PAT Clinic Nurses' List Of Informational System Needs

Positive Aspects of the On-line Patient Information System

The Existing Access Pathway. In general, the PAT clinic nurses describe the current automated patient information system as adequate, however the do mention that it is slower than the "old lab terminal" system in retrieving lab results. They prefer the existing access pathway to CareChart because: as CareChart offers them no new or valuable features; they are comfortable using current system; and they need access to all of the functions other than data viewing or display.

When trying to locate patient information, some of the nurses prefer to access the computer first, while others use the chart. Those who use the computer, report that they do so because: the on-line medical record has data they need; Orthopedic clinic dictation reaches the patient information database very efficiently; Radiology reports are well defined and reach the patient information database fairly quickly.

The CareChart Application. Specifically, the nurses describe CareChart as displaying some or all of the patient data they need, easy to use for patients on the schedule, helpful, useful when the data is complete, and useful now that user support fixed her problem. While, only one nurse describes CareChart as the first source she uses for patient data needs, two nurses mention wanting access to CareChart in other departments where they work.

While most of the nurse interview responses regarding time and training were critical, a few nurses made positive remarks. One user describes CareChart as "getting faster with each patient", and another as "not time consuming once in the application". Others believe that accessing all the patient data available in

CareChart saves both the nurses' preparation time as well as the time the patient has to spend being evaluated. Regarding training, two of the nurses remarked on how helpful they found one-to-one training, describing it's most helpful aspect as being the "inside tips" about specific functions, jobs tasks and shortcuts they were able to receive.

Concerns Regarding the On-line Patient Information System

The Existing Access Pathway. In general, the nurses describe experiencing equipment related problems (lack of workstations, and non-functional workstations) during the CareChart pilot testing project. They also complain that the whole system is sometimes down during the day when they need it. But most frequently, their complaints center around the time it takes them to use the computer and the resultant impact it has on their abilities to complete their job tasks. In addition, because of their time urgency concerns, they mention that using the computer interferes with patient contact & rapport, that time is always being a problem, as well as mentioning concerns about not having time to practice their new computer skills after training classes.

Their also express their concerns regarding the competing demands they experience for their time in terms of the computer's impact on their workload: if the computer doesn't have the patient data they have to backtrack and utilize other sources to get it, a task they see as increasing their patient care workload. Having to have two separate systems for collecting and storing patient data appears to them as a duplication of their efforts, doubling their work load or creating more work, and generating more, not less paper. In addition, if they find other software products they would like to use in conjunction with the current system, they have been unable to ascertain that their agency's user support department will be supportive.

The CareChart Application. Specifically, the nurses describe CareChart as interfering with the other programs they use to complete their job tasks and responsibilities. The nurses use the on-line data for statistical reports, and Quality Assurance projects. Once the CareChart pilot began, these other programs crashed, necessitating them taking work home, completing the tasks using their home computers. Other times, when they tried to access CareChart, they received error messages, some of which they nurses believed were incorrect. Also, they describe workstation crashes due to "bugs in CareChart" occurring during the pilot project, leaving them without a workstation to access on-line patient data.

Regarding the design of CareChart application, the nurses describe it as awkward; getting in and out of the application is cumbersome, and moving from patient to patient is slow. For example, searching through the folders of patient data is time consuming, and the dictated reports folders are inadequately labeled, requiring the nurses to search through all of the documents to locate those they are looking for.

There are no on-line indicators to signal when patient's tests are completed or if the results are pending, requiring the nurses to sign-on to CareChart repeatedly, searching for patient's results. Also, CareChart only displays data for patients on the daily schedule, and only allows displaying or viewing data. The nurses have to get out of the application to retrieve data on patients who have been "added on" to the daily schedule, or if they need to use another function, such as ordering patient tests. In addition, the nurses do not utilized the GUI icon on the CareChart desktop to enter the existing access pathway, preferring to sign-on directly to the existing access pathway, and bypassing the wait associated with the workstation to load CareChart.

One of the recurring themes in the nurses concerns regarding CareChart, is time. They feel a strong sense of time urgency, and CareChart only seems to compound this issue. The CareChart application takes a prolonged amount of time for workstation the to load, is time consuming to sign-on to, and is slow moving between patients. If CareChart contains the patient data they are looking for, they often are require to search through all of the available information for that patient to find the specific data they want. In addition, they describe experiencing long waits for requested changes to be made to CareChart, as well as having no support to fix the problems they report.

The other major theme evident in the nurses CareChart concerns pertains to their knowledge of, and interest in, the application. Almost all of the nurses describe themselves using the term "computer illiterate", regardless of their home computer ownership, use and skill level. They have a limited understanding of the overall local area network system their agency has installed, and therefore an even smaller understanding of how CareChart and the PAT clinic fits into this information systems picture. The do not feel they know how to use CareChart efficiently, what it can do for them , or even the extent of the patient data it contains. Many of the nurses describe their CareChart training as minimal and/or inadequate, perhaps fueling an already developing disinterest in computer technology. Only one nurse reports that individual, unguided exploration of the CareChart application was helpful to her knowledge of CareChart. Most of the nurses describe their knowledge of CareChart as incomplete due to their infrequent exposure to it or their lack of use, their fear of exploring computers in general, their fear of damaging the system or patient data, their lack of understanding of the Windows format, and their minimal interest in learning more. When asked why they do not tell the system coordinators about their problems with CareChart, they respond by saying they

can't complain about an application they won't use, or that they do not ask for what they want, unless they know it is possible to accomplish.

Concerns Specific To CareChart And The Available Patient Data

Many of the nurses' responses pertain to the data they retrieve from the system, data that is not available on-line or through CareChart, whether the data is complete or current, data they want, and what their uses are for all of this patient data.

They currently use the existing access pathway to retrieve Lab results, order tests, check their clinic schedule, as well as the schedules for individual patients, retrieve patient demographic and financial information and check on surgery dates. However, they would like the capability of retrieving patient assessments, i.e.: medical history with dates of admissions, illnesses, and injuries and treatments; surgical history with dates and procedures, anesthesia records, and treatments; and physical examinations or as synopses of patients' medical and surgical histories. In addition, they want to retrieve patient information in the form of dictated summaries (admitting and discharge notes, procedures), new and old test results (Labs, Pulmonary Function studies, Chest X-rays, ECGs, CT scans), any other diagnostic work-up or consultations, outside physician records, current medication information, drug allergies, patient demographic information (financial data, financial screening reports, insurance coverage, addresses), and social work consultation reports (referrals, case management notes, histories and summaries). Furthermore, they would like this information on all patients; those currently in this agency's patient information database system, and those newly referred to the system.

While the majority of this data is for delivering direct patient care, the nurses visualize other possible for this data. They would like to generate patient care notices regarding post-operative care and discharge instructions, and

produce resource use reports from their patient care data. Currently, patient care notices are generated by hand, and the resource use reports require the labor intensive practice of entering the data by hand into other database programs.

When they are unable to retrieve the data they need from the patient information database, these nurses get their data from numerous sources: the ancillary service departments, the chart, other institutions, the referring clinic, the referring doctor, from other staff, and from the patients. They also describe: (a) long delays waiting for patient data to become available on-line; (b) how handwritten data is never available on-line, prompting their concerns regarding incomplete patient data and data currency; and (c) they question how they are to know who's data is on-line and who's is not, as well as if the on-line data is current. In response to these concerns, at least two of the nurses mention accessing the chart first, before ever signing on to access the on-line patient information database.

Indeed, the nurses may consequently search all of these various sources for patient information, simply because they do not know if they data they need is available on-line and where on-line it is stored. Which types of patient data are dictated, and hence likely to reach the on-line patient information database, remains uncertain, raising another system use concern for these nurses. Several separate and distinct patient information database systems exist. With many different people needing access to patient data, the nurses would like all of the patient data they need stored and accessible through one on-line database system.

Having ready access to all of this patient information allows the Adult Nurse Practitioners to prioritize patients' problem lists and health concerns, and to plan the types of tests patients will need to undergo in completing their pre-anesthesia evaluations. The clinic nurses use the extensive medical history,

Appendix H

Demographic Data for the Nurse Interview Subjects

Subject	Age Range	Gender	Computer Ownership	Duration of Ownership	Uses
Subject # 1	40-49	Female	yes	5 yrs	" word processing, trying to get information off Medline, to communicate with my CC mail, send and receive messages"
Subject # 2	50-59	Female	yes	6 months	"checking account, writing, playing games, for work when I'm at home, they fax things to me"
Subject # 3	40-49	Female	yes	6 months	"on the Internet about 3 wks." "other business; advertising, accounting, web page, surf, e-mail, faxing."
Subject # 4	40-49	Female	yes	unknown	"Internet access; library book reservations, word processing; alternative medicine software."
Subject # 5	40-49	Female	yes	a couple of years	"word processing, kid reports".
Subject #6	not available	Female	not available	not available	not available
Subject # 7	30-39	Female	yes	6 yrs	"I .. can do alot of things". "We run a business at home....and we're windows 95 based".
Subject # 8	40-49	Female	no	not available	not available
Subject # 9	30-39	Female	yes	1 year	"fun, e-mail, Internet surfing, looking-up information, personal interest, non-medical.....calculator function"
Subject # 10	30-39	Female	yes	8 months	"primarily e-mail, just for letter writing, financial information"

Appendix I

Data for Research Question Number One

The Frequency of CareChart Use

Table I1. The frequency of days CareChart was not used to retrieve patient data.

	April	May	June	Total	Percent Of Days Clinic Open (64)
CareChart Not Used	9	5	8	22	34.4
Existing Access Pathway Not Used	0	1	4	5	7.8

Table I2. Frequency of CareChart and existing access pathway use.

Pathway	Actual Data		
	N	Retrievals	Percent
CareChart	114	53	3.0
Existing Access Pathway	1724	1724	97.0
Total System Use (CareChart + Existing Access Pathway)	1838	1777	100

Appendix J

Data for Research Question Number One

Do The Data Retrievals Vary By Nurse?

Table J1. Frequency of data retrievals by individual nurse.

Application	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	Total
CareChart	7	16	11	19	0	0	0	0	0	0	53
Existing Access	119	529	163	442	0	471	0	0	0	0	1724
Total System	126	545	174	461	0	471	0	0	0	0	1777

Table J2. Percentage of data retrievals by individual nurse.

Application	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
CareChart	5.6	2.9	6.3	4.1	0	0	0	0	0	0
Existing Access	94.4	97.1	93.7	95.9	0	100	0	0	0	0
Total System	100	100	100	100	0	100	0	0	0	0

Table J3. Average daily use of CareChart by individual nurse.

Application	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
CareChart	7	16	11	19	0	0	0	0	0	0
Total Number of Days Worked	17	30	15	34	2	48	0	0	0	0
Average CareChart Use per Days Worked	100	100	100	100	0	100	0	0	0	0

Table J4. Frequency of data retrievals by nurse role group.

Application	Clinic			
	ANP	RNCM	Nurses	Total
CareChart	26	27	0	53
Existing Access	561	692	471	1724
Total System	587	719	471	1777

Table J5. Percentage of data retrievals by nurse role group.

Application	ANP	RNCM	Clinic Nurses
CareChart	4.9	3.1	0
Existing Access	95.2	63.6	100

Table J6. Frequency of data retrievals by individual nurses within role groups.

Application	ANP		RNCM			Clinic Nurses				
	#1	#4	#2	#3	#7	#5	#6	#8	#9	#10
CareChart	7	19	16	11	0	0	0	0	0	0
Existing Access	119	442	529	163	0	0	471	0	0	0
Total System	126	461	545	174	0	0	471	0	0	0

Table J7. Percentage of data retrievals by individual nurses within role groups.

Application	ANP		RNCM			Clinic Nurses				
	#1	#4	#2	#3	#7	#5	#6	#8	#9	#10
CareChart	5.6	4.1	2.9	6.3	0	0	0	0	0	0
Existing Access	94.4	95.9	97.1	93.7	0	0	100	0	0	0
Total System	100	100	100	100	0	0	100	0	0	0

Table J8. Average daily use of CareChart by individual nurse, within role groups.

Application	ANP		RNCM			Clinic Nurses				
	#1	#4	#2	#3	#7	#6	#5	#8	#9	#10
CareChart	7	19	16	11	0	0	0	0	0	0
Total Number of Days Worked	17	30	15	34	0	48	2	0	0	0
Average CareChart Use per Days Worked	100	100	100	100	0	100	0	0	0	0

Appendix K

Research Question Number One

Type of Data Retrieved by Application

Type of Data	CareChart		Existing		Total System	
	N	%	N	%	N	%
None	61		0		61	100%
Lab	33	2.7%	1179	97.3%	1212	100%
Dictated Reports	13	3.9%	319	96.1%	332	100%
Diagnosis/Procedural Summaries	6	4.7%	123	95.3%	129	100%
Radiology	1	3.3%	30	96.7%	31	100%
Allergy	0	0	16	100%	16	100%
Radiation Oncology	0	0	5	100%	5	100%
Clinical Summaries	0	0	43	100%	43	100%
Demographic/Insurance	0	0	7	100%	7	100%
Pulmonary Function	0	0	2	100%	2	100%

Appendix L

Research Question Number One

Do These Data Retrievals Vary By Nurse And By Type Of Data?

Table L1. Total number of types of data accessed by nurse and by application.

Application	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
CareChart	2	3	4	2	0	0	0	0	0	0
Existing Access	5	6	8	6	0	6	0	0	0	0

Table L2. Different types of data retrieval by each nurse using CareChart.

Data Type	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
Lab	3	9	1	18	0	0	0	0	0	0
Dictated Reports	0	5	7	1	0	0	0	0	0	0
Diagnosis and Procedural Summaries	1	2	2	0	0	0	0	0	0	0
Radiology	0	0	1	0	0	0	0	0	0	0
Total	2	3	4	2	0	0	0	0	0	0

Appendix M

Table M1: Technical Issues Category, Hardware Sub-Category: Equipment Positives Cluster.

User	N	Description	Example
RN			
#8	1	(+) Likes mouse vs light pen	"I like the mouse, and I like [Other] much better that [Other]". For me to understand it I'm not too computer literate here,.....and so the [Other] and the mouse I love it. I'd rather just use the mouse....."
Total	1		

Appendix M

Table M2: Technical Issues Category, Software Sub-Category: Specific CareChart Design Positives Cluster.

User RNCM	N	Descriptors	Example
#2	1	User support fixed her problem	"no, because they fixed it for me, at first it only went back 90 days, and now it goes back a year and they put discharge home health under continuing care (the folder on the CareChart desktop), and so I do use it"
#2	1	Uses CareChart	paraphrased: Uses CareChart or goes through "Patient Services" icon all the time
#2	1	Data she needs in CareChart now	"no, because they fixed it for me, at first it only went back 90 days, and now it goes back a year and they put discharge home health under continuing care (the folder on the CC desktop), and so I do use it"
#3	1	Can find data in CareChart	"I have no difficulty in trying to find the information I need in it [CareChart]"
#3	1	CareChart easy to use for patients on schedule	"it's easy to use here, because the whole patient roster is here..."
#3	1	CareChart helpful	"I find it very helpful"

User	N	Descriptors	Example
ANP			
#1	1	CareChart useful when data complete	"So, it's all in one place in the CareChart, as long as it is, as long as it's complete, that's really useful."
#1	1	Uses CareChart first	"I use the chart, I use the computer, I use the patient, ...and sometimes we go back and find information from past files from other institutions. Usually I will go into CareChart first, and then if I want to get at specific information then I get the nurses to get that out here."
#4	1	CareChart helpful	yes; chart review; medical record information before the patient appointment "generally before I see the patient, before they arrive in clinic; very helpful"
#4	1	Gets data from CareChart	" I have to look in the printed medical record, and if the information isn't in the medical record that I'm looking for, then I go into CareChart, and if it isn't there it probably doesn't exist."
Total	10		

Appendix M

Table M3: Technical Issues Category, Software Sub-Category: Time Comments Cluster.

User	N	Descriptors	Example
RNCM			
#2	1	Seems to speed up with use	"now see this is the part that bothers me too, ...I just this patient....., I always icon onto pre-op orders, and it takes forever; it [CareChart] seems to get faster with each patient.....it's crazy"
ANP			
#1	1	Saves patient time	"When I come what I usually do, particularly if I've got a really heavy day, is I'll go through and I'll look at specifics of patients that are coming that day, so that I can prepare myself: OK what 's the problem, what types of stuff do I need to investigate, you know, are there any specific labs that I need to order in advance. So, that it cues me into a lot of stuff that maybe the patients don't tell me about . It shortens the time, I think, in the room, because I can just verify some of that information, instead of having to seek it all out...."
#1	1	Saves prep time	"When I come what I usually do, particularly if I've got a really heavy day, is I'll go through and I'll look at specifics of patients that are coming that day, so that I can prepare myself.....and also if I've got, if I use this as a synopsis, it saves a heck of a lot of time going through the chart to try and find things because the charts are often confusing, and things can get misplaced in charts. When you get there, part of it is missing, or and some of that stuff is pretty difficult to track down. So, it's all in one place in the CareChart, as long as it is, as long as it's complete, that's really useful. Saves alot of time."
#4	1	Not time consuming once in it	"I don't find it [CareChart] that time consuming once I get into it, it takes a long time to bring it up"
Total	4		

Appendix M

Table M4: Technical Issues Category, Software Sub-Category: What Works Cluster.

User	N	Description	Example
RN			
#9	1	Uses computer to get data first	"oh, sure, if it's [the chart] here..[but]..not if I can use the computer, I prefer to use that [the computer] first."
#10	1	Uses [Other] because has data she needs	"...everything I think I use is there [in Other system]"
RNCM			
#2	1	Uses [Other] because has data she needs	(Do you go into Other) "All the time. "Cause that's where I get my information, ...see the thing just came up....."
#3	1	Uses [Other] because has data she needs	(do you ever get patients that you are going to see that aren't on the roster?) "yea, I had one today.....so I went into [Other} to get info on them".
#4	1	Ortho dictation into LCR very efficiently	"sometimes I do [Do you ever call the referring clinic], occasionally patients are moving through the systems faster than the paper trail and for instance, Orthopedics clinic sees a patient and holds onto the medical record. patient immediately comes over for their pre-op evaluation and I have nothing. However, they are dictating, and somehow their dictation gets into LCR and [Other] and CareChart very, very quickly. So, I can often retrieve a history and physical from an Ortho patient through LCR before I actually have the medical record in my hand. Pretty much that's the only service who's doing it. I don't know what they're doing differently, but it's very, very efficient."
#4	1	Radiology gets data into LCR pretty well	"radiology reports already in LCR, and good system for getting it into the LCR loop.....works pretty good"
#4	1	Radiology reports well defined	"radiology reports already in LCR, [works pretty good]...defining what's in there, CT of head, abdomen...."

User	N	Descriptors	Example
ANP			
#1	1	Moving between patients not as big a problem	"Yea. It's a little slow sometimes getting from patient to patient, but I don't think that's the problem. The major problem is getting into it to begin with. It's slow, and I have to leave it, ..."
Total	8		

Appendix M

Table M5: Resource Issues Category, Competing Demands Sub-Category: Interest in Computers Cluster.

User	N	Descriptors	Example
LPN			
#5	1	Likes windows format	[Windows format easier with [Other]?] "yea, I like that a lot"
RN			
#9	1	Comfortable exploring computer applications	[are you comfortable exploring new systems?] "un, hm."
#9	1	Feels comfortable with computers	".... anything with how you think about how the computer gives you information or interfaces makes sense to me, so if I need to find something, I can find it, it doesn't frustrate me to.....if there is something wrong, I always assume that there is a solution to it, I don't assume that it's broken or it just doesn't work"
#9	1	Looks for solutions	"....so if I need to find something, I can find it, it doesn't frustrate me to.....if there is something wrong, I always assume that there is a solution to it, I don't assume that it's broken or it just doesn't work"
#9	1	Self-adjusting to working with computers	"anything in a windows environment, anything with how you think about how the computer gives you information or interfaces makes sense to me, so if I need to find something, I can find it, it doesn't frustrate me to..... I don't assume that it's broken or it just doesn't work"
#9	1	Windows format makes sense	"anything in a windows environment.....makes sense to me"
#10	1	Self-adjusting to working with computers	" yes, I'm pretty adept at doing things, so it's not to bad, I fumble my way through the best I can, if I have any questions, I just ask someone else what I do I need to do to get this stuff"

User	N	Descriptors	Example
RNCM			
#2	1	Expanding her use of Windows	"...one of the hardest things for me to learn was to be patient, when it didn't come up, I was clicking again I thought, oh it didn't take it, and that was with windows too, and now I just use some of the options under windows to do different things"
#3	1	Self-adjusting to working with computers	" oh, computers are computers I just kind of work with them....if I don't get it one way, I'll get it another...."
#3	1	Likes windows format	"I think windows is great....I love windows"
#7	1	Likes windows format	"I guess the other suggestion that would link in with CareChart is that I like the idea of all the folders and the accessibility to go in there and collect the information on a pt....."
#1	1	CareChart not available in PACU	"Yes, I do here, don't use in PACU because were not on it yet"
Total	12		

Appendix M

Table M6: Resource Issues Category, Training Sub-Category: Training Comments Cluster.

User	N	Descriptors	Example
RNCM			
#2	3	One-one training helpful	(would you have had more trouble if you hadn't' had one-one-one help?) "yes" some people think with windows, you don't need training "that's not true, I think you're going to have a lot of problems with computers..... , "[name], she would come over and problem solve with me.....they were very good about meeting with me, and saying how did it meet my needs, and that sort of thing. I think that they did very good, and that's probably why I use [CareChart]. Because [name] would come over, and sit down with me. [It's better to have the one-on-one interaction] right."
ANP			
#1	1	One-one training helpful	"Actually, either [names] came up one day too and she spent about an hour with me. That was helpful. I think there are some things that I don't know that I can do with this...that would kind of be like that inside knowledge like you were saying, you can pull this up by using this icon."
Total	4		

Appendix M

Table M7: Data Management Issues Category, Data Needs Sub-Category: Data They Want Cluster.

User	N	Descriptors	Example
LPN			
#5	2	Type of patient data needed	"I was trying to get lab result, basically, that's the main thing" "we need a hard copy [of the EKG]"
#5	2	What data she wants on-line	"Those two things are mainly what we are calling around for, EKG's and work-ups from other hospitals"
RN			
#8	2	Type of patient data needed	"EKG print outs..... we get Pulmonary Function, we get Radiology" paraphrased: clinical history, dictated reports, summaries
#9	1	Type of patient data needed	(What do you use the LCR for?) "um, order processing, looking up labs, patient demographics, checking on surgery dates, schedule checking"
#9	2	What data she wants on-line	"just things that haven't been assessed recently, whether their allergies are up to date, what their current weight is. Just pretty minimal assessment data...." "usually those records have been sent to the referred MD, that they're referred to, they are usually sitting in a clinic, they're not interfaced with the OHSU system"
#10	2	Type of patient data needed	"primarily lab work, getting out recent dictations that they've had, progress notes, try and see if they've had any kind of consultations with physicians" "again, if there's old records form anesthesia or from this clinic, PAT, or any kind of you know recent progress notes that are in there [in the hard chart,], so we can look back and see what kind of surgeries they've had, and that kind of thing"

User	N	Descriptors	Example
RNCM			
#2	1	Type of patient data needed	" I'll actually look at patients history to see if they have any prior home health, what illnesses, history of them, hm, we get a little history of them prior to going in and talking to them."
#2	1	Wants CareChart on inpatient side	"I'd like for it to be available in house" ...laughs "I've had one in-patient case manager come over, and I had it up, and I was showing her, you know, just what it is, what it is.....and this is what you can get."
#2	1	Wants to move efficiently around in patient data	"um, that I can't get from CareChart ?..I need the financial specialist reports,...whether they've been seen or not. Eventually you get it under admitting notes, but there can be several days, in there that you don't know if they've seen the patient, and their system isn't connected to ours....."
#2	1	Needs financial screening report	"um, that I can't get from CareChart ? What information do I need..I need the financial specialist reports,...whether they've been seen or not."

User	N	Descriptors	Example
RNCM			
#3	1	What she uses patient data on CareChart for	"I don't know anything about this person, so I go and find them, and then I look for dictated reports so I can figure out before I'm going to visit this person and talk to them and teach them about their care .....I pull up there history and what they've been through, sometimes their is some social history there.....then I can have at least what the system has in about them. It really prepares me to see this person, ...and actually I make very active use of this CareChart because I do this with all the patients.....and by the time they get here, I'm ready for them.....and I couldn't do that without the CareChart, I really like it" "I try to find the most recent information" "a little cursory look at what all has gone on with them " "no social history here, that would be helpful, ...where they live is relevant" "now I have a real good idea of what has been going on with this person, ...now I have the scoop now I have a picture and now I start.....that's how I use it and I find it very helpful"
#3	1	Wants social work summary on-line	"Are you kidding...yes.....absolutely....this information I have to glean out of the patient, or glean out of the .....very, very helpful to have this [social work summary] on here"

User	N	Descriptors	Example
RNCM			
#7	1	Uses on-line data for QA activities	"I keep statistics on referring clinics that send patients here, I track, ... I'm keeping statistics on that [HCPA or high risk screen] is to note whether or not the clinics who are referring patients here have had patients fill them out before they get here....I'm also looking at how many referrals I'm making, what types of referrals I'm making, like we talked about respiratory, child life. We use it [the data] for case management statistics, it's also an educational tool to be able to go back to the referring clinic and show what got missed, you now how can we pick up on these sooner for patients, and not address them the day before they are coming in for surgery.....so, that's what my statistics are for, and I've been graphing how many high risk screens were completed before people came here, graphing referral clinics, that sort of thing....."
#7	1	What data she wants on-line	after the interview: paraphrased wants software for post discharge care of "procedure" Cranie patients - not really anything available excepatient for one with a FP focus
#7	2	Type of patient data needed	"I look alot at demographics, addresses, insurance coverage, admitting notes..." " And more of my focus is on the insurance and home needs and that sort of thing. Primarily the Nurse Practitioners assessment that's done here. I also go through the charts and look at old case management notes, as far as particular medical information that I need, here in this clinic I just need an overall summary of what is happening, so I'm not really picking apart the same sorts of physical assessment things that the nurses would get in here...."

User	N	Descriptors	Example
ANP			
#1	1	What she uses patient data on CareChart for	"When I come what I usually do, particularly if I've got a really heavy day, is I'll go through and I'll look at specifics of patients that are coming that day, so that I can prepare myself: OK what 's the problem, what types of stuff do I need to investigate, you know, are there any specific labs that I need to order in advance. SO, that it cues me into a lot of stuff that maybe the patients don't tell me about . It shortens the time, I think, in the room, because I can just verify some of that information, instead of having to seek it all out, and also if I've got, if I use this as a synopsis, it saves a heck of a lot of time going through the chart to try and find things because the charts are often confusing, and things can get misplaced in charts. When you get there, part of it is missing, or and some of that stuff is pretty difficult to track down. So, it's all in one place in the CareChart, as long as it is, as long as it's complete, that's really useful. saves alot of time."
#1	1	Wants extra synopsis on CareChart	".....I'd like an extra synopsis, on CareChart of problems they are seeing, surgeries that they've had, and dates, that kind of stuff, because that would make it more accessible. Otherwise I still have to search through what's on the CareChartto pull out the stuff that I'm need."
#1	1	What data she wants on-line	".....comprehensive history of this person, you know we all do our own little histories, but it'd be nice to see that history updated I think with dates of surgeries, dates of procedures, dates of illness and injuries and what the treatment was at that time. Just a flow chart of those things would be very helpful. EKG's and chest x-rays. Off hill- would like to get off hill records."

User	N	Descriptors	Example
ANP			
#4	3	What data she wants on-line	"it would be lovely to see EKG wave forms on the computer, visiting parties have said that as well, they would like to see CT scans on the computer, ...it'd be great....." "I'd like to see ...it would be ideal to have laboratory and x-ray information from other hospitals on the computer to cut down dramatically on workload and faxing." "I would like to see anesthesia records assessable in the computer system, I look for those alot, I'd love to see old EKG's "
#4	1	What she uses patient data on CareChart for	"[does chart reviews, gets medical record information] generally before I see the patient, before they arrive in clinic....."
#4	1	Wants data from most recent hospitalization	"Wouldn't it be lovely if I could see somewhere on a screen which's a dictated report from ENT, what's a dictated report from Ortho, where is the admit history and physical.....from the most recent hospitalization"
#4	1	Wants discharge summary on-line	".....where is that discharge summary?"
#4	2	Wants mandated dictation of patient data	"I just which it was mandated that everybody put all the information in there, so I don't have to look for hand written pieces....at least for outpatient, if everybody dictated their notes, or if everybody dictated their history & physical, everybody dictated the discharge summary, my work would decrease incredibly...operative reports are a nice piece of dictation....." " every single discharge summary should be dictated, every single pre-op history & physical should be dictated and in LCR, so many people have to look at that information, so, many people want the same information, ...so that we don't have to do it over again and over again and over again."

User	N	Descriptors	Example
ANP			
#4	1	Type of patient data needed	"chart reviews, today's history and physical--I almost always go into [Other] to pull up lab work; and on my pre-op mode with [Other], (also my pre-op mode in CareChart) that gives me my list of lab results, dictated results, pulmonary function studies; whatever; the stuff I need to review"
#4	1	Wants reports labeled by who wrote it	"Wouldn't it be lovely if I could see somewhere on a screen which's a dictated report from ENT, what's a dictated report from Ortho..... "
Total	34		

Appendix N

Table N1. The Reasons Nurses Give For Not Using CareChart: Nurse interview responses.

Overall	N/%	Category	N/%	Sub-Category	N/%	Cluster	N/%
Reasons Given For Not Using CareChart	217	Technical Issues	75/35%	Hardware	11/ 5%	Equipment problems	4/ 2%
						System Does Not Work	7/ 3%
				Software	**64/ 30%**	Specific CareChart Design Concerns	16/ 7%
						Time Concerns	**36/ 17%**
						Existing Software Adequate	12/6%
		Resource Issues	88/40%	Competing Demands	36/ 17%	Human Resource	21/10%
						Disinterest in Computers	15/7%
				Training	**52/ 24%**	Lack of Knowledge	21/10%
						Training Concerns	**31/ 14%**
		Data Management Issues	54/ 25%	Data Needs	30/ 14%	Data Not On-Line	24/11%
						Data Incomplete	6/ 3%
				Data Availability	24/ 11%	Data Not Available Through CareChart	9/ 4%
						Inability to alter data on-line	4/ 2%
						Question Data's Currency	11/5%
Totals	217/ 100%		217 100%		217/ 100%		217/ 100%

Table N2. Positive Aspects Specifically Related to CareChart and Nurses' General Information System Wants & Needs: Nurse interview responses.

	N	Category	N/%	Sub-Category	N/%	Cluster	N/%
Positive Aspects Specifically Related to CareChart	39	Technical	23/ 59%	Hardware	1/ 4%	Equipment Positives	1/ 4%
				Software	22/ 56%	Specific CareChart Design Positives	10/ 43%
						What Works	8/ 35%
						Time Comments	4/ 17%
		Resource	16/ 41%	Competing Demands	12/ 16%	Interest in Computers	12/ 75%
				Training	4/ 6%	Training Comments	4/ 25%
Totals			39/ 100%		39/ 100%		39/ 100%
Nurses' General Information System Wants & Needs	34	Data Management Issues	34/ 100%	Dat a Needs	34/ 100%	Data They Want	34/ 100%