

NURSES' KNOWLEDGE, BELIEFS, MOTIVATION AND COMPUTER USE

SATISFACTION

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## ABSTRACT

RESEARCH PAPER: Nurses' Knowledge, Beliefs, Motivation and Computer Use Satisfaction

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The nursing profession has experienced an increase in use of computer systems in both nursing education and all types of health-care facilities. By evaluating the knowledge base and attitudes of nurses, the level of acceptance towards computerized charting can be predicted (Burkes, M. 1991).

The purpose of this study is to examine relationships among nurses' computer use knowledge, satisfaction, beliefs, motivation, and computer use satisfaction with an electronic documentation system in an acute care setting. This is an approximate replication of Burkes (1991) study, which will use Vroom's (1964) Expectancy Theory as the framework. The sample will include 100 registered nurses working on medical surgical units in a hospital located in southern Ohio. Participants will be fulltime registered nurses who are currently using computerized documentation and agree to participate in this study. Ball State University Institutional Review Board and the participating hospital will approve the study.

Burkes (1991) questionnaire will be administered to those nurses who agree to participate in this study. Findings will identify nurses' perceptions, beliefs, satisfaction,

and motivation towards computer use and the relationship of computer knowledge and acceptance by nurses.

## Chapter I

### Introduction

Computerized technology is an important issue for health care professionals and organizations. Over the past 40 years, computer technology has evolved significantly. Initially, areas such as human resources, finance, and logistics systems were computerized however; within the past two decades, electronic medical record (EMR) systems have slowly been introduced to the nursing profession (Smith, Smith, Krugman, & Oman, 2005). The EMR allows for rapid access to patients records, which leads to improved patient care, patient safety, and significantly influence patient outcomes (McLane, 2005).

As the use of computer technology continues to rapidly advance in our society, nurses are being challenged to incorporate the use of computers into their daily routine of providing patient care. Even though nurses have used computers for many years to place orders and lookup test results, they are reluctant to give up the traditional means of charting and adopt electronic documentation. Since nurses represent the largest group of computer users in healthcare, it is imperative to understand nurses' perceptions, attitudes and motivational factors towards the use of computers in order to ensure a successful implementation of a documentation system (Lee, 2004). Findings from prior research studies on nurses' attitudes towards computers revealed conflicting results. Some

researchers found that nurse attitudes were mostly positive, while other studies discovered that age and education significantly influenced ones attitude (Brumini, Kovic, Zombori, Lulic, & Petrovecki, 2005), yet other studies revealed that many nurses are uncomfortable and inexperienced with computers (Alquraini, Alhashem, Shah, & Chowdhury, 2007). Additional barriers identified by nurses include system downtime; system speed too slow; not enough computers; duplicate entries; frequent rebooting; unable to log on; and various technical issues (Moody, Slocumb, Berg, & Jackson, 2004).

As new innovations are introduced into an organization, major changes are evoked, especially for those directly involved in using the innovation. Adopting a clinical information system is an enormous undertaking by any type of health care facility. According to Wilhoit, Mustain, and King (2006), to ensure the correct information system has been selected for an organization requires a deliberated strategy, leadership commitment and involvement, an organized project structure, and extraordinary efforts by clinicians to master and integrate new tools into their routine. Additionally, Wilhoit et al. (2006) recommends that Information Systems (IS) provides and maintains the most up-to-date technology enabling nurses to use clinical information systems without difficulty. Nurses need the ability to quickly and effortlessly access and synthesize information and evidence from a wide variety of sources, evaluate the quality and importance of accessed information and evidence, perform relevant manipulations of the information to describe best evidence, and to disseminate the results of their activities (Swan, Lang, & McGinley, 2004).

Integration of computer technology in health care requires that objective and comparative information on how nurses view the use of computers and the factors affecting these attitudes is available. Nurses have difficulty understanding the advantages of an EMR system due to feeling threatened by the computer and feelings of loss of control (Shoham & Gonen, 2008). As acute care facilities transition to some type of an electronic patient records (EPR) system, it is necessary to identify user's computer knowledge, experience, attitudes and images towards EPR prior to implementation (Dillon et al., 2005). Successful implementation of an EPR requires listening to users' perceptions of the impact that a system change would have on core work values, recognizing the barriers to adoption of the technology, and creating an action plan for working through likely user resistance. Knowing user difficulties and barriers to using technology could help prevent or minimize the discomforts created during the transition stage (Lee, 2007).

The goal of an electronic documentation system is to improve patient safety, communication and documentation, provide greater access to patient's charts, decrease paperwork, and improve patient outcomes (Darbyshire, 2004). Therefore, it is crucial that the documentation system meets the needs of the clinicians in a particular practice setting. The system should be easy to learn and navigate, efficient, provide error messages when errors occur, and the ability to view the overall picture of patient progress and care. Additionally, there must be an adequate number of computers available and the end users must believe that the electronic medical record enhances performance with

minimal effort. Perceived usefulness of an electronic documentation application has been found to have positive correlates with the staff's use of the system (McLane, 2005).

### *Background and Significance*

The introduction and use of computer technology has become increasingly prevalent in the healthcare industry. Initially, computers were used for financial, accounting and administrative purposes (Burkes, 1991). In 1965, Technicon Medical Information System was implemented in a California hospital. By 1971, this system was being used on patient care units to communicate physician's orders to ancillary departments and provide test results. During this period of time, other hospital information systems were being implemented in various large hospitals within the United States. While these computer systems were highly successful in their performance, support for clinical care and nursing practice was limited in the 1970's and 1980's. This is due to the fact that hospitals were receiving fee-for-service reimbursement for services provided. Therefore, a hospital information system capable of performing billing functions would be implemented prior to a system that provided nurses the ability document clinical care (Staggers, Thompson, & Snyder-Halpern, 2001).

By the late 1980's and early 1990's, the healthcare industry was experiencing the effects of inflation related to the current fee-for-service reimbursement plan. In an attempt to contain the cost of healthcare, promote health and wellness, and disease prevention, managed care was introduced. In order to support the managed care focus, the need for a computer-based patient record (CPR) application was identified. This type of system would have the ability to effectively track and manage patient care across the

lifespan, decrease replication and redundancy of data, improve the consistency, accuracy and availability of information as well as, decrease hospital costs for storage of records, staff time and immediate retrieval of patient's clinical records (Staggers et al., 2001).

Since the turn of the 21<sup>st</sup> century, rapid advancements have been made in the development and integration of a computer-based patient record (Staggers et al., 2001). These advancements in technology may have been influenced by President Bush's 2004 mandate that requires all Americans to have an electronic medical record (EMR) by 2014. President Bush envisions the development of a nationwide interoperable health information technology infrastructure to improve the quality and efficiency of health care (Bush, 2004). This initiative has served to bring health care and technology communities together to address identified barriers to creating an EMR (American Medical Association, 2008).

As computer technology continues to rapidly evolve in our society, nurses are being challenged to incorporate the use of computers into their daily routine of providing patient care. The objective of electronic documentation is to reduce the amount of paperwork, improve documentation, enhance access to patient's charts, and improve patient outcomes (Darbyshire, 2004). Even though nurses have used computers for many years, they are reluctant to give up the pen and paper and adopt computerized documentation (Smith et al., 2005). Nurses represent the largest group of computer users in healthcare, further research is needed to evaluate barriers experienced by nurses that may hinder or prevent the adoption of computer technology (Lee, 2004).

According to Burkes (1991, p. 190), over the past several years, there has been dramatic growth in the development of computerized nursing programs to assist the nursing profession. Computerized nursing programs, such as care plans and charting, are being used in a variety of health-care settings. The measurement and evaluation of user's attitudes may enhance effective program implementation and computer use. In a study conducted by Burkes (1991), Vroom's (1964) expectancy theory was used as the framework to explain the relationship between nurse's satisfaction, belief, and motivation of electronic documentation.

#### *Statement of the Problem*

Computerized documentation systems are increasingly being used by nursing professionals in acute care facilities. Therefore, positive attitudes by nurses towards the use of computer technology are necessary to ensure a successful electronic documentation implementation. According to Burkes (1991), evaluating nurse's knowledge base, attitudes, perceptions, beliefs, and satisfaction towards computer use can predict the level of acceptance towards computerized charting.

#### *Purpose of the Study*

The purpose of this study is to examine relationships among nurses' computer use knowledge, satisfaction, beliefs, motivation, and computer use satisfaction with an electronic documentation system.

### *Research Questions*

1. Is there a relationship between nurses' beliefs and computer-use satisfaction?
2. Is there a relationship between level of motivation to use computers and use of computer documentation system?
3. Is there a relationship between computer use beliefs and motivation?
4. Is there a relationship between computer knowledge and computer-use satisfaction beliefs and motivation?

### *Conceptual Theoretical Framework*

This study will use Burkes (1991) customized version of Vroom's (1964) Expectancy Theory as the framework to explain the relationship between nurses' satisfaction, belief, and motivation of electronic documentation. Vroom's Expectancy Theory is commonly used to describe an individual's motivation and the rationale of decision making. Vroom's Expectancy Theory affirms that human choice is subjectively rational. People do not always make optimal decisions although; they do make decisions they believe to be optimal at that period in time (Vroom, 1964).

According to Vroom (1964), the Expectancy Theory is based upon three beliefs: valence (V) the strength of an individual's preferred outcome; instrumentality (I) the degree in which a first level outcome will lead to the second level outcome; and expectancy (E) the probability or strength of belief that a certain action will lead to a desired outcome. Vroom (1964) refers to motivation as a force governing a person's choices or behavior such as, nurses' motivation to use computers. Burkes (1991) tailored version of Vroom's (1964) Expectancy Theory states, preference for a computerized

charting outcome (satisfaction) times (X) the expectation that using computerized nursing programs will lead to preferred outcomes (beliefs) and will promote a willingness or likelihood (=) by nurses to use computerized nursing programs (motivation). Individual nurse characteristics pertaining to the use of computerized nursing programs are the final variable to consider in this model (Burkes, 1991).

### *Definition of Terms*

#### *Computer Use Satisfaction*

Conceptual: “an attitude of preference for a certain computer-use outcome/reward, resulting from using computerized nurse charting” (Burkes, 1991, p. 193).

Operational: Burkes (1991) designed the five section questionnaire based on Vroom’s (1964) Expectancy Theory. Satisfaction was measured by a 21 item questionnaire. The questionnaire used a Likert-type scale to measure nurses satisfaction of computer use. The Likert-type scale ranged from 1-5, with 1 = strong dissatisfaction and 5 = strong satisfaction.

#### *Computer Use Belief*

Conceptual: “an expectation that the action of using a computerized nursing program will be followed by a preferred computer-use outcome/reward” (Burkes, 1991, p. 193).

Operational: Burkes (1991) designed the 18 item questionnaire to measure nurse’s computer-use beliefs. A Likert-type scale was used to assign a value of 1 – 5, with 1

indicating strong dissatisfaction, disagreement, or unlikelihood; and 5 indicating strong satisfaction, agreement, or likelihood.

#### *Computer Use Motivation*

Conceptual: “a willingness, inclination, or likelihood to use computerized nursing programs” (Burkes, 1991, p. 193).

Operational: Burkes (1991) designed the 17 item questionnaire to measure nurse’s computer-use beliefs. A Likert-type scale was used to assign a value of 1 – 5, with 1 indicating strong dissatisfaction, disagreement, or unlikelihood; and 5 indicating strong satisfaction, agreement, or likelihood.

#### *Computer Use Knowledge*

Conceptual: “a level of understanding of a computer system’s purpose, function, and interaction with nursing staff (included general, hospital information, and nursing information systems)” (Burkes, 1991, p. 194).

Operational: Computer knowledge will be measured by the use of a questionnaire designed by Burkes (1991). The questionnaire will be comprised of 12 true, false, or uncertain items. The answers will be given a values of : 0 = incorrect, 1 = uncertain, and 2 = correct. Scores will be added to obtain a total score for each variable in the survey.

#### *Individual and Demographic Variables*

Operational: individual and demographics were measured with a 10 item questionnaire designed by Stronge (Stronge & Brodt, 1985) which Burkes (1991) modified with his permission. Questionnaire topics included (a) age, (b) educational

level, (c) amount of computer experience, (d) length of time working as a nurse, and (e) amount of nursing-related computer knowledge.

### *Limitations*

Limitations of this study may include such factors as the sample being limited to one facility within the hospital network located in Dayton, Ohio, reduced generalizability of the findings to other settings or samples due to the uniqueness of the current computer system being used, unknown responses of nurses who did not return the survey, and the potential for biased beliefs of nurses completing the survey.

### *Assumptions*

Assumptions in this study include such variables as Vroom's Expectancy Theory accurately measures and describes the relationships between nurses' satisfaction, belief, and motivation of electronic documentation, Burkes interpretation and customization of Vroom's Expectancy Theory is accurate, and participants will use a professional and honest approach in the completion of the survey.

### *Summary*

Computerized technology is an important issue for healthcare professionals and organizations. The influx of computers and various forms of information technologies has changed the way healthcare is provided, delivered, and accessed today. Healthcare facilities are becoming more technologically advanced as well as, consumers are becoming more knowledgeable in the use of these technologies (Repique, 2007). Therefore, nurses in the 21<sup>st</sup> century must become savvy in the use of computers. Integration and use of computers performed by nurses, is an innovation that requires

nurses to change their workflow. Additionally, integration of a new technology in the field of healthcare requires that objective and comparative information on how nurses view the use of computers and the factors affecting these attitudes is available (Shoham & Gonen, 2008). Computer knowledge and skills are crucial for all nurses to function effectively and deliver quality care in the current healthcare environment (Wilhoit et al., 2006) however; many times computer systems do not provide nurse's with specific information in order to provide accurate documentation (Shoham & Gonen, 2008). According to Burkes (1991), success of a computer system may be related to the nurses' acceptance and attitudes towards the system.

The purpose of this study was to examine relationships among nurses' computer use knowledge, satisfaction, beliefs, motivation, and computer use satisfaction with an electronic documentation system. This is an approximate replication of Burkes (1991) study using Vroom's (1964) Expectancy Theory as the framework.

## Chapter II

### Literature Review

Since the introduction of computer technology more than 40 years ago, the use of computers has been slow to reach the health care arena. Initially, computers were designed for administrative and business purposes (Burkes, 1991). Over the past several years, there has been a dramatic growth in the development and introduction of computer technology into the health care industry. For that reason, the nursing profession has experienced an increase in use of computer systems both in nursing education and all types of health-care facilities. According to Burkes (1991), evaluating the knowledge base, attitudes (motivation), and perceptions of nurses, the level of acceptance towards computerized charting can be predicted. The purpose of this study is to examine relationships among nurses' computer use knowledge, satisfaction, beliefs, motivation, and computer use satisfaction with an electronic documentation system. This is an approximate replication of Burkes (1991) study.

#### *Theoretical Framework*

This study uses Vroom's (1964) expectancy theory as the framework to explain the relationship between nurse's satisfaction, belief, and motivation of electronic documentation. Vroom's Expectancy Theory is one of the most commonly used theories to describe an individual's motivation and the rationale of decision making. Vroom's

Expectancy Theory affirms that human choice is subjectively rational. People do not always make optimal decisions although, they do make decisions that they believe to be optimal at that period in time (Vroom, 1964). According to Vroom, all individuals have different sets of goals, which can be used as motivators if they believe there is a positive correlation between efforts and performance, favorable performance will result in a desirable reward, the reward will satisfy an important need, or the desire to satisfy the need is strong enough to make the effort worthwhile.

Vroom's Expectancy Theory is based upon three beliefs: valence (V), expectancy (E), and instrumentality (I). Vroom defines valence as the strength of an individual's preferred outcome. Thus, a positive valence would indicate that a person would prefer attaining an outcome rather than not attaining an outcome. Instrumentality is the degree in which a first level outcome leads to a second level outcome. Expectancy is the strength of belief that a certain action will lead to a desired outcome (Vroom, 1964). Vroom refers to motivation as a force governing a person's choices or behavior such as, nurse's motivation to use computers. Therefore, individual satisfaction (preference for an outcome) times (X) expectancy (belief that act will produce a preferred outcome) equals (=) motivation for an individual to perform the act (Vroom, 1964). As a result, an individual's choice to either perform or reject the act completes Vroom's expectancy theory. To better understand individual characteristics and computer-use attitudes of nurses, Burke (1991) tailored Vroom's theory to: preference a computerized charting outcome (satisfaction) times (X) the expectation that computerized charting use will lead to preferred outcomes (beliefs) and promote a likelihood (=) that nurses will use

computerized charting (motivation). Individual nurse characteristics pertaining to the use of computerized charting are the final variable to consider in Burkes (1991) model.

#### *Statement of Organization of the Literature*

The literature review is comprised of quantitative and qualitative research studies regarding nurses' satisfaction, beliefs, motivation, knowledge, and computer use satisfaction of an electronic documentation system. The literature review is organized into four sections; nurses' attitudes and skills towards computer use, nurses adopting computer technology, implementation of computer systems, and evaluating computer systems.

#### *Nurses' attitudes and skills related to computer use*

Burkes (1991) descriptive correlational study examined relationships between nurses' knowledge, skills, attitudes, beliefs, motivation, and computer use satisfaction with a computerized charting system. Vroom's (1964) expectancy theory was the framework used in Burkes (1991) study.

The sample consisted of 133 ICU staff nurses who worked either full-time or part-time, and had used computerized charting at the LDS Hospital in Salt Lake City, Utah. Supervisors, clinical specialists, head nurses and assistant head nurses were excluded from this study (Burkes, 1991). All nurses received a survey packet which contained a cover letter, consent form, and a questionnaire. It was estimated that the survey would take approximately 10 – 15 minutes to complete.

The investigator designed questionnaire contained five sections which measured nurse's knowledge, satisfaction, beliefs, motivation, and individual characteristics relating to computer use in nursing. According to Burkes (1991), the questionnaire used

a Likert-type scale to measure the Satisfaction, Beliefs, and Motivation sections of the survey ranging from 1-5, with 1 = strong dissatisfaction and 5 = strong satisfaction. A true, false, or uncertain format was used for the Knowledge subscale. Four Informatics Nurses reviewed the survey for content validity. This review resulted in a 95% agreement among the four reviewers. Cronbach's alpha coefficient and the split-half technique were used to examine the questionnaire's internal consistency reliability (n=56). The Alpha coefficients were calculated for the five subsections of the Beliefs portion of the questionnaire ranging from  $r = -0.534$  to 0.65.

Findings for the knowledge section revealed a low alpha coefficient of 0.360 which may have been attributable to the majority of the subjects selecting the "uncertain type" as an answer for 6 out of 13 Knowledge questions. Satisfaction findings showed that nurses' with greater computer experience were less satisfied with computerized charting whereas, nurses with less computer experience displayed a greater level of satisfaction. Findings for beliefs proved that computer-use satisfaction, beliefs and motivation were significantly related to one another. Findings for motivation revealed that nurses' who had positive attitudes towards computer use and beliefs had a higher degree of motivation compared to nurses' that did not possess positive attitudes.

Hypotheses 1, 2, and 3, supported that nurses' computer use satisfaction and beliefs were significantly related. Computer use satisfaction was related to motivation. Hypotheses 4 rejected the assumption that younger nurses would display greater computer use attitudes of satisfaction, beliefs, and motivation. Hypotheses 5 rejected the theory that a higher educational level would exhibit greater computer use attitudes.

Hypotheses 6, nurses' with a greater amount of computer experience would demonstrate a greater computer use satisfaction, beliefs, and motivation was rejected. Hypotheses 7, less time as a nurse did not show any correlation between the length of time as a nurse with beliefs and motivation however; there was significant correlation with greater satisfaction. Hypotheses 8, computer knowledge did not correlate significantly with satisfaction or motivation however; there was a significant positive correlation with beliefs. Therefore, since a significant positive correlation had previously occurred among beliefs, satisfaction, and motivation, the positive correlation of knowledge with beliefs may imply that nurses' knowing about computers may relate to their motivation to use computerized nursing programs (Burkes, 1991).

Findings from this study revealed the importance of developing positive attitudes and computer-use acceptance by the staff to ensure the success of computerized documentation. Burkes (1991) concluded that understanding the diverse levels of computer knowledge and determining an overall knowledge baseline of nurses' computer-use needs, attitudes, beliefs, skills, and readiness to learn was instrumental in the implementation of a successful system.

In another study, Moody et al. (2004) conducted a descriptive, cross-sectional study, which examined the functionality of the current Electronic Health Record system and examined nurses' attitudes, perceptions, preferences and needs associated with electronic health record documentation along with perceived effects related to patient care. Moody et al. (2004) used a convenience sample that consisted of 100 nursing personnel (RN's, LPN's and nursing assistants) who were employed at a large Magnet

hospital located in a metropolitan area of southwest Florida. This study was conducted on 23 clinical units that used some sort of electronic documentation. Participants worked both day and night shifts and were assured that all responses would remain anonymous. There were 120 questionnaires that were distributed onsite by three nursing graduate students to the nursing staff on the 23 units. Of the 120 questionnaires distributed, 103 were returned. Three of the questionnaires were discarded due to excessive missing data (>30%) therefore, leaving 100 questionnaires that were acceptable thus yielding a response rate of 83%. According to Moody et al. (2004), 98 of the respondents were white females with a mean age of 43.26 (range = 21 – 61 years). The sample was nearly equal in the number of staff working day shift (n = 47) and staff working night shift (n = 43). In addition, the nursing staff indicated they had worked in nursing on an average of 15.6 years. Furthermore, 80% of the nursing staff considered themselves as experienced computer users.

Moody et al. (2004) utilized a method of usability assessment, designed solely to gain direct input from nurse users. This type of instrument assesses various aspects of functionality and usability of a system in order to understand user satisfaction, perceived problems, barriers and frustrations associated with a particular system.

The investigator-developed instrument was designed for all levels of nursing personnel who use one or more methods of electronic documentation. This approach allowed for objective and subjective measures on the questionnaire in order to assess attitudes and opinions of the end users regarding the functionality of the facilities electronic health record documentation system. According to Moody et al. (2004), the

questionnaire consisted of a fixed format for questions pertaining to demographics, electronic health record documentation preferences, perceived functionality, barriers to and sources of frustration of using electronic health records. Additionally, there were two open-ended questions asked in order to identify key barriers and frustrations with the staff's overall assessment of functionality of the current electronic health records system.

Nurses' attitudes to the electronic health records were assessed with a five-item Likert-type attitude scale which included five response categories. The questionnaire contained five items pertaining to attitudes regarding the use of the electronic health records system. The scores of these five items were totaled with a range of scores from 5 to 25. A high score indicated a positive attitude toward the use of the electronic health records and a low score indicated a negative attitude toward the electronic health record system (Moody et al., 2004). Three nurses certified in nursing informatics were asked to assess the content validity and rate the relevancy of the instrument. Results indicated that the content validity index of the scale was high ( $k = 0.94$ ) and the content was relevant for all levels of nursing personnel (Moody et al., 2004). Cronbach's alpha coefficient was moderately high ( $r = 0.77$ ). Scores on the five-item attitude scale were summed to yield a total attitude score toward the use of electronic health records. Total scores ranged from 8 to 25 ( $M = 19.14$ ,  $SD = 4.06$ ).

According to Moody et al. (2004) findings from the use of the electronic health record indicated that 96% of the users were confident using the current electronic health records, 99% believed that help was always available and 85% thought they worked in a "user-friendly" environment. On the other hand, 81% of the respondents indicated that

computer access was available for electronic health record use, only 44% considered the current system optimally functional while 61% reported frustration with multiple electronic health record documentation systems. Other areas of frustration include hardware, software and system problems. Approximately 61% of respondents indicated that issues such as, interruptions while documenting patient care, duplicate documentation, and the inability to chart medications, vital signs, and assessments at the bedside due to patient rooms being small, and inadequate computer performance as other areas that caused major dissatisfaction among the nursing staff.

Other findings by Moody et al. (2004) study indicated that overall, nurses had positive attitudes of electronic health records improving patient care. This is evidenced by 81% of the staff believed that electronic health records were more of a help than a hindrance to care, while 75% indicated that electronic health records improved the quality of documentation. Additionally, 76% of the respondents believed that electronic health records would improve patient care however, 64% stated electronic health records did not decrease workload. Additional demographic findings revealed that older nurses tended to have a less positive attitude toward electronic health record documentation. Bivariate correlation between years of nursing experience and total attitude score was not found to be significant.

According to Moody et al. (2004), independent studies were completed on the two open-ended survey questions. Findings from the first question did not show a significant difference in attitudes between day shift nurses and night shift nurses. Results from the second survey question indicated that experienced computer users were more favorable

toward the use of electronic health records than the less experienced users. Users indicated the most common barriers to the use of electronic health records included system downtime; system speed too slow; physicians refusing to use computer systems and requesting staff to enter data for them; not enough computers; duplicating documentation; frequent rebooting; unable to log on; and technical issues with laptops.

Moody et al. (2004) concluded that overall nurses' attitudes towards the use of electronic health records were positive. Many believed that electronic health records decreased the workload as well as, improved documentation, which would lead to improved patient safety and patient care. Additionally, more than half of the participants preferred electronic documentation at the bedside however, computers were not always available.

Positive nurse attitudes towards computer technology are necessary to ensure a successful electronic documentation implementation. Results from previous studies pertaining to nurses' attitudes towards computers have revealed conflicting results. Some studies have revealed that nurses' attitudes were positive with no significant influence of age or education, whereas other studies found age and education to be a significant negative influence (Brumini et al., 2005). The purpose of this study was to assess nurses' attitudes towards computers in Croatian hospitals and compare the results to similar data published in other countries. Brumini et al. (2005) modified The Nurses' Attitudes towards Computers (NATC) with items from The General Attitudes toward Computers among Podiatrists.

The setting was two Croatian Hospitals; Dubrava University Hospital in Zagreb and Rijeka University Hospital Center in Rijeka from November 2003 to March 2004. Head nurses distributed the questionnaires during daily nurse staff meetings to all nurses employed at Rijeka University Hospital Center. At Dubrava University Hospital, one quarter of the nurses were randomly selected to participate in the study. Prior to the distribution of the questionnaires, nurses were informed about the subject of the study, and the confidentiality of responses was ensured (Brumini et al., 2005).

Out of the 1,130 surveyed nurses, 1,081 properly completed and returned the questionnaire: 141 nurses from Dubrava University Hospital and 940 from the Rijeka University Hospital Center (total response rate 96%). All subjects were analyzed as a single group due to the absence of any significant differences in gender, age, education, and computer science education among nurses in these two hospitals.

According to Brumini et al. (2005), the questionnaire consisted of eight closed questions and 30 statements on attitudes, which was divided into three parts: (a) demographic data (4 questions); (b) data about computer experience (4 questions); and (c) statements on attitudes towards computers. Part one consisted of demographic data which included questions pertaining to gender, age, education, and computer science education. The second part contained questions regarding place, frequency, and purpose of computer usage. Part three consisted of 30 randomly placed statements which measured the respondents' attitudes towards computers. One half of the statements were phrased negatively while the other half was phrased positively. Responses were offered

on a Likert-type scale from 1-5, with 1 equaling strong disagreement and 5 equaling strong agreement. There was not a time limit placed on completing the questionnaire.

Results from Brumini et al. (2005) study are shown with a mean, standard deviation (SD), and 95% confidence intervals (CI) of mean. Factor analysis was performed on all statements after the 15 negative statements were converted to positive statements. Three-factor solution was obtained by screen-plot analysis. One-way ANOVA was used to compare the average total score between groups and Tukey-b test for post hoc analysis. All statistical values were considered significant at the P level of 0.05.

Findings from Brumini et al. (2005) study revealed nurses showed a high total score of 120 +/-15 out of 150, thus indicating positive attitudes towards computers. Nurses younger than 30 years old had more of a positive attitude than older nurses. Additionally, nurses with a bachelors' degree had a higher score than nurses with a high school degree. In general, nurses who use computers for any purpose were found to have higher attitude scores than nurses who did not use computers.

Brumini et al. concluded that computer education and experience are key contributing factors in the development of positive nurse attitudes towards computers. Therefore, it is necessary to assess nurses' attitudes towards computers and develop computer classes for the various user levels. Providing computer education will improve nurses' attitudes towards computers thus ensuring a successful implementation of electronic documentation.

*Nurses adopting computer technology*

For many years nurses have used computers to place orders and lookup test results, yet were reluctant to adopt computerized documentation. It is imperative to understand nurses' perceptions, attitudes and motivational factors towards the adoption of computers. Lee's (2004) grounded theory study was conducted to analyze and evaluate nurses' perceptions toward utilizing a computerized care plan system and how nurses adopt new technology. This author examined the applicability of Rogers' Innovation-Diffusion Model, mainly the users' perceptions of an innovation's characteristics and how nurses' adopt new technology into their current nursing practice.

The setting was a large hospital located in northern Taiwan. In 1998, the hospital implemented computerized nursing care plan (CNCP) for all in-patient units. The study was conducted on three respiratory intensive care units. The sample consisted of 12 female nurses who had used the CNCP system for at least 6 months. The nurses had worked for the hospital for more than 3 years. The ages of this group ranged from 20 to 30 years of age. Eight nurses had an associate degree, three had graduated from college, and one was in a nursing master's program. All but two of the nurses had previously taken computer courses, and six participants had previously worked with computers. All 12 nurses participated in a one-on-one, in-depth interview regarding experiences using the CNCP system.

According to Lee (2004, p 233), semi-structured interviews lasted from 30 to 45 minutes and addressed questions such as, "What do you think about the CNCP?" "How does it affect your work?" and "What suggestions would you offer for implementing or

maintaining the system?” Each interview was tape recorded with the consent of the participant. The recruitment process ended when no new content or repeated topics emerged in the interview process.

Data were analyzed by transcribing the content verbatim from tape-recorded interviews and confirming this data with each participant. The researcher focused on comparing how the innovation characteristics and interview content from Rogers’ model, described the nurses’ pattern of adopting the CNCP. As a result, constant comparative analysis was used to examine the relationship between Rogers’ model and the interview content (Lee, 2004). This process began by open coding the interview data line by line, into a term or word that best represented the essence of the data. Next, the terms or words were analyzed for similarities or differences to identify major themes in adopting the new system.

Rogers’ Innovation-Diffusion Model compared the innovation characteristics perceived by users to nurses’ experiences with the CNCP. The five innovation characteristics; relative advantage, compatibility, complexity, trialability and observability identified common themes among nurse users. The following themes were identified: “paper savings,” “sense of control,” “added work stress,” “lack of linkage between care plan and patient care,” “improved assessment sequence,” “user-friendly system,” “the need for education on using nursing diagnoses,” “inadequate nursing content,” “format rigidity and inadequate space,” “charting evaluations and outcomes,” and “symbol of professionalism” (Lee, 2004 p 234).

Findings for relative advantages identified by nurses with the use of the CNCP system included decrease use of paper, easy-to-read format and a sense of control when creating care plans. On the other hand, such things as slow computer response time, printer problems and system down time increased the level of stress to the staff. Findings for the innovation characteristic compatibility revealed that nurses did not believe that computerized care plans improved the daily care provided to patients. However, some nurses revealed that the CNCP improved patient assessment documentation.

Complexity, the third major factor influencing acceptance of an innovation, revealed that nurses' viewed the CNCP program as being very user friendly however; nurses' expressed concern to the "click and print" approach. This sort of charting would decrease critical thinking skills and could potentially cause an oversight on a patient assessment. Nurses indicated a need for classes that pertained to the use of nursing diagnoses rather than computer skills. Trialability results revealed that nurses were not happy with the content design of the CNCP. This was evidenced by no appropriate nursing diagnoses, too few nursing interventions, and no available selective care evaluation (Lee, 2004). Observability was the last factor to influence user acceptance of an innovation. When nurses receive immediate feedback from the computer, perceptions of new technology tends to be positive. Nurses in this study were interested in knowing if the outcomes of their care plans made a difference in care quality, however no information was available (Lee, 2004).

Lee (2004) concluded that Roger's Innovation-Diffusion Model accurately described nurses' perception and adoption of new technology in every day practice.

Through the use of Roger's model, nurses are becoming more receptive to the use of computers. While the use of CNCP gave nurses a sense of professionalism, there were areas that did not provide benefits to the nursing staff or care provided to patients.

Prior research has proven that many variables can influence nurse's attitudes and images toward the use of an electronic patient records system (EPRS) prior to implementation. In a study conducted by Dillon et al. (2005), the attitude and image an individual develops, pertaining to the use of computers, determines the individual's intention to accept an EPRS. Dillon et al. (2005) recognized the need to identify user's computer knowledge, experience, attitudes and images towards EPRS prior to implementation. The purpose of Dillon et al. (2005) study was to identify user's intention to adopt and use a new electronic patient record system. Identifying dissatisfied users issues and recognizing the overall nature of user complaints, would create a better organized strategic approach for implementation and ultimately enhance the adoption of the new technology. Dillon et al. used a regression model, designed to identify variables that would predict attitude and in turn system adoption and use of the EPRS.

The study setting was a 450-bed regional hospital. All nursing staff at the hospital was aware that a new hospital-wide information system was being installed. According to Dillon et al. (2005), within 30 days of the survey being mailed, the new system would go "live" in most of the nursing units. In about 60 days the remaining units would go "live". Hospital administration prepared the nursing staff by offering periodic training sessions. Nursing staff was updated of the implementation timeline by respective unit nurse managers and a hospital-wide newsletter.

Surveys were distributed, via US mail, to all part-time (minimum of 12 hours per week) and full-time hospital nursing staff (greater than 612 staff members) prior to the implementation of the hospital-wide EPRS. All received an addressed envelope that contained (1) a cover letter that solicited the respondents' cooperation and assured anonymity, (2) the survey instrument, (3) an entry form for a drawing for a \$100 gift certificate, and (4) a return envelope addressed to the research team. According to Dillon et al., one hundred forty surveys were returned prior to the drawing deadline for an acceptable response rate of 22.9%. Ten of the 140 drawing entries were selected randomly, the winning nurses were contacted and prizes were delivered the following day. All hospital employees were informed of the drawing winners via the hospital newsletter.

Dillon et al. used an investigator-developed questionnaire that consisted of four sections. In the second section, Dillon et al. incorporated Davis' attitude instrument and Settle et al. image profile instrument in the third section. The questionnaire began with demographic questions that identified the sex, age, level of nursing education, and full or part-time employment status. One question was a subjective rating of computer expertise (beginner, novice, average, experienced, and expert) and one question was asked to gather a response for computer ownership (yes or no).

The second section contained a five-question general-attitude survey. The mean of the five standard 7-point Likert rating scales was used to create an attitude index that was in turn used to measure a nurse's overall attitude. The attitude instrument was taken from Davis, and consisted of the leading phrase, "All things considered, my using the

new [vendor/product name] patient record system is:” followed by the five attitude measures (good/bad, wise/foolish, favorable/unfavorable, beneficial/harmful, and positive/negative). Each had a range of 1 to 7, with the positive item positioned at 1 and the negative item labeled at 7. The 4 on the 7-point scale was labeled neutral.

The third section of Dillon et al. questionnaire was designed to obtain image profiles of the new hospital-wide EPRS in the minds of the respondents. Developed from the marketing and advertising literature, the image profile procedure was taken from Settle et al. The image profile instrument contained 25 words or phrases identified by a focus group to describe computer technologies. Nine words could be regarded as positive items and 16 negative. The items were listed randomly and respondents circled a number on a 7-point semantic distance scale to show how well they felt each described the new “ERPS”. The extremes were labeled “perfectly” and “not at all”.

The final section of the survey provided the respondents an opportunity to share general comments regarding the new EPRS. An open-ended question was asked: “Do you have any comments or concerns regarding the upcoming computer systems?” with five lines of open writing space (Dillon et al., 2005).

Cronbach’s alpha coefficient was used to examine the questionnaires internal consistency reliability for both image (positive and negative) and attitude. The positive image scores had a Cronbach’s alpha of .93, negative image scores of .95, and the attitude score was .96. These alpha scores are very acceptable, thus indicating that the factors within each multi-item variable are highly interrelated (Dillon et al., 2005).

Construct validity is concerned with whether the image items formed two distinct factors (positive and negative). Construct validity was assessed by factor analysis. During the exploratory factor analysis, three factors were identified: one for the positive image items, one for the negative image items, and a third that contained three negative items. These three factors were considered invalid and removed from the questionnaire. Ultimately, the remaining items clearly formed two factors, one for the nine positive image dimensions and one for the 13 negative image dimensions (Dillon et al., 2005).

In Dillon et al. (2005) study, T tests for independent samples were used to locate response differences for type of employment (full or part-time), sex, and computer ownership. Analysis of variance (ANOVA) was used to determine response differences for age, level of nursing education, and self-described level of computer expertise.

Hypothesis 1, was to determine what demographic characteristics and self-reported computer use variables affect a nurse's attitude toward an EPRS. According to Dillon et al. (2005) study, no significant differences were found for type of employment, sex, computer ownership, level of nursing education, and self-described level of computer expertise. Only one variable, age, presented with a significant difference in nurses' attitudes toward the new EPRS. Post hoc analysis revealed that there were significant differences between the second age category (30-39 years old) and the next two categories of 40-49 and 50-59. According to Dillon et al., the age category of 20-29 was not found to be significantly different from the others. Even though there was a significant difference for age between the groups, all age categories presented with positive attitude measures. Overall, data suggest a very positive attitude toward the

adoption of the new EPRS technology. The mean scores are on the positive side of neutral for 21 of the 22 grouping characteristics.

Hypothesis 2, examined the image profile of an EPRS and the affects it has on a nurse's attitude toward the system. Findings from Dillon et al. study revealed that the 22 image profile measures were found to significantly affect the attitude of the nurses when anticipating the introduction of a new ERPS. The items on the image profile that scored the highest as well as, appeared as the most negative were threatening, disgusting, discouraging, risky to use, and dehumanizing. These results show nurse's concerns regarding the implementation of the new computer system and the effects of the system on other staff and patients rather than the extra time it will require on the part of the individual nurse.

Hypothesis 3, examined whether or not the image profile of an EPRS would serve as a predictor of system adoption and use. Findings revealed that age was the only significant independent variable in the regression analysis. Other variables such as, type of employment, gender, computer ownership, level of nursing education, and level of computer expertise were not found to be significant. Dillon et al. (2005) study revealed that age has both a direct (.11) and indirect (.12) effect via image on attitude.

The authors concluded that on the whole, the nurses surveyed have a positive attitude toward EPRS. Differences between attitude and image results are likely found in education and implementation. Therefore, administrators need to realize that the nursing staff will be supportive of technology, provided overall system effectiveness and if patient care concerns are addressed. In addition, an organized and strategic approach to

implementation will improve employees' attitudes and images of computer technology. Other steps to improve attitudes and images of the nursing staff include group or individual training, provide staff with computers where they can "practice", and offer employees an affordable computer-buying plan. This would encourage staff to become more familiar with computers and common software programs thus improving their confidence and computer expertise.

The integration of computer technology to the nursing profession requires nurses to modify their current patient care processes as well as, their functional role in the department. For a successful implementation to occur, previous studies have revealed the importance of understanding how nurses view the use of computers and the factors affecting these attitudes (Shoham & Gonen, 2008). The purpose of Shoham and Gonen (2008) study was to determine registered nurses attitudes related to intent to use computers in the hospital setting as a predictor of future behavior. Additionally, Shoham and Gonen were interested in identifying the relationship between the attitudes of nurses and various variables related to intent to use computers, such as the ability to control behavior, threat and challenge, experience with computers, and the organizational and departmental climate. Shoham and Gonen (2008) study was based on Ajzen's theory of planned behavior (TPB). The TPB addresses the relationship between attitudes, subjective norms, perceived behavioral control, and the intention of nurses to use the computer. According to Ajzen, the term "behavioral intention" describes people's degree of willingness to try and the degree of effort they are willing to devote, with the goal of performing the behavior, all of which is affected by attitudes, social influence, and

behavioral control. The TPB explains individual behavior based on attitude, subjective norms, and perceived behavioral control.

The theoretical background is also based on the assumption that the threat and challenge in using computers are influential on human behavior. Shoham and Gonen (2008) elected to use Lazarus and Folkman's threat and challenge model to examine how nurses assess the risks of using a computer.

The setting was a major medical center located in central Israel which employs more than 1100 RN's. The sample consisted of 411 RN's which ranged in age from 20 to 65 years old. All participants were females since approximately 8% of the RN's employed at this facility are males. According to Shoham and Gonen, at the time of this study, a reputable survey revealed that 6% of all RN's in the United States were males. Therefore, the researchers decided to exclude the gender from this research. Of the 50 inpatient departments, 35 departments were randomly selected which represented all RN's in the medical centers' different departments. Forty-three percent of the sample nurses were bachelors prepared while 10% had obtained a master's degree; 29% of the participants were nurse managers, and 71% were staff nurses. Prior to the distribution of the questionnaire, participants' privacy in this research study was conveyed by maintaining total confidentiality of their personal details and by the application of the Declaration of Helsinki principles, as required by Israel (Shoham & Gonen, 2008). Questionnaires were randomly distributed to the RN's, and the entire process of completing the questionnaires was performed anonymously. Of the 502 questionnaires distributed, 411 were returned, for a response rate of 81.7%.

The investigator designed questionnaire contained four sections that examined nurses attitudes toward the use of computers, nurses perception of environmental support for use of computers, a research model for examining indices affecting nurses' intention to use computers, and demographic information. According to Shoham and Gonen (2008), the study tool was a Likert-style questionnaire. Part 1 of the questionnaire examined the planned behavior theory based on Ajzens' questionnaire with the addition of one factor; the tendency toward innovativeness. This section included 36 items on a scale with a range of 1 to 5, with 5 being the highest rating and 1 to 7, with 7 being the highest rating. Descriptive statistics was used to describe the attitudes of the nurses regarding the introduction of computerization.

Part 2 of Shoham and Gonens' questionnaire examined nurses' attitudes toward the use of computers based on Stronge and Brodt's Nurses' Attitudes towards Computerization (NATC) questionnaire. The questionnaire examined the attitudes of nurses toward computers by means of statements pertaining to five areas: benefit to institution; patient care issues; superior capabilities of computers' willingness to use computers; and legal issues in computer use. Pearson correlations were used to examine the relationship between continuous variables, such as the relationship between attitudes of nurses and their behavioral intention.

According to Shoham and Gonen (2008), Part 3 of the questionnaire looked at the nurses' sense of threat and challenge regarding the use of computers at work, based on the coping model developed by Lazarus and Folkman in 1984. This questionnaire was translated into Hebrew and underwent a validity and reliability test. Participants were

presented with 14 items and were asked to evaluate on a 7-point scale, pertaining to the sense of threat in the use of computers, such as “To what degree do you feel that use of a computer in your work at the department will limit your independence?” ( $\alpha = 0.86$ ). The sense of challenge in the use of computers was tested by questions such as “To what degree do you feel that the use of a computer in your work will have a positive effect on your functioning as a nurse?” ( $\alpha = 0.84$ ). Variance analyses were used by Shoham and Gonen to examine the relationship between categorical variables. Part 4 of the questionnaire examined demographic details, professional background, and individual computer use (Shoham & Gonen, 2008).

Findings for nurse’s attitudes toward the use of computers were positive, for both the general attitudes index and the specific attitudes index. According to Shoham and Gonen (2008), for years nurses were educated in accordance with a role-related model, whereby their roles were expressed in devoting attention to the patient and in humane and personal treatment. As a result, some nurses display sensitivity and hostility toward the integration of computers, as it is liable to harm the direct relationship with the patient.

Findings related to nurses’ perception of environmental support for use of computers (subjective norms) revealed the importance of developing a sense of self-efficacy among nurses to maintain the support and correct climate in the department and throughout the facility. Additionally, the Shoham and Gonen (2008) study found correlations between the perception of threat and challenge and the intention to use computers. Therefore, nurses who fear the use of computers and perceive them as a threat will have less positive attitudes toward the use of computers. These nurses may

also see the computer as a factor threatening their confidence in the job they perform, while other nurses may fear that the computer will take them away from the bedside or possibly eliminate nursing positions.

Nurses with computer experience, were found to have a higher degree of self-efficacy, a higher ability to accept innovation and a higher behavioral intention to use computers. For that reason, nurses with a high degree of self-efficacy and a high ability to accept innovation ultimately have a higher degree of readiness and curiosity to be interested in new and challenging areas. Additionally, Shoham and Gonen discovered a relationship existed between the departmental climate and the threat and challenge. According to the authors, this finding stemmed from nurses who are satisfied with their position, perceive the departmental climate as friendly, willingly come to work, and feel less threatened by changes and innovations. In an environment of aggression, suspicion, and lack of faith, nurses would be less likely to readily adopt changes such as computerized documentation.

Lastly, Shoham and Gonen (2008) examined indices affecting nurses' intention to use computers by individually applying various variables to the concept of nurses' attitudes toward working with computers. All research variables were tested in a model based on TPB. Findings revealed that departmental climate, previous experience, and education are clear factors in explaining the variance of the threat. As a result, a pleasant, stress-free department atmosphere can provide nurses with a sense of security thus allowing them to feel less threatened by computers. Additionally, the TPB proved that the head nurses' support is a highly critical element, given her enormous influence on the

staff. Other findings include, various indices explained 45% of nursing attitudes and 49% of behavioral intentions.

Shoham and Gonen (2008) concluded that the introduction of computers in the nursing profession is an innovation requiring changes in nurse's workflow. For a successful integration of computers in clinical areas, nurses must support the process. Therefore, the better the nurses' attitudes and assessment of their abilities related to computer use, the higher their intention to use computers.

#### *Implementing computer systems*

Understanding nurses' perceptions, beliefs, and satisfaction regarding the use of an electronic system and how nurses adopt this new technology into their every day nursing practice are essential factors to ensure a successful implementation of a computer system. Carter and Axford (1993) examined the importance of identifying nurses' learning needs regarding the use of computers as another essential factor for a successful implementation. Carter and Axford (1993) used Knowles' adult learning theory as the framework.

The sample population consisted of two groups of registered nurses; an expert group and a novice group. The first group (experts) consisted of 10 informaticians who were also registered nurses residing in the state of Victoria. The second group (novices) consisted of a random sample of 150 registered nurses practicing in all large major teaching hospitals in Melbourne, Australia (Carter & Axford, 1993).

Carter and Axford (1993) conducted this study in two parts. Part 1 consisted of round 1 and round 2. The first part (round 1) of the study consisted of a three-round

Delphi technique in order to collect and organize the expert's opinion on what specific computer knowledge and skills registered nurses' needed to know to effectively use computers in nursing practice and essential content for computer training. The information obtained from this expert group formed the questionnaire to be used in the second part of the study. In part 1 round 2, the experts rated each area according to importance and identified specific knowledge/skills of each. Part 1 round 3 consisted of the same expert groups coming to a Delphi consensus to ensure a high level of content validity for the questionnaire. This questionnaire would be presented to the registered nurses in the second part of the study.

Part 2 of the study involved a random sample of 150 registered nurses practicing in all large major teaching hospitals in Melbourne, Australia. The primary role for these nurses was to deliver primary care. They were defined as computer novices for the purposes of this study. Questionnaires were distributed for nurses to complete and return. Participants were asked to rate the specific computer-related content that was identified by the experts, as essential or nonessential according to their computer knowledge. Demographic data was collected from the sample and compared to the Victorian Nurses' Register to validate the representativeness of the sample. The sample was found to be similar in terms of gender, age, and basic nursing qualifications to the general population of nurses practicing in major metropolitan teaching hospitals (Carter & Axford, 1993).

Of the 150 questionnaires distributed, there was a 64% return rate. To determine if the group believed an item to be essential or nonessential, a frequency of 50% or greater was required. Experts indicated that 44 items were essential and 31 items were

nonessential. Novices indicated that 17 items were essential and 58 were nonessential. Both groups agreed on 48 items of which, 17 were considered essential and 31 nonessential. Expert and novice disagreement was found to be statistically significant on 19 items ( $p < 0.05$ ). Carter and Axford (1993) decided that it was a more conservative decision to risk error in identifying an item as possibly different, when in fact it was not, rather than to adjust the alpha level down a posteriori to account for the 27 multiple comparisons.

Findings revealed the necessity to understand Knowles' theory of adult learning which states, the learner needs to be the primary driving force of the content. Additional findings from this study revealed the need for three groups of content to be considered when developing an educational curriculum. According to Carter and Axford (1993), the first content group was identified by the novice group and validated by the expert group as being essential information with the highest priority to be taught in the computer training courses. The second group of computer knowledge and skills content was considered by the expert group to be essential information for computer users to know however; the novice group disagreed with the experts. Therefore, since the novice had a limited amount of computer knowledge and skills, the ability to recognize the "need to know" was not present. For that reason, it is important for the experts to teach the necessity of why the novice needs to know this information first, and then move on to computer knowledge and skills. The last content group was considered to be nonessential by both the expert and novice groups. This content group would be taught to the novice learners at a later date (Carter & Axford, 1993).

Carter and Axford (1993) concluded, there were three distinct content groups of computer knowledge/skills items that nurses need to be educated on in order to effectively and efficiently use computers in practice. By understanding these content groups, nurse educators can better develop computer training curricula which will focus on the learning needs of nurses that are considered to be computer novices.

The nursing profession has been slow in adopting computerized charting into practice. Currently many acute care facilities have begun implementing computerized documentation systems and have realized the need to better understand the issues nurses had with information technology. The purpose of Lee (2007) study was to explore nurses' experiences at the early stage of implementing a nursing information system. Lee (2007) used a 2-year longitudinal study to explore nurses' perspectives of the impact of a nursing information system on their daily practice. A focus group design was used to gain insight into nurses' attitudes, beliefs and opinions regarding experiences incurred during the early stages of implementing the nursing information system. According to Lee (2007), the focus groups strategy was chosen as a less intimidating approach than one-on-one interviews to gain information about the topic of interest.

The study took place at an 800-bed teaching hospital in northern Taiwan. The hospital employed approximately 300 nurses. The sample was recruited by announcing the need for nurses who worked on four surgical units to volunteer. According to Lee (2007), of the 90 nurses working on these units, 22 agreed to participate. During the early stage of implementation, nurses were required to chart on at least one patient during their shift both online and on paper. Since the nursing information system had been pilot

tested on these four units during the design phase, the staff nurses from these units were purposively sampled to obtain the most in-depth feedback on the systems' impact (Lee, 2007).

Once the institutional review board approved the study, data was collected from November to December 2004. Nurses who volunteered to participate in the study received a document which explained the study purpose, interview questions, and the data collection process with tape recordings prior to signing the consent form and being interviewed. According to Lee (2007) this guaranteed anonymous and voluntary participation in the study. The researcher conducted four focus groups, which consisted of four or five nurses, who had volunteered to participate in the study. Participants were instructed to meet in the conference room after their shift. Each participant received an interview guide consisting of questions such as, "How do you use this nursing information system in your care routines?" "What has been the impact of using this technology on your daily practice?" "Is this the system that you expected to work with?" "Have you encountered any problems or difficulties using the system?" "How do you manage or solve these problems?" "Do you have any issues that you would like to discuss?" and "Do you have any suggestions for using this system in the future?" At the conclusion of each focus group, nurses were asked to provide demographic information which included age, educational background, nursing experience and computer experience. Focus groups lasted approximately 1.5 to 2 hours. Upon completion of the session, each participant received a small gift to express gratitude for contributing to the study (Lee, 2007).

Data of verbatim transcripts of taped interviews were analyzed as proposed by Miles and Huberman. Raw data were open coded, line by line, to identify each incident or theme. Next, the contents of the transcripts were compared and contrasted with one another. The identified concepts or themes were arrayed either in tables or diagrams to indicate patterns or relationships among themes. Lastly, major concepts were abstracted, and themes were categorized from the content of these tables and diagrams for conclusions to be drawn about the nurses' descriptions.

Demographic findings from Lee's (2007) study revealed all participants were female nurses. Roughly half of the 22 participating nurses (n=10) were 26 to 30 years old, followed by those younger than 25 years (n=9). The remaining participants (n=3) were 36 to 40 years old. More than half of the nurses (n=12) had associate degrees and the rest (n=10) had baccalaureate degrees. Approximately half of the participants (n=10) had 4 to 8 years of nursing experience, followed by those with fewer than 3 years of experience (n=9). The remainder (n=3) had more than 10 years of nursing experience. The majority (n=15) had never used a computer at work, and all but one participant had taken computer courses.

Findings from the focus group interviews identified five major themes concerning the early stage of system implementation. According to Lee (2007), these themes included system advantages of reminders and convenience, dissatisfaction with the content design and the charting process, keyboard entry issues, concerns about system reliability and data security, and stresses attributable to added work and poor interdisciplinary cooperation.

Findings for system advantages of reminders and convenience identified by nurses included pop up reminders of potential problems related to the patients nursing diagnosis. In addition, the nurse would then select appropriate interventions for care by simply picking and clicking suitable choices from preprogrammed lists in the computer system. On the other hand, nurses were dissatisfied with content design and the charting process. Participants stated the categories of patient condition should be based on nursing care, not traditional medical classifications. Additionally, when nurses participating in the study had questions or computer problems, they reported not knowing who to refer questions to or how to contact Information Systems (IS) to obtain an answer therefore, they would skip the problem (Lee, 2007).

Keyboard data entry was another major issue identified by nurses in the early implementation stage. Nurses stated the training was insufficient, especially in typing skills and specialized functions such as the use of “hot keys”. Study participants recommended designing computer training that provides need-to-know aspects of the system rather than teaching all features of the system at once. Other teaching strategies included instructor-led classes or computer-based training and hands-on practice (Lee, 2007).

Confidentiality of patient data and system reliability were additional concerns of nurses in Lee (2007) study. Even though the current system used firewalls and antivirus programs to protect patient data, all users must understand the importance of keeping their own user ID and password secure as well as, logging themselves off of the computer prior to leaving the computer.

Lastly, nurses expressed concerns of increased stress related to additional work and poor interdisciplinary cooperation. Nurses reported competing with physicians and physicians' assistants for computers due to a lack of available computers on the nursing units. Additionally, physicians and physicians' assistants claimed to be busy and therefore would ask nurses to retrieve patient information on the computer. Nurses also identified communication issues from other departments that were in the process of implementing a computer system (Lee, 2007).

Lee (2007) concluded, findings from this study indicated that nurses recognized the convenience of the reminder functions and references available for patient care. On the other hand, nurses had issues with the content design and charting process, keyboard data entry, concerns regarding confidentiality and system reliability, increased workload and poor interdisciplinary cooperation. Therefore, to facilitate in the early stage of transitioning from paper charting to the implementation of computerized documentation, the author suggested nurses' involvement in system design, the importance of providing sufficient computer and keyboard training, redesigning workflow, and improving interdisciplinary communication (Lee, 2007, p 299). Providing computer education and improving nurses basic hardware and software skills can lead to many positive outcomes. Basic understanding and knowledge of computers will improve nurses confidences levels thereby, enhancing nurses ability to problem solve computer related issues as well as, provide suggestions to improve the system content and charting processes. Ultimately, this will lead to system acceptance by nurses and a successful implementation of a computerized documentation system.

*Evaluating computer systems*

Larrabee et al. (2001), evaluated documentation completeness before and after implementation of an electronic documentation system. The study examined differences in documentation completeness of nurse assessment of patient outcomes (NASSESS), achievement of patient outcomes (NGOAL), nursing interventions completed (NQVAL), and routine assessments before and after the implementation of a nursing information system (NIS). Researchers used a time-series design which included three time points; Time 1 (August 1995), 1 month prior to NIS implementation, Time 2 (April 1996) 6 months post NIS implementation, and Time 3 (April 1997), 18 months post NIS implementation.

Larrabee et al. (2001) study took place in a 100-bed university hospital located in western Tennessee. The study included three units implementing NIS; two medical/surgical units, one with 31 beds and one with 32 beds; and one 23-bed intensive-care step-down unit. A stratified sample of records was randomly selected by medical records personnel based on the percentage of admissions for each of the three nursing units at three different points in time. The combined sample consisted of a minimum of 90 records at each selected time point. Prior to implementing NIS, a project team, consisting of a project manager and four Registered Nurses' (RN's) was developed to customize the documentation system. The documentation software purchased did not contain care planning dictionaries therefore, requiring the project team to enter data elements into the diagnoses, interventions, and outcome dictionaries. For the diagnosis dictionary, the North America Nursing Diagnosis Association (NANDA) diagnoses were

utilized. For the intervention dictionary, activities listed in the Nursing Intervention Classification were used. For the outcome dictionary, the project team generated outcome statements since there was no outcomes taxonomy available at that time. For the care plan dictionary, the project team opted to use data from diagnoses, interventions, and outcomes dictionaries to create standardized care plans. By entering the data elements into corresponding dictionaries, this enabled nurses to customize and individualize nursing care plans by selecting the appropriate diagnoses, related interventions and outcomes from the respective dictionaries. Once the dictionaries were created, the NIS project team provided an 8-hour educational class to all RN's on the use of nursing order entry, assessment documentation, and components of developing care plans.

Larrabee et al. (2001) utilized a quasi-experimental design to examine differences in nursing documentation completeness for patient outcomes assessments; patient outcomes achieved (beneficence), interventions (quality), and routine assessments (vital sign, daily weights, and intake and output) before and after NIS implementation for: (a) combined sample data, (b) with-in unit data, and (c) among-unit data. According to Larrabee et al. (2001), data were obtained by retrospective chart reviews at designated times. Nursing assessments of patient outcomes (NASSESS), beneficence or patient outcomes achieved (NGOAL), and nurse perceived quality (NQUAL) was measured using the Nursing Care Plan Data Collection Instrument (NCP DCI). The chart review tool incorporates elements of the patient care plan as criteria for evaluating documentation. By using the NCP DCI tool, the data collector reviews documented

nursing care from the time the care plan was initiated to the time the care plan was discontinued or the patient was discharged. Chart review was limited to a maximum of three nursing diagnoses, goals, and interventions.

The NASSESS score was the ratio of the number of times nursing assessment outcomes were documented to the number of times assessment outcomes should have been documented on a selected patient. NGOAL score was the ratio of the number of times patient outcomes were met to the number of times patient outcomes were assessed. NQUAL score was the ratio of the number of times nursing interventions were documented to the number of times they should have been documented.

Measurement of routine assessments was the ratio of the number of time they were documented, according to physician orders, nurse orders, or hospital policy. Once approval was obtained from the Institutional Review Board, three volunteer staff nurses were educated on the use of NCP DCI by the originator of the instrument. Acceptable interrater reliability (ANOVA,  $p < 0.05$ ) was demonstrated prior to and midway through each data collection time point.

As the data collectors reviewed each chart, care plan elements were transcribed onto the NCP DCI. When more than three diagnosis, outcomes, or interventions occurred, three were randomly selected for review. Next, each chart was reviewed for documentation of expected outcomes and interventions. Average chart review time was 2 hours. Prior to collection of data at Time 3, staff nurses were retrained on the use of the NIS. Emphasis was placed on individualizing nursing care plans by charting the most relevant nursing diagnoses, expected outcomes, and interventions. Additionally, nurses

were instructed to document the status of patient progress toward achieving outcomes. Two months after the education intervention, Time 3 data was collected (Larrabee et al., 2001).

Findings from Larrabee et al. (2001) study, which examined completeness of nursing documentation as combined sample, revealed significantly different mean NASSESS, NGOAL, AND NQUAL scores among the three time periods. Mean NASSESS and NGOAL scores were significantly lower at Time 2 than at Times 1 and 3, yet the mean NQUAL score was significantly higher at Time 3 than at Times 1 and 2. Analyses of variance showed statistically significant differences among the three time points for the mean blood pressure, with Time 2 mean scores being lower than Times 1 and 3. I & O mean scores was higher at Time 3 than either Time 1 or 2 and mean temperature, pulse, respiration, and weight scores were higher at Time 3 than Time 2 however, none was statistically significant. Mean scores for all variables with the exception of NQUAL declined between Time 1 and Time 2, however all improved by Time 3 therefore, suggesting that six months of NIS use is not a sufficient amount of time for RN's to master NIS documentation. Time 3 scores for all variables were higher than Time 2, indicating that continued use and re-education were effective in improving documentation.

Research results pertaining to the completeness of nursing documentation within nursing units revealed that each nursing unit's mean scores for NASSESS varied significantly among the three time points. Mean scores for NQUAL and NGOAL varied significantly among the three time points for Unit 1 and 2 but not Unit 3. Additionally,

when Larrabee et al. (2001) evaluated nursing documentation completeness among nursing units they noted a significant difference in mean NASSESS scores among nursing units at each time point. A consistent pattern for which unit had the highest or lowest scores could not be determined however, Unit 3 had the lowest score for Time 2 and 3. The units mean NQUAL, blood pressure, pulse, respiration, and I & O scores differed at Time 1 only. The units mean score differed on daily weights at Time 3 only. The mean NGOAL scores did not differ by nursing unit at any of the time points. Multivariate analysis of variance revealed that time and re-education had a significant effect on the mean scores for NASSESS, NGOAL, and NQUAL. Finally, findings suggested that unit differences in variable scores indicate that one unit may not be representative of other units. This may be due to differing characteristics of units or nurses, which may influence documentation completeness.

Larrabee et al. (2001) concluded that a nursing information system did not improve documentation completeness within the first 6 months post-implementation. The authors noted that after re-education and more time working with the NIS, findings revealed a significant improvement of NASSES, NGOAL, NQUAL, and blood pressure scores by Time 3. Additionally, researchers from this study acknowledged several limitations, which may under represent RN's use of the nursing process to address the needs of patients. Larrabee et al. (2001) recommended periodic evaluation of documentation completeness after implementation to determine problem areas that may require further education or revisions in the program in order to improve patient record data validity for patient care decisions, quality improvement, and research.

The use of computer technology continues to increase in the health care industry thereby impacting nursing practice. The objective of electronic documentation is reduction in paperwork allowing nurses to devote more time to patients, improve documentation, provide greater access to patient's charts, and improve patient outcomes. The purpose of Darbyshire (2004) interpretive phenomenology qualitative study was to discover nurses and midwives' perceptions, understandings and experiences of Computerized Patient Information Systems (CPIS) in their everyday practice. This study examined nurses and midwives' meanings, perceptions, and understandings related to CPIS. Clinicians' perspectives of the CPIS on patient care, clinical practice and outcomes were investigated (Darbyshire, 2004). The research question was "What are nurses' and midwives' experiences of using computerized patient information systems (CPIS) in every day clinical practice?"

This study included various hospitals across the southern and eastern areas of Australia. Potential participants were approached and invited to participate in the study. There were a total of 13 focus group interviews which were held in hospitals in five different cities. The participants ranged from Level 1 RN's, to Clinical Nurse Consultants and nurses with IT management roles. The sample consisted of 53 participants from 25 different public and private hospitals and community areas. Participants' backgrounds included general medical/surgical, midwifery, child health, mental health, anesthetics, clinical support, emergency, theatres, intensive care, and community health.

According to Darbyshire (2004), group interviews lasted between 45 and 90 minutes. Initially, questions started off broad and became more specific as the interview progressed. Interviews were tape-recorded, transcribed and checked to ensure accuracy and completeness of interview data. Data collection and initial analysis were completed concurrently in order for emerging themes to develop from early data to inform subsequent interviews. Each interview was analyzed manually line-by-line to identify and explore salient themes, patterns, events, perceptions, understandings, and practices that highlighted the practitioners' experiences of using computerized patient information systems. As data was collected and analyzed, each question and response was labeled with the focus group number, interviewer and participant number. This method of labeling the dialog of each participant assists in establishing an analytical "trustworthiness" by showing participation by various members of the focus group.

Overall, findings from this study revealed two themes; "CPIS as beneficial and valuable," and "CPIS as irrelevant, useless or sinister". Few participants viewed CPIS as being beneficial in their practice. Benefits of CPIS identified by the subjects included the reduction of administrative and repetitive tasks and improvement of legibility of documentation (Darbyshire, 2004, p. 19). Findings for the second theme, CPIS as irrelevant, useless or sinister," participants revealed that CPIS was difficult and time consuming to use, incompatible with other computer systems and was unable to capture the "reality" and actual acuity of the patients.

Darbyshire (2004) concluded that the majority of clinicians were dissatisfied with the CPIS, with good reason. Clinicians were promised improvements of CPIS, which

have not occurred along with the belief of being powerless in influencing the needs from a clinical viewpoint to enhance an electronic documentation system. These beliefs were validated by the Chief Information Officer, who stated that the clinicians' were "resistant to change" and that the answer was to provide "more education and training". To ensure acceptance of a CPIS by clinicians, diverse variables need to be identified and developed in order to provide an adequate system that will meet the needs of administration and clinicians thus yielding a positive patient outcome.

Computerized documentation systems are increasingly being used by nursing professionals in acute care facilities. Numerous studies have examined the relationship between nurse's computer knowledge and attitude and acceptance of using computers however; few studies examine the relationship between efficiency of computer use and nurses' daily practice. The purpose of Lee et al. (2004) study was to test a model of factors influencing the efficient use of a computerized nursing care planning (CNCP) system among hospital clinical nurses. The investigator developed a model, which explores factors that affect the use of nursing information systems. The model consists of three major categories of variables related to computer use: demographic, computer experience, and technology factors.

The study setting was a medical center in Taiwan that implemented the CNCP in 1998. The system has been in use in all inpatient nursing care units since implementation. According to Lee et al. (2004), a previous study revealed that most nurses viewed this system as being user-friendly. Novice nurses were educated by experienced computer users in the unit who provided hands-on experience and assistance

with computerized charting. Of the 738 nurses who answered the questionnaire, 612 (84%) were clinical nurses and the rest shared management responsibilities.

This study was a secondary analysis of data from a previous study establishing the reliability and validity of a scale for evaluating CNCP systems. The original scale contained 40 items, and after factor analysis, 22 items were retained. Each of the 22 questionnaire items were rated using a Likert type scale from 1 to 4 with 1 equaling strongly disagree and 4 equaling strongly agree. Descriptive statistics were used to describe the demographic characteristics of the study sample. Correlation and binary logistic regression analyses were applied to explore the relationships between demographic, computer experience variables and technology factors, and to predict the efficiency of computer use in the proposed model. According to Lee et al. (2004), the procedure for developing the instrument and its reliability and validity have been reported elsewhere.

Statistical findings revealed that nurses generally valued using the CNCP system. Lee et al. (2004) analyzed data from 612 clinical nurses, and the internal consistency was 0.88. The alpha coefficients for the subscales were: patient care 0.81; nursing efficiency 0.83; professionalism 0.42; usage benefit 0.65; education/training 0.63; and usability 0.62.

Demographic findings from the 612 participants revealed that more than half (55.6%) were between 20 and 25 years old, followed by those who were between 26 and 30 (38.4%) years old. Most nurses (77.8%) had an associate degree, followed by those with

a baccalaureate degree (21.4%). The majority (59.1%) had worked in nursing for 3-10 years, followed by those with 1-2 years experience (26.8%) (Lee et al., 2004).

Approximately three-quarters (73.6%) of nurses had computer skills to use two to four Microsoft applications, yet 67.6% rated their computer skill level as “average”, while 24.7% rated their skill level “below average”. About one-third (33.5%) expressed feeling no pressure to using the nursing information system, while 39.5% admitted that they had at least one usage pressure source. Slightly more than one-third (34.6%) spent less than half an hour and 36.4% spent between one half to one hour daily using the CNCP however, 70% spent less than 1 hour each day using the CNCP. This was followed by 17.8% who spent between 1 to 2 hours each day using the CNCP. Demographic variables, computer experience variables, computer experience variables, and perceived technology characteristics were tested for correlation with daily usage hours. The following variables were significantly correlated with daily use of the CNCP: self-rated computer knowledge level ( $r = 0.08$ ,  $P = 0.048$ ), number of usage pressure sources ( $r = 0.17$ ,  $P = 0.000$ ), patient care ( $r = -0.09$ ,  $P = 0.021$ ), nursing efficiency ( $r = -0.14$ ,  $P = 0.000$ ), education/training ( $r = -0.25$ ,  $P = 0.000$ ), and usability ( $r = -0.142$ ,  $P = 0.000$ ). These results indicated that nurses who rate themselves as having less computer knowledge, less computer usage pressure, and who perceived more technology characteristics in patient care, nursing efficiency, usability and education/training spent less time each day using the computerized care plan (Lee et al., 2004).

Since the dependent variable was a categorical variable, logistic regression was applied for data analysis. Findings revealed nurses over age 30 used the CNCP five times

more than nurses under age 25. By adding 1 year of age increased the time they used the system by 1.6 times. Therefore, being younger, having more education, self-rating oneself as having a lower level of computer knowledge and less usage pressure, perceiving having more education/training and system usability, and perceiving less usage benefit were associated with spending less time using the CNCP system. The number of computer skills, perceived technology use in patient care, nursing efficiency and professionalism were not significantly related to overall use.

Lee et al. (2004) concluded that the purpose of using computer technology in nursing is to improve the quality of patient care. Nurses use various types of computer technology when providing patient care. The CNCP is a documentation tool that impacts compliance with charting standards, nursing efficiency, and user acceptance/satisfaction, rather than a tool for obtaining a physical measurement on a patient. According to Lee et al. (2004), it would be expected that nurses would spend less time charting thus allowing them more time to provide patient care. On the other hand, creating a thorough care plan may provide better care guidelines thereby, improving patient care.

Computerized documentation systems continue to be developed to improve the efficiency of charting allowing nurses to spend less time charting and more time with patients. Currently, computer software integrates documentation, care planning, order entry, and charting thus creating a complex system and dissatisfaction among the nursing staff. The purpose of Smith et al. (2005) comparative descriptive study was to determine the impact of computerized documentation on staff attitudes, completeness of documentation, and time required for documentation. The standardized languages of

Nursing Interventions Classification (NIC) and Nursing Outcomes Classification (NOC) were used for the organizational framework.

A convenience sample was obtained from 82 Registered Nurses (RN's) in a western teaching hospital. The majority of the RN's had worked in nursing between 1 and 5 years and were between the ages 20 and 30 years old, female, BSN prepared and had various experience with computers. Smith et al. (2005) did not find any significant demographic differences between the pre-implementation and post-implementation participants.

The researchers utilized a quasi-experimental design. Data was collected both pre-computerization and post-computerization. According to Smith et al. (2005), nurses' attitudes were measured using the Stronge and Brodt Nurses' Attitudes Toward Computerization questionnaire, consisting of a 20-item, Likert-type 1 to 5 rating scale, with a total score range of 20 to 100, with a high score indicating a positive attitude. Questions were arranged into five categories: patient care, benefit to institution, job threat, legal aspects, and capabilities of computers. Researchers reported a split-half reliability quotient of  $r = 0.90$  as a measure of internal consistency. Subsequent researchers rated the instrument to be reliable with Cronbach's alpha of .92 and .93, respectively. Participants consisted of 46 Registered Nurses (RNs) who were employed on a 26-bed orthopedic and neuroscience unit and an 18-bed pulmonary unit. Surveys were distributed to the staff on the two units 1 month prior to computerization and 1 year post-computerization implementation. Demographics were collected on all participating subjects.

Smith et al. (2005) used an investigator developed observation tool to evaluate documentation time of nursing care. This tool measured 10 activities frequently performed by nursing while providing patient care. Activities include medication preparation and administration; direct patient interaction; information review, including paper and computer; communication with other care team members; documentation; and personal breaks. Observations were conducted on 82 RN's for 2-hour time periods, purposely chosen to reflect likely documentation times. Data elements included: time of day, type of nursing activity, and location of activity. The observation time periods matched pre-computerization and post-computerization for day of the week and time of day. Observations were completed between 1 and 4 months pre-computerization and 1 year post-computer implementation. Observation times were totaled for each activity, and then aggregated to obtain pre-observation and post-observation times/averages by minutes for each activity.

Completeness of documentation was evaluated by the presence or absence of 89 patient care elements contained within eight core NIC interventions. Core NIC interventions included pain, falls, physical assessment, skin assessment, discharge planning, vital signs, hygiene, and teaching. A diagnosis-related group selected every fourth patient from a 31-day list of discharges for each unit. A pre-chart audit was completed approximately 1 month prior to going live, and the post-chart audit was conducted approximately 11 months post-computerization. The purpose of the audit was to determine the documented presence or absence of each patient care element within the eight core nursing interventions (Smith et al., 2005).

Findings from the Nurses' Attitude toward Computerization questionnaires which were distributed to 46 RN's pre-implementation and post-implementation revealed statistically significant differences ( $P = .004$ ) in nurses attitudes toward computerized documentation between pre and post-computerization. According to Smith et al. (2005), nurses had more negative attitudes post-computerization, as evidenced by a decrease in the mean attitude scores from 70.7 to 61.4. The most significant decline in scores were evident in survey statements such as, computers make nurses' jobs easier, computers save steps and allow nursing staff to become more efficient, increased computer usage will allow nurses more time for patient care and computer increases costs by increasing nurses' workload.

According to Smith et al. (2005), results that examined the differences in completeness of documentation pre and post, computer implementation indicated an improvement in documentation as evidenced by 34% increase of completed documentation post-computerization. The NIC area showed the most improvement in completeness of documentation included pain assessment, safety surveillance, teaching, skin surveillance, neurological assessment, and discharge planning. Other results in this area indicated there was no change in 60% of the NIC areas while only 5% of the NIC areas were less complete. The less complete elements included pain reassessment, MD notification of pain outcomes, and neurological assessment elements of gait, skin, and diaphoresis.

Smith et al. (2005) examined the time nurses spent charting pre and post computerization on one unit as well as any differences between units. Findings

differences revealed the time nurses spent charting, measured in minutes, showed no statistical change from pre-computerization to post-computerization. Direct patient care decreased from 40.4 minutes pre-computerization to 35.5 minutes post-computerization ( $P = .15$ ). Additionally the researchers noted a significant difference ( $P = .002$ ) between overall time taken to chart between the two study units. Nurses on the pulmonary unit took longer to chart than nurses on the orthopedic/neuroscience unit, both pre-computerization and post-computerization.

Smith et al. (2005) concluded there was a significant improvement in the quality of computerized documentation however, no significant change was noted in time spent documenting. Nurses' attitudes may improve during the post-computerization period.

Computer technology and the use of electronic health records (EHR's) have been slow to reach the smaller community-based acute care facilities. There are various contributing factors for the slow influx of EHR's such as, an enormous investment of capital, human resources, and the affects EHR's place on a multitude of providers. Computer systems have the potential to improve or create obstacles to work performance, communication, and documentation. Since nurses play a key role in providing and coordinating patient care, the extent to which EHR's enhance or detract from nurses' role performance can be expected to affect patient outcomes. According to Kossman and Scheidenhelm (2008), there is insufficient knowledge regarding how nurses' use of EHR's affects their role performance and patient outcomes in community-based acute care settings. The purpose of this descriptive qualitative study was to describe how community hospital nurses use EHR's as they provide patient care and their views of the

impact of EHR use on their work and patient outcomes. Kossman and Scheidenhelm (2008) used Doran's nursing role effectiveness model as the theoretical framework for assessing the effect of EHR's on nurses' role performance and patient outcomes.

The setting was a medical-surgical floor and intensive care unit (ICU) at two community hospitals within a regional Midwestern healthcare system, both in the second year of implementing the same EHR system. Nurses at both facilities used laptop computers on carts and desk computers to access the EHR. Hospital 1 had 157 beds and was located in a midsize city (110,000); hospital 2 had 47 beds and was located in a rural community. According to Kossman and Scheidenhelm, these two types of units were chosen because they differ in attributes that theoretically may affect nurses' work: patient acuity, workload, and pace of work.

The sample consisted of 46 nurses from both hospitals participating in the study. The EHR system had been in use for 18 months and participants in this study had used this system for at least six months. At the larger urban hospital, 31 nurses completed 29 surveys and 15 interview/observations. At the smaller rural hospital, 15 nurses completed 13 surveys and 7 interview/observations. Six nurses who participated in interview/observations did not complete demographic data forms, therefore percentages in the demographic table are based on 40 participants.

According to Kossman and Scheidenhelm (2008), this descriptive qualitative study, based on phenomenological principles used questionnaire surveys, individual interviews, and observations techniques to describe nurses' experiences with EHR use in community-based hospitals and the meaning the nurses derived from this experience.

Questionnaire surveys consisting of open-ended questions were collected first to explore the boundaries of the phenomenon of how nurses use EHR's and perceive its impact on work performance and outcomes. Next, the researcher observed nurses on the study units' use of EHR's and concurrently interviewed them. These observations/interviews allowed the investigator to identify practice patterns as well as problems encountered with EHR use including nurse developed "work-arounds". Trustworthiness was addressed through the use of triangulation.

Analysis was concurrent with data collection. Interview data was coded for themes representing meaning of the experience and facilitated by a qualitative software program. Emerging codes and themes influenced observations and questions in later interviews, as clarification, validation, or refutation was sought (Kossman & Scheidenhelm, 2008).

Findings from Kossman and Scheidenhelm (2008) study revealed that nurses perceived the use of the EHR as extensive and time consuming; both helping and hindering nursing work; having positive and negative effects on patient outcomes; and was preferred over paper charts but should perform better to support nursing work.

Hypothesis 1 examined how community hospital nurses use EHR's. According to the Kossman and Scheidenhelm (2008) study, nurses reported using EHR's for all aspects of patient care such as shift assessments, care planning, treatments, medication administration, admission and discharges. Additionally, nurses used computers to access worklists, review orders, view transcribed reports, obtain results from lab and diagnostic testing, interdisciplinary notes, and past history.

Nurses estimated they spent from 25 to 98% of their work shift using the EHR, with a median of 50% and mean of 56.6%. The majority (73%) reported spending at least half of their shift using the EHR system however; three nurses reported spending more than 90% of the shift using the HER system. These three nurses were employed at the rural hospital, all reported high levels of comfort with computer technology. Two nurses were in their 30s while one was in her 50's. Observations of nurses made by the researchers noted they chart on 23 screens per patient during day shift initial assessments. As the number of screens nurses are required to access for documentation and retrieval of information increases, reading and screen refresh time add to the total time nurses spent interacting with the EHR (Kossman & Scheidenhelm, 2008).

Hypothesis 2 explored the effects that nurses think EHR use has on their ability to perform nursing care. Findings from Kossman and Scheidenhelm (2008) study revealed that nurses reported the use of EHR's as having both advantages and disadvantages. Advantages reported by nurses of the EHR include increased access to patient care information, improved efficiency, and organization all of which enhanced their work performance. Disadvantages of an EHR identified by nurses that hindered their job performance included an increase amount of time spent retrieving or documenting information, less time spent with the patient, interfering with written interdisciplinary communication, and hindering critical thinking. Overall, nurses thought the benefits of an EHR outweighed the detractions, while two nurses preferred paper charting.

Hypothesis 3 evaluated the relationship between the use of an EHR and how it affects patient outcomes. Findings revealed that many nurses thought EHR use improved

patient safety by preventing patient errors. On the other hand, nurses believed that the quality of patient care decreased with the use of the EHR. Many nurses reported spending more time on the computer than providing patient care at the bedside.

Kossman and Scheidenhelm (2008) concluded that EHR's presented both advantages and disadvantages to nurses in the documentation of patient care and patient outcomes. Overall, nurses agreed that the advantages of the EHR system outweighed the disadvantages. Improving patient safety and preventing patient errors are just a few of the positive patient outcomes associated with the use of EHR systems.

### *Summary*

Literature reviews have revealed the importance of developing positive attitudes and computer-use acceptance among the nursing staff. Burkes (1991) believed that understanding the diverse levels of computer knowledge and determining nurses' computer-use needs, skills, attitudes, beliefs and readiness to learn were instrumental in the implementation of a successful electronic documentation system. Numerous studies have also revealed the importance of computer education and prior computer experience as key fundamentals for the promotion of positive computer attitudes (Brumini et al. 2005).

Burke (1991) selected Vroom's (1964) expectancy theory to examine nurses' computer-use attitudes and identify variables that correlate with identified attitudes. According to Vroom (1964), the expectancy theory is based on conscious choices and the processes that an individual undergoes during the decision making process. Vroom's (1964) theory consists of valence, expectancy and instrumentality, which equal

motivation. Vroom defines valence as an individual's preference of obtaining an outcome. The individual may ask themselves, "Is the outcome I get of any value to me?" Expectancy refers to an individual's belief of whether or not they are able to complete a task. Instrumentality is a probability belief that links one outcome to another outcome. For instance, an individual may ask "what's the probability that, if I do a good job, that there will be some kind of outcome (reward) in it for me?" Therefore, the individual considers the various levels of outcomes and peruses the level that offers the most desirable reward (Vroom, 1964).

As innovated changes continue to diffuse into healthcare systems, further research needs to be completed in order to assess barriers incurred by nurses, which may hinder or prevent the adoption of computer technology (Lee, 2004). A study conducted by Shoham and Gonen (2008), discussed computers in the nursing profession as an innovation requiring the modification of nurse's current workflow. According to Dillon et al. (2005), nursing staff will support and adopt new technology and process changes if overall system effectiveness and patient care concerns are addressed, adequate computer education is provided and practice computers available for staff use.

Successful implementation of an electronic documentation system requires completion of the screen build, testing, and user computer education classes. Research shows the importance of nurse's involvement during system design, computer and keyboard training classes, redesigning workflow, and improving interdisciplinary communication (Lee, 2007).

The majority of healthcare in the United States occurs in community-based hospitals, which have been slow to embrace the use of computer technology. Currently, national efforts to improve the quality of healthcare have placed a strong focus on information technology to support safe and effective practice (Kossman and Scheidenhelm 2008). Unfortunately, not all electronic healthcare record (EHR) systems meet nurse's needs for documenting care plans and patient outcomes (Darbyshire, 2004). Additional literature review revealed that computerized charting systems did not always demonstrate immediate improvement in documentation however; when additional education was provided as well as, time for staff to become more familiar with the computer system, an improvement in documentation was noted (Larrabee et al., 2001).

Overall, findings have revealed that EHR systems improve patient outcomes by improving the users' ability to work efficiently and effectively. Therefore, an EHR system must be selected that best meets the needs of the workplace culture, practices, and various user types. Nurse administrators and bedside nurses should be involved in selecting a system that has the ability to streamline documentation, communication, and accessing test results. Using a well designed EHR system will decrease the time nurses spend at a computer thereby, allowing them to spend more time at the bedside providing quality care and improving patient outcomes.

RES 697 Literature Review Table

Source	Problem, Purpose, and Research Questions	Framework or Concepts	Sample	Design	Instruments	Results
1. Burkes, M. (1991)	<p><b><u>Problem:</u></b> Use of computer technology continues to expand in nursing education and practice. Evaluating nurse's attitudes regarding the use of computers may assist in predicting and explaining nurse's reactions towards computerized charting.</p> <p><b><u>Purpose:</u></b> Examine relationships between nurses' skills, knowledge, attitudes, beliefs,</p>	Vroom's (1964) Expectancy Theory	133 ICU staff nurses who worked either full-time or part-time, and had used computerized charting at a LDS Hospital in Salt Lake City, Utah.	Descriptive Correlational Design	Investigator designed questionnaire contained five sections that measured nurses' knowledge, satisfaction, beliefs, motivation, and individual characteristics relating to computer use in nursing.	Nurses' attitudes towards computer use were significantly related to satisfaction to beliefs, satisfaction to motivation and beliefs to motivation. Factors such as age, higher levels of education and computer experience did not reveal greater computer use beliefs, satisfaction, or motivation. Less time as a nurse revealed greater satisfaction of computer use. Nurses with computer knowledge showed a significant positive correlation with beliefs. Therefore, having a basic understanding of

	motivation, and computer use satisfaction with a computerized charting system.					computers may increase motivation to use computerized charting.
2. Moody et al. (2004)	<p><b><u>Problem:</u></b> Current EHR in use at study site presented several issues to the end users.</p> <p><b><u>Purpose:</u></b> Assess system functionality; identify nurses' preferences for electronic documentation methods, perceived problems and barriers to EHR's documentation.</p> <p><b><u>Questions:</u></b> (1) Nurses' perceptions about an EHR, its functionality, problems/barriers,</p>	Waltz et al. procedure: Measurement in Nursing Research	100 RN's, LPN's, and NA's employed at large Magnet hospital in Florida.	Descriptive Cross – Sectional Design	Investigator – developed questionnaire.  Used procedure recommended by Waltz et al.	<p>Overall, nurse's attitudes were positive towards EHR improving the quality of documentation, patient safety and patient care.</p> <p>The majority of nurse's preferred bedside documentation however; there were several environmental barriers that prevented this from occurring.</p> <p>Nurses with computer experience displayed more positive attitudes toward EHRs than nurses who did not have much computer experience.</p>

	and frustration related to EHR?; (2) What methods of electronic charting do nurses prefer and where do they prefer to enter data?; (3) Disposition of nurses toward using EHR?; (4) Are nurses' attitudes related to demographic factors?					Older nurse's attitudes were found to be less positive toward computerized documentation.
3. Brumini et al. (2005)	<b><i>Problem:</i></b> Positive attitudes by nurses towards computer technology are necessary to ensure a successful electronic documentation implementation. Results from previous studies have revealed	The Nurses' Attitudes towards Computers (NATC)  The General Attitudes toward Computers among Podiatrists.	1081 total participants . 141 nurses from Dubrava University Hospital and 940 from the Rijeka University Hospital Center.	Cross – Sectional Design	Investigator – developed questionnaire	Nurses have positive attitudes towards computers. Nurses younger than 30 years old had more of a positive attitude than older nurses.  Nurses with a bachelors' degree had a higher score than nurses with a high school degree.

	<p>conflicting results.</p> <p><b><u>Purpose:</u></b> Assess nurses' attitudes towards computers in Croatian hospitals and compare the results to similar data published in other countries.</p>					<p>Nurses who use computers for any purpose were found to have higher attitude scores than nurses who did not use computers.</p>
4. Lee, T. (2004)	<p><b><u>Problem:</u></b> Understanding nurse's perceptions, attitudes and motivational factors toward the adoption of computerized documentation.</p> <p><b><u>Purpose:</u></b> Analyze and evaluate nurse's perceptions toward utilizing a computerized care plan system</p>	Roger's Innovation-Diffusion Model	12 female nurses who had used computerized nursing care plan (CNCP) for at least 6 months.	Qualitative-Grounded Theory	Semi-structured one-on-one interviews regarding experience using system.	Roger's Innovation-Diffusion Model accurately described nurses' perception and adoption of new technology in every day practice. Through the use of Roger's model, nurses' are becoming more receptive to the use of computers. While the use of CNCP gave nurses' a sense of professionalism, there were areas that did not provide benefits to the

	<p>and how nurses adopt new technology.</p> <p><b><u>Questions:</u></b>          “What do you think about CNCP?” “How does it affect your work?” “What suggestions would you offer for implementing or maintaining the system?”</p>					<p>nursing staff or care provided to patients.</p> <p>CNCP was lacking in nursing diagnoses and interventions and the ability to evaluate patient care.</p>
5. Dillon, T. W., Blankenship, R., & Crews, Jr., T. (2005)	<p><b><u>Problem:</u></b>          Research shows many variables influence nurse’s attitudes and images toward using EPR system prior to implementation. The attitude and image an individual develops, related to the use of</p>	<p>Regression Model designed to identify variables that would predict attitude and in turn system adoption and use of the EPR.</p>	<p>140 full-time and part-time nurses correctly completed a survey and returned it to the research team prior to the deadline.</p>	<p>Descriptive Design</p>	<p>Dillon et al. used an investigator-developed questionnaire. Davis’ Attitude instrument and Settle et al. Image Profile instrument were incorporated into the questionnaire.</p>	<p>Results revealed that age has both a direct and indirect effect in nurses’ attitudes toward EPR. 22 image profile measures were found to significantly affect the attitude of the nurses when anticipating the introduction of a new ERP.</p>

	<p>computers, determines ones intention to accept an EPR.</p> <p><b><u>Purpose:</u></b> Identify user's intention to adopt and use an EPR.</p> <p><b><u>Questions:</u></b> What demographic characteristics and self-reported computer use variables affect a nurses' attitude toward EPR? Does the image profile of an EPR affect a nurse's attitude toward the system? Would the image profile of an EPR serve as a predictor of system adoption and use?</p>					
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<p>6. Shoham, S., &amp; Gonen, A. (2008)</p>	<p><b><u>Problem:</u></b> Integration of computer technology to nursing requires nurses to modify patient care processes and functional role in the department. Successful implementation requires understanding how nurses view the use of computers and factors affecting these attitudes.</p> <p><b><u>Purpose:</u></b> Determine registered nurses (RN's) attitudes related to intent to use computers in the hospital setting as a predictor of future behavior.</p>	<p>Ajzen's Theory of Planned Behavior (TPB)</p> <p>Lazarus and Folkman's Threat and Challenge Model</p>	<p>411 female RN's ranging in age from 20 to 65 years old. Forty-three percent of the sample nurses were bachelors prepared while 10% had obtained a master's degree; 29% of the participants were nurse managers, and 71% were staff nurses.</p>	<p>Descriptive Correlational Design</p>	<p>Investigator designed questionnaire</p>	<p>Introduction of computers in the nursing profession is an innovation requiring changes in nurse's workflow. For a successful integration of computers in clinical areas, nurses must support the process. Therefore, the better the nurses' attitudes and assessment of their abilities related to computer use, the higher their intention to use computer.</p>
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<p>8. Lee, T. (2007)</p>	<p><b><u>Problem:</u></b> Need to better understand nurses issues with computerized documentation.</p> <p><b><u>Purpose:</u></b> Explore nurses' experiences at the early stage of implementing an information system.</p> <p><b><u>Questions:</u></b> (1) "How do you use this nursing information system in your care routines?" (2) "What has been the impact of using this technology on your daily practice?" (3) "Is this the system that you expected to work with?"</p>	<p><b><u>Concept:</u></b> Explore nurses' perspectives of the impact of a computerized documentation system has on daily practice.</p>	<p>22 RN's that worked on surgical units</p>	<p>Qualitative</p>	<p>Focus Groups</p>	<p>Nurses recognized the convenience of automatic reminder functions and references available for patient care that are associated with computerized charting. Nurses had issues with content design, charting process, keyboard data entry, concerns regarding confidentiality and system reliability, increased workload and poor interdisciplinary cooperation.</p> <p>To facilitate the early stage of transitioning from paper charting to computerized documentation, the author suggested nurse's become involved in system design, the importance of providing sufficient</p>
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	(4) “Have you encountered any problems or difficulties using the system?” (5) “How do you manage or solve these problems?” (6) “Do you have any issues that you would like to discuss?” and (7) “Do you have any suggestions for using this system in the future?”					computer and keyboard training, redesigning workflow, and improving interdisciplinary communication.
9. Larrabee, J. H., et al. (2001)	<b><u>Problem:</u></b> Healthcare cost continues to soar nationwide thereby, creating the need for nurses to demonstrate how patient care provided by the nursing profession contributes to	<b><u>Concept:</u></b> EHR’s improve patient care, interventions, goals, and outcomes.	A stratified sample of records was randomly selected by medical records personnel based on percent of admissions for each of	Quasi-experimental study	Retrospective chart reviews were completed using the Nursing Care Plan Data Collection Instrument (NCPDCI) at designated time points; Time 1 (August 1995), 1 month prior to	The nursing information system did not improve documentation completeness within the first 6 months post-implementation. The author’s noted that after re-education and more time working with the NIS, findings revealed a significant improvement of

	<p>improving patient outcomes.</p> <p><b><u>Purpose:</u></b> To examine the differences in documentation completeness of nurse assessment of patient outcomes (NASSESS), achievement of patient outcomes (NGOAL), nursing interventions completed (NQUAL), and routine assessments before and after implementation of a nursing information system (NIS).</p>		<p>the three nursing units at three time points. The combined sample consisted of a minimum of 90 records at each time point.</p>		<p>NIS implementation, Time 2 (April 1996) 6 months post NIS implementation, and Time 3 (April 1997), 18 months post NIS implementation.</p>	<p>NASSES, NGOAL, NQUAL, and blood pressure scores by Time 3.</p>
<p>10. Darbyshire, P. (2004)</p>	<p><b><u>Problem:</u></b> A clearer understanding of the impact of</p>	<p><b><u>Concept:</u></b> Examine nurse's perceptions</p>	<p>Focus Group interviews involved</p>	<p>Qualitative Design / Interpretive Phenomenology</p>	<p>13 Focus Group Interviews</p>	<p>Overall, findings revealed two themes; "CPIS as beneficial and valuable," and "CPIS</p>

	<p>computers on healthcare and nursing practice is needed.</p> <p><b><u>Purpose:</u></b> Discover nurses' perceptions, understandings, and experiences of Computerized Patient Information Systems (CPIS).</p> <p><b><u>Question:</u></b> "What are nurses' experiences of using CPIS in every day clinical practice?"</p>	and understandings of computerized information systems in everyday practice.	53 practitioners. Participants consisted of nurses and midwives from various practice settings.	gy.		<p>as irrelevant, useless or sinister".</p> <p>Few participants viewed CPIS as being beneficial in their practice. Benefits of CPIS identified by the subjects included reduction of administrative and repetitive tasks and improved legibility of documentation.</p> <p>Findings for the second theme; CPIS as irrelevant, useless or sinister. Subjects revealed that CPIS was difficult and time consuming to use, incompatible with other systems and unable to capture the "reality" and actual acuity of the patients.</p>
11. Lee et al. (2004)	<b><u>Problem:</u></b> Numerous studies have examined	<b><u>Concept:</u></b> Explore factors that	612 clinical nurses	Secondary Analysis	Investigator designed questionnaire	Nurses use various types of computer technology when

	<p>the relationship between nurse's computer knowledge, attitude, and acceptance of using computers however; few studies examine the relationship between efficiency of computer use and nurses' daily practice.</p> <p><b><u>Purpose:</u></b> Test a model of factors influencing the efficient use of a computerized nursing care planning (CNCP) system among hospital clinical nurses.</p>	<p>influence nurses use of a CNCP system.</p>				<p>providing patient care. The CNCP is a documentation tool that impacts compliance with charting standards, nursing efficiency, and user acceptance/satisfaction, rather than a tool for obtaining a physical measurement on a patient. Therefore, it would be expected that nurses would spend less time charting thus allowing them more time to provide patient care. However, creating a thorough care plan takes additional time but in the end it may provide better care guidelines thereby, improving patient care.</p>
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<p>12. Smith et al. (2005)</p>	<p><b><u>Problem:</u></b> Improvements have been made to computer software used to support nursing documentation however; these systems do not meet the functional requirements for nursing.</p> <p><b><u>Purpose:</u></b> Determine impact of computerized documentation on staff attitudes, completeness of documentation, and time required to document.</p> <p><b><u>Questions:</u></b> (1) “What is the difference in nurse scores on the Nurses’ Attitude Toward Computerization</p>	<p>Nursing Interventions Classification (NIC) and Nursing Outcomes Classification (NOC) were used for the organizational framework.</p>	<p>82 female bachelors prepared RN’s employed at a teaching hospital. The majority of the RN’s had worked in nursing between 1 and 5 years and were between the ages 20 and 30 years old, with various levels of computer experience.</p>	<p>Quasi-experimental design was used to answer each research question. Data was collected both pre-computerization and post-computerization.</p>	<p>Nurses’ attitudes toward a computerized system were measured using the Stronge and Brodt Nurses’ Attitudes Toward Computerization questionnaire.</p> <p>Documentation time of nursing care was measured by observations using an investigator developed tool.</p>	<p>A study was completed prior to implementing computerized charting. The study evaluated staff attitudes toward computerization time needed for documentation, and comprehensiveness of charting entries. Data from staff surveys, observations, and chart audits were conducted pre and post computer implementation revealed that staff attitudes toward computers were less positive, the time required for charting was unchanged however; nurse’s documentation was more complete.</p>
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	<p>questionnaire pre and post computer implementation?”</p> <p>(2) “What is the difference in charting time requirements pre and post computer implementation?”</p> <p>(3) “Is charting more complete post – computerization?”</p>					
13. Kossman, S. P., & Scheidenhelm, S. L. (2008)	<p><b><u>Problem:</u></b> Insufficient knowledge of EHR use by nurses and affects on role performance and patient outcomes in community-based acute care settings.</p> <p><b><u>Purpose:</u></b> Explore how</p>	Doran’s Nursing Role Effectiveness Model for the theoretical framework.	46 nurses from two different hospitals who worked either on a medical-surgical unit or in the ICU. The EHR system had	Descriptive qualitative study was based on phenomenological principles.	Questionnaire, individual interviews, and observation techniques.	Nurses perceived the use of the EHR as extensive and time consuming; both helping and hindering nursing work; having positive and negative effects on patient outcomes; and was preferred over paper charts but should perform better to support nursing work.

	<p>community hospital nurses use EHR's when providing patient care and impact that EHR use places on nurse's workload and patient outcomes.</p> <p><b><u>Questions:</u></b>  (1) "How do community hospital nurses use an EHR?" (2) "What effect do they think EHR use has on their ability to perform nursing care?" (3) "What effect does EHR use have on patient outcomes?"</p>		<p>been in use for 18 months at both hospitals and participants had used this system for at least six months.</p>			
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## Chapter III

### Methods and Procedures

#### *Introduction*

Since the inception of computer technology several decades ago, computer use has been slow to reach the medical profession. Over the past several years, there has been rapid growth in the development and design of software programs for the medical profession. As a result, the nursing profession is experiencing an increase in use of computer systems. Many health-care facilities have either implemented electronic documentation (EMR) systems or are in the process of implementing an EMR system. Consequently, this process change has created a unique group of challenges and issues for nurses. This is evident by nurse's slow adoption of computerized documentation. Therefore, it is necessary to examine nurses' knowledge, attitudes, satisfaction, motivation and perceptions of nurses towards electronic documentation, to predict nurse's level of acceptance of computer use. This chapter contains a description of the methods and procedures that will be used in this study.

#### *Purpose*

The purpose of this study is to examine relationships among nurses' computer use knowledge, satisfaction, beliefs, motivation, and computer use satisfaction with an electronic documentation system. This is an approximate replication of Burkes (1991) study.

### *Research Questions*

1. Is there a relationship between nurses' beliefs and computer-use satisfaction?
2. Is there a relationship between level of motivation to use computers and use of computer documentation system?
3. Is there a relationship between computer use beliefs and motivation?
4. Is there a relationship between computer knowledge and computer-use satisfaction beliefs and motivation?

### *Population, Sample and Setting*

This study will take place in a large hospital located in Dayton, Ohio. The sample will consist of all registered nurses who are employed either full-time or part-time on a medical/surgical unit, are using the computerized documentation system, and are willing to participate. The anticipated sample is approximately 100 (one-third) registered nurses from all medical/surgical units. Clinical nurse managers, supervisors, clinical nurse specialists, and case managers will be excluded from this study. All eligible participants will receive an invitation via email to participate in the upcoming survey. In approximately two weeks, each eligible participant will receive a survey packet via United States Postal Service.

### *Protection of Human Subjects*

This research proposal will be submitted to the Institutional Review Boards (IRB) of Ball State University and the participating hospital for review to ensure the researcher is not violating the rights of human subjects. Permission to use the questionnaire will be obtained from the original author of the instrument. Subjects in the proposed research study will respond voluntarily by completing the questionnaire and returning it in the

postage paid preaddressed envelope supplied in the survey packet. Implied consent will be assumed for each survey that is completed and returned. Additionally, this method assures participant confidentiality and anonymity. Participant's human rights will be protected at all times. Each returned questionnaire will be assigned a number for identification purposes only. No names will be obtained in this study. No risks or discomfort are foreseen in this study. Benefits from this study include greater insight of registered nurses' computer use knowledge, satisfaction, beliefs, motivation, and computer use satisfaction with an electronic documentation system in an acute care setting.

### *Procedures*

Upon receiving approval from the IRB units, the Vice President of Nursing Services at the participating hospital will be contacted for approval of the research plan. Next, the directors and managers of each medical/surgical unit involved in the study will receive copies of the invitation letter and cover letter explaining the study. This is for informational purposes only.

Once approval is received from the Vice President of Nursing Services, all potential participants will receive an invitation via the healthcare facilities email system, to participate in the upcoming study. The email will encourage all potential subjects to participate in the study however; the invitation will also state that this study is strictly voluntary and that participants may withdraw from the study at any time. The email will discuss the purpose and benefits of the study, and provide assurance that participants rights will be protected at all times. Confidentiality of data obtained from this study and participant's anonymity are ensured to prevent possible repercussions in the future. The

survey will take approximately 10 – 15 minutes to complete and no risks or discomforts have been identified by participating in this study. In closing, the invitational email will state that all potential participants will receive the survey packet in approximately two weeks via United States Postal Service. The survey packet will contain a cover letter with further instructions and Burkes (1991) five section questionnaire. In addition, a postage paid preaddressed envelope will be supplied to return the completed survey and maintain confidentiality of each participant's identity.

### *Instrumentation*

Burkes (1991) Nurses' Computer Use Attitude Questionnaire will be used to measure nurse's knowledge, perceptions and satisfaction in relation to computer usage. Burkes investigator designed questionnaire contains five sections that measure nurses' (a) knowledge, (b) satisfaction, (c) beliefs, (d) motivation, and (e) individual characteristics related to computer use in nursing. Burkes (1991) designed the questionnaire sections based on the literature review, adaptation of Vroom's Expectancy Theory, and input from expert nurses at the study site. According to Burkes (1991), the Beliefs and part of the Individual and Demographic Data sections consisted of a questionnaire by Stronge that was modified with his permission. Additionally, Burkes (1991) reworded one question of Stronge's tool to improve clarity and deleted two willingness-related items to avoid overlap between the current study's tool sections.

A Likert-type scale will be used to measure the Satisfaction, Beliefs, and Motivation sections of the survey ranging from 1-5, with 1 equaling strong dissatisfaction and 5 equaling strong satisfaction. Assigned values were inverted for negative statements. In the Knowledge section, participants had a choice of a true, false, or

uncertain type of response for each question. Answers were given a value of 0-2. For example, 0=incorrect, 1= uncertain, and 2= correct. Item scores were added to obtain a total score for each section of the survey (Burkes, 1991 p 194).

### *Reliability and Validity*

Four Informatics Nurses reviewed the survey for content validity. This review resulted in a 95% agreement among the four reviewers (Burkes, 1991). Cronbach's alpha coefficient and the split-half technique were used to examine the questionnaire's internal consistency reliability (n=56). The Alpha coefficients were calculated for the five subsections of the Beliefs portion of the questionnaire ranging from  $r = -0.534$  to  $0.65$ . According to Burkes (1991), two Beliefs questions in the adapted tool were deleted which increased the range to  $0.534-0.655$ . The satisfaction sections had a Cronbach alpha of  $.888$ , while the motivation section had a Cronbach alpha of  $.912$ , whereas the knowledge section had a low alpha coefficient of  $0.360$  (Burkes, 1991 p 194).

### *Research Design*

A five section questionnaire designed by Burkes (1991) will be used to measure nurses' knowledge, satisfaction, beliefs, motivation and individual characteristics related to the use of computers in nursing. The questionnaire is based on adaptation of Vroom's (1964) expectancy theory. This study is a replication of Burkes' 1991 quantitative study of identifying and relating nurses' attitudes toward computer use. A correlational design will be used in this study to identify the relationships between nurses' (a) beliefs and satisfaction; (b) motivation and computer use; (c) beliefs and motivation; and (d) satisfaction, beliefs and motivation. Correlational study designs examine relationships among variables. The researcher can seek to describe a relationship, predict relationships

among variables, or test the relationships proposed by a theoretical proposition.

Therefore, large samples are needed in order to produce a large variance in the variable scores to determine the existence of a relationship between two or more research variables within an identified situation (Burns and Grove, 2005).

### *Data Analysis*

Pearson correlation coefficients were used to test the relationships between the study variables in Burkes (1991) study. The Pearson Product-Moment Correlation Coefficient or the Pearson  $r$ , is commonly used by research to examine the relationship between two variables. The outcome of the Pearson correlation analysis is an  $r$  value between -1 and +1. The  $r$  value indicates the degree of linear relationship between the two variables. A score of zero indicates no linear relationship. A value of -1 indicates a perfect negative (inverse) correlation and a value of +1 indicates a perfect positive linear relationship (Burns and Grove, 2005). According to the Pearson correlation coefficient results in Burkes (1991) study, nurses' computer use satisfaction ( $r = .783, p < 0.001$ ), beliefs ( $r = .651, p < 0.001$ ), and motivational attitudes ( $r = .598, p < 0.001$ ) are significantly related to one another. Nurses that were younger in age and nurses with higher levels of education did not correlate significantly with computer use attitudes of satisfaction, beliefs, and motivation. Findings for nurses with computer experience produced significant negative correlations with satisfaction ( $r = -.265, p < 0.05$ ). In other words, nurses with computer experience were less satisfied with computerized charting however; nurses with less computer experience, significantly correlated with a greater satisfaction. On the other hand, subjects with less nursing experience indicated a greater satisfaction with computerized charting while the more experienced nurses produced

significant negative correlation with computer use satisfaction. Lastly, nurses with computer knowledge did not correlate significantly with satisfaction or motivation, but did produce a significant positive correlation with computer use beliefs ( $r = 0.229$ ,  $p < 0.05$ ) (Burns and Grove, 2005).

### *Summary*

Identifying and understanding the relationships between nurses computer-use satisfaction, beliefs, and motivation is imperative for development of positive attitudes and computer-use acceptance by nursing staff. The purpose of this study is to examine relationships among nurses' computer use knowledge, satisfaction, beliefs, motivation, and computer use satisfaction with an electronic documentation system. The sample will consist of registered nurses who are employed either full-time or part-time on a medical/surgical unit, are using the computerized documentation system, and are willing to participate. The anticipated sample is approximately 100 (one-third) registered nurses from all medical/surgical units at a hospital located in Dayton, Ohio. Upon receiving approval from the IRB units of Ball State University, the participating hospital and the Vice President of Nursing Services of the selected hospital, all potential participants will receive an invitation via the facilities email system discussing the purpose and benefits of the study and encouraging potential subjects to participate in the upcoming survey. Participation in this study is strictly voluntary, participants may withdraw from the study at any time, and assurance of every participant's rights will be protected at all times. Confidentiality and anonymity will also be ensured. Potential participants will receive the survey packet in approximately two weeks via United States Postal Service.

A correlational design will be used in this study to examine and identify the relationships between nurses' (a) beliefs and satisfaction; (b) motivation and computer use; (c) beliefs and motivation; and (d) satisfaction, beliefs and motivation. Pearson correlation coefficients will be used to test the relationships between the study variables. Once the data is analyzed, results and recommendations will be shared the Vice President of Nursing Services who will distribute to the appropriate members of nursing leadership.

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