EXAMINING THE RELATIONSHIP BETWEEN NURSING INFORMATICS COMPETENCY AND EVIDENCE-BASED PRACTICE COMPETENCY AMONG ACUTE CARE NURSES

by

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DEDICATION

To my parents Josefina and Felix Tacaraya, Mom and Dad, I only hope that I can accomplish as much as you have in your lifetimes. I am so proud to be your daughter. Thank you for the life and opportunity you have given me.

To my awesome husband, Jason, our lives together have always included the PhD program. During the PhD program, we were engaged, bought a condo, got married, bought a house, adopted a dog, had a child, adopted another dog…I am so excited to see what comes next! You and I make a great team. I know I can accomplish anything with you by my side. I will always be grateful for the love and understanding you have given me to achieve my goals.

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LIST OF ABBREVIATIONS

American Nurses Association ..... ANA
American Recovery and Reinvestment Act ..... ARRA
Association of Women's Health, Obstetrics and Neonatal Nursing ..... AWHONN
Advancing Research and Clinical Practice through Close Collaboration ..... ARCC
Bachelor's of Science in Nursing ..... BSN
Caring Efficacy Scale ..... CES
Department of Health and Human Services ..... DHHS
Doctor of Nursing Practice ..... DNP
Electronic Medical Records ..... EMR
Evidence-Based Practice ..... EBP
Evidence-Based Medicine ..... EBM
Evidence-Based Nursing ..... EBN
EBP Self-Efficacy Scale ..... EBPSE
Evidence-Based Practice Questionnaire ..... EBPQ
General Self-Efficacy Scale ..... GSES
George Mason University ..... GMU
Health Information Technology ..... HIT
Information Technology ..... IT
Institute of Medicine ..... IOM
Institutional Review Board ..... IRB
Master's of Science in Nursing ..... MSN
Nurses' Attitudes Toward Computers Questionnaire ..... NATC
Nurses' Computer Attitudes Inventory ..... NCATT
New General Self-Efficacy Scale ..... NGSE
Registered Nurse ..... RN
Outcome Expectancy for EBP ..... OE-EBP
Operating Room ..... OR
Self-Assessment of Nursing Informatics Competencies Scale ..... SANICS
Self-Efficacy in EBP ..... SE-EBP
Sherer et al.'s General Self-Efficacy Scale ..... SGSE
Staggers Nursing Computer Experience Questionnaire ..... SNCEQ
Technology Informatics Guiding Education Reform ..... TIGER
Quality and Safety Education for Nurses ..... QSEN
United Kingdom ..... UK
United States ..... U.S.
Women's and Children's ..... W&C

ABSTRACT

EXAMINING THE RELATIONSHIP BETWEEN NURSING INFORMATICS COMPETENCY AND EVIDENCE-BASED PRACTICE COMPETENCY AMONG ACUTE CARE NURSES

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In 2003, the Institute of Medicine (IOM) released a report entitled *Health Professions Education: A Bridge to Quality,* which recommended that every nurse be educated to deliver patient-centered care as part of an interdisciplinary team, emphasizing evidence-based practice, quality improvement approaches, and informatics. Evidence-based practices (EBP) represent an efficient and cost-effective infrastructure for ensuring quality of care and improving patient outcomes. Many healthcare information technology applications are incorporating computerized decision-support systems that have been developed from EBP. Nurses, the largest group of healthcare providers, need to develop informatics competency in order to effectively translate and use or implement EBP. Nurses increasingly require information technology competency to effectively practice in the current healthcare environment. Nursing informatics competencies are a worldwide necessity for the acute care nurse. Yet, there is limited research on the relationship

between nursing informatics competency and evidence-based practice competency, two separate yet related competencies that are recommended by the IOM for all nurses.

The purpose of this research study was to examine the relationship between nursing informatics competency and evidence-based practice competency and to assess how these competencies may vary by personal and job-related characteristics among acute care nurses. Data were collected in a multihospital system using three established surveys measuring general self-efficacy, nursing informatics competency, and evidence-based practice competency. The convenience sample included 197 acute care nurses who participated in a voluntary study in January 2014 at a multihospital system in Virginia. This study used descriptive statistics, bivariate correlation, and multiple regression to analyze the data.

The findings from this study reveal that nursing informatics competency is related to EBP competency (r =. 548, $p < .01$). There was also a weak but statistically significant correlation with self-efficacy and EBP competency ($r = .248$, $p < .01$). Furthermore, nursing informatics competency predicted EBP competency, by accounting for 30% of the variance. This research also offered a starting point to determine acute care nurses' self-reported informatics and EBP competencies. Study findings may inform the design of interventions to enhance nursing informatics competency and EBP competency among acute care nurses.

CHAPTER ONE: INTRODUCTION

Background

The Institute of Medicine (IOM) released a report, *Health Professions Education: A Bridge to Quality* 11 years ago, which recommended that "all health professionals should be educated to deliver patient-centered care as members of an interdisciplinary team, emphasizing evidence-based practice, quality improvement approaches, and informatics" (2003, p. 45). Thus the nursing profession must prepare its members to effectively use informatics skills involving computers, information, and informatics literacy (Hart, 2008) and implement evidenced-based practice (EBP).

EBP is a problem-solving approach to the delivery of care that incorporates the best available scientific evidence from well-designed studies in combination with a clinician's expertise and patients' preferences within a context of caring (Fineout-Overholt, Levin, & Melnyk, 2004). Informatics is the combination of information science, computer science, and disciplinary-specific science (Buerck & Feig, 2006). The American Nurses Association (ANA) defines nursing informatics as a specialty that integrates nursing science, computer science, and information science to manage and communicate data, information, knowledge, and wisdom in nursing practice (2008).

Informatics competencies are among the essential components of an infrastructure that supports evidence-based practice. A clinician with an understanding of informatics

gains knowledge concerning the possibilities and limitations of systematically processing data, information, and knowledge. Informatics competencies also support building evidence—from clinical practice to research protocols—as well as retrieving and applying evidence to practice (Curran, 2003). Using informatics reduces variation in practice and helps prevents errors, as clinicians learn that mastering the information and knowledge needed to make informed decisions is essential (Curran, 2003).

Eleven years later, as the United States (U.S.) seeks to restructure healthcare to improve quality and safety, and to bridge the gap between evidence and practice, information technology (IT) is one process to enhance information access and support decision making (Doebbeling, Chou, & Tierney, 2006; McBride, Delaney, & Tietze, 2012). Additionally, IT may help meet other objectives such as delivering EBP (Doebbeling et al., 2006). This includes an integrated repository of the patients' demographic and medical history with efficient access to information supporting patients and providers in shared healthcare decisions (Doebbeling et al., 2006). The informatics infrastructure needed for EBP includes data acquisition methods, as well as healthcare data standards, standardized terminology, data repositories, rule repositories, clinical event monitors, data-mining techniques, digital sources of evidence, and communication technologies (Bakken, Cimino, & Hripcsak, 2004; Doebbeling et al., 2006).

Informatics is still an emerging science in healthcare (Hwang & Park, 2011), and has become a mandate for nursing practice. In 1994, the ANA published its *Scope of Nursing Informatics Practice and the Standard of Nursing Informatics Practice* (Ozbolt & Saba, 2008). One year later, the American Nurse Credentialing Center established

certification in nursing informatics as an area of specialty practice (Ozbolt & Saba, 2008). In 2001, a research-based list of informatics competencies for nurses was created by Staggers, Gassert, and Curran. The following year, Staggers et al. (2002) developed four levels of nursing informatics practice ranging from beginning nurses to informatics innovators. The increased use of informatics can be attributed to government regulations and standards as well as increased importance placed on informatics within the healthcare industry.

The United States government stressed the importance of information technology in 2009 when President Barrack Obama signed the American Recovery and Reinvestment Act (ARRA) into law, which invested $48.8 billion in Health Information Technology (HIT) (U.S. Department of Health and Human Services [DHHS], 2009). The Obama administration and healthcare experts believe that electronic information systems are vital to improving the health and healthcare of Americans (Blumenthal, 2009). In a major speech on January 8, 2009, President Obama stated, "To improve the quality of healthcare while lowering its costs, we will make the immediate investments necessary to ensure that within five years, all of America's medical records are computerized."

IOM's 2003 report endorsed the development of five competencies for all healthcare providers: to provide patient-centered care, to work in interdisciplinary teams, to use evidence-based practice, to apply quality improvement, and to use informatics (Flood, Gasiewicz, & Delpier, 2010). To address the gap in teaching nursing informatics across nursing programs, the National League for Nursing (2008) and the American Association of Colleges of Nursing (2008) advocated to include informatics and EBP in nursing

programs. In 2007, only 38% of nursing programs taught informatics, and student achievement related to informatics ranked lowest among the Quality and Safety Education for Nurses (QSEN) competencies (Smith, Cronenwett, & Sherwood, 2007). Smith et al.'s survey results revealed deficiencies and provided nursing programs with insight into areas with opportunities for improvement, especially in informatics and EBP.

In 2012, researchers reviewed the top online nursing schools from the *U.S. News and World Report* list for informatics courses offered in each program (Hunter, McGonigle, & Hebda, 2013). The findings revealed that among the 24 schools reviewed, 6 had no informatics content in any level. The websites of the other 18 top schools listed informatics content for 10 at the baccalaureate level, 9 at the master's level, and 4 at the doctoral level. Only 1 school had content in all three levels. Furthermore, only 4 schools offered a focus on nursing informatics. The researchers also found diverse titles given to the informatics-type courses, which implied possible variations in course content (Hunter et al., 2013). The challenge for academic nursing programs is to standardize the structure and delivery of informatics courses across their curricula as well as collaborate with universities that offer a more robust program of study in this area.

EBP has been a commonly used term in the past few years to describe practice based upon the best research evidence. Sometimes EBP has been interchangeable with evidence-based medicine (EBM), and in nursing it may be referred to as evidence-based nursing (EBN). EBP is the conscientious use of the best current evidence in making decisions about patient care (Straus, Glasziou, Richardson, & Haynes, 2011). The EBP process has seven steps: cultivating a spirit of inquiry; asking the clinical question;

collecting the most relevant and best evidence; critically appraising the evidence; integrating all the evidence with one's own clinical expertise, patient preference, and values in making a practice decision or change; evaluating the practice decision or change; and disseminating the outcomes of the EBP decision or change (Melnyk & Fineout-Overholt, 2011).

EBP requires making decisions about how to provide care at a time when patients and families are becoming more informed about their healthcare decisions. The publication of patient care standards and outcomes have made healthcare a competitive market as well. Some patients and families are choosing where to receive healthcare according to outcomes and patient satisfaction (Ellerbe & Regen, 2012), creating an impetus to incorporate evidence into healthcare practice, specifically in nursing, since nursing provides a large portion of patient care—especially in acute care settings. However, EBP has not been adopted as a universal solution and has only been implemented sporadically (Melnyk & Fineout-Overholt, 2011). In areas where tradition and evidence do not agree, nursing practice continues to follow tradition (Makic, Martin, Burns, Philbrick, & Rauen, 2013). An example in the adult acute care setting is the use of large-bore intravenous catheters for blood administration (Makic et al., 2013). It is believed that small-bore catheters result in slower infusion rates and cell hemolysis during blood administration. However, the evidence shows that in nonurgent blood administration, small-bore catheters can be used without hemolysis (Makic et al., 2013). One solution is to maximize technology to improve clinical and administrative processes and enhance delivery of safe patient care.

In particular, IT healthcare systems, which support the creation of large, integrated databases of patient-specific information, allow real-time management of populations of similar patients. These systems can provide computer-based decision support and computerized provider order entry, track usage of standardized order sets, and deliver electronic health records that give patients and caregivers the necessary information for optimal care. This electronic health information exchange must also ensure security and privacy and provide system compatibility to facilitate sharing patient information at the point of care to eliminate duplicate testing and improve quality (Doebbeling et al., 2006). In short, informatics competence is a prerequisite for today's healthcare professionals to use IT to ensure optimal care and patient safety, and to enable EBP at the bedside (Desjardins, Cook, Jenkins, & Bakken, 2005). Therefore, determining if a relationship exists between nursing informatics and EBP is essential to improving nursing practice in an age of advancing IT.

Statement of the Problem

EBP provides an efficient, effective, and cost-effective way to provide safe care. However, healthcare institutions and nurses face challenges in adopting EBP into daily use (Oman, Duran, & Fink, 2008). Many nurses believe they lack the necessary skills to implement EBP and also lack organizational support (Rickbeil & Simones, 2012). Nurses indicate they do not understand the research process. For this reason, the development of expertise among staff nurses in using computers, databases, and search engines is a key recommendation to increase EBP usage (Rickbeil & Simones, 2012). The other major barrier to EBP is the culture of the organization and whether the organization supports new

ideas and changes in clinical practice (Rickbeil & Simones, 2012). Healthcare institutions need to develop champions of EBP and cultivate the culture of seeking evidence for clinical practice.

It is important for nurses to know what EBP means, how to use it, and understand the implication of EBP in patient safety and outcomes. Nurses cannot rely solely on basic nursing education; rather, they must keep abreast of new evidence in the literature (Rickbeil & Simones, 2012) regarding research findings and technology advances.

HIT, for example, can reduce clinical errors, improve delivery of preventative health services, provide decision support, and encourage completeness of documentation through prompts and reminders (Lu, Kotelchuck, Hogan, Johnson, & Reyes, 2010). The adoption of electronic medical records (EMRs) can improve acute care and chronic disease management by lowering rates of missing clinical information, offering better evidence-based guidelines, reducing medications errors, and improving the coordination of patient care (Hahn et al., 2011).

Nurses need to understand the purpose, implementation, and application of HIT and its direct link to improving patient outcomes as part of EBP. For this reason, nurses in all specialties and roles must have knowledge and skills to use IT, making informatics competencies a necessity for nurses (Chang, Poynton, Gassert, & Staggers, 2011). However, nurse educators and faculty find it challenging to include informatics in an already full curriculum (Flood et al., 2010). Nursing faculty themselves often lack a clear understanding of computer and IT literacy within the profession (McNeil, Elfrink, Beyea, Pierce, & Bickford, 2006). Many nursing programs (n = 103, 39%) rated their faculty as

advanced beginner in teaching and using information technology (McNeil et al., 2003). Furthermore, only 29% reported their faculty members at the competent level. If nursing faculty members do not have an understanding of nursing informatics, how can they educate new nurses? Research shows that nursing students at all levels need nursing informatics integrated into the nursing curriculum (Bembridge, Levett-Jones, & Jeong, 2010; Choi & Bakken, 2013; Edwards & O'Connor, 2011). BSN programs are addressing computer literacy skills but not information literacy skills (McNeil et al., 2003). Recent research found that Doctor of Nursing Practice (DNP) students need to improve their informatics competence (Choi & Zucker, 2013).

Healthcare institutions also face similar challenges in incorporating new competencies into an already-full clinical orientation. Nurses responsible for professional and educational development in healthcare institutions have a variety of experience levels and age ranges similar to faculty in academia. The clinical nurse specialist role focuses on improving clinical care through educating nursing personnel who provide direct care, primarily in hospitals. According to the U.S. DHHS (2010), 63.6% of clinical nurse specialists are over 50 years old and only 18.2% are under 45 years old. Tools such as personal computers, the Internet, and electronic databases did not exist when older nurses were in school. These tools are needed for EBP. Nurses educated after 1990 are more likely to be skilled at seeking electronic information (Pravikoff, Tanner, & Pierce, 2005).

Nurses no longer have a choice about whether to use electronic health information systems—and nursing informatics is more than just entering patient data (Schleyer, Burch, & Schoessler, 2011). To meet the demands for change in healthcare, providers need the

knowledge, skills, and resources to communicate and manage information effectively and efficiently in an electronic environment (McNeil et al., 2006). Nurses who are comfortable with the skills associated with EBP are more positive toward incorporating it into practice (Pravikoff et al., 2005) because they understand the value of EBP. EBP skills include computer skills, information literacy, and the ability to use databases to find relevant evidence (Melnyk & Fineout-Overholt, 2011).

The findings from this study may help determine which areas of nursing informatics and evidence-based practice need greater focus in designing better educational programs. The subscales of both competency surveys addressed knowledge, skills, and attitude, and also provided information on deficits. Additionally, results from this study identified factors associated with nursing informatics competency and EBP competency, which can be a starting point to develop a strategy to support nurses with informatics practice.

Purpose Statement

The purpose of this study was to examine the relationship between nursing informatics competency and evidence-based practice competency and to assess how these competencies may vary by personal and job-related characteristics among acute care nurses.

Research Questions

1. What is the relationship between acute care nurses' self-assessment of their nursing informatics competency and their evidence-based practice competency?
2. To what extent do nursing informatics competency and evidence-based practice competency vary by personal and job-related characteristics (i.e. age, nursing

degree, years of RN experience, clinical specialty, shift, currently working in a Magnet facility, current position, and time spent on EMR during shift)?

3. Does nursing informatics competency predict evidence-based practice competency after controlling for personal and job-related characteristics?

Conceptual Underpinning for the Study

The conceptual model was adapted from Staggers et al. (2002), seen in Figure 1. The model begins with the personal characteristics (i.e. age, nursing degree, years of RN experience, general self-efficacy), and job-related characteristics (i.e. clinical specialty, shift, Magnet facility, current position, time spent on EMR during shift) of the nurse because these factors contribute to nursing informatics competency. General self-efficacy is under personal characteristics in the model because it is considered to be a trait-like belief in one's competence (Scherbaum, Cohen-Charash, & Kern, 2006). Computer skills, informatics knowledge, and informatics skills are components in nursing informatics competencies, which are a prerequisite to EBP competency. The final outcome of this research study, and hence the adapted model, is EBP competency.

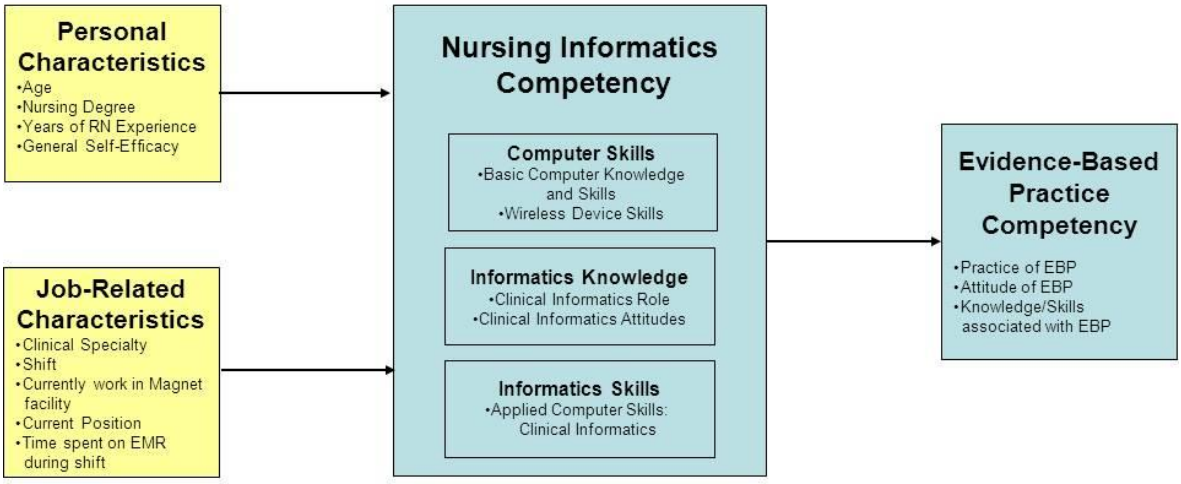

Figure 1. Proposed conceptual model of Nursing Informatics Competency and Evidence-Based Practice Competency adapted from Staggers, Gassert, and Curran's (2002) Information Management Framework. Note: RN = registered nurse, EMR = electronic medical records.

The foundation for this study was the seminal work conducted by Staggers et al. in developing the Information Management Framework, which consisted of computer skills, informatics knowledge, and informatics skills (2002). The authors chose the term *computer skills* to be consistent with the general literature on using technology. The term corresponds with computer literacy or IT skills. To distinguish the two terms, *informatics knowledge* is the theoretical and conceptual basis for the specialty, while *informatics skills* are the use of methods, tools, and techniques particular to informatics (Staggers et al., 2002). The Information Management Framework was expanded in this current study by adding (a) Basic Computer Knowledge and Skills and Wireless Device Skills to computer skills, (b) Clinical Informatics Role and Clinical Informatics Attitudes to informatics knowledge, (c)

Applied Computer Skills: Clinical Informatics to informatics skills, and (d) adding EBP competency.

Four levels of nursing informatics competencies were developed by Staggers et al. (2001): beginning nurse, experienced nurse, informatics nurse specialist, and informatics innovator. Yoon, Yen, and Bakken (2009) based their work on Staggers et al.'s to develop the Self-Assessment of Nursing Informatics Competencies Scale (SANICS). The authors chose the competencies for beginning and experienced nurses to include in SANICS. In addition, they developed items related to standardized terminologies, such as EBP and wireless communication, because those concepts were addressed in the nursing informatics curriculum at Columbia University, New York (Yoon et al., 2009). As a result, SANICS has five subscales for measuring nursing informatics competency which were incorporated into this current study's model.

Technology and computers are infrastructures that provide the framework for EBP. In turn, the skills needed for EBP incorporate nursing informatics skills, as the EBP process consists of searching for evidence and evaluating the credibility of information (Pravikoff, 2006). Thus, EBP competency was added to this current study's conceptual model to provide a robust measure of knowledge, use, and attitudes toward EBP. The subscales for EBP include the practice of EBP, attitude of EBP, and knowledge/skills associated with EBP (Figure 1).

The conceptual model was developed from the literature and previous research conducted on informatics competency and EBP competency. Another theoretical framework used with informatics competency in the literature is based on Benner's Novice

to Expert model (Courtney, Alexander, & Demiris, 2008); Diffusion of Innovation Theory (Chang & Crowe, 2011; Gosling, Westbrook, & Spencer, 2004) and EBP theoretical frameworks use Bandura's Social Cognitive Theory (Chang & Crowe, 2011; Chang et al., 2011; Mahon, Nickitas, & Nokes, 2010) or the Translation Research Model (Adams & Barron, 2010), and/or the Advancing Research and Clinical Practice Through Close Collaboration (ARCC) model (Fineout-Overholt et al., 2004). These theoretical frameworks did not meet the criteria for this research because the prior research studies in nursing informatics and EBP research focused on implementation, whereas this research examined the relationship between two competencies: nursing informatics and EBP.

Conceptual and Operational Definition of Terms

This research study examined the relationship between nursing informatics competency and EBP competency among acute care nurses. Nurses working in an acute care setting may have diverse personal and job-related characteristics that may influence practicing EBP and applying informatics. Independent variables that can affect EBP are personal characteristics of nurses: age, nursing degree, years of RN experience, and general self-efficacy. Job-related characteristics are clinical specialty, shift, working in a Magnet facility, current position, time spent on the electronic medical record (EMR), and nursing informatics competency. These variables are defined in Table 1.

Table 1

Variable Definitions

Variables	Conceptual Definitions	Operational Definitions
Independent Variable		
Age	Age in years	Answer to Question 1 on Demographics of Registered Nurses questionnaire
Nursing Degree	Associate Diploma Baccalaureate, traditional Baccalaureate, 2nd Degree Master's PhD/DNP in Nursing	Answer to Question 2 on Demographics of Registered Nurses questionnaire
Years of RN Experience	Self-reported years of RN experience	Answer to Question 4 on Demographics of Registered Nurses questionnaire
General Self-Efficacy	"Individuals' perception of their ability to perform across a variety of different situations" (Judge, Erez, & Bono, 1998, p. 170)	Mean Score to the 8-item questionnaire on the New General Self-Efficacy Scale (NGSE); 5-point Likert scale (1 = strongly disagree, 5 = strongly agree)
Clinical Specialty	Self-reported by selecting type of clinical unit	Answer to Question 5
Shift	Day (12 hours or 8 hours) shift Evening shift Night (12 hours or 8 hours) shift	Answer to Question 3 on Demographics for Registered Nurses questionnaire
Magnet	Currently working in a Magnet facility	Answer to Question 6
Current Position	RN1, RN2, RN3, RN4	Answer to Question 7
Time Spent on EMR	The amount of time in hours spent on EMR during shift	Answer to Question 8
Nursing Informatics Competency	The integration of knowledge, skills, and attitudes in the performance of various nursing informatics activities within four prescribed levels of nursing practice: beginning nurse, experienced nurse, informatics nurse specialist, and informatics innovator (Staggers & Gassert, 2000).	Score to the 30 items on the Self-Assessment of Nursing Informatics Competency Scale (SANICS); 5-point Likert Scale (1 = not competent, 5 = expert)
Outcome or Dependent Variable		
Evidence-Based Practice Competency	A lifelong problem-solving approach to clinical decision making that involves the conscientious use of the best available evidence with one's own clinical expertise and patient values and preferences to improve outcome for individuals, groups, communities, and systems (Melnyk & Fineout-Overholt, 2011).	Score to the 24 items on the Evidence-Based Practice Questionnaire (EBPQ); 7-point Likert scale (1 = never, 7 = frequently); 7-point semantic scale; 7-point Likert scale (1 = poor, 7 = best)

Competency is a vague and broadly defined concept (Bradshaw, 1998). There is not a common agreement or measurement of this variable. As a concept, competency incorporates a variety of domains in knowledge, skills, and attitudes (Ilic, 2009). Clinicians may demonstrate overall competence in their relevant discipline by a four-step process that includes knowledge, competence (specific to task), performance, and action. Competence also includes problem-solving skills and the abilities to work as a team member and communicate effectively (Ilic, 2009). Assessing competencies can focus on any or all domains.

According to Alspach (1992), *competence* refers to a "potential ability, a capability to function in a given situation" (p. 10), and *competency* is "one's ability to integrate knowledge, attitudes, and skills in performance" (p. 10). Therefore, this current study used Upton and Upton's (2005) tool, the EBP Questionnaire, which measures practice of EBP, attitudes toward EBP, and knowledge/skills of EBP to assess nurses' EBP competency.

In summary, nursing informatics is a prerequisite for EBP and is the infrastructure needed to improve patient care. Since 2003 when the IOM endorsed the need for competencies in nursing informatics and EBP, little research has been done on the relationship between the two competencies, particularly among acute care nurses. The findings from this study may advance nursing science by providing evidence that nursing informatics competencies should be integrated into healthcare systems for nurses working in the acute care setting.

CHAPTER TWO: LITERATURE REVIEW

The review of literature for the present study included a systematic search using five reference databases: CINAHL, Medline, ERIC, Library Literature and Information Science, and Computers and Applied Sciences Complete. Published manuscripts were selected if they were published between 2003 to present. Key words included, but were not limited to: nursing informatics competency, informatics competency, informatics competencies, informatics competence, computer competency, computer competencies, computer literacy, technology competency, evidence-based practice, evidence-based medicine, evidence-based nursing and EBP. Approximately 158 articles were reviewed for relevance; reference lists of relevant articles were used to identify more resources. Only English-language articles were reviewed.

Personal and Job-Related Characteristics

Age

Age is used as a demographic variable in the majority of studies evaluating nurses' attitudes, acceptance, and use of healthcare IT. According to the *2008 National Sample Survey of Registered Nurses* conducted by the U.S. DHHS (2010), the average age of graduating RNs was 30.8 years for the years ranging from 2005-2008. The average age of RNs was 46 years old. Most of the U.S. RN population, then, is composed of individuals who have not been in a structured nursing education program for over 20 years and did not

grow up in an era when technology utilization was commonplace in educational institutions or private homes (Hart, 2008). Nursing informatics became a specialty in 1994 (Ozbolt & Saba, 2008) and EBP began gaining momentum with the founding of the Cochrane Center and Cochrane Collaboration in 1992 and 1993 respectively. Dr. Archie Cochrane, a British epidemiologist, founded EBP in 1972 when he published a book criticizing the medical profession for not providing rigorous reviews of evidence to help policy makers and organizations make informed decisions about healthcare (Melnyk & Fineout-Overholt, 2011).

One study, which did not include nurses, showed self-reported healthcare EBP characteristics varied with EBP exposure, stages of training, profession, and age (McEvoy, Williams, & Olds, 2010). The researchers found that older subjects (> 24 years) scored higher in all domains of the questionnaire regarding EBP (relevance, terminology, practice, confidence, and sympathy). Scores for the older respondents (> 24 years) were significantly higher than for respondents ≤ 24 years ($p < 0.05$). This study took place in a large Australian university with students and faculty ($N = 918$) from allied health disciplines (McEvoy et al., 2010). Although this study had a younger sample size due to the university setting, the study showed that EBP exposure varied with profession and age. This study differs from the current study which did not take place in a university setting where the typical age of a student is younger.

In another research study conducted in Australia, there was a significant but weak association between older nurses and difficulty in understanding research, not feeling confident in judging the quality of research reports, and struggling to identify the

implications of research findings for their own practice (Mills, Field, & Cant, 2009). Age was tested by year and as age increased, knowledge did not. The purpose of the study was to determine the knowledge and practice of EBP in Australian general practice nurses. The researchers used a questionnaire distributed to 1,800 nurses in Australia with a 33% response rate for a total of 590 nurses (Mills et al., 2009). The results also showed that older nurses had significantly less education qualifications and younger nurses held more recent university experience ($p < .01$, CI 95%). One limitation is the fact that the authors did not define "older," but the mean age of participants was 45.3 years. In the current study, specifically defining older and younger assisted in targeting which age group had the most or least difficulty with EBP competency and nursing informatics competency.

Computer literacy, or computer competence, is a component of nursing informatics competency (Hsu, Hou, Chang, & Yen, 2009). Hsu et al. conducted their study in Taiwan and South Korea with the majority (71.8%) of respondents being below 30 years of age. They had a total of 203 valid questionnaires. Age had a significant positive impact on the computer literacy of responding nurses ($p < 0.002$) when data from the two countries were pooled (Hsu et al., 2009). Nurses' average computer literacy increased by 0.176 as their "age" increased by 1 year, but this must be viewed in the context of 31.7% of respondents who were ≤ 25 years old and 40.1% who were between 26-30 years old. The respondents were all young nurses; therefore, for computer literacy to increase is not surprising considering they are working more with computers in their workplace. The mean score of computer literacy for all respondents was 3.153 out of a 5-point scale (Hsu et al., 2009). Another research study which examined the characteristics of Intensive Care Unit (ICU)

nurses and computer competence in Taiwan found that age and nursing experience were highly correlated to computer competency ($r = 0.89$, $p < 0.01$) (Huang & Lee, 2011). A total of 114 nurses enrolled in the study with an average age of 29.37 and average years of service of 6.47 years (Huang & Lee, 2011). The study demonstrated that nurses less than 30 years old had higher computer competency; however, the average age of nurses in the United States is 46 years. Both of these studies took place in foreign countries, and their national average age of nurses may be different; therefore, it was important to determine if age could be a significant variable in nursing informatics competency and EBP competency in a culturally diverse metropolitan area as this current study did. Also, both Taiwan and South Korea implemented a national health insurance system and used the latest IT to provide better quality of services. The current study took place in a multihospital system where the latest state-of-the-art EMR had been implemented.

Nurses' attitudes toward computers may potentially affect their utilization of nursing informatics (Kaya, 2011). Kaya's study in Turkey, for example, found significant differences in attitude for different age categories ($p < 0.001$). The researcher had 890 participants with a mean age of 34.24 years from a university hospital and a state hospital. The purpose of the study was to determine which factors affected nurses' attitudes toward computers in healthcare (Kaya, 2011). The effects of nurses' age on attitudes, measured by the Pretest for Attitudes Toward Computers in Healthcare Assessment Scale, were examined with secondary multiple comparison analysis. The higher score indicated a more positive attitude: The highest score was being very confident that they can learn to use a computer and lowest score was having cyberphobia. The results showed statistically

significant differences between the age groups of 25 years or younger and 42 years or older ($p = 0.006$), as well as those 26 to 33 and 42 years or older ($p = 0.000$), and 34-41 and 42 years or older ($p = 0.14$). The highest attitude score was in the 26-33 year age group, followed by less than 25 years, 34-41 years, and 42 years or older. Also, a correlation between nurses' attitude score and nurses' ages showed scores were reduced with increasing age ($r = -0.178$, $p = .000$), indicating a negative effect of age on attitudes toward computer in healthcare. The study showed that younger nurses had better attitudes toward computers in healthcare. Since the study took place in Turkey it only measured attitudes of Turkish nurses. Another limitation was that the type of clinical unit the nurses worked on was not collected. In the current study attitude was measured as a subscale in both the nursing informatics competency and EBP competency, and several additional work-related characteristics were collected such as shift and type of unit worked.

Campbell and McDowell (2011) found that nurses had moderately positive correlation between year of birth and computer literacy ($r = 0.552$, $p < .001$). The study was conducted at one small (100-bed) community hospital with a tool that measured computer literacy designed for nursing students, which could be considered a limitation (Campbell & McDowell, 2011). The response rate was 44% ($N = 112$), and the majority of the RNs were born in the 1960s, making them in their 50s at the time of the study. This current research measured more than computer literacy, as the SANICS tool used in this study measured beginning and experienced nurse informatics competency. Another difference from the Campbell and McDowell (2011) study is that this current study used five community hospitals instead of one.

Age is an important variable in this study, as research shows older nurses (McEvoy et al., 2010; Ozdemir & Akdemir, 2009) are more likely to use or implement EBP; there are also studies showing that older nurses have difficulty understanding research (Mills et al., 2009). EBP includes being able to critically appraise the evidence (Melynk & Fineout-Overholt, 2011). The literature also shows younger nurses are more computer literate (Campbell & McDowell, 2011) and have a better attitude toward technology (Kaya, 2011). Since EBP incorporates informatics skills, it is important to know if age is a predictor. Also, this current study's specification of what ages of nurses are considered older and younger will advance knowledge because the typical newly graduated RN is 30.8 years and many research articles define "older" as being more than 30 years (McEvoy et al., 2010; Ozdemir & Akdemir, 2009).

Nursing Degree

In the IOM (2010) report, *The Future of Nursing: Leading Change, Advancing Health*, there is a recommendation to increase the proportion of nurses with a BSN to 80%. There are different findings from various research studies on whether education level is significant in computer competency. However, research shows that educational levels are correlated with EBP usage (Eizenberg, 2011; Koehn & Lehman, 2008).

In EBP, educational levels were found to have a statistical difference ($p = .001$) on use, knowledge, skills, and attitudes of EBP (Koehn & Lehman, 2008) in a large medical center in the United States. Of the four educational levels (Diploma, Associate's degree, Bachelor's degree of science in nursing (BSN), and Master's degree), the BSN group ($n = 195$) demonstrated significantly higher scores than the Associate degree group ($n = 123$) in

EBP scores using the EBPQ (Koehn & Lehman, 2008)—the same survey tool used in this current study. Koehn and Lehman also collected type of unit as a demographic variable but did not test for significance of the type of unit and scores on the EBPQ. One strength of their study is it was conducted in the United States and the nursing education system is standardized, meaning the degrees from colleges or universities are the same throughout the United States. Also, nurses in the United States must take a national exam that measures competencies needed to perform safely and effectively as entry-level nurses.

A study conducted in northern Israel showed that nurses with a degree were more likely to report using EBP than those without a degree (Eizenberg, 2011). The study explored the relationship between nurses' personal and professional factors and EBP. There was no relationship between gender ($p = 0.34$) and age ($p = 0.56$) and EBP. There was also no relationship between nurses' workplace (hospital or community) and EBP. A limitation to this study was the lack of background information to describe the nursing educational system in Israel. In the demographic section of the study respondents selected either RN plus BA studies, RN plus BA in Nursing, or just RN. It is unclear what the researcher meant by degree and whether the breakdown referred to a BA and/or BA in nursing. This current study collected highest nursing degree to avoid confusion of nonnursing degree types. Another study found the nurses' attitudes (rho = 0.248, $p < 0.01$) and knowledge (rho = 0.254, $p < 0.01$) toward EBP was significantly correlated with nursing education (Thiel & Ghosh, 2008). Theil and Ghosh's study was conducted in an acute care hospital ($N = 121$) to assess RNs' readiness for EBP. Although the sample size was small, it did

take place in a teaching hospital and the results showed that nurses had a positive attitude toward EBP.

One study showed that educational level of nurses had no influence on computer literacy in nurses in Taiwan and South Korea ($p = 0.010$) (Hsu et al., 2009). Both countries have a nursing education system which includes a master's and bachelor's program (Hsu et al., 2009). It was determined that educational level did not have an influence on computer literacy. In fact, education level negatively impacted nurses' computer literacy in South Korea when the data were analyzed separately with an adjusted R^2 value of 0.389. Another study contradicted those results and found that, for nurses in Taiwan, the higher their education, the better their computer competency ($r = 0.24$, $p < 0.1$) (Huang & Lee, 2011). The study revealed computer competency had a statistically significant relationship with education ($F = 3.76$, $p < 0.5$) (Huang & Lee, 2011). Nursing education was also statistically significant in another study (Kaya, 2011) between 2-year degree and bachelor's degree groups ($p = 0.000$), and 2-year degree and master's or higher group ($p = 0.000$). The highest score in attitude was in the master's degree or higher level of education groups, followed by bachelor's degree and 2-year degree (Kaya, 2011). The correlation between nurses' educational level and computer literacy was also found to be statistically significant ($p \leq .05$) in a study conducted by Campbell and McDowell (2011). Nursing education degree has been shown to have significance in computer literacy and computer competency—but not necessarily with nursing informatics competency. This current study measured nursing informatics competency, which is more than just computer-based skills as nursing informatics includes information management.

Another study, conducted in Turkey, showed that older (≥ 30 years) and highly experienced (> 11 years) nurses were more likely to implement evidence into practice ($p < 0.05$). The study recruited 219 nurses from three hospitals to identify the factors that nurses believe were essential for research evidence to become the basis of their practice (Ozdemir & Akdemir, 2009). Although their study used three hospitals, the three hospitals were dependent on the university and due to the accreditation requirements, most nurses were highly educated when compared to other hospitals in Turkey. Two-thirds (66%) of the nurses had university-level nursing education which is relatively high considering the goal for United States nurses is 80% by 2020. This current study also had highly educated nurses, BSN and above (69.5%), due to the number of universities surrounding the study area, which is a limitation because it is not a true representation of the entire population of nurses in the United States.

Multiple studies have shown a direct correlation between higher education and the use of EBP and computer literacy or competency (Campbell & McDowell, 2011; Huang & Lee, 2011; Koehn & Lehman, 2008; Theil & Ghosh, 2008). Nursing higher education programs such as bachelor's or master's degrees usually include research courses which support EBP. Nursing degree is therefore an important variable to collect in order to determine if nursing degree impacts EBP and nursing informatics competency.

Years of Nursing Experience

One study showed the length of nurses' work experience did not influence their computer literacy (Hsu et al., 2009). Another study found the more experience nurses had with computer technology, the weaker their computer competency ($r = -0.26$, $p < .01$)

(Huang & Lee, 2011). Nursing experience had an inverse relationship with computer experience and competency (Huang & Lee, 2011). Huang and Lee also found age and nursing experience were highly correlated (r = -0.89, p < .01). Age and nursing experience are usually correlated because as nurses age they gain more nursing experience. This current study collected years of nursing experience because there continues to be varying results of years of nursing experience correlating with computer competency or literacy.

A recent study comparing undergraduate and graduate nursing students' nursing informatics competency (Choi & De Martinis, 2013) reported that graduate students had higher mean scores than undergraduate students in all five subscales. Although there was statistical significance for the overall mean between undergraduate and graduate students (p = .02), only three subscales (clinical informatics role, clinical informatics attitude, and wireless device skills) were statistically significant. These findings may reflect graduate students' longer years of working in nursing practice (64.9% had more than 10 years) compared with less or no nursing experience of undergraduate students (97.1% had no experience or < 2 years). More experience in clinical nursing practice may affect how much exposure one has to informatics systems knowledge and skills (Choi & De Martinis, 2013). The study used an electronic version of the SANICS and had 289 nursing students participate with a response rate of 56.9%. There are several strengths to the Choi and De Martinis (2013) study, one being that the response rate was high and another that the researchers successfully used the electronic version of SANICS which supports the feasibility of this current study's data collection method. The researchers emailed the link to the listserv of the two programs and sent a reminder email which was similar to the

current research's procedure. There is a dearth of studies on informatics competency assessment in the hospital setting among acute care nurses.

On the other hand, in a study conducted in 2006-2007, years of nursing experience had a statistically significant positive correlation with practice of EBP ($r = 0.10$, $p \leq 0.01$) and knowledge/skills associated with EBP ($r = 0.08$, $p \leq 0.05$), but not with attitudes toward EBP ($r = 0.04$) (Brown et al., 2010). The study took place with nurses ($N = 1{,}301$) from four hospitals in California. The objective of the study was to explore perceived barriers to research use and implementation of EBP. The majority of the participants were between 50-59 years of age, and included staff nurses, nurse managers, clinical nurse specialists, and nurse midwives. Although the study had a large response rate, the majority of respondents were practicing at advanced levels of nursing and the majority had > 21 years of RN experience. However, the majority of respondents had only BSN degrees. The BSN and staff nurse positions showed statistically negative correlations with one or more of the EBPQ subscales ($r \leq 0.20$). The Brown et al. (2010) study used the same EBPQ survey tool that the current research study used, but the current study differed by analyzing data on only acute care nurses.

Another study found that nurses in Singapore who had worked 6 to 10 years perceived themselves as having high EBP self-efficacy ($M = 3.14$, $SD = .489$) which was considered significant at $p < .10$, and they had less difficulty applying EBP ($M = 3.20$, $SD = .697$) which was not significant (Mokhtar et al., 2012). However, only nurses with more than 10 years of work experience were perceived to attach greater importance to EBP training ($M = 3.91$, $SD = .700$) which was considered significant at $p < .10$. The study had

342 nurse participants in a government hospital and found that more than 80% of the nurses had not had any training related to EBP, although experienced nurses valued the importance of training. The researchers developed their own self-reporting questionnaire which included a section on attitudes and knowledge of EBP (Mokhtar et al., 2012). The study had a large percentage of nurses who did not have any training in EBP, although a substantial amount of nurses understood what EBP was; the current research study did not capture whether nurses had received EBP training but collected their knowledge about, attitude toward, and skills using EBP.

Research has shown years of nursing experience is a factor in EBP (Brown et al., 2010; Moktar et al., 2012) but not necessarily with computer competency (Huang & Lee, 2011). However, years of nursing experience does increase nursing informatics competency at the graduate school level (Choi & De Martinis, 2013). Therefore, years of nursing experience was an important variable to collect and analyze in this current study among acute care nurses.

Clinical Specialty

Few studies collected clinical specialty as a work setting characteristic in relation to evidence-based practice adoption or implementation (Majid et al., 2011). The majority of studies collected workplace or work setting such as rural or urban (Mills, Field, & Cant, 2011), hospital or community (Eizenberg, 2011), primary care or secondary care (Leasure, Stirlen, & Thompson, 2008), and academic medical center or not-for-profit (Cadmus et al., 2008) as work setting characteristics. Koehn and Lehman (2008) did collect clinical units as a work setting characteristic and the majority of the questionnaires returned were from

the pediatric unit. The different types of units that participated were pediatric, women's health unit, medical/surgical units, nondirect care units, and emergency and critical care units which were combined into one unit. The researchers did not discuss possible reasons for the difference in return rate from different clinical units. A limitation that was discussed was the medical center had recently begun their Magnet journey and corresponding heightened awareness of EBP may have skewed the results. The importance of comparing clinical specialty and EBP competency is that it can help develop a systematic plan for implementing an educational intervention.

There are also few studies that compare clinical specialty in IT. The use of HIT in ICUs has improved medical and nursing documentation with reduction in medication errors and with improved data quality (Fraenkel, Cowie, & Daley, 2003). In the study conducted by Huang and Lee (2011) on two ICU units in Taiwan, the clinical information system interface usability assessment was statistically significant in the total score ($t = 3.33$, $p < .001$) and in the four categories of program design, function, efficiency, and general satisfaction ($p < .05$). The research did compare the two ICUs and found surgical intensive care unit (SICU) nurses had a higher average score on overall computer competency and scored the overall usability of the system higher. SICU nurses scored highest on understanding the limitation of computers and medical intensive care unit (MICU) nurses scored highest on usage of computers. Nurses on both units scored low on the concept of computer programming. Interestingly, the lowest score for usability on both units was general satisfaction, and the highest score was program design, which included items like "clinical information system lets me obtain laboratory results faster," "makes the nursing

evaluation form more complete," and "helps me to quickly search complete patient information" (Huang & Lee, 2011). The study asked several open-ended questions and observed nurses for 2 hours over a 4-week period to gather how they were spending their time. The practice patterns of the two ICUs differed: The researchers found that SICU nurses performed more direct nursing care, associated care, and personal activities but less indirect nursing care than MICU nurses. Several strengths of this study are the researchers used both qualitative and quantitative methods and had a high response rate of 89.8%. Another strength was this study took place in large medical center in Taiwan and both ICUs were large: SICU had 25 beds and MICU had 33 beds. In the current study, units were grouped together and comparisons were made with different unit specialties such as critical care, medical-surgical, and procedural areas.

Medical-surgical nurses typically do not have as much exposure to new technology as nurses who work on specialty units like intensive care units (Welton, Unruh, & Halloran, 2006). For instance, medical-surgical units do not have the constant monitoring systems that critical care units do, and they may have patient-to-nurse ratios as high as 8:1 (Welton et al., 2006). Other clinical specialties like psychiatric nursing have been found to have deficiencies in database and Internet utilization, which are basic skills for EBP (Koivunen, Välimäki, & Hätönen, 2010). Koivunen et al.'s study took place in Finland at a psychiatric hospital (N = 183). Psychiatric nurses may not use computers or information technology like acute care nurses (Koivunen et al., 2010). The study also found that nurses under 40 years had better Internet skills than those over 40 years (p = 0.001). A descriptive study conducted on gastroenterology nurses (N = 225) found they were aware of EBP yet lacked

the skills and resources to implement EBP (Baker, Ellett, & Dudley-Brown, 2010). The study used an electronic survey and was posted on the Society of Gastroenterology Nurses and Associate's website which could have influenced the type of responses from nurses as the nurses belonged to a professional organization and may have already been aware of EBP and been involved in evidence-based guidelines. Research has shown there are differences in clinical specialties using IT and EBP; therefore, in this current research study clinical specialty was an important variable to analyze.

Clinical specialty as an independent variable is even rarer than collecting it as a work setting characteristic because the atmosphere of each nursing unit differs depending on the leadership and culture (Lee & Ko, 2010). Lee and Ko collected clinical specialty and analyzed it as a group-level variable. The researchers did not specify the nursing units but did explain that 53.8% were general nursing units which minimally outnumbered specialty nursing units. They had respondents from 182 nursing units in 28 hospitals with a total of 1,996 nurses. The purpose of their research, however, was the effects of self-efficacy, positive affectivity, and collective efficacy on nursing performance of hospital nurses, not nursing informatics nor EBP—although, Lee and Ko (2010) did find self-efficacy and years of experience ($r = .29$, $p < .0001$) significantly correlated.

Very few research studies assessed multiple clinical specialty areas because competencies are different for each unit. There are many factors that contribute to differences in clinical specialty practice: length of orientation, years of experience, and patient ratios. This current research study collected the type of clinical areas in which nurses worked to compare differences in competency levels among clinical specialties.

General Self-Efficacy

In 1977, Bandura introduced self-efficacy as part of the social learning theory, defining self-efficacy as "the conviction that one can successfully execute the behavior required to produce the required outcome" (p. 193). Self-efficacy was treated as a domain-specific theory, but has been extended to be more general and to be thought of as a personality trait (Alexopoulos & Asimakopoulou, 2009).

General self-efficacy refers to global confidence in one's coping ability across a wide range of demanding or new situations (Schwarzer, Bäßler, Kwiateck, Schroder, & Zhang, 1997). The concept of generalized self-efficacy was also presented by Sherer et al. in 1982, who stated generalized self-efficacy has three properties: (a) it incorporates all past success and failure experiences in a person's life, (b) there are individual differences in general self-efficacy beliefs, and (c) a person's general self-efficacy should influence expectations of ability in new situations. The definition of general self-efficacy by Judge et al. (1998) is individuals' perceptions of their ability to perform across a variety of different situations. The researchers noted that self-efficacy is not the same as self-esteem because what an individual masters may not be fundamental to that which is valued by the individual (Judge et al., 1998).

Individuals with high level of self-efficacy are thought to be more active and persistent in handling dynamic situations (Vardaman, Amis, Dyson, Wright & Van de Graaff, 2012) such as nursing informatics and EBP. Such people are also more likely to view the situations as learning experiences or opportunities (Ashford, 1988). Furthermore, individuals with high levels of self-efficacy tend to experience increased psychological

well-being and job satisfaction (Jimmieson, Terry, & Callan, 2004). Research has shown that highly efficacious individuals may be better at handling difficult tasks. In this current study, general self-efficacy was a personal characteristic of the RN because determining self-efficacy could affect the self-reported competencies of nursing informatics and EBP.

In the workplace, employees' perceived self-efficacy affects how they manage job requirements and challenges (Bandura, 1997). Employees either adapt by managing their jobs better or by disengaging from the situation and putting forth minimal effort (Manojlovich, 2005). An increase in perceived self-efficacy may help improve coping strategies in stressful job situations such as nursing (Manojlovich, 2005). In a descriptive design study, Manojlovich (2005) found the Professional Practice Scale to be moderately related to self-efficacy ($r = 0.45$, $p < .01$) in nurses from Michigan who were randomly chosen ($N = 376$). Because EBP is a part of professional practice (Kiss, O'Malley, & Hendrix, 2010), Manojlovich used the Caring Efficacy Scale (CES) to determine if self-efficacy could contribute to professional nursing behaviors. The CES was not related to the nursing leadership scale ($r = 0.06$, $p = .32$). Manojlovich (2005) tested whether nursing leadership affected the indirect paths through self-efficacy and found a good model fit ($p > 0.25$, CFI = .999, NNFI = .996, RMSEA = .032). The study recommended that nursing leadership provide opportunities for enhancing self-efficacy.

Undergraduate nursing students from three universities in Australia participated in a study that used surveys ($N = 971$) and focus groups ($N = 24$) (Levett-Jones et al., 2009). A recurring theme was their anxiety toward unfamiliarity with information and communication technology. However, a number of students did express a degree of

confidence and self-efficacy toward information and communication technology. The quantitative data analysis supported the findings from the qualitative phase of the study in which 26% (n = 251) of students were unclear about the relevance of information and communication technology competence to clinical nursing practice. Only 61% of the students felt "very confident" using MS Word™ applications and 36% were not at all confident in spreadsheet application and using PowerPoint™ (Levett-Jones et al., 2009). According to the authors, this was interesting because the majority of the students were required to submit assignments using these applications. Lastly, 69% felt "very confident" using the Internet, which included employing search engines, browsing general information, and sending emails. Levett-Jones et al.'s (2009) study only provided frequencies for the quantitative findings; no statistically significant figures were reported.

In another study conducted with Australian nurses (43.3% response rate), the researchers found level of confidence followed a similar trend to level of experience in the use of information technologies (Eley, Fallon, Soar, Buikstra, & Hegney, 2008). Confidence in the use of computers was more of a barrier as numbers of years in nursing increased: Nurses with 0-5 years of nursing were more confident with computers than nurses with 11 or more years in nursing ($p < 0.05$). There was a high overall level of confidence in the use of common applications such as using the mouse, keyboard, and Internet. Confidence was low in evidence-based practice resources, reference tools, and statistical software. The relationship between age and confidence in use of computer applications was stronger than that for numbers of years worked (Eley et al., 2008). Younger and newer nurses expressed greater experience and confidence in use of computer

applications. However, “very confident” was an infrequent response; most confident nurses just chose “confident” (Eley et al., 2008).

The lack of skill and confidence in nurses being able to effectively appraise literature remains a barrier to EBP (Kiss et al., 2010). A pilot study ($N = 15$), which consisted of 60% who had specialty certification and 40% who had taken a continuing education class in appraising research literature within the past 2 years, found nurses were better prepared to critically appraise the literature and were more inclined to make EBP happen (Kiss et al., 2010). The pre- and posttest had a self-efficacy subsection specific to literature appraisal which was designed with an 11-point rating scale ranging from 0% (no confidence) to 100% (completely confident). There were two interactive sessions between the pre- and posttest. In the postintervention self-efficacy subsection 19 out of 20 showed significant ($p < .05$) improvement. Participants also significantly increased their knowledge. Therefore, enhanced knowledge may have affected their self-efficacy (Kiss et al., 2010). Although this was a pilot study, the results showed a significant increase in research knowledge ($p = .004$) and an increase in self-efficacy ($p = .002$). One limitation is the research was a pilot and the researchers did not describe how long the interactive sessions were: an 8-hour, 4-hour, or 2-hour session. The researchers did recommend resources be allocated for training and time for nurses to adopt new practices. Although the current research study did not have an intervention nor did it have a specific self-efficacy scale measuring EBP competency or nursing informatics competency, it did have a general self-efficacy scale. Self-efficacy is a mechanism for behavior change, and having the

nurses complete all of the surveys may have inadvertently generated interest in nursing informatics and EBP.

In the current study, measuring nurses' general self-efficacy was proven to be a variable needing measurement because nursing informatics competency and EBP competency are constantly changing, either because of new technology or new evidence being published. Nurses must develop strategies to keep abreast of new information in the workplace. It was important to determine whether general self-efficacy affected the relationship between nursing informatics competency and EBP competency.

Studies of the Relationships Between Additional Job-Related Characteristics and Nursing Informatics and EBP competencies

The job-related characteristics in this study included shift worked, currently working in a Magnet facility, current position, and time spent on electronic medical records during their shift. Previous studies have suggested these job-related characteristics may relate to nursing informatics competency and/or EBP competency.

Nurses work a variety of shifts depending on the clinical unit's census and volume of admissions. An example is the Emergency department which has shifts that start at 7:00 am, 8:00 am, 9:00 am, 10:00 am, and 3:00 pm and end 12 or 10 hours later. Night staff have reported a higher level of teamwork (Kalisch & Lee, 2009). Because of the limited resources during the night shift, staff must rely on each other. There is a reduced access to expert advice, and decreased managerial involvement and leadership (Nilsson, Campbell, & Andersson, 2008). Smaller teams tend to perform higher when compared to larger teams (Kalisch & Lee, 2009). The differences between day and night nurses are not always

acknowledged, which leads to a poor understanding of the differences between the shifts (Powell, 2013).

According to Melnyk, Fineout-Overholt, Gallagher-Ford, and Kaplan (2012), differences existed in responses of nurses from Magnet versus non-Magnet institutions. A random sample of 1,015 RNs responded for a response rate of 5%. Nurses in Magnet institutions reported higher levels of consistent implementation of EBP by their healthcare systems, availability of EBP experts, organizational support, routine educational offering in EBP, and recognition of EBP efforts. There was a statistical difference in total score for EBP for those working in a Magnet versus non-Magnet institutions ($p < .001$). However, there was no significant difference in 8 of the 18 items related to needs and access to support EBP. Examples of these items are, "I am clear about the steps in EBP," "My educational program prepared me well to consistently implement EBP," and "It is important for me to gain more knowledge and skills in EBP" (Melnyk et al., 2012). In the current research study, the participants were asked if they currently worked in a Magnet facility.

Current position was also a variable. The clinical ladder was developed to recognize the RN's decision to remain at the bedside and concentrate on expertise in clinical practice (Riley, Rolband, James, & Norton, 2009). Clinical ladder programs are designed to reward nurses for specific criteria, such as education, research, and clinical and leadership skills. In this study the clinical ladder was measured by the variable of current position: Nurses could be RN1, RN2, RN3, or RN4. The positions are differentiated by their job titles at the research site. An RN1 is newly graduated or has less than one year of experience, or is

returning to direct patient care after a prolonged absence. There is no application process to become an RN2, it is automatic after 18 months. An RN3 requires a portfolio submission with all the clinical ladder program requirements including being nationally certified in a clinical specialty. An RN4 also requires a portfolio submission, compliance with all the clinical ladder program requirements, and the applicant must have at least a bachelor's degree in nursing.

Lastly, the number of hours spent on electronic medical records (EMR) during their shift was an important variable to collect because the subject healthcare system just recently implemented a new system. Nurses could be spending more time than usual documenting because the system is new. Previous research revealed that 19% of a nurse's time is spent completing documentation in EMRs (Yee et al., 2012).

Nursing Informatics Competency

There are multiple lists of nursing informatics competencies in the literature, yet there is little consensus about which competencies are critical for effective use of IT or informatics. Defining specific informatics competencies is an important need in nursing because it serves as the foundation for determining the educational needs for all nurses (Staggers & Gassert, 2000).

Staggers et al. (2001) built a comprehensive list of informatics skills and knowledge for nurses at four levels of practice: beginning nurse, experienced nurse, informatics specialist, and informatics innovator. The definitions of these levels of practicing nurses provided by Staggers et al. (2001) are in Table 2.

Table 2

Definitions of Four Levels of Practicing Nurses in Informatics

Beginning Nurse

- Has fundamental information management and computer technology skills.
- Uses existing information systems and available information to manage practice.

Experienced Nurse

- Has proficiency in a domain of interest (e.g. public health, education, administration).
- Highly skilled in using information management and computer technology skills to support their major area of practice.
- Sees relationships among data elements and makes judgment based on trends and patterns within these data.
- Uses current information systems but collaborates with the informatics nurse specialist to suggest improvements to systems.

Informatics Nurse Specialist

- An RN with advanced preparation possessing additional knowledge and skills specific to information management and computer technology.
- Focuses on information needs for the practice of nursing, which includes education, administration, research, and clinical practice.
- Practice is built on the integration and application of information science, computer science, and nursing science.
- Uses the tools of critical thinking, process skills, data management skills (including identifying, acquiring, preserving, retrieving, aggregating, analyzing, and transmitting data), systems development life cycle, and computer skills.

Informatics Innovator

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

Note. From Staggers, Gassert, and Curran (2001), p. 306.

The following year researchers validated the items by using a three-round Delphi study with 72 respondents (Staggers & Thompson, 2002; Staggers et al., 2002). In the beginning, there were 305 competencies; by the end, 281 competencies achieved an 80% or greater agreement for both importance and appropriateness at the correct level of practice. The Delphi study had a high rate of participation, which indicated a strong level of interest

and the need for a comprehensive list of nursing informatics competencies (Staggers et al., 2002). This was the first study to include all four levels of nurses, creating competencies for the beginning nurse and experienced informatics nurse specialist, and examining the categories of computer skills, informatics knowledge, and informatics skills (Staggers et al., 2002).

Building on prior research by Staggers et al. (2002), Curran (2003) proposed a set of informatics competencies for nurse practitioners. The initial list of informatics competencies was extracted from the experienced nurse level of Staggers et al.'s (2002) research with an additional 14 items to strengthen areas of knowledge and skills needed by nurse practitioners for EBP, which are a specific subset of informatics competencies (Curran, 2003). A total of 32 informatics competencies were agreed upon and shared among faculty at Columbia University. The list of competencies for nurse practitioners is serving as a temporary guide until a research-based list becomes available. Developing competencies that are research based serves as a foundation for educational initiatives.

A study conducted in Taiwan by Jiang, Chen, and Chen (2004) found seven domains of computer competencies. The researchers also used the Delphi technique with 29 respondents. The domains were concepts of hardware, software, and networks; principles of computer applications; skills of computer usage; program design; limitations of the computer; personal and social issues; and attitudes toward the computer. The end result was 94 competencies in the seven domains (Jiang et al., 2004). One limitation was that the panel only had two experts from companies which designed hospital information systems. There was a shortage of nursing informatics experts in Taiwan. The researchers

did not use the term *nursing informatics*, but items under several of the domains could have been considered nursing informatics knowledge or skill. For instance, in Staggers et al.'s (2001) list of competencies, under informatics knowledge is "describe ways to protect data" and under personal and social issues in Jiang et al.'s study is "know the importance of confidentiality when processing computerized data and medical records." This item could be considered informatics knowledge. Another item, "know that females can be computer literate, just like males are" is an item that reflects culture and era. One study that extended the above research on nursing informatics competency was an exploration of nursing informatics competency and satisfaction related to online education. Nurses who had higher nursing informatics competency were more satisfied with online education (Lin, Lin, Jiang, & Lee, 2007).

A recent research study also conducted in Taiwan by Chang et al. (2011) added 42 items to the original list of competencies at the four levels by Staggers et al. (2002). The researchers used a web-based three-round Delphi method with 32 respondents in Round 1, then 22 respondents for Rounds 2 and 3 (Chang et al., 2011). The results from this study found that 318 of the original 323 nursing informatics competencies achieved consensus for both item importance and appropriate level of nursing practice. The additional competencies reflect new technologies and EBP needed in nursing. The authors did mention Taiwan has few nursing informatics specialists and the panel of experts was chosen for expertise in nursing.

One study developed informatics competency using the International Medical Informatics Association recommendation on education in health and medical informatics.

Garde, Harrison, and Hovenga (2005) developed a web-based questionnaire and surveyed Australian nurses on specific knowledge and skills for health informatics professionals. The questionnaire was based on the International Medical Informatics Association's set of recommendations on education (Garde et al., 2005). Only 82 nurses completed the questionnaire, which had 74 items in the following categories: specific health informatics knowledge/skills; information technology knowledge/skills; people and organizational knowledge/skills; clinical, medical, and related knowledge/skills; various knowledge/skills and various other knowledge/skills (Garde et al., 2005). The reliability ($\alpha = 0.985$) of the questionnaire had good results and validity was tested by checking the correlation between the mean values for each of the five skills categories and an external criterion related to the construct. The external criterion was one question on the overall degree of competency required for the respective skills category. The researchers anticipated a bias because only people with Internet access and the appropriate IT literacy could respond to the questionnaire, but attempted to control for this by asking for the individual nurse's primary role and primary interest in health informatics. The researchers used the term *health informatics* and Australia was in the process of developing a global health informatics education framework for health professionals. The fact that the term *informatics* was used in the study exposed the participants to the newest term in health information technology. Australia does not have a validated nursing informatics competency list like Staggers et al. (2002) and has begun to create a national set core of competencies. In 2007 the Australian Nursing Federation began their project of a literature review, online survey of nurses, and

focus groups interviews in order to draft competency standards for nursing informatics (Foster & Bryce, 2009).

Nursing informatics competencies will continue to evolve and require rethinking to remain current and pertinent (Chang et al., 2011). It takes 17 years, for example, for research to reach the bedside practice (Simpson, 2010). The research article by Chang et al. was submitted in 2009, but it took two years before publication in an international journal. If educational or healthcare institutions wanted to review the latest informatics competencies, they would already be behind. There is a lack of standard competencies for informatics as shown by the different studies conducted in the United States, Taiwan, and Australia, which reveals a need for standard competencies for nursing informatics as well as surveys that are psychometrically sound measurements to assess informatics competencies.

Technology is changing rapidly and therefore an initiative such as the Technology Informatics Guiding Education Reform (TIGER) is designed to address a set of skills needed by all nurses who will practice in the profession (Hebda & Calderone, 2010). Private agencies and the United States government funded the TIGER initiative to enable nurses to weave informatics technologies into their daily practice at all levels. The TIGER initiative also established the TIGER Informatics Competencies Collaborative to formulate a unified vision of nursing informatics as a core competency for all practicing nurses (Choi & Bakken, 2013).

Computer literacy is the knowledge of computers, including the use of software applications such as word processors, spreadsheets, databases, presentation software, and

electronic mail (Hebda & Calderone, 2010). *Information literacy* is the ability to recognize that information is needed and have the ability to locate, evaluate, and use needed information effectively. Together, computer and information literacy provide the foundation for informatics competencies (Hebda & Calderone, 2010). More importantly, information literacy is an important step in promoting EBP. The access to journals, databases, and other sources of evidence-based information has improved and the information-literate nurse can weigh the quality and significance of research findings for the care of the patient (Hebda & Calderone, 2010). Information literacy is the bridge to EBP, but there continues to be barriers such as lack of awareness of the importance of EBP, unfamiliarity in using database searches, inadequate exposure to EBP, and lack of time (Foo et al., 2011; Upton & Upton, 2005; Waters, Crisp, Rychetnik, & Barratt, 2009).

The term *competency* is widely used in nursing education, administration, and practice without an accurate understanding of its meaning (Staggers & Gassert, 2000). Alspach (1992) defined *competence* as the potential ability and capacity to function in a given situation while *competency* is based on actual performance. A recent study by Fernandez et al. (2012) found 14 definitions of the term competence in articles from the health sciences education field developed from competency-based curricula in medical education. The definition for nursing informatics competencies in this current study is "the integration of knowledge, skills and attitudes in the performance of various nursing informatics activities within prescribed levels of nursing practice" (Staggers & Gassert, 2000).

Evidence-Based Practice Competency

EBP has become more important in healthcare since the mid-1990s as it provides a framework for clinical problem solving (Upton & Upton, 2006). In 2005, the national competencies for EBP were published (Stevens, 2009). This was the first set of competencies developed in the United States and is divided into undergraduate, master's, and doctoral level. The competencies were geared for an academic setting but could be translated into basic, intermediate, and advanced levels of competency for clinicians.

EBP refers to the integration of the best evidence, clinical expertise, and patient values in making decisions about the care of an individual patient (Institute of Medicine, 2003). The three components of EBP can be further explained as follows. Best evidence includes evidence that can be quantified, evidence based on qualitative research, and evidence derived from the practical knowledge of experts. Clinical expertise is derived from the knowledge and experience developed over time from practice. Lastly, patient values and circumstances are the individual preferences, concerns, expectations, financial resources, and social supports that are brought by each patient to a clinical encounter. Information from all sources may be relevant when deciding how to apply evidence (Institute of Medicine, 2003).

Nurses have traditionally relied on information generated from only one component: clinical expertise (Kring, 2008), and it is estimated that only 46% of nursing practices are evidenced-based (Kring, 2008). The EBP movement was ignited by the Cochrane Collaboration; the IOM later released a series of reports, beginning in 1999, on the state of healthcare in America (Kring, 2008). To support the EBP movement, the

American Nurses Credentialing Center included EBP and other research standards in their Magnet Recognition Program. Hospitals have implemented the EBP models to guide their efforts in achieving an EBP environment. Only about 4.45% of hospitals have achieved Magnet designation and only 15% of all nurses work in an EBP framework (Kring, 2008). Further complicating the situation, 47 EBP frameworks have been identified in the literature (Stevens, 2013).

Measuring competency in EBP depends on how it is defined. There are many surveys to measure different components of EBP, including Self-Efficacy in EBP, Outcome Expectancy for EBP, EBP Beliefs, EBP Implementation, and EBP Readiness. The current study used the EBPQ to measure competency because it incorporated all three constructs: attitudes, knowledge, and use (Rice, Hwang, Abrefa-Gyan, & Powell, 2010), which are similar to the constructs for measuring informatics. The SANICS tool is composed of five subscales which also include attitudes, knowledge, and skills.

Lack of time is frequently identified in the literature as a barrier to EBP (Cadmus et al., 2008; Leasure et al., 2008; Pravikoff et al., 2005). Another barrier is the ability to seek information. Thiel and Ghosh (2008) found the majority of their respondents (72.5%) indicated that when they needed information they consulted peers rather than using journals and/or books. In a study done in an acute care hospital, only 24% of the nurses indicated they used Cumulative Index to Nursing and Allied Health Literature (CINAHL) (Thiel & Ghosh, 2008). Results showed that many nurses have access to technological resources and feel they have the ability to engage in basic information gathering but not in higher levels of evidence gathering (Thiel & Ghosh, 2008). Another study found that 67% of

respondents sought out information from a colleague (Pravikoff et al., 2005). Journal articles, research reports, and hospital libraries were seldom reported as being used as sources of information, and 58% reported not using research reports at all to support their practice (Pravikoff et al., 2005).

Summary

The dependent or outcome variable for this study was EBP competency, a self-report scale that examined nurses' day-to-day use of EBP, which for the current research measured competency. The higher score indicates more frequent use of EBP, greater knowledge of the value of EBP, and more positive attitude toward EBP. There were nine personal (age, nursing degree, years of nursing experience, self-efficacy) and job-related characteristics (clinical specialty, shift, currently work in a Magnet facility, current position, time spent on EMR during shift). Previous literature has shown these personal and job-related characteristics may show a relationship with nursing informatics competency and EBP competency.

Few research studies have measured acute care nurses' self-assessment of informatics competency using all three components of nursing informatics competency: knowledge, skill, and attitude. There are no known studies that examine the relationship between nursing informatics competency and EBP competency. The current study fills that gap by examining the relationship between nursing informatics competency and EBP competency among acute care nurses and assessing how these competencies vary by personal and job-related characteristics.

CHAPTER THREE: METHODOLOGY

The methodology for the current study is described in the following sections: research design, setting, population and sample, study instruments, data collection procedures, measures, data analysis, and ethical considerations of the study.

Research Design

This descriptive, cross-sectional, quantitative study examined the relationship between nursing informatics competency and evidenced-based practice (EBP) competency among acute care nurses. Several study variables were assessed in relationship to nursing informatics competency and EBP competency.

Setting

The setting for this study included acute care hospitals in Northern Virginia. The not-for-profit healthcare system at which this study was conducted consists of five hospitals with more than 1,700 licensed beds and 3,893 registered nurses (RN) at four levels: RN1, RN2, RN3, and RN4s. RN1 through RN4 are job titles for direct care nurses in the hospitals. Acute care nurses work in a variety of units within the hospitals with multiple units in all the hospitals, for example, medical, surgical, critical care, and procedural units. Northern Virginia is one of the most culturally diverse regions in the country (Virginia Area Health Education Center, 2012).

Population and Sample

The sample was comprised of RNs in one large medical system consisting of five acute care hospitals. The inclusion criteria for participation were acute care RNs working at one of the acute care hospitals with a job title of RN1, RN2, RN3, or RN4. The exclusion criteria included nurses who did not work in one of the acute care hospitals or were managers or had other job titles besides RN1, RN2, RN3, or RN4. Also, the System Nursing Research Council at the research site was conducting a research project on EBP Beliefs and Implementation on one unit from each hospital, and recommended that these units be excluded. One unit from each hospital was identified and excluded. The study used power analysis to determine the sample size for the Pearson's correlation coefficient and multiple regression analysis.

Calculations of whether the sample size was adequate to avoid Type I and Type II errors was completed using Cohen's sample size determinations (1992). According to Polit and Beck (2012), most nursing studies have modest (small to medium) effects and cannot expect effect sizes in excess of 0.50. Cohen (1988) recommends the sample size for a medium ($r^2 = 0.13$) effect size with a significance level of 0.05 and Power of 0.80 should be around 118 for 10 independent variables. According to Cohen (1992), the sample size for a medium ($r^2 = 0.13$) effect size for multiple regression with a significance level of 0.05 and Power of 0.80 should be around 110 for 8 independent variables. Therefore, the survey was distributed to a minimum of 130 participants, allowing for 10% nonparticipation. There were 10 independent variables at the beginning of the study and only 8 were

significant and used in multiple regression. A total of 197 participants provided sufficient power for the statistical analyses.

Study Instruments

Several instruments were examined for use in this study. Through an extensive review of studies that used these instruments, the researcher assessed reliability, validity, number of items, and feasibility of using each instrument. According to Polit and Beck (2012), reliability coefficients greater than 0.70 are usually adequate; however, coefficients of 0.80 or greater are highly desirable. A summary of the study instruments is provided later in Table 3.

The New General Self-Efficacy Scale (NGSE) has eight items rated on a 5-point Likert scale from 1 = strongly disagree to 5 = strongly agree (Chen, Gully, & Eden, 2001). The NGSE is designed to evaluate self-efficacy across an extensive range of work-related contexts (Chen et al., 2001). Chen et al. (2001) assessed the psychometric properties of the tool with undergraduate and graduate students in three studies. The first study was conducted with undergraduate students taking upper-level psychology courses. In this study, the students took the survey three times (n_1 = 275, n_2 = 245, n_3 = 222) with an internal consistency of moderate to high (α = 0.87, 0.88, and 0.85, respectively). In the second study, undergraduate students (N = 323) were surveyed 14 days prior to taking their final exam and then 2 days after receiving their final exam grade; an internal consistency of 0.86 and .090 was found. In the final study, 54 Israeli managers attending an executive graduate program using a Hebrew version of NGSE took the survey 2 weeks apart (Chen et

al., 2001), with an internal consistency of 0.85 and 0.86. The overall Cronbach's alpha ranged from 0.85-0.90, which was comparable to other measures of general self-efficacy.

Two other surveys that measure general self-efficacy were considered for this study. Sherer et al.'s (1982) General Self-Efficacy (SGSE) scale has 17 items rated on a 5-point scale (1 = agree strongly and 5 = disagree strongly) with a Cronbach's alpha of 0.86. The SGSE has been widely used in clinical, educational, and organizational settings (Chen et al., 2001). The goal of the SGSE was to develop a measure of self-efficacy that is not tied to specific situations or behavior (Sherer et al., 1982). Another survey is the General Self-Efficacy Scale (GSES), originally developed in Germany, which has been translated into 28 different languages and has 10 items rated on a 4-point scale with 1 = not at all true and 4 = exactly true (Schwarzer & Jerusalem, 1995). Scholz, Doña, Sud, and Schwarzer (2002) reported that the internal consistency coefficients for Schwarzer and Jerusalem's tool have ranged from 0.75 to 0.91. The primary purpose of the tool is to assess the strength of an individual's belief in his or her ability to respond to new or difficult situations and to deal with any associated obstacles (Schwarzer & Jerusalem, 1995).

In Scherbaum et al.'s (2006) study comparing all three surveys, it was found that Chen et al.'s (2001) NGSE survey provides equivalent information about general self-efficacy with fewer items. The NGSE was used in the current study as it is the newest instrument developed among the instruments in consideration and it contains the least number of items. All self-efficacy-related instruments had similar reliability and validity.

Evaluating and measuring nursing informatics competency has been difficult because of the fast-paced environment of technology. Nursing informatics encompasses

such differing categories as knowledge, attitudes, and skills, which makes instruments for collecting data to measure nursing informatics competency difficult. Examples of such instruments are Staggers Nursing Computer Experience Questionnaire (SNCEQ), Nurses' Attitudes Toward Computers Questionnaire (NATC), and Nurses' Computer Attitudes Inventory (NCATT). The SNECQ is a 32-item, 5-point questionnaire in which the participants rate past or present computer use and their past or present computer knowledge (Staggers, 1994). NATC was highly utilized in the late 1990s (Hobbs, 2002). The NATC focused on nurses' beliefs, concerns, and willingness to use computers in general. Lastly, the NCATT measured computers and patient care, computer anxiety, and patient confidentiality and computers (Jayasuriya & Caputi, 1996). These instruments measured a component of nursing informatics competency and focused on computers.

A relatively new instrument published by Yoon et al. (2009) was used to measure Nursing Informatics Competency in the current study, the Self-Assessment of Nursing Informatics Competencies Scale (SANICS). The authors granted permission to use the instrument (Appendix A). The scale consists of 30 items rated on a 5-point Likert scale (1 = not competent to 5 = expert). Five factors explain 63.7% of the variance. Cronbach's alpha is a measure of reliability and SANICS has the following Cronbach's alphas: clinical informatics role $\alpha = 0.91$, basic computer knowledge and skills $\alpha = 0.94$, applied computer skills: clinical informatics $\alpha = 0.89$, nursing informatics attitude $\alpha = 0.94$, and wireless device skills $\alpha = 0.90$. The SANICS was first given to nursing students who entered the baccalaureate portion of their combined BS/MS program in 2006 or 2007 (Yoon et al., 2009). Their sample was predominately White females between ages 20 and 30 years old.

Choi (2012) also conducted a study using the SANICS with nursing students, with the largest group of those nurses between ages 20 and 29. Choi found that registered nursing (RN) to BSN (mean 3.21) and Accelerated BSN (mean 3.01) students were competent in informatics, but traditional prelicensure students were not. When comparing competency scores by track, the data showed that RN to BSN and traditional prelicensure students differed significantly in overall informatics competency ($F(2, 92) = 4.31$, $p = .02$). All students perceived they lacked competence in two subscales areas, "applied computer skills" and "clinical informatics role." Establishing a baseline of informatics competencies in undergraduate nursing students is critical in planning informatics curricula and adequately preparing students to promote safe, evidence-based nursing care (Choi, 2012). By using SANICS in the current research study, the researcher established a baseline of current informatics competencies among acute care nurses.

The researcher also evaluated several evidence-based practice instruments for consideration in this study. The EBP Beliefs ($\alpha = 0.9$) and EBP Implementation ($\alpha = 0.96$) scales were designed to be used together to measure nurses' attitudes and use of evidence-based practice (Melnyk, Fineout-Overholt, & Mays, 2008). Tucker, Olson, and Frusti (2009) developed the EBP Self-Efficacy scale (EBPSE), since self-efficacy is an important determinant in nurses' EBP, and personal factors (such as lack of confidence) are often potential barriers to EBP. The EBPSE required participants to write their level of confidence for each item which ranged from 0% to 100% for 17 statements. The participants had to write their percentage in the blank instead of circling a percentage. The Cronbach's alpha ranged from 0.95-0.98.

Another tool measuring self-efficacy and outcomes, designed by Chang and Crowe (2011), was called Self-Efficacy in EBP (SE-EBP) and Outcome Expectancy for EBP (OE-EBP). Both SE-EBP ($\alpha = 0.97$) and OE-EBP ($\alpha = 0.97$) demonstrated high reliability. Possible responses ranged from 0 = no confidence to 10 = extremely confident. Ultimately, the EBP self-efficacy questionnaires did not fall within the scope of this study because general self-efficacy was already being measured with a different tool. The EBPQ scale, on the other hand, was selected because it incorporates all three of the constructs (practice, attitude, and knowledge/skills), unlike the EBP Beliefs and EBP Implementation Scales, which only measure EBP attitude and use.

On the Evidenced-Based Practice Questionnaire (EBPQ) developed by Upton and Upton (2006), each item on the questionnaire is scored from 1 to 7, however, depending on the subscale there is a different meaning. On the subscale measuring practice from 1 = never to 7 = frequently, attitude toward EBP is a 7-point semantic differential scale and knowledge/skills associated with EBP 1 = poor, 7 = best. An average score can then be calculated for each subscale (Practice (1), Attitudes (2), and Knowledge/Skills (3)). The overall Cronbach's alpha was 0.87 for the entire questionnaire. The subscales had good internal reliability for the three subscales: practice ($\alpha = 0.85$), attitude ($\alpha = 0.79$), and knowledge/skills ($\alpha = 0.91$) (Upton & Upton, 2006). Construct validity was obtained by exploring the correlation between questionnaire scores and an independent measure of awareness of EBP and discriminate validity. Correlation coefficients were found to be in the range of 0.3-0.4 ($p < 0.001$), which suggests a positive but moderate relationship (Upton & Upton, 2006). The questionnaire is a self-report scale that explores nurses' day-

to-day use of EBP. The EBPQ, with 24 items, has been shown to be user-friendly, quick, and easy to complete (Upton & Upton, 2006). In developing the questionnaire for EBP, Upton and Upton's largest group of participants was in the age range of 30 to 39 years old.

This study, then, used the NGSE developed in 2001 to measure general self-efficacy, SANICS developed in 2009 to measure nursing informatics competency, and EBPQ developed in 2006 to measure EBP competency. All three instruments proved to be reliable and valid. The instruments used in the current study, subscales, and psychometric properties are summarized in Table 3. The three instruments are available in Appendix B.

Table 3

Study Instruments, Subscales, and Psychometric Properties

Study Instrument Name	Subscales	Psychometric Properties
New General Self-Efficacy (8 items)	• Evaluates self-efficacy across a broad range of work-related contexts	Chen, Gully, and Eden (2001) assessed psychometric qualities in three separate studies. In Study 1 psychology students (n = 275, n = 245, n = 222) were surveyed three times, Cronbach's alpha 0.87, 0.88, 0.85. In Study 2, students (N = 323) were surveyed twice, Cronbach's alpha 0.86 and 0.90. In Study 3, managers attending an executive graduate program (N = 54) were surveyed twice, Cronbach's alpha 0.85, 0.86. Cronbach's alpha was 0.67 for Greek primary school children (N = 551) (Alexopoulos & Asimakopoulou, 2009).
Nursing Informatics Competency (30 items)	• Clinical Informatics Role • Basic Computer Knowledge and Skills • Applied Computer Skills: Clinical Informatics • Clinical Informatics Attitudes • Wireless Device Skills	Cronbach's alpha for subscales 0.94, 0.89, 0.90, 0.89, 0.84 (Choi & Bakken, 2013), overall Cronbach's alpha 0.96; study was conducted on undergraduate and graduate nursing students (N = 302). Cronbach's alpha for subscales 0.91, 0.93, 0.90, 0.89, 0.89 (Choi, 2012), overall Cronbach's alpha 0.95 (Choi, 2012); study was conducted on traditional RN-BSN and Accelerated BSN (N = 131). Cronbach's alpha for subscales 0.91, 0.94, 0.89, 0.89, 0.89; overall Cronbach's alpha 0.95 (Yoon et al., 2009); study was conducted on nursing students entering BS/MS program (N = 336).
Evidence-Based Practice Competency (24 items)	• Practice • Attitude • Knowledge/Skills	Cronbach's alpha for subscales 0.85, 0.79, 0.91; overall Cronbach's alpha 0.87 (Upton & Upton, 2006); study was conducted on nurses working in hospitals randomly selected across Wales (N = 751). Cronbach's alpha for subscales 0.87, 0.72, 0.95, overall Cronbach's alpha 0.94 (Koehn & Lehman, 2008); study was conducted in a large medical center in the United States (N = 422). Cronbach's alpha for subscales 0.89, 0.67, 0.94 (Brown et al., 2010); study was also conducted in the United States with a convenience sample (N = 1,301). Cronbach's alpha for subscales 0.82, 0.64, 0.88, overall Cronbach's alpha 0.89 (Upton, Scurlock-Evans, Stephens, Upton, & Ladeira, 2012); study was conducted on allied health professionals employed by NHSScotland (N = 154).

Lastly, the research study collected information on eight personal and job-related characteristics of RNs that may influence their nursing informatics competency and EBP competency. The section was labeled the Demographics of Registered Nurses. These characteristics were age, nursing degree, years of RN experience, type of clinical unit, shift worked, whether the nurse currently worked in a Magnet facility, current position, and how much time he or she typically spent on the electronic medical records system during a shift; the demographics of Registered Nurses section was established by the researcher.

Instrument Pilot Study

The researcher conducted a paper–pencil instrument pilot using a convenience sample of five volunteer medical-surgical nurses to estimate the amount of time it would take to complete the survey. The instrument took approximately 20-25 minutes to finish. Several nurses asked, "Why can't I do this online?" This statement was interesting because these nurses considered themselves "not to be good to with the computer." Some of the nurses stated, "We do all sorts of surveys online, it's really easy!" One nurse mentioned the font was too small, and another indicated it would be completed faster if it were done online. Based on these comments, the instrument was adapted electronically using the software system Qualtrics™, a larger font was used, and the survey was made available via computer.

Data Collection Procedures

After receiving approval from the George Mason University (GMU) Office of Research Integrity and Assurance, the researcher provided the hospital system's System Research Coordinator with an executive summary of the research study and identified a

point of contact for each hospital. Then, the researcher submitted the approved protocol from GMU to the subject hospital system's Institutional Review Board (IRB). Once approved, the researcher contacted each hospital to determine if additional requirements were needed. No additional requirements were needed. The researcher presented the protocol to the System Research Council where each hospital had a representative which allowed the council to ask questions about the protocol.

The survey was distributed electronically by the point of contact at each hospital using methods best suited for their organization. This included posting a link on the organization's intranet, distributing the recruitment flyer with directions to locate the intranet link, distributing the recruitment letter electronically with the survey link, and sending an email about the study with the link embedded in the email. Participation was voluntary, and individual responses were not available to administrators or anyone who had responsibility for evaluating nursing performance. Again, depending on each hospital's preference, the electronic survey was delivered by email, letter attached to email, and/or recruitment flyer with directions to where the link was posted was included. The survey link was posted on the intranet for all nurse employees who agreed to participate in this study from January 6th to January 20th, 2014. The researcher attended research council meetings at three of the five hospitals and a shared governance meeting at one hospital in order to advertise participation. Since no meetings were scheduled during the timeframe for the last hospital, the researcher toured the facility with the clinical nurse specialist, posted flyers, and spoke with the charge nurses of units. After the first week, a reminder email was sent to the each hospital's point of contact with the recruitment flyer embedded in the body

of the email. The researcher toured the second largest hospital in the system daily on day and night shift for the second week. The motto the researcher used was "200 in 2 weeks" because a common question was "How many surveys do you need to collect?" Nurses were eager to participate. One nurse even participated from Spain while on vacation.

Internet-based surveys are more effective when the target population has both email and Internet access (Truell, Bartlett, Alexander, 2002). For this study, data were collected using an electronic survey tool with encryption, Qualtrics. Because study information and informed consent appeared on the first page of the survey, informed consent was implied if the participant chose to continue with the study and enter data.

All data were kept confidential by using a password-protected survey tool site and a password-protected computer. No individuals had access to the data except for the researcher. Once the data were downloaded and analyzed from the electronic survey tool website, the dataset in the electronic survey tool was deleted.

Measures

Descriptive analyses were conducted on all personal and job-related characteristics (such as age, nursing degree, years of RN experience, clinical specialty) and total scale items (NGSE, SANICS, and EBPQ) to determine their distribution. First, age was collected as a continuous variable. Previous studies such as Yoon et al. (2009) divided age into groups of 20-29, 30-39, 40-49, and 50-64; Choi's study (2012) used similar ranges. Both Yoon et al. and Choi conducted their research with nursing students and, therefore, their sample had younger participants. Researchers who have used the EPBQ scale have categorized age into 21-30, 31-40, 41-50, and > 50 years (Koehn & Lehman, 2008; Upton

& Upton, 2006) when describing their sample. However, Brown et al.'s (2010) research study, which took place in hospitals in California, categorized nurses' ages into < 30, 30-39, 40-49, 50-59, and > 60 years old. Based on this evidence, in the current research, age was a categorical variable. The distribution of this variable was categorized into three age groups: < 35, 36-49, and > 50 years old. Koehn and Lehman (2008) and Brown et al. (2010) also collected information on nursing degrees by having four categories, but the categories differed. Koehn and Lehman (2008) had Diploma and Associate degree separated, whereas Brown et al. (2010) had them combined. Also, Brown et al. (2010) had a category for Doctoral degree. In the current research, the variable nursing degrees had five categories: Diploma, Associate, Baccalaureate traditional, Baccalaureate 2nd degree, and Master's. Previous research in nursing informatics competency and EBP competency did not distinguish between Baccalaureate traditional versus Baccalaureate 2nd degree. However, there is research to support that 2nd degree students have higher critical thinking skills than traditional BSN students (Newton & Moore, 2013).

The variable years of RN experience was measured as continuous using the question: "How many years have you worked as a Registered Nurse (RN)?" Brown et al. (2010) had five categories: < 1, 1-7, 8-12, 13-20, and > 21. From a clinical perspective, there is a big difference between a nurse with 1 year of experience and 7 years of RN experience. In Hsu et al.'s (2009) research study, years of work experience among Taiwanese and South Korean nurses was categorized into < 2 years, 3-5 years, 6-10 years, and 10 years and above when they reported their demographics. In the current research study, upon examining the distribution of the collected data for this variable, the following

categories were created for years of RN experience: < 4.5 years, 5-10 years, 11-25 years, and > 26 years.

In order to measure each nurse's clinical specialty, participants answered the question, "In which type of clinical unit do you currently work?" They were asked to only select one unit. The nurses were given the option of selecting "other" in case the type of clinical specialty was not listed. Clinical specialty is a categorical variable and included categories such as critical care, medical/surgical, women's and children's (W&C), and operating room/procedural areas. If "other" was selected, it was recoded into one of the above categories. The researcher consulted with three nursing clinical experts to decide how to create categories for types of nursing unit. For example, the emergency room and step down units were classified as a Critical Care area. Obstetrics, Pediatrics, and Labor and Delivery were classified into the Women's and Children's (W&C) area. The Operating Room/Procedural area consisted of presurgical testing departments, interventional radiology, and the vascular access department. Two out of the three consultants classified the Neonatal Intensive Care (NICU) unit as W&C while the other classified it as a Critical Care unit, so it was decided that NICU should be classified under W&C due to their service delivery model. Another discrepancy was classifying the Post Anesthesia Care Unit (PACU), as two out of the three consultants classified PACU as an Operating Room/Procedural department while one considered it a Critical Care unit. It was decided that PACU should be classified under OR/Procedural department.

Other demographic variables that were collected included shift usually worked by selecting only one out of day shift, evening shift, or night shift. The 12-hour and 8-hour day

shift were combined into one category. Evening, 12-hour night shift, and 8-hour night shifts were also combined into the night category. Another work-related characteristics was whether or not the nurse currently worked in a Magnet facility (yes, no, do not know). In order to analyze this variable, those who were not working in a Magnet facility or did not know whether they were working in a Magnet facility were combined into one category. The last work-related characteristic was their current position with the option to choose RN1, RN2, RN3, RN4, or other. Shift worked and Magnet facility were made into dichotomous variables. There was one continuous variable being collected on the demographics section of the questionnaire via the question about how much time the participant spent on the computer using an electronic medical record (EMR) during his or her shift in hours. Due to the lack of literature to support how this variable should be computed, the researcher coded this variable into three categories: less than 5 hours, 6-9 hours, and greater than 10 hours after reviewing frequencies and quartiles related to the distribution of this variable.

The general self-efficacy score for nurses was a continuous variable because the score was measured by the mean of the eight items on the New General Self-Efficacy Scale (Chen et al., 2001). Nurses rated their agreement or disagreement with each statement on the scale from 1 = strongly disagree to 5 = strongly agree.

The nursing informatics competency variable was a continuous variable and was measured by using the SANICS, which has five subscales which incorporate computer skills, informatics knowledge, and informatics skill. Specifically, the subscales “Basic Computer Knowledge and Skill” and “Wireless Device Skills” measure computer skills.

The two subscales "Clinical Informatics Roles" and "Clinical Informatics Attitude" measure informatics knowledge. Finally, the subscale "Applied Computer Skills: Clinical Informatics" measures informatics skills. A minimum score of three on the SANICS (Yoon et al., 2009) indicates competence. Each of the subscales were examined to determine the mean score. The overall mean SANICS score across all five subscales was also calculated.

The outcome variable, EBP competency, was measured by using the 24-item EBPQ scale. This was a continuous variable. The overall mean score for the questionnaire was used. However, previous research did categorize EBP competency scores ranging from high and moderate to low (Koehn & Lehman, 2008; Upton, Scurlock-Evans, Stephens, Upton, & Ladeira, 2012). In this current study, the researcher determined that since the overall EBP competency was moderately high there was no need to categorize the score into high, moderate, and low. Instead, the EBP competency was constructed using the three subscales: practice, attitude, and knowledge/skills.

Reliability analysis was used to measure the consistency of the self-efficacy scale. Separate reliability analyses were conducted for each subscale and the total scale for both nursing informatics competency and EBP competency. The Cronbach's alphas indicate the overall reliability and values around .8 are considered adequate (Polit, 2010).

Data Analysis

Data were analyzed using the IBM SPSS version 21.0 software (IBM Corp., 2012). Screening data prior to analysis served an important purpose in this study. Before beginning any analyses, frequencies, mean, standard deviations, and quartiles with minimum and maximum values were used to preliminarily evaluate the data. Accuracy of

the data is crucial, as is identifying the missing data and outliers. There are several methods for handling missing data. The first is to delete the cases or variables if a few of them are missing; other ways are to estimate the missing values by using prior knowledge for a replacement value extracted from the data, or to use a regression approach (Mertler & Vannata, 2005). In this study, both methods were used. The researcher deleted cases if more than four items were missing and used the mean of the subscale or scale for the items that were missing less than four. For scale items, a column was created in order to compute missing values to make it easier to identify how many missing values there were in the dataset. Once the missing values were input with the mean of the subscale or scale, then remaining variables were computed. The variables that needed to be computed were for the self-efficacy score, nursing informatics competency score, and EBP competency score. Then the mean scores were computed for each subscale for nursing informatics competency and EBP competency. Self-efficacy did not have subscales. Identifying outliers was an important step in preparing the data for analysis because outliers can distort the results of a study (Mertler & Vannata, 2005). Outliers were found in the self-efficacy scale, but upon further investigation, no identifiable error was made. The researcher ran analyses on the self-efficacy scale, with and without outliers, and no significant difference was found; therefore, the outliers were kept in the analysis.

Descriptive statistics were conducted for all variables considered in this study. These analyses included frequency distributions, means, standard deviations, and percentages. Quartiles and several graphical devices were used to assess the distribution of each personal and job-related variable.

The first objective of this study was to determine the relationship between acute care nurses' self-assessment of their nursing informatics competency and their EBP competency as well as personal and job-related characteristics. Correlational analyses using the Pearson's correlation coefficient for continuous variables to determine any significant correlations between the nurses' self-assessment of their nursing informatics competency and their EBP competency were conducted. Correlation analyses were also conducted between the personal and job-related characteristics (age, years of RN experience, time using EMR during shift), self-efficacy, and nursing informatics competency. Further, correlational analyses was conducted between the personal and job-related characteristics (age, years of RN experience, time using EMR during shift), and the outcome variable EBP. These analyses assisted the researcher in determining which variables should be entered into the final regression models.

The second objective was to identify how nursing informatics competency and EBP competency varied by personal and job-related characteristics such as age, nursing degree, years of RN experience, and clinical specialty. *T*-tests and analysis of variance (ANOVA) were conducted in order to determine any significant differences in nursing informatics competency and EBP competency across all different personal and job-related characteristics. Independent *t*-tests were conducted with variables that only had two categories such as Magnet/non-Magnet facilities and day shift/night shift. The personal and job-related characteristics with multiple levels were age, nursing degree, years of RN experience, clinical specialty, current position, and how much time they spent on the EMR

during their shift. These analyses assisted the researcher in determining factors to be included in the regression analyses.

The third objective was to determine whether nursing informatics competency predicted EBP competency after controlling for personal and job-related characteristics such as age, nursing degree, years of nursing experience, clinical specialty, shift, and current position were examined. Multiple linear regression was used to answer the third objective. Specifically, three models were built; the first determined if nursing informatics competency predicted EBP competency without controlling for any potential confounders. Next, the researcher determined if the model with nursing informatics competency as an independent variable still predicted EBP competency while adjusting for self-efficacy. The final model was to determine if nursing informatics competency continued to predict EBP competency after controlling for personal and job-related characteristics (e.g. age, degree, years of nursing experience, clinical specialty, shift, and current position). In order to complete this analysis, dummy coding was needed since several categorical variables had at least two levels. One level from each variable was chosen as a baseline group with the following groups: under 35 years of age, Diploma degree, less than 4.5 years of RN experience, medical/surgical areas, and RN1. Depending on the number of groups, dummy codes were created for each one to enter into the analysis.

In order to control for self-efficacy and other personal and job-related characteristics, semipartial correlations were conducted. Semipartial correlation quantifies the relationship between two variables while accounting for the effects of a third variable on only one of the variables in the original correlation (Field, 2013). Semipartial correlation

analyses were useful in trying to explain the variance between EBP competency and nursing informatics competency when personal characteristics and job-related characteristics were held constant.

Assumptions

In conducting multiple linear regression, one must examine the following assumptions in order to have reliable and unbiased results: normality, linearity, and homoscedasticity (Mertler & Vannata, 2005). All assumptions were met in this current study.

Normality. The assumption that the sample is normally distributed was assessed by Q-Q plots. The multivariate normality consists of positive or negative skewness and positive or negative kurtosis (Tabachnick & Fidell, 2001). Prior to examining multivariate normality the researcher first assessed univariate normality.

Linearity. The next assumption is that there is a straight line relationship between two variables (Tabachnick & Fidell, 2001). Linearity was assessed by using scatterplots, which were oval-shaped and clustered around the zero line (Tabachnick & Fidell, 2001).

Homoscedasticity. The last assumption is that the variability in scores for one continuous variable is closely similar to all values of another continuous variable (Tabachnick & Fidell, 2001). To evaluate this assumption, a plot of residuals against independent variables formed a straight line (Munro, 2005).

Multicollinearity

In multiple regression, multicollinearity can cause problems if there is moderate to high intercorrelation among predictor variables. There are two ways to assess

multicollinearity. The first is to run tolerance statistics for each independent variable, which resulted in values close to zero. The second method is to examine values for variance inflation factors (VIF) that were less than 10 (Mertler & Vannatta, 2005). In the current study, the largest VIF was less than 10 and there were no tolerances below 0.1 which could indicate a serious problem. Also, researchers should avoid the use of a set of independent variables when there are intercorrelations that are .85 or higher (Polit, 2010). The highest intercorrelation in this study was between age and years of RN experience which was .81.

Research questions, variables, and statistical tests are included in Table 4. The variables also include the subscales of the instruments being used.

Table 4

Research Questions, Variables, and Statistical Tests

Research Questions	Variables	Statistical Tests
1) What is the relationship between acute care nurses' self-assessment of their nursing informatics competency and their evidence-based practice competency?	Nursing Informatics Competency • Clinical Informatics Role • Basic Computer Knowledge and Skills • Applied Computer Skills: Clinical Informatics • Clinical Informatics Attitudes • Wireless Device Skills Evidence-Based Practice (EBP) Competency • Practice of EBP • Attitude of EBP • Knowledge/Skills associated with EBP	Bivariate Correlations (Pearson's *r*)
2) To what extent does nursing informatics competency and evidence-based practice competency vary by personal and job-related characteristics?	• Nursing Informatics Competency • Evidence-Based Practice Competency • Age • Highest Nursing Degree • Years of Nursing Experience • General Self-Efficacy • Clinical Specialty • Shift • Currently Magnet • Current Position • Time Spent on EMR During Shift	*t*-Tests ANOVA
3) Does nursing informatics competency predict evidence-based practice competency after controlling for personal and job-related characteristics?	• Nursing Informatics Competency • Evidence-Based Practice Competency • Age • Highest Nursing Degree • Years of Nursing Experience • General Self-Efficacy • Clinical Specialty • Shift • Current Position	Multiple Regression

Ethical Considerations

This study required approval from the George Mason University Office of Research Integrity and Assurance and the subject hospital system's Institutional Review Board prior to initiation of data collection. All possible unique identifiers were removed from the dataset such as IP addresses. The George Mason University Office of Research Integrity

and Assurance determined that this project fell under the exemption category #2. Approval to proceed with the study was granted on December 2013 (Appendix C). This study was also exempt from the subject hospital system's requirements and was granted permission to proceed on January 2014.

Summary

This descriptive, cross-sectional, quantitative study took place in Northern Virginia and three study instruments (NGSE, SANICS and EBPQ) were used. All three instruments were valid and reliable. The data collection took place in January 2014 using an electronic software system. Nurses were emailed the link for the survey. The data analysis plan was discussed for each variable. The study required approval from both George Mason University Office of Research Integrity and Assurance and the hospital system's IRB. The results of statistical analyses are detailed in Chapter 4, and the discussion of the results is in Chapter 5.

CHAPTER FOUR: RESULTS

This chapter describes the findings related to nursing informatics competency and evidence-based practice (EBP) competency among acute care nurses in a five-hospital system. Statistical analyses were conducted to explore three research questions:

- What is the relationship between acute care nurses' self-assessment of their nursing informatics competency and their EBP competency?
- To what extent do nursing informatics competency and EBP competency vary by personal and job-related characteristics?
- Does nursing informatics competency predict EBP competency after controlling for personal and job-related characteristics?

Sample Characteristics

There were 3,893 registered nurses (RN) employed who had the current position of either RN1, RN2, RN3, or RN4 across five hospitals in one system. However, the researcher is not sure of how many RNs actually received the email because electronic mail distribution lists may not have been current. The survey may not have reached all 3,893 RNs. RN1 through RN4 provide direct patient care. A total of 241 nurses participated but 36 were excluded because they selected "other" for current position, which the researcher assumed meant non-RN1 to RN4. Respondents who chose "other" were able to type in their job title and most were management, although some left it blank so it could not be

determined if they provided direct patient care. Therefore, a total of 205 nurses participated. The sample for this study was 5% of the target population and was a voluntary convenience sample. Among the 205 respondents, 7 individuals left more than 7 items blank on the questionnaires (not including the demographic section) and 1 respondent omitted an entire subscale comprised of 4 items, therefore they were also omitted from analysis. A total of 45 respondents left fewer than 4 items blank. The mean substitution method (Mertler & Vannata, 2005) was used to replace missing values for these 45 respondents. The final analytic sample consisted of 197 participants.

Table 5 presents descriptive statistics of the study sample including means, standard deviations, and percentages. In general, this sample of nurses had a mean age of 43 years (*SD* = 11.8), had a Bachelor of Science in Nursing (BSN) degree or higher in nursing, about 16 years of nursing experience (*SD* = 12.51), and spent about 7 hours per shift (*SD* = 3.24) documenting on the electronic medical record. Specifically, respondents ranged in age from 23 to 70 years old. Respondents were placed into age groups of less than 35, 36-49, and greater than 50 years old. The largest percentage of respondents (34.5%) was between the ages of 36 and 49 years old, however, the lowest percentage of respondents (29.9%) was less than 35 years old.

The education distribution was 17 (8.6%) nurses with Diploma, 43 (21.8%) with Associate's degrees, 87 (44.2%) with a BSN traditional, 32 (16.2%) with a 2nd degree BSN, and 18 (9.1%) nurses with a MSN. The BSNs were not combined for analysis because the number of participants for 2nd degree BSN and Diploma nurses were very similar and there were significant differences between them. Nurses' years of experience ranged from 1 to

45 years (M = 15.7, SD = 12.51) and they were placed into groups based on years of RN experience: less than 4.5 years, 5 to 10 years, 11 to 25 years, and greater than 26 years. The largest percentage of respondents (27.9%) had between 11 and 25 years of RN experience.

Critical care areas had the highest proportion of respondents (36.5%), followed by medical/surgical areas (27.9%), then W&C areas (22.8%), and finally OR/procedural areas (12.2%). The majority of respondents were from day shift in either 12-hour or 8-hour day shifts (69%). Evening (1.5%), 12-hour night (27.4%), and 8-hour night (1%) shifts were also combined into the night category. Approximately 54.0% of the respondents said they were working in a Magnet facility, 43.1% said they were not, and 2% said they did not know. The majority of respondents were RN2 (65%), followed by RN3 (17.8%), RN4 (12.2%), and finally RN1 (5.1%). The clinical ladder and those working in direct care had the current positions of RN1 through RN4. New nurses with less than one year of experience are RN1s, those with more than one year of experience are RN2s. In order to become an RN3 or RN4, one must apply to the clinical ladder committee with a professional portfolio demonstrating professional advancement such as a professional certification and/or being an active member of a nursing committee such as research or informatics. There is also an increase of pay with an advancement from RN2 to RN3 and RN3 to RN4.

The amount of time spent on the EMR during the shift ranged from 1 to 16 or more hours (M = 7.14, SD = 3.23), even though the shift options were either 8-hour day, 12-hour day, 8-hour evening, 8-hour night, or 12-hour night. It is possible that one or two respondents misread the question or selected the incorrect number of hours from the list. It

is also possible that they felt they stayed over their shift to document. However, there are nurses who routinely work 16-hour shifts. Regardless, the median was 7.00 hours. There was an equal distribution between those who spent less than 5 hours (35.5%) and between 6 to 9 hours (35.5%) on EMR. Lastly, the mean self-efficacy score of respondents (scale of 1 to 5) was 4.25 (*SD* = 0.66). The median score for self-efficacy was also 4.25.

Table 5

Description of Sample Characteristics

Characteristics	Mean (SD)	*n* (%)	Missing n (%)
Age (years)	43.42 (11.8)	191 (97)	6 (3)
< 35		59 (29.9)	
36-49		68 (34.5)	
> 50		64 (32.5)	
Nursing Degree: Education		197 (100)	0 (0)
Diploma		17 (8.6)	
Associate's		43 (21.8)	
Bachelor's, traditional		87 (44.2)	
Bachelor's, 2nd		32 (16.2)	
Master's (MSN)		18 (9.1)	
Years of RN Experience	15.7 (12.51)	196 (99.5)	1 (0.5)
< 4.5		44 (22.3)	
5-10		52 (26.4)	
11-25		55 (27.9)	
> 26		45 (22.9)	
Clinical Specialty		196 (99.5)	1 (0.5)
Critical Care Area		72 (36.5)	
Medical/Surgical Area		55 (27.9)	
Women's and Children's Area		45 (22.8)	
OR/Procedural Area		24 (12.2)	
Nursing Shift		195 (99.0)	2 (1)
Day (12 hour and 8 hour)		136 (69.0)	
Evening/Night (12 hour and 8 hour)		59 (29.9)	
Working in a Magnet Facility		196 (99.5)	1 (0.5)
Yes		107 (54.3)	
No or Do Not Know		89 (45.2)	
Current Position		197 (100)	0 (0)
RN1		10 (5.1)	
RN2		128 (65.0)	
RN3		35 (17.8)	
RN4		24 (12.2)	
Time Spent on EMR during shifts (hours)	7.14 (3.23)	194 (98.5)	3 (1.5)
< 5 hours		70 (35.5)	
6-9 hours		70 (35.5)	
> 10 hours		54 (27.4)	
Self-Efficacy Score	4.25 (0.66)	197 (100)	0 (0)

Note. $N = 197$.

Descriptive Statistics of Nursing Informatics and Evidence-Based Practice Competencies

Table 6 shows descriptive statistics for the total and subscale scores of the EBP Questionnaire and the Self-Assessment of Nursing Informatics Competency. The potential range for nursing informatics competency score was 1 to 5. The median score for nursing informatics competency was 3.17, with an average of 3.27 (*SD* = .802, range 1.17-5). The nursing informatics competency scale had five subscales; for three subscales the median score was slightly higher than the average. Basic computer knowledge and skills had a median score of 3.40 which was higher than the average for that subscale (*M* = 3.31, *SD* = .909, range 1-5); wireless device skills had a median score of 3.00 which was lower than the average (*M* = 3.28, *SD* = 1.12, range 1-5); clinical informatics role had a median score of 3.20 and was higher than the average (*M* = 3.13, *SD* = .856, range 1-5); clinical informatics attitude had a median score of 3.75 and was higher than the average (*M* = 3.70, *SD* = .830, range 1-5). Lastly, applied computer skills in clinical informatics had a median score of 2.25 which was lower than the average for the subscale (*M* = 2.45, *SD* = 1.14, range 1-5).

The potential range for EBP competency was 1 to 7. The median score for the total EBP competency score was 5.25 (range 2.58-6.88), with an average of 5.12 (*SD* = .850). The subscales of EBP competency were practice or use of EBP, attitude toward EBP, and individual knowledge/skills associated with EBP. The median scores for each of the EBP subscales were slightly higher than the average scores. Specifically, practice or use of EBP had a median score of 5.17 (*M* = 4.97, *SD* = 1.20, range 1-7), attitude of EBP had a median

score of 5.5 (*M* = 5.32, *SD* = 1.17, range 1.25-7) and lastly, knowledge/skills associated with EBP had a median score of 5.21 (*M* = 5.12, *SD* = .913, range 2.21-7).

Table 6

Descriptive Statistics of Nursing Informatics and Evidence-Based Practice Competencies

Competencies	Mean (SD)	Median	Range
Nursing Informatics Competency Total Score	3.21 (.802)	3.17	1.17-5
Computer Skills			
Basic Computer Knowledge and Skills	3.31 (.909)	3.40	1-5
Wireless Device Skills	3.28 (1.12)	3.00	1-5
Informatics Knowledge			
Clinical Informatics Role	3.13 (.856)	3.20	1-5
Clinical Informatics Attitude	3.70 (.830)	3.75	1-5
Informatics Skills			
Applied Computer Skills: Clinical Informatics	2.45 (1.14)	2.25	1-5
EBP Competency Total Score	5.12 (.850)	5.25	2.58-6.88
Practice of EBP	4.97 (1.20)	5.17	1-7
Attitude of EBP	5.32 (1.17)	5.50	1.25-7
Knowledge/Skills Associated With EBP	5.12 (.913)	5.21	2.21-7

Note. *N* = 197.

Cronbach's Alpha for Scales

Cronbach's Alpha for self-efficacy, nursing informatics competency, and EBP competency were calculated for each of the subscales. Table 7 shows that with the exception of Attitude of EBP, all scores had an alpha above .80.

Table 7

Cronbach's Alpha for Nursing Informatics Competency and Evidence-Based Practice Competency Subscales

Variable	Cronbach's Alpha	Number of Items
New General Self-Efficacy Scale	.960	8
Nursing Informatics Competency Total Score	.971	30
Computer Skills		
Basic Computer Knowledge and Skills	.964	15
Wireless Device Skills	.932	2
Informatics Knowledge		
Clinical Informatics Role	.913	5
Clinical Informatics Attitude	.940	4
Informatics Skills		
Applied Computer Skills: Clinical Informatics	.937	4
EBP Competency Total Score	.938	24
Practice of EBP	.899	6
Attitude of EBP	.748	4
Knowledge/Skills associated with EBP	.947	14

Overall Differences in Nursing Informatics Competency, Evidence-Based Practice Competency, and Self-Efficacy Across Sample Characteristics

Objective 1: Relationship Between Nursing Informatics Competency and EBP Competency

The first objective of this study was to determine the relationship between nursing informatics competency and EBP competency. In order to examine the relationship between nursing informatics and EBP competencies, bivariate Pearson correlations were conducted. The results from the correlation analysis for personal and job-related characteristics are displayed in Table 9. There was a moderate and significant positive correlation between EBP competency and nursing informatics competency ($r = .548$, $p <$

.01). There was also a weak but statistically significant correlation between EBP competency and self-efficacy ($r = .248$, $p < .01$). Age ($r = -.394$, $p < .01$) and years of RN experience ($r = -.332$, $p < .01$) had a moderate inverse relationship with nursing informatics competency. As age and years of RN experience increased, nursing informatics competency decreased. Age and years of RN experience ($r = .813$, $p < .01$) were also strongly correlated.

Table 8

Correlation Matrix for Continuous Variables

Variables	1	2	3	4	5	6
1 EBP	1.00					
2 Nursing Informatics	.548**	1.00				
3 Self-Efficacy	.248**	.11	1.00			
4 Age (Years)	.01	-.394**	.03	1.00		
5 RN Experience (Years)	-.03	-.332**	.03	.813**	1.00	
6 Time using EMR during shift	.14	.12	.05	-0.12	-.11	1.00

Note. **Correlation is significant at the 0.01 level (2-tailed).

Objective 2: How Nursing Informatics Competency and EBP Competency Vary by Personal and Job-Related Characteristics

The second objective of this study was to identify how nursing informatics competency and EBP competency varied by personal and job-related characteristics. Analysis of variance (ANOVA) was used to compare the average total score for EBP competency, nursing informatics competency, and self-efficacy across six main characteristics of nurses: age, nursing degree, years of RN experience, clinical specialty, current position, and time spent on EMR during shift. Table 8 presents differences in the average scores of EBP competency, nursing informatics competency, and self-efficacy

across several personal and job-related characteristics. The description of the findings in this subsection pertains to the overall differences in the average scores of nursing informatics competency, EBP competency, self-efficacy, and for personal and job-related characteristics.

The age group that scored the highest on EBP competency (M = 5.22, SD = .848, p = .375) and self-efficacy (M = 4.29, SD = .610, p = .686) was between the ages of 36 and 49 years old. However, the differences in EBP scores across age groups were not statistically significant. The lowest scoring group was less than 35 years old in EBP competency (M = 5.01, SD = .778), which was also not statistically significant. However, they were the highest scoring group (M = 3.54, SD = .606) in nursing informatics competency. The lowest scoring group in nursing informatics competency (M = 2.78, SD = .810) was that in which nurses were more than 50 years old, and this was a statistically significant difference compared to the other age groups ($p < .001$).

The highest scoring group in EBP competency and nursing informatics competency by type of degree was those with a MSN, followed by the nurses with a 2nd degree BSN. The lowest scoring group in EBP competency and nursing informatics competency was the Diploma group. Both EBP competency (p = .017) and nursing informatics competency (p = .006) showed a statistical significance by type of degree. Nurses with a 2nd degree BSN also scored the highest average in self-efficacy followed by those with MSNs. However, there was no statistical significance between type of degree and self-efficacy for this group.

Nurses with 11 to 25 years of RN experience had the highest average score in EBP competency (M = 5.27, SD = .885). Nurses with fewer than 4.5 years of RN experience

scored the highest on nursing informatics competency (M = 3.44, SD = .603). Nurses with more than 26 years of RN experience scored lowest on EBP competency (M = 4.95, SD = .885). These differences, however, were not statistically significant (p = .129). Nurses with more than 26 years of RN experience also had the lowest score on nursing informatics competency (M = 2.76, SD = .847) and this was a statistically significant difference compared to the other groups (p < .001). However, this group of nurses with more than 26 years of RN experience scored high on self-efficacy (M = 4.28, SD = .666) along with those with 11 to 25 years of RN experience (M = 4.28, SD = .658). No statistical differences were observed in the average self-efficacy score by years of RN experience (p = .939).

Among the clinical specialty groups, OR/Procedural areas scored the highest in EBP competency (M = 5.30, SD = .673). This difference, however, was not statistically significant (p = .113). Critical Care scored the highest in nursing informatics competency (M = 3.37, SD = .776) compared to W&C (M = 2.91, SD = .732), and this was a statistically significant difference (p = .023). The lowest scoring clinical specialty in EBP competency was W&C (M = 4.88, SD = .813) without reaching statistical significance.

Nurses working night shift (M = 3.44, SD = .714) scored significantly higher (p = .010) than day shift (M = 3.12, SD = .825) nurses in nursing informatics competency. In EBP and self-efficacy competency, the scores between day and night shift nurses were similar (p = .906 and p = .901, respectively). Those working in non-Magnet facilities (M = 5.08, SD = .854) scored higher than those in Magnet facilities (M = 5.19, SD = .876) in EBP competency. Nurses working in Magnet facilities scored slightly higher in nursing

informatics competency (*M* = 3.21, *SD* = .832) than non-Magnet facilities (*M* = 3.20, *SD* = .776). However, none of these differences were statistically significant.

Nurses in RN4 positions scored the highest in EBP competency (*M* = 5.22, *SD* = .880) compared to other current positions, however, this was not statistically significant (*p* = .896). Nurses in RN4 positions also scored the lowest in nursing informatics competency (*M* = 2.91, *SD* = .880) compared to other current positions, and these differences were statistically significant (*p* = .033). Nurses in RN1 positions scored the highest in nursing informatics (*M* = 3.54, *SD* = .513) and in self-efficacy (*M* = 4.33, *SD* = .487). No statistically significant differences were observed in the average self-efficacy score by current positions (*p* = .250).

Nurses spending more than 10 hours on the EMR scored higher on EBP competency (*M* = 5.33, *SD* = .734) than nurses spending less than 5 hours or 6 to 9 hours (*M* = 5.04, *SD* = .867, and *M* = 5.05, *SD* = .886, respectively) however, these differences were not statistically significant (*p* = .111). Also, nurses spending more than 10 hours on the EMR scored highest on nursing informatics competency (*M* = 3.38, *SD* = .662), however, this was not a statistically significant difference compared to other groups spending less than 5 hours or 6 to 9 hours (*p* = .234). Nurses spending less than 5 hours on the EMR scored lower on self-efficacy (*M* = 4.20, *SD* = .587) than nurses spending more than 10 hours on the EMR (*M* = 4.30, *SD* = .661) without researching statistical significance (*p* = .697).

Three independent sample *t*-tests were performed to compare EBP competency, nursing informatics competency, and self-efficacy between day and night shift and whether

the nurse currently worked in a Magnet facility. Results are displayed in Table 8. Levene's test was used to assess the assumption of equality of variance. There was a significant difference between day and night shift for nursing informatics competency ($t(193) = .701$, $p = .010$) but no significant differences were found in EBP competency ($t(193) = .213$, $p = .906$) or self-efficacy ($t(193) = 1.87$, $p = .901$). In Table 8, nurses currently working in a Magnet facility were compared to those who were not. No significant differences were found in the average total scores for EBP competency ($t(194) = -.698$, $p = .486$), nursing informatics competency ($t(194) = .135$, $p = .893$), or self-efficacy ($t(194) = -1.15$, $p = .250$) between nurses working in a Magnet and non-Magnet facility.

Posthoc tests were conducted to assess pairwise comparisons for each of the outcome variables across different levels of the independent variables. These results are not displayed in a table. In order to avoid Type I errors, posthoc Bonferroni corrections were used in all of ANOVA analyses. Since age had three groups, the significance level would be .017 (.05/3). There was a statistically significant difference, $F(2,188) = 17.20$, $p < .001$, in the average nursing informatics competency score between those less than 35 years old and those ≥ 50 years old, and between those 36 to 49 and ≥ 50 years old. The less than 35 years and 36 to 49 age groups had statistically significant higher average nursing informatics competency scores than the ≥ 50 years old group ($p = .05$).

ANOVA analyses were used to compare the average total score for EBP competency, nursing informatics competency, and self-efficacy among the five education groups. The Bonferroni correction involved adjusting the significance criterion to .010 (.05/5) significance level. There was a statistically significant difference in the total

average score of EBP competency $F(4,192) = 3.10$, $p = .017$ and nursing informatics competency $F(4,192) = 3.76$, $p = .006$ between the Diploma nurses and MSN nurses. Specifically, the Diploma nurses scored on average significantly lower on EBP competency and nursing informatics competency than the MSN nurses. Diploma nurses also scored significantly lower on nursing informatics competency than 2nd degree BSN nurses.

Bonferroni correction was completed using .013 (.05/4) significance level for years of RN experience because there were four groups, and again there was a significant difference for nursing informatics competency, $F(3,192) = 7.95$, $p < .001$. Those with less than 4.5 years, 5 to 10 years, 11-25 years of RN experience had a significantly higher average nursing informatics competency scores than those with greater than 26 years of RN experience.

ANOVA analysis was also conducted for clinical specialty and the main outcome measures. Bonferroni correction was completed using .013 (.05/4) significance level. There was a significant difference among the four clinical specialties for nursing informatics competency, $F(3,192) = 3.24$, $p = .023$. Critical care areas on average scored significantly higher on nursing informatics competency than W&C areas. ANOVA was used again to compare EBP competency, nursing informatics competency, and self-efficacy among nurses' current positions which had four levels. There was a significant difference in the average score for nursing informatics competency by type of current position, $F(3,193) = 2.98$, $p = .033$. However, when the Bonferroni correction was applied, the statistical significance did not remain. The last ANOVA analysis was conducted for time spent on EMR during shift which had three groups, with a Bonferroni correction of .017 (.05/3)

significance level. There was no significance difference in the average scores across the various groups for time spent on EMR.

Table 9

Assessing Differences in Evidence-Based Practice, Nursing Informatics and Self-Efficacy by Sample Characteristics

Variable	*N* (%)	EBP Mean (SD)	*Test-Statistic*	*p*	Nursing Informatics Mean (SD)	*Test-Statistic*	*p*	Self-Efficacy Mean (SD)	*Test-Statistic*	*p*
Age (years)			*F*=.986	*p*=.375		*F*=17.20	*p*<.001**		*F*=.377	*p*=.686
< 35	59 (30.9)	5.01 (.778)			3.54 (.606)			4.19 (.664)		
36-49	68 (35.6)	5.22 (.848)			3.34 (.801)			4.29 (.610)		
> 50	64 (33.5)	5.06 (.910)			2.78 (.810)			4.22 (.728)		
Nursing Degree			*F*=3.10	*p*=.017*		*F*=3.76	*p*=.006*		*F*=2.15	*p*=.077
Diploma	17 (8.6)	4.16 (.827)			2.73 (.623)			4.15 (.298)		
Associates	43 (21.8)	5.13 (.829)			3.14 (.860)			4.24 (.698)		
Bachelors, trad	87 (44.2)	5.06 (.867)			3.17 (.788)			4.15 (.776)		
Bachelors, 2nd	32 (16.2)	5.27 (.822)			3.48 (.661)			4.51 (.432)		
MSN	18 (9.1)	5.55 (.666)			3.58 (.862)			4.40 (.432)		
Years of RN Experience			*F*=1.92	*p*=.129		*F*=7.95	*p*<.001**		*F*=.136	*p*=.939
< 4.5	44 (22.4)	4.97 (.822)			3.44 (.603)			4.21 (.417)		
5-10	52 (26.5)	5.22 (.787)			3.42 (.677)			4.22 (.832)		
11-25	55 (28.1)	5.27 (.885)			3.22 (.874)			4.28 (.658)		
> 26	45 (23.0)	4.95 (.885)			2.76 (.847)			4.28 (.666)		
Clinical Specialty			*F*=2.02	*p*=.113		*F*=3.24	*p*=.023*		*F*=2.33	*p*=.076
Critical Care	72 (36.7)	5.23 (.826)			3.37 (.776)			4.33 (.651)		
Medical/Surgical	55 (28.1)	5.07 (.813)			3.23 (.797)			4.05 (.849)		
W&C	45 (23.0)	4.88 (.983)			2.91 (.732)			4.33 (.464)		
OR/Procedural	24 (12.2)	5.30 (.673)			3.23 (.875)			4.32 (.450)		
Nursing Shift			*t*=-.118	*p*=.906		*t*=-2.56	*p*=.010*		*t*=-.124	*p*=.901
Day	136 (69.7)	5.10 (.854)			3.12 (.825)			4.24 (.726)		
Night	59 (30.3)	5.12 (.850)			3.44 (.714)			4.25 (.494)		
Working in a Magnet Facility			*t*=-.698	*p*=.486		*t*=.135	*p*=.893		*t*=-1.16	*p*=.250
Yes	107 (54.6)	5.08 (.823)			3.21 (.832)			4.20 (.642)		
No	89 (45.4)	5.19 (.876)			3.20 (.776)			4.31 (.700)		
Current Position			*F*=.200	*p*=.896		*F*=2.98	*p*=.033*		*F*=.316	*p*=.250
RN1	10 (5.1)	5.21 (.730)			3.54 (.513)			4.33 (.487)		
RN2	128 (65.0)	5.11 (.813)			3.30 (.778)			4.28 (.578)		

(continued)

Table 8. Assessing Differences (continued)

Variable	*N* (%)	EBP Mean (SD)	*Test-Statistic*	*p*	Nursing Informatics Mean (SD)	*Test-Statistic*	*p*	Self-Efficacy Mean (SD)	*Test-Statistic*	*p*
RN3	35 (17.8)	5.06 (1.01)			3.02 (.829)			4.19 (.903)		
RN4	24 (12.2)	5.22 (.880)			2.91 (.880)			4.17 (.770)		
Time Spent on EMR during shifts (hours)			*F*=2.22	*p*=.111		*F*=1.46	*p*=.234		*F*=.362	*p*=.697
< 5 hours	70 (36.1)	5.04 (.867)			3.18 (.880)			4.20 (.587)		
6-9 hours	70 (36.1)	5.05 (.886)			3.15 (.810)			4.26 (.746)		
> 10 hours	54 (27.8)	5.33 (.734)			3.38 (.662)			4.30 (.661)		

Note. ***p* < .001, **p* < .05, W&C = Women's and Children's.

Objective 3: Did Nursing Informatics Competency Predict EBP Competency After Controlling for Personal and Job-Related Characteristics?

The third objective was to determine whether nursing informatics competency predicted EBP competency after controlling for personal and job-related characteristics. All assumptions were met for multiple regression. Semipartial correlations were also completed to examine if personal and job-related characteristics contributed to the explanation of EBP competency above and beyond what was explained by nursing informatics. Results from regression analyses revealed that nursing informatics competency accounts for 30% of the variance in EBP Competency (Model 1) (Table 10). When self-efficacy was entered into the model (Model 2), R^2 was increased by 4%. Once all personal and job-related characteristics were entered into the model (Model 3), R^2 was increased by another 10%, making the total explained variance reach 43%.

Nursing informatics competency, self-efficacy, and age were also significantly associated with EBP competency. Nursing degree, years of RN experience, clinical specialty, current position, and shift did not have a significant effect on EBP Competency. Nursing informatics competency, self-efficacy, and age (under 35 years versus greater than 50 years) showed significant semipartial correlations with EBP competency of .51 ($p < .001$), .16 ($p = .006$), and .18 ($p = .002$), respectively. Based on the squared semipartial correlations, the largest amount of unique variance in EBP competency was explained by nursing informatics competency (25.6%), then by age (under 35 years versus greater than 50) (3.2%), followed by self-efficacy (2.5%).

Table 10

Multiple Regression Analyses

	Predictors	Unstandardized β coefficients	Standard error	*p*-value	Semi-partial correlations	*p*-value	R^2	*F* for R^2 change
Dependent Variable: Evidence-Based Practice								
Model 1	Nursing Informatics	.58	.06	.000	.55**	.000	.30**	83.67
Model 2	Nursing Informatics	.56	.06	.000	.52**	.000	.34**	48.88
	Self-Efficacy	.24	.08	.002	.19*			
Model 3	Nursing Informatics	.63	.07	.000	.51**	.000	.43**	7.34
	Self-Efficacy	.22	.08	.006	.16*			
Age	Under 35 vs 36-49 years	.23	.13	.093	.10			
	Under 35 vs greater than 50 years	.56	.18	.002	.18*			
Degree	Diploma vs ADN	.40	.21	.063	.10			
	Diploma vs BSN	.35	.20	.077	.10			
	Diploma vs 2nd BSN	.39	.23	.092	.10			
	Diploma vs MSN	.41	.25	.095	.10			
Years of RN Experience	Less than 4.5 vs 5 to 10	.19	.15	.205	.07			
	Less than 4.5 vs 11 to 25	.17	.18	.348	.05			
	Less than 4.5 vs greater than 26	-.08	.22	.732	-.02			
Clinical Specialty	Med/Surg vs Critical Care	.04	.12	.769	.02			
	Med/Surg vs W&C	-.06	.14	.669	-.02			
	Med/Surg vs OR (Procedural)	.12	.18	.517	.04			
Current Position	RN 1 vs RN 2	-.15	.24	.522	-.04			
	RN 1 vs RN 3	-.10	.27	.717	-.02			
	RN 1 vs RN 4	.12	.29	.672	.02			
Shift	Day vs Night	.10	.12	.378	.05			

Note. *$p < .05$, **$p < 001$, W&C = Women's and Children's, OR = Operating Room, RN = Registered Nurse.

Summary of Findings

Research Question 1 was: What is the relationship between acute care nurses' self-assessment of their nursing informatics competency and their evidence-based practice (EBP) competency? Table 9 presents findings related to Pearson correlation statistics used to determine the relationship between nursing informatics competency and EBP competency. Among the variables tested (nursing informatics competency, self-efficacy, age, years of RN experience, and time using EMR during shift), the strongest correlation was between nursing informatics competency and EBP competency, followed by self-efficacy and EBP competency. Nursing informatics competency accounted for 30% (r^2 = .30) and self-efficacy accounted for 6.2% (r^2 = .062) of the variability in EBP competency. The higher self-efficacy scores were significantly associated with higher EBP competency. Furthermore, since age and years of RN experience were strongly correlated, as the age of nurses and nursing experience increased, nursing informatics competency decreased. However, age and years of RN experience did not have an association with EBP competency. Finally, time spent on EMR did not have a significant association with either nursing informatics competency or EBP competency.

Research Question 2 was: To what extent do nursing informatics competency and EBP competency vary by personal and job-related characteristics? *T*-tests and one-way analysis of variance (ANOVA) were conducted to determine whether there were significant differences in the average score of EBP competency and nursing informatics competency among different levels of the personal and job-related characteristics. Significant differences were observed in the average score of EBP for nursing degree and

self-efficacy. The average score of nursing informatics competency varied significantly across different age groups, nursing degree, years of RN experience, clinical specialty, and current position. Time spent on EMR during shift was not significant for either nursing informatics competency or EBP competency. *T*-tests for independent samples were conducted and no significant differences existed for nurses currently working in a Magnet facility versus non-Magnet facility for average EBP competency or average nursing informatics competency scores. However, there was a significant difference in the average score for nursing informatics competency between nurses working day shift and night shift.

Research Question 3 was: Does nursing informatics competency predict EBP competency after controlling for age, nursing degree, years of nursing experience, clinical specialty, and general self-efficacy? Nursing informatics competency was entered into Model 1 as a solo predictor since significant correlation was observed between EBP and nursing informatics competencies. Higher mean scores for EBP competency were associated with higher nursing informatics competency scores. Thus, nursing informatics competency was a significant predictor of EBP competency. In Model 2, self-efficacy made a modestly significant contribution (R^2 = .34). Finally, in Model 3, since the ANOVA analysis indicated a significant difference between age, degree, years of RN experience, clinical specialty, current position, and shift, they were entered into the model. Model 3 was substantially more successful in predicting EBP competency (R^2 = .43), and all three models were statistically significant ($p < .001$). However, nursing

degree, years of RN experience, clinical specialty, current position, and shift were not significant in the model.

Overall, the statistical analyses revealed there is a significant relationship between nursing informatics competency and EBP competency. Furthermore, nursing informatics competency and EBP competency varied by several personal and job-related characteristics. Higher levels of nursing education and self-efficacy were significantly associated with higher mean scores of EBP competency. Nursing informatics competency was a powerful predictor of EBP competency. The inclusion of personal and job-related characteristics improved the overall prediction of EBP competency.

CHAPTER FIVE: DISCUSSION

The purpose of this study was to examine the relationship between nursing informatics competency and evidence-based practice (EBP) competency among acute care nurses and to assess how these competencies may vary by personal and job-related characteristics. This study collected data from nurses at one multihospital system for 2 weeks in the beginning of January 2014. A literature search supported selection of the main independent and outcome variables for conducting this study. Descriptive statistics provided a profile of the study sample. Bivariate analyses assessed relationships between the main independent variable (nursing informatics) and other personal and job-related characteristics. Multiple regression analyses were conducted to determine whether nursing informatics competency continued to make a significant contribution to the prediction of EBP competency among acute care nurses after controlling for variables which previous research found to be associated with both. The adapted Information Management Framework provided a basic foundation for nursing informatics competency but not necessarily EBP competency. However, since nursing informatics competency predicted EBP competency, it served as a framework to interpret the results for this study.

This chapter considers how the study's findings extend understanding about the relationship among these variables. Results are discussed within the context of current

literature (Chapter 2). This chapter concludes by discussing the strengths and limitations of the study, with implications for nursing practice, policy, and future research.

Personal and Job-Related Characteristics

Age

The national average age of RNs is 46 years old (U.S. DHHS, 2009). The average age of RNs in this study was 43 years old, which mirrors the average age in the US. Age was not found to be a significant factor in EBP competency in this study. However, other studies (McEvoy et al., 2010; Mills et al., 2009) showed age as a significant factor. McEvoy et al. (2009) showed that older respondents (> 24 years) scored significantly higher than respondents younger than 24 years on EBP. Their mean age was 22 and their sample was in an Australian academic setting from five allied health professional disciplines (not including nursing) who completed a questionnaire on EBP. The researchers chose the categories of less than and greater than 24 years old because most Australian students have completed an entry-level degree by then. The primary objective was to see if prior exposure to EBP, stage of training, and type of professional health discipline influenced their EBP profile. The current study had a sample of health professionals who were nurses already in the workforce, so it is difficult to compare it to the above research results.

In an Australian study by Mills et al. (2009), the mean age of nurses participating in the study was 45 years old. Their sample also broadly represented their national workforce. There was a significant but weak association between “older” nurses and difficulty in understanding research reports, not feeling confident in judging the quality

of research reports, and finding difficulty in identifying the implications of research findings for their own practice. Mills et al. (2009) did not define what the age range was for "older." It can be assumed that by reviewing the age range in their demographics that older is greater than 40 years. Moreover, there were five categories for age, 20-29 (6%), 30-39 (18%), 40-49 (41%), 50-59 (30%) and greater than 60 years (5%).

In the current study, age was a significant factor in nursing informatics competency. Age also had a significant impact on computer literacy in the study by Hsu et al. (2009). The mean ages of Taiwanese and South Korean nurses were 27 and 30 years old, respectively, much younger than the mean of the current study, 43 years. The distribution of older nurses differed greatly from the current study. Taiwanese and South Korean nurses' participation was 1% and 10% from nurses greater than 40 years old respectively, whereas in the current study 33% of participants were greater than 50 years old. Again in Huang and Lee's study (2011), the mean age (M = 29.37) was considerably younger than in the current study. The classification of subjects only had 5.3% greater than 36 years old. Because age and years of experience were highly correlated, years of experience was taken as a representative of the two, which revealed that the more experienced the nurses were with computer technology, the weaker their computer competency. The current study also showed a strong correlation with age and years of experience, but age and years of experience were separated for analysis.

In a study conducted in Turkey (Kaya, 2011), ANOVA analyses showed a significant difference of attitudes toward computers in healthcare for different categories of age. The study had four age groups: less than 25, 26 to 33, 34 to 41, and greater than

42 years old. The effects of nurses' age showed a statistically significant difference of attitude toward computers between all age groups and those greater than 42 years old. The mean age was 34.2 years old but the distribution of participants who were greater than 42 years old was 13%. Similarly, in the current study, there was also a statistically significant difference with all age groups and those greater than 50 years old in nursing informatics competency.

Campbell and McDowell (2011) also found a significant correlation with year of birth and computer literacy: As year of birth increased (younger age), computer literacy increased. Their method of determining age was by birth year but the study did not mention the year data collection occurred.

Although the literature reported statistically significant associations between age and EBP, no significant association existed in this study. However, nurses less than 35 years old did score the lowest in EBP competency in comparison to the other two categories. Furthermore, younger nurses (less than 35 years old) likely received EBP education in their academic curricula since it is more likely that they graduated recently. Since EBP is taught in academia and senior nurses have developed skills in EBP (Gerrish, Ashworth, Lacey & Bailey, 2008), it was expected new graduates would score higher on EBP competency, although this was not the result in this study. Further, it is plausible that nursing culture disempowers new graduate nurses, meaning they are therefore not able to develop autonomy in implementing EBP. However, there was a statistically significant inverse relationship with age and nursing informatics competency.

However, nurses less than 35 years old did score the highest in nursing informatics competency. This could be for a variety of reasons, especially considering the current explosion of technology like the iPhone and iPad which makes finding information in general easier. The younger population has grown up with technology and expects the most current technology in the workplace. Frequently, the researcher had heard complaints from younger staff members about not having the latest Internet Explorer software on the hospital computers or having a weak WiFi connection in the hospital. In this study, age was used as a continuous variable and was categorical because the researcher wanted to define "older" and "younger" nurses. Many studies in the literature did not define the age at which one is considered older; in this current study older is considered over 35 years.

Nursing Degree

There was a statistically significant difference in EBP competency between Diploma-prepared nurses and MSN nurses. This finding is consistent with prior research revealing that nurses with degrees have a greater tendency to read research literature and implement evidence-based findings in their practice (Eizenberg, 2011; Mokhtar et al., 2012; Ozdemir & Akdemir, 2009). Another research study which supports these results is by Thiel and Ghosh (2008), which indicated a correlation between knowledge of EBP and level of nursing education. Interestingly, Thiel and Ghosh (2008) revealed that knowledge scores of EBP increased as level of education increased, which was not the case in this study. Although it was not statistically significant, traditional BSN nurses scored lower than Associate degree nurses in EBP competency. One possible explanation

could be that the Associate degree nurses are taking courses toward their BSN, therefore making their exposure to EBP more recent.

The distribution for educational levels in the sample of this study was different from the national distribution as reported by the U.S. DHHS (2010) as Diploma (13.9%), Associate (36.1%), BSN (36.8%), and MSN (13.2%). This study had a lower percentage of Diploma, Associate, and MSN respondents than the national distribution. However, this study had a much higher percentage of BSN or higher prepared nurses at 69.5%. Another study (Koehn & Lehman, 2008) found that differences in attitude were significant toward EBP between BSN and Associate degree nurses; that study also had a higher percentage of Diploma and Associate degree nurses than this study. The multihospital system in this current study has many universities in close proximity so it is not surprising that there is a high percentage of nurses with a BSN degree—although the multihospital system must increase its proportion of BSN educated nurses by 10% to reach the target IOM (2010) recommendation of 80% of nurses with a BSN degree.

The findings of this study also indicated that Diploma nurses scored significantly lower on nursing informatics competency than 2nd degree BSN and MSN nurses. This study separated 2nd degree BSN from traditional BSNs in order to distinguish any differences because the 2nd degree BSN program has gained momentum in the last 10 years. Prior research found students with a bachelor's degree in a nonnursing field who are enrolled in an accelerated nursing program had higher class test scores, national standardized examination scores, skills laboratory performance, and final course grade than traditional BSN student (Korvick, Wisener, Loftis, & Williamson, 2008). The

findings from this study are consistent with other research supporting that educational levels of nurses are significantly associated with computer competency (Campbell & McDowell, 2011; Hsu et al., 2009; Huang & Lee, 2011). In one research study (Campbell & McDowell, 2011), there was also no statistical difference in computer literacy between Associate's degree nurses and those with BSNs as in this current study—but there was a statistical difference in computer literacy between Diploma and Associate's degree and Diploma and BSN nurses, which this study did not show. However, in Kaya's (2011) study, there was a significant difference in attitude toward computers with those with an Associate's degree and BSN. Lastly, the findings from this study contradict the finding by Hsu et al. (2009) that computer literacy was negatively influenced by educational level. Although other research studies measured computer competency or computer literacy, the current study measured nursing informatics competency which encompasses both. Furthermore, Diploma nurses are typically older since the program has decreased remarkably in the 20th century (U.S. DHHS, 2010). Therefore, this study showed that age was a significant factor in nursing informatics competency and most Diploma nurses are more than 50 years old.

Many organizations, including the one at which this research was completed, have initiatives to reach the IOM (2010) recommendation of 80% being BSN prepared before 2020. There are multiple RN to BSN programs in the area. It is evident that the Diploma nurses need the most education in EBP and nursing informatics competency. Most Associate degree programs do not require coursework in statistics and nursing research process, which are generally not required until the BSN or MSN levels of nursing

education (Koehn & Lehman, 2008). Furthermore, most educational programs have a technology competent of either downloading or uploading documents or using a web-based Learning Management System (LMS) to deliver online or web-enhanced courses.

Years of Nursing Experience

In the current study, the researcher found a significant inverse correlation with years of RN experience and nursing informatics competency. These findings were contradictory to previous findings by Hsu et al. (2009), who found the length of nurses' work experience did not influence their computer literacy. Hsu et al.'s (2009) demographics for years of work experience were divided into four categories with the lowest frequency being 10 years and above and the highest frequencies being 0 to 2 years and 3 to 5 years. The mean years of work experience was 5.4 years for Taiwanese nurses and 8.03 years for South Korean nurses. Huang and Lee (2011) also had a low mean years of service of 6.47. However, they showed the more experienced nurses were weaker in their computer competency. This current study had a higher mean of 12.51 years of RN experience; the highest frequency was 11 to 25 years of RN experience and the lowest frequency was less than 4.5 years. The distribution of years of nursing experience was different from Hsu et al.'s and Huang and Lee's studies because this study had more experienced nurses. It is plausible that since the prior studies took place in foreign countries with different healthcare and educational systems, nurses with less years of RN experience may have been more eager to participate. Also, in Hsu et al.'s study (2009), the head nurse distributed the survey, and in Huang and Lee's study (2011) the survey were distributed to only two ICUs.

This current study had similar results to Huang and Lee (2011) with nursing experience having an inverse relationship with computer competency, except in this study nursing informatics competency was measured. Another study that recently compared undergraduate and graduate nursing students' nursing informatics competency found that graduate nurses scored significantly higher than undergraduate nurses (Choi & De Martinis, 2013). Even though the graduate students were older than the undergraduate students, the graduate students had more experience than the undergraduates (Choi & De Martinis, 2013). Although their study was done in an academic setting, it reveals valuable information of the possibility of online education impacting nursing informatics competency. Further, it shows that RN experience is relevant factor in nursing informatics competency and participants in the current study had many years of RN experience.

Years of RN experience was not associated significantly with EBP competency in this study. This was contradictory to a Brown et al.'s (2010) study in which years of RN experience had a positive correlation with two of the subscales for EBP, practice and knowledge/skills associated with EBP. Nurses in Brown et al.'s study included staff nurses, managers, clinical nurse specialists, and nurse practitioners, whereas this current study only included staff nurses at the bedside. Brown et al.'s study had the largest amount of nurses in the greater than 21 years of RN experience group, similar to the current study which also had the largest amount in the 11 to 25 years of RN experience group. Brown et al.'s study also had over 1,000 nurses participate which makes it a robust study. These differences in nurses' advanced positions and years of RN experience may

explain the differences observed in EBP competency between Brown et al.'s study and the current study.

Another study found that highly experienced nurses were more likely to implement evidence into practice (Ozdemir & Akdemir, 2009). In Mokhtar et al.'s (2012) study, nurses with 6 to 10 years of experience had the highest mean in evidence-based self-efficacy, whereas those with more than 10 years of experience had difficulties in applying evidence-based activities. Mokhtar el al.'s study also had the majority of their nurses in the 0 to 5 years of experience category. In contrast, this current study had nurses with 11 to 25 years of RN experience score the highest mean in EBP competency and the lowest scoring were those with greater than 26 years of RN experience.

Clinical Specialty

Nursing units were placed into four categories: Critical Care, Medical/Surgical, Women's and Children's (W&C) area, and Operating Room/Procedural areas. The only significant difference existed between Critical Care and W&C areas for nursing informatics competency. Interestingly, W&C scored the lowest on both EBP and nursing informatics competency. The units that were incorporated into the W&C specialty were Labor and Delivery (L&D), Neonatal Intensive Care (NICU), and Family Centered Care. Additionally, these departments have a large membership in the Association of Women's Health, Obstetric, and Neonatal Nursing (AWHONN), which has published six evidence-based clinical protocols such as neonatal skin care and transition of preterm infant to an open crib (AWHONN, 2013). They also have a position statement on Health Information Technology and recommend obstetric information be available to all healthcare providers

across the woman's lifespan because of information that is important after pregnancy, labor, and birth. An example given was the presence of gestational diabetes during pregnancy and the higher risk of obesity and type 2 diabetes. Perinatal nursing and neonatal nursing are two areas in which there is a foundation of nursing research to guide care (Gennaro, 2010). Therefore, W&C scoring the lowest on both EBP competency and nursing informatics competency is an interesting finding since their professional organization has been active in EBP and nursing informatics. EBP education is likely needed specific to W&C areas to show how EBP guides their practice at the bedside. Further, as noted in Chapter 3, NICU was incorporated into the group of W&C although NICU is a critical care unit. A plausible explanation is that the W&C areas had a higher number of Diploma nurses, and Diploma nurses had the lowest average EBP competency score and nursing informatics competency score in this study.

Huang and Lee's (2011) research compared two critical care units where technology was taken for granted because of integration of ventilators and bedside monitors with an electronic medical record. The surgical intensive care unit (SICU) had a higher mean score than the medical intensive care unit (MICU) on all seven computer abilities. In the current study, critical care areas also had the highest mean nursing informatics competency. Critical care nurses are often more experienced and offer highly specialized patient care (Chow, Chin, Lee, Leung, & Tang, 2012).

Although there was no significance difference in clinical specialty for EBP competency in the current study, previous research in psychiatric and gastroenterology showed that nurses in these areas lack computer skills in implementing EBP (Baker et al.,

2010; Koivunen et al., 2010). Since nursing informatics competency is part of EBP, this research supports that further education is needed in nursing informatics competency.

General Self-Efficacy

In the current research study, there was a significant relationship between self-efficacy and EBP competency, but no relationship between self-efficacy and nursing informatics competency. The results from this current study were not consistent with previous research that showed self-confidence and computer experience had a positive correlation (Eley et al., 2008). However, computer experience is only a small portion of nursing informatics competency. When comparing the mean self-efficacy score to other research studies conducted on nonclinical staff, nurses scored higher. The current study had a self-efficacy score of $M = 4.25$ ($SD = .66$). In Chen, Gully, and Eden (2004), their first sample consisted of undergraduate students with the average age of 23 and they scored 3.88 ($SD = .52$), whereas their second sample consisted of health maintenance organization employees with an average age of 42 and they scored 4.22 ($SD = .43$).

A recent study conducted by Winslow (2013) in a small Magnet community hospital showed nurses who pursued a subsequent degree scored higher in self-efficacy ($M = 4.50$) than those who did not pursue a subsequent degree ($M = 4.27$). However this finding was not statistically significant. The study was not a comparison of Magnet hospitals, but a study on nurses' self-efficacy and academic degree advancement. Winslow (2013) used the same self-efficacy questionnaire that this current study used, and that study also resulted in no statistical significance between self-efficacy and age or

between self-efficacy and years of RN experience, which was similar to this current study.

The significant relationship between self-efficacy and EBP competency is still an important factor since EBP competency incorporates nursing informatics competency. Nurses who have high general self-efficacy are more active in handling dynamic situations (Vardaman et al., 2012) such as the implementation of a new EMR which affects the whole hospital system or implementing a new EBP protocol which could affect the hospital or a specific unit.

Another consideration for the inconsistent findings is the order in which the participants took the survey. The general self-efficacy scale items were first in the survey, then EBP competency, and finally nursing informatics competency. The results may have been influenced because of the order of surveys, nursing informatics competency having the most items and being the last to complete. Furthermore, general self-efficacy may not be the correct tool to measure nursing informatics competency. According to Bandura (2012), people differ in their efficacy across various domains. The general self-efficacy scale did not specify the activities to be performed in nursing informatics competency.

Shift

The majority of the units in the subject multihospital system have 12-hour shifts. In this current study, day shift scored slightly lower than night shift for EBP competency; although the difference was not statistically significant, it was significant for nursing informatics competency. Results were not consistent with previous research which showed day shift nurses scored higher on a nurses' attitude toward computers assessment

scale, however, it was not significant (Kaya, 2011). Also, night shift resulted in a higher level of teamwork than day shift according to Kalisch and Lee (2009). Since there is less managerial involvement, nurses rely on each other for support. Interestingly, working day shift or night shift did not significantly affect EBP competency. One research study showed nurses on night shift felt learning opportunities were suboptimal at night (Powell, 2013). However, in this current study, nurses on both day and night shift had similar levels of EBP competency, yet day shift nurses scored significantly lower than night shift nurses for nursing informatics competency. A plausible explanation is there are not as many resources on night shift, when nurses must search for the answer on the intranet of the organization.

Currently Magnet

There were minimal mean differences in nursing informatics competency and EBP competency between working in a Magnet hospital versus non-Magnet hospital. The results were contrary to previous research that resulted in significant difference in EBP between Magnet and non-Magnet institutions (Melnyk et al., 2012). The three Magnet hospitals in this multihospital research study implemented a new EMR 6 months prior to the non-Magnet hospital. All hospitals had been using the new EMR for either 6 months or 1 year when data collection occurred for this study. Also, the two non-Magnet hospitals had attempted to acquire Magnet status but were unsuccessful. Furthermore, EBP has been a systemwide initiative for the past 3 years regardless of Magnet status and all five hospitals use the same policies, protocols, and guidelines. Therefore, it is plausible that the two non-Magnet hospitals are practicing at a Magnet level since both

continue to be on the journey for Magnet. A major criterion for receiving Magnet recognition is nurses' active involvement in research and EBP (Koehn & Lehman, 2008).

Current Position

In this study, there was no significant difference in EBP competency among the RN1 through RN4 groups. However, there was a slight significant difference in mean score between RN1 and RN4 for nursing informatics competency. RN3s and RN4s are considered unit leaders; therefore, it is interesting that they scored lower than RN1s and RN2s. However, RN3 and RN4s are older and there was an inverse relationship with age and nursing informatics competency. In order to climb the clinical ladder, specifically from RN2 to RN3 or RN3 to RN4, the nurse must complete a portfolio and the requirements of the clinical ladder. Recently the requirements have changed to incorporate more tracks (i.e. active participation in an EBP project or membership on a nursing informatics council or active superuser for the EMR), and the organization has noticed a decrease in applications to become an RN3 or RN4. Also, it is plausible that RN1s were used as superusers in the implementation of the new EMR.

Time Spent on EMR During Shift

This variable had no statistical significance in either nursing informatics competency or EBP competency. This variable was collected to gather information on nurses' self-reported time spent on EMR during their shift and whether it correlated with nursing informatics competency or EBP competency. There were no correlations between nursing informatics competency or EBP competency and time spent on EMR during their shift. Although the variable had no statistical significance, it did provide information on

how much time respondents spent on the EMR during their shift. On average, nurses spent over half their shift (*M* = 7.14 hours) on the EMR. Yee et al. (2012) found nurses spent 19% of their time documenting in EMR; however, in this current study 59.5% of their time was spent on EMRs.

Nursing Informatics Competency

Prior to this study, the nursing informatics competency questionnaire, SANICS, had mainly been used in the academic setting, with either graduate or undergraduate programs. However, this current study was in an acute care setting and continued to have high internal consistency reliabilities: Cronbach's alpha for the total scale was .97. In previous research studies Cronbach's alpha ranged from .95-.96 (Choi, 2012; Choi & Bakken, 2013; Choi & De Martinis, 2013; Yoon et al., 2009).

Nursing informatics competence was indicated by a minimum score of 3 (Yoon et al., 2009) and in this study the total mean score was 3.21 (*SD* = .802). Overall, 121 nurses (61.4%) scored a 3 or above on nursing informatics competency. Further analysis was done to verify if there were groups that were not competent. Nurses with the following personal and job-related characteristics scored less than 3 in the nursing informatics competency scale, which is considered not competent: nurses who were greater than 50 years of age, or had a Diploma degree, or had greater than 26 years of RN experience, or worked in a W&C area, or held an RN4 position. Previous studies showed the mean score was 3.01 (*SD* = .72) for undergraduate students and 3.23 (*SD* = .70) for graduate students (Choi & De Martinis, 2013). Another study showed the overall mean for student nurses was 3.15 (*SD* = .71) (Choi & Bakken, 2013). Interestingly, one study showed that RN to

BSN (*M* = 3.21, *SD* = .87) and accelerated BSN students (*M* = 3.01, *SD* = .68) were competent but traditional prelicensure nursing students were not (*M* = 2.82, *SD* = .55) (Choi, 2012). The current study had a competency level similar to graduate students (Choi & De Martinis, 2013), possibly because graduate students typically have nursing practice experience. Furthermore, the subject multihospital system implemented a new electronic medical record in November 2012 which could have influenced the competency levels of nurses. Nurses' informatics competency is considered a determinant of successful implementation of electronic medical records since they are the largest group in the healthcare workforce (Hwang & Park, 2011).

For the subscales of nursing informatics competency, the lowest mean score was in "Applied Computer Skills: Clinical Informatics" which contained item such as "extract data from clinical data sets" and "use applications to develop testing materials such as e-learnings." Previous research also resulted in this subscale being the lowest scoring subscale among the 5 subscales (Choi, 2012; Choi & Bakken, 2013; Choi & De Martinis, 2013). It is plausible that acute care nurses have not been exposed to terms like data sets or diagnostic coding. The current study findings also indicate the highest mean score was for "clinical informatics attitude" subscale. User attitude is a component that influences technology adoption (Chow et al., 2012). The nurses in this study had a positive attitude toward nursing informatics.

Hospital-based nurse educators can emphasize nursing informatics competency educational programs to those groups that are not competent. Faculty can strengthen the nursing informatics curriculum by interweaving them into all courses at the

undergraduate and graduate level. According to McNeil et al. (2003), 18% of nursing programs that were surveyed reported their faculty as novices in using IT tools and teaching nursing IT content and skills. Because nursing informatics was not incorporated in nursing curricula 25 years ago, nurses who have been working for 25 years or more may not have had the related education or worked with information technology. Awareness of the term nursing informatics and how it relates to EBP are crucial to ensure best outcomes.

Evidence-Based Practice Competency

In this study, most of the Cronbach's alphas were above 0.8 which is similar to other studies for EBP competency (Koehn & Lehman, 2008; Rice et al., 2010; Upton et al., 2012). Values of .7 to .8 are acceptable for Cronbach's alpha (Field, 2013). This current study had a mean score of 5.12 (*SD* = .85) for EBP competency which was higher than Koehn and Lehman's (2008) results of a mean score of 4.89 (*SD* = .90). In Koehn and Lehman, nurses scored highest on practice, then attitude, and lowest on knowledge/skills of EBP. In this study, it was the opposite: Nurses scored highest on attitude, then knowledge/skills, and lowest on practice. In Brown et al.'s (2010) study, nurses also scored highest on attitude, then knowledge/skills, and lowest on practice. This is consistent with research indicating that nurses have barriers to implementing EBP into practice because of lack of knowledge and skills (Abrahamson, Fox, & Doebbeling, 2012; Majid et al., 2011). The subscales were ranged from 1 to 7, however, each subscale had a different meaning; in practice of EBP 1 = never and 7 = frequently, attitude toward

EBP had a 7-point semantic differential scale, and for knowledge/skills associated with EBP 1 = poor and 7 = best (Brown et al., 2010).

The age group which scored the lowest in EBP competency was those less than 35 years of age. Interestingly, that group is usually newly graduated and since more universities are incorporating EBP into their nursing curriculum, one would have thought they would have scored higher. The less than 35 years of age group also scored the lowest on self-efficacy; therefore, it is plausible that they do not have enough confidence to implement and practice EBP. However the EBP competency scores in general for all the groups of age, shift, Magnet facility, current position, and time spent on EMR during shift scored above a 5, which on a scale from 1 to 7 is considered practicing EBP, having a positive attitude, and having greater knowledge/skill of EBP. There were only 3 categories that had below a 5 (degree, years of RN experience, and clinical specialty) and they were in the Diploma nurses, RNs with less than 4.5 years of experience, RNs with greater than 26 years of experience, and W&C areas. Again, the group with less than 4.5 years of RN experience scored the lowest on self-efficacy, which supports that they may not have enough confidence in maneuvering the system to implement and practice EBP. Previous research found the greater number of years in practice, the less nurses were interested in and felt it was important to gain more knowledge and skills in EBP (Melynk et al., 2012). This current research study supported this finding because nurses with greater than 26 years of RN experience scored lower than a 5 on EBP competency.

The multiple regression analysis resulted in nursing informatics competency predicting EBP competency. When all eight independent variables (nursing informatics

competency, self-efficacy, age, degree, years of RN experience, clinical specialty, current position, and shift) were placed in the model, there was an even stronger prediction of EBP competency. Eizenberg (2011) found research skills as a predictor for EBP. Nursing informatics competencies incorporate online literature searches along with technical skills such as using an external storage device to save journal articles. According to previous research, nurses are ready for and value EBP. However, there are many barriers (Melnyk et al., 2012) such as lack of time, knowledge, mentors, and organizational support which have not changed over the past two decades. This current study provides one possible solution for overcoming barriers in EBP competency which is having nursing informatics competency. Nursing informatics competency consists of computer skills, informatics knowledge, and informatics skills which can assist with the implementation of EBP.

Limitations

In this study, nursing informatics competency was measured using nurses' self-report, not their actual performance on computer skills, informatics knowledge, and informatics skills. EBP competency was also self-reported (practice, attitude, and knowledge/skills). Nurses could under- or overestimate their competency because they were self-reporting. However, nursing informatics competency and EBP competency were not tied to performance or evaluation, so there was little motivation to overestimate. Also, the researcher emphasized in bold sentences at the beginning of the questionnaire that there were no right or wrong answers.

The study was conducted in one multihospital system, using convenience sampling, so generalization of the findings is limited. This study cannot be generalized to other nursing populations in examining nursing informatics competency and EBP competency. Therefore, it is possible that the responses reflected factors that are unique to the organization. The target nurse population for an accurate participation rate was a limitation because the researcher relied on others to send out the link through email. One hospital point of contact sent the email to the managers and asked the managers to forward the email to their staff, while other points of contact sent emails directly to staff. Nurses may not have read their email in time to participate in the survey since it was only open for 2 weeks. Also, since the survey was electronic, participants had to possess basic computer skills to access and complete the survey. The use of an electronic survey may have deterred some participants which may have led to response bias. Only participants with IT skills would be more inclined to participate. However, previous research has shown that data from electronic surveys and paper-and-pencil surveys have comparable results (Knapp & Kirk, 2003; Pettit, 2002). Further, electronic survey participants are recruited much quicker.

There was also confusion regarding the definition of "acute care" nurses. Some thought it did not pertain to them if they worked in Endoscopy, Same Day Surgery, or Ambulatory Care. During recruitment meetings one nurse asked, "I make presurgical testing calls to patients at home, so I don't really work at the bedside." Also, some of the nursing informatics terms and EBP processes may have been unfamiliar to participants.

This is a limitation because participants may not have understood the items that needed to be answered.

Another limitation was that two of the five hospitals in the subject system were on the Magnet journey while the other three were already Magnet. Magnet requires nurses to use EBP and show outcomes of EBP projects. This factor was addressed by asking whether or not the participant was currently employed at a Magnet hospital. Finally, another limitation was survey fatigue. Nurses have been asked to respond to many electronic questionnaires or surveys and may not have fully or accurately read the questions. The order of self-efficacy, EBP, and nursing informatics survey items may have influenced the responses since nursing informatics had many unfamiliar terms and was the last set of items to answer.

Strengths

A major strength of this research was its methodology. The study was publicized to nurses in a short period of time through the intranet of the organization. Another strength was determining that there is a relationship between nursing informatics competency and EBP. This research provides evidence that these two competencies are related and should be viewed as supporting one another. Establishing a baseline of nursing informatics competency and EBP competency in acute care nurses was also significant, as this is vital to plan educational workshops to adequately prepare nurses in nursing informatics in order to promote EBP.

The results of this research project extend the work of previous studies examining nursing informatics competency (Choi, 2012; Choi & Bakken, 2013; Choi & De

Martinis, 2013) by surveying nurses' working experiences in an acute care setting. This current study also supported previously known characteristics of nursing informatics competency and EBP competency. It examined associations between nursing characteristics, nursing informatics competency, and the outcome. The population from which the sample was taken were about 70% BSN prepared, which is close to the IOM (2010) recommendations of 80% in 2020. The age of the sample from this study was also similar to the national age of nurses.

Implications

Practice

This study has significance for nursing practice, especially for nurse leaders in the hospital setting. Nurses are inundated with information from multiple sources and must manage the data, give meaning to the data, and turn the data into information to perform effectively. Information technology is a tool that can assist with the management of information. Healthcare is being redesigned with technology at the core to improve patient safety and quality of care (Spencer, 2012). Technology such as wireless solutions, mobile computers, and automated exchanges between clinicians and patients is transforming the delivery of care (Healthcare Information and Management Systems Society [HIMSS], 2011). In the academic setting, there are multiple resources for incorporating nursing informatics competency and EBP competency into the classroom. However, there continues to be a gap of how to educate nurses in the acute care setting. Keeping up with new technology and the current best evidence is challenging.

This research study shows that since there is a relationship between nursing informatics competency and EBP competency, providing educational opportunities that address both of these topics simultaneously may increase nurses' EBP competency and nursing informatics competency in an acute care setting. Further, this research study found that nurses have a moderately high self-efficacy and will do well with their ability to perform across a variety of different situations such as nursing informatics and EBP if given the tools.

This research study also introduced nurses to nursing informatics competency and EBP competency. The tool itself was educational for nurses, especially with terminology in both nursing informatics and EBP, by using phrases such as "formulated an answerable question," "critically appraise," "networks to navigate systems," and "external storage devices." Interestingly, nurses were interested in nursing informatics and were eager to know the results. The researcher was contacted by five nurses asking advice about universities that offer a program in nursing informatics, how to get certified in nursing informatics, and how to get involved in nursing informatics. The EBP competency listed the steps in EBP and therefore nurses who took the survey were actually going through the steps of EBP. It is also plausible that the participants were confused on the definition of terms in nursing informatics competency and EBP competency and did not know how to answer the questions. One nurse stated in an email that the nursing informatics competency section was "hard" and "confusing"; however, she completed it.

Future Research

The conceptual framework for this study, which was adapted from the Information Management Framework by Staggers et al. (2002), was a basic model to develop further research questions. Although all the variables proposed were not significant for EBP competency, the majority were significantly associated with nursing informatics competency. Results also suggest the need for further investigation because nursing informatics competency alone only predicted 30% of variance in EBP competency. More research is needed to determine what tools are needed for nurses to be successful in EBP. Also, further analyses into the subscale components of nursing informatics competency and EBP competency could produce more data on strengths and weaknesses of nurses. Another possible area of further research is a comparison of nondirect care nurses such as management and direct care nurses. This study only collected data on RN1s, RN2s, RN3s, and RN4s for current position. Future research on this topic should simplify current position by having selections such as staff nurse, manager/director, and educator/clinical specialist. Another variable to collect in order to capture all aspects of education would be to identify those who are currently in school for academic degree advancement.

Future research on clinical specialty is also needed. An important factor to consider is that each nursing unit differs depending on its leadership and culture (Lee & Ko, 2010). Since this study collected data from many different units and categorized them into larger groups, it is difficult to capture the atmosphere of the clinical specialty. Another research study could include developing a specific tool for nursing informatics

self-efficacy. Also, actual EBP competency could be measured with questions such as "Find an article in the research database" or "Write a Problem, Intervention, Comparison, Outcome (PICO) question."

Policy

The implications of this study have relevance for governmental policies. The American Recovery and Reinvestment Act (ARRA) includes Medicare and Medicaid incentive payments to providers and hospitals that use certified Health Information Technology (HIT) products for meaningful use. Meaningful use criteria continue to evolve and nurses are key stakeholders in the implementation of EMRs. Nurses must lead the planning, design, evaluation, and optimization of HIT since they have the greatest amount of direct patient contact (HIMSS, 2011). Furthermore, it is essential for nurses to be competent in nursing informatics and understand the complexities of healthcare practices. Integrating industry standards for HIT interoperability with clinical standards for practice and education is needed.

Education

The results from this current research support initiatives to incorporate nursing informatics education into academia. The Technology Informatics Guiding Education Reform (TIGER) initiative established specific objectives for education and faculty development. Several objectives included the use of informatics competencies, theories, research, and practice examples throughout nursing curriculums and to develop strategies to recruit, retain, and educate current and future nurses in the areas of informatics education, practice, and research. In addition, work groups were established to address

specific issues relevant to each stakeholder such as nursing school accrediting associations, state boards of nursing, and Associate degree nursing programs (TIGER, 2007).

Implications from this study support current educational polices. The Robert Wood Johnson Foundation funded the Quality of Safety Education for Nurses (QSEN) project which outlined six key areas of competencies for nurses, two of which are nursing informatics and EBP. The website for QSEN provides teaching strategies for faculty in informatics and EBP. There is also a forum to share teaching ideas (Spencer, 2012). Following the standards in nursing curriculum for nursing informatics and EBP as outlined in the *Essentials of Baccalaureate Education* (AACN, 2008) is necessary from admission into a nursing program to graduation. IOM (2003) recommendations made 11 years ago have reached the acute care nurse.

Summary

Results from this research study indicated that there was a relationship between nursing informatics competency and EBP competency. Furthermore, six significant variables are associated with nursing informatics competency: age, degree, years of RN experience, clinical specialty, shift, and current position. There were three significant variables associated with EBP competency: degree, self-efficacy, and nursing informatics competency. The major strength of this study was the methodology and research design. The findings showed a relationship existed between nursing informatics competency and EBP competency, despite no known research studies showing any correlation between the two competencies. Other research studies measure information literacy but not

nursing informatics. Several limitations are the small sample size, lack of generalizability to other populations, and nurses' self-reported competency rather than actual performance. Further research is needed to examine other variables that influence nursing informatics competency and EBP competency among nurses in other settings such as those currently enrolled in degree advancement programs. Implications for practice from this study show that nursing informatics competency is needed to further EBP competency. This study also supports governmental and educational policies that recommend every nurse be educated in nursing informatics and EBP.

APPENDIX A. PERMISSION TO USE SCALE

Permission to use New General Self-Efficacy Scale, Self-Assessment of Nursing Informatics Competency, and Evidence-Based Practice Questionnaire

RE: New General Self-Efficacy Scale
Gilad Chen [giladchen@rhsmith.umd.edu]
Sent: Monday, April 08, 2013 3:30 PM
To: stacaray
Attachments: New General SE Scale.docx (23 KB) ; Chen, Gully, & Eden (2004,~1.pdf (153 KB)

Suzy,
The information attached should be helpful. Feel free to use the scale.
Best of luck,
Gilad

Gilad Chen
Ralph J. Tyser Professor of Organizational Behavior
Chair of Management & Organization Department
Associate Editor, Journal of Applied Psychology
Robert H. Smith School of Business
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301-405-0923 TEL
giladchen@rhsmith.umd.edu
http://www.rhsmith.umd.edu
http://www.rhsmith.umd.edu/management/faculty/chen.aspx

From: stacaray [mailto:stacaray@masonlive.gmu.edu]
Sent: Monday, April 08, 2013 1:21 PM
To: giladchen@rhsmith.umd.edu
Subject: New General Self-Efficacy Scale

Hello Dr. Chen,

I wanted to get your permission to use your "New General Self-Efficacy Scale" in my dissertation. My committee wanted to add another variable to my study which is determining the relationship between nursing informatics competency and Evidence-based competency among acute care nurses. I thought by bringing in what their perception of their ability to perform in different situations would be helpful in looking at the relationship.

Also, I enjoyed reading your article publish back in 2001 and wanted to know your thoughts on Schwarzer's scale.

Thank you for your time.

RE: SANICS

Yoon, Sunmoo [sy2102@mail.cumc.columbia.edu]
Sent: Thursday, September 20, 2012 10:41 AM
To: stacaray
Cc: Suzanne Bakken (suzanne.bakken@dbmi.columbia.edu)
Attachments: SANICS Plus_tool.docx (21 KB)

Hello Suzy Tacaraya,

I am excited to hear that you are interested in finding out the relationship between two tools.
The tool is attached.
If it's possible, do you mind letting us know the characteristics of your applied population (e.g. a hundred RNs in XX hospital , students in master's level at XX school)?
Thank you very much.

Sunmoo Yoon, RN, PhD
Postdoctoral Research Scientist
School of Nursing
Department of Biomedical Informatics
Columbia University
630 West 168 street, Georgian 227
sy2102@columbia.edu

From: stacaray [mailto:stacaray@masonlive.gmu.edu]
Sent: Wednesday, September 19, 2012 6:00 PM
To: sy2102@columbia.edu
Subject: SANICS

Hello,

I am a doctoral student working on my dissertation and I found your article and was interested in using your scale. I am only in the proposal phase but I wanted to know if there will be a significant relationship with nursing informatics competencies and technological compentence as caring (Dr. Rozzano Locin's tool). I haven't quite got the purpose statement but I am working on it!

Thank you for your time.

Suzy Tacaraya Fehr RN-BC, MS, CNE

George Mason Unversity

703 585-6019 cell phone

PhD(c)

RE: EBP Questionnaire

Laura Scurlock-Evans [l.scurlock-evans@worc.ac.uk]
Sent: Friday, October 19, 2012 8:54 AM
To: stacaray
Attachments: Evidence Based Practice QU~1.doc (66 KB) ; Upton&UptonEBPQ(2006).pdf.pdf (63 KB)

Dear Suzy,
I am a Psychology Technician and assist with requests for Professor Upton's publications. Professor Upton and Dr. Upton are happy to provide you with a copy of the measure free of charge and grant permission to use it in your research, with the proviso that as authors they are acknowledged in any communication, including publication, in which the questionnaire is used.
I have attached a copy of the questionnaire and a paper which contains details of its development and construction (Upton & Upton, 2006). Each item on the questionnaire is scored from 1-7 (i.e. 1=Poor – 7= best) and an average score can then be calculated for each subscale (Practice (1), Attitudes (2) and Knowledge/Skills (3)).

In accordance with UK copyright law we would be grateful if you would refer anyone else interested in using the EBPQ to us, rather than distribute copies of the questionnaires to third parties yourself. This will also help the authors gauge the level of interest in the questionnaire and its application in the clinical/research/educational setting. We would love to know more about your planned project – we are always interested to hear about how the EBPQ is being used.
Many thanks for your interest in the EBPQ and good luck with your project. Please feel free to contact me if you would like any further information.

Best wishes,

Laura

Laura Scurlock-Evans BSc (Hons), PGD PRM (Open), MBPsS
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Keep connected with Psychological Sciences, join us on facebook and twitter:
http://www.facebook.com/group.php?gid=128934369394
www.twitter.com/PsychUoW

Please note: in line with University policy, I can only respond to student emails sent from official University of Worcester email accounts.

From: stacaray [mailto:stacaray@masonlive.gmu.edu]
Sent: 16 October 2012 22:55
To: Dominic Upton
Subject: EBP Questionnaire

Hello Dr. Upton,

I am a doctoral student at George Mason University in Virginia. I recently read your article, " Development of an EBP questionnaire for nurses" and wanted to know if I could use your questionnaire in my dissertation. I wanted to explore the relationship between nursing informatics and EBP.

APPENDIX B. SCALE

New General Self-Efficacy Scale, Self-Assessment of Nursing Informatics Competency, and Evidence-Based Practice Questionnaire

Examining the Relationship between Nursing Informatics Competency and Evidence-Based Practice Competency among Acute Care Nurses

Thank you for participating in this important study to evaluate characteristics of registered nurses, nursing informatics competency and evidence-based practice (EBP) competency. Both nursing informatics and EBP are essential in providing safe quality care to our patients. This study will help identify the variables that contribute to EBP competence. All data will be kept confidential and will only be reported in aggregate and will not be traceable to individuals.

This survey will only take about 20-25 minutes to complete. Please remember to scroll down and click on the red "Next" button.

Part I:

General Self-Efficacy Scale©

(Developed by Chen, Gully, and Eden, 2001)

Please use the scale below to rate your agreement (or disagreement) with each of the following statements about yourself.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
(1)	(2)	(3)	(4)	(5)

1. _____ I will be able to achieve most of the goals that I have set for myself.
2. _____ When facing difficult tasks, I am certain that I will accomplish them.
3. _____ In general, I think that I can obtain outcomes that are important to me.
4. _____ I believe I can succeed at most any endeavor to which I set my mind.
5. _____ I will be able to successfully overcome many challenges.
6. _____ I am confident that I can perform effectively on many different tasks.
7. _____ Compared to other people, I can do most tasks very well.
8. _____ Even when things are tough, I can perform quite well.

Part II

Evidence-Based Practice Questionnaire (EBPQ)©.

(Developed by D.R. Upton and P.M. Upton, 2005)

This questionnaire is designed to gather information and opinions on the use of evidence-based practice among health professionals. There are no right or wrong answers for we are interested in *your* opinions and *your* own use of evidence in *your* practice. As you respond to the questions, consider your clinical assignments and your care of your patients.

1. Considering your practice in relation to an individual patient's care over the *past* year, how often have you done the following in response to a gap in your knowledge (please √ or X):

Formulated a clearly answerable question as the beginning of the process towards filling this gap:

Never ☐ ☐ ☐ ☐ ☐ ☐ ☐ **Frequently**

Tracked down the relevant evidence once you have formulated the question:

Never ☐ ☐ ☐ ☐ ☐ ☐ ☐ **Frequently**

Critically appraised, against set criteria, any literature you have discovered:

Never ☐ ☐ ☐ ☐ ☐ ☐ ☐ **Frequently**

Integrated the evidence you have found with your expertise:

Never ☐ ☐ ☐ ☐ ☐ ☐ ☐ **Frequently**

Evaluated the outcomes of your practice:

Never ☐ ☐ ☐ ☐ ☐ ☐ ☐ **Frequently**

Shared this information with colleagues:

Never ☐ ☐ ☐ ☐ ☐ ☐ ☐ **Frequently**

2. Please indicate (by √ or X) where on the scale you would place yourself for each of the following pairs of statements:

My workload is too great for me to keep up to date with all the new evidence	☐ ☐ ☐ ☐ ☐ ☐ ☐	New evidence is so important that I make the time in my work schedule
I resent having my clinical practice questioned	☐ ☐ ☐ ☐ ☐ ☐ ☐	I welcome questions on my practice
Evidence based practice is a waste of time	☐ ☐ ☐ ☐ ☐ ☐ ☐	Evidence based practice is fundamental to professional practice
I stick to tried and trusted methods rather than changing to anything new	☐ ☐ ☐ ☐ ☐ ☐ ☐	My practice has changed because of evidence I have found

3. On a scale of 1 to 7 (with 7 being the best) how would you rate your:

Please circle one number for each statement							
	Poor						**Best**
Research skills	1	2	3	4	5	6	7
Information Technology skills	1	2	3	4	5	6	7
Monitoring and reviewing of practice skills	1	2	3	4	5	6	7
Converting your information needs into a research question	1	2	3	4	5	6	7
Awareness of major information types and sources	1	2	3	4	5	6	7
Ability to identify gaps in your professional practice	1	2	3	4	5	6	7
Knowledge of how to retrieve evidence	1	2	3	4	5	6	7
Ability to analyze critically, evidence against set standards	1	2	3	4	5	6	7
Ability to determine how valid (close to the truth) the material is	1	2	3	4	5	6	7
Ability to determine how useful (clinically applicable) the material is	1	2	3	4	5	6	7
Ability to apply information to individual cases	1	2	3	4	5	6	7
Sharing of ideas and information with colleagues	1	2	3	4	5	6	7
Dissemination of new ideas about care to colleagues	1	2	3	4	5	6	7
Ability to review your own practice	1	2	3	4	5	6	7

All information will be treated as confidential and will not be traceable to individuals.

Self-Assessment Nursing Informatics Competency Scale Plus– SF30

For each statement, indicate your current level of competency on the scale of 1 to 5 by circling the number, where:
1 = Not competent, 2 = Somewhat competent, 3 = Competent, 4 = Proficient, and 5 = Expert

		Not competent	Somewhat competent	Competent	Proficient	Expert
1	As a clinician (nurse), participate in the selection process, design, implementation and evaluation of systems	1	2	3	4	5
2	Market self, system, or application to others	1	2	3	4	5
3	Promote the integrity of and access to information to include but not limited to confidentiality, legal, ethical, and security issues	1	2	3	4	5
4	Seek available resources to help formulate ethical decisions in computing	1	2	3	4	5
5	Act as advocate of leaders for incorporating innovations and informatics concepts into their area of specialty	1	2	3	4	5
6	Use different options for connecting to the internet (phone line, mobile phone, cable, wireless, satellite) to communicate with other systems (e.g., access data, upload, download)	1	2	3	4	5
7	Use the Internet to locate (e-learning, teleworking), download items of interest	1	2	3	4	5
8	Use database management program to develop a simple database and/or table	1	2	3	4	5
9	Use database applications to enter and retrieve information	1	2	3	4	5
10	Conduct on-line literature searches	1	2	3	4	5
11	Use presentation graphics (e.g., PowerPoint) to create slides, displays	1	2	3	4	5
12	Use multimedia presentations	1	2	3	4	5
13	Use word processing	1	2	3	4	5
14	Use networks to navigate systems (e.g., LAM, WLAN, WAN)	1	2	3	4	5
15	Use operating systems (e.g., copy, delete, change directories)	1	2	3	4	5
16	Use existing external storage devices (e.g., network drive, CD, DVD, USB flash drive, memory card, online file storage)	1	2	3	4	5
17	Use computer technology safely	1	2	3	4	5
18	Navigate Windows (e.g., manipulate files using file manager, determine active printer, access installed applications, create and delete directories)	1	2	3	4	5
19	Identify the basic components of the computer system (e.g., features of a PC, workstation)	1	2	3	4	5
20	Perform basic trouble-shooting in applications	1	2	3	4	5
21	Use applications for diagnostic coding	1	2	3	4	5
22	Use applications to develop testing materials (e.g., e-learning)	1	2	3	4	5
23	Access shared data sets (e.g., Clinical Log Database, Minimum Data Set)	1	2	3	4	5
24	Extract data from clinical data sets (e.g., Clinical Log Database, Minimum Data Set)	1	2	3	4	5
25	Recognize that health computing will become more common	1	2	3	4	5
26	Recognize that the computer is only a tool to provide better nursing care and that there are human functions that cannot be performed by computer	1	2	3	4	5
27	Recognize that one does not have to be a computer programmer to make effective use of the computer in nursing	1	2	3	4	5
28	Recognize the value of clinician involvement in the design, selection, implementation, and evaluation of applications, systems in health care	1	2	3	4	5
29	Use wireless device (PDA or cellular telephone) to locate and download resources for patient safety and quality care	1	2	3	4	5
30	Use wireless device (PDA or cellular telephone) to enter data	1	2	3	4	5

Part IV

Demographics of Registered Nurses

1. What is your age (in years)?_____

2. Please select the highest nursing degree you have obtained:
   - _____ Diploma
   - _____ Associate Degree
   - _____ Baccalaureate, traditional
   - _____ Baccalaureate, 2nd Degree
   - _____ MSN
   - _____ PhD/DNP

3. Which hospital shift do you usually work (please select one)?
   - _____ Day shift (8-hour shift)
   - _____ Day shift (12- hour shift)
   - _____ Evening shift (8-hour shift)
   - _____ Night shift (8-hour shift)
   - _____ Night shift (12 hour shift)

4. How many years have you worked as a Registered Nurse (RN)? _____

5. In which type of clinical unit do you currently work (Please select one)?
   - _____ Adult Critical Care
   - _____ Emergency Department
   - _____ Float Pool
   - _____ Medical
   - _____ Medical-Surgical Combined
   - _____ Neonatal Intensive Care
   - _____ Obstetrics
   - _____ Operating Room
   - _____ Oncology
   - _____ Other: _____
   - _____ Pediatrics
   - _____ Pediatric Intensive Care
   - _____ Perioperative/PACU
   - _____ Labor & Delivery
   - _____ Psychiatry
   - _____ Step Down
   - _____ Surgical
   - _____ Transplant Unit

6. Do you currently work in a Magnet facility
   - _____ Yes
   - _____ No
   - _____ Don't Know

7. What is your current position? _____ RN 1 _____ RN 2 _____ RN3 _____ RN4 _____ Other

8. How much time do you typically spend on the computer using an Electronic Medical Record system (i.e. EPIC) during your shift?_____

APPENDIX C: IRB APPROVAL

GEORGE MASON UNIVERSITY

Office of Research Integrity and Assurance

Research Hall, 4400 University Drive, MS 6D5, Fairfax, Virginia 22030
Phone: 703-993-5445; Fax: 703-993-9590

DATE:	December 19, 2013
TO:	Kathleen Gaffney, PhD
FROM:	George Mason University IRB
Project Title:	[504903-1] Examining the Relationship between Nursing Informatics Competency and Evidence-Based Practice Competency among Acute Care Nurses
SUBMISSION TYPE:	New Project
ACTION:	DETERMINATION OF EXEMPT STATUS
DECISION DATE:	December 19, 2013
REVIEW CATEGORY:	Exemption category #2

Thank you for your submission of New Project materials for this project. The Office of Research Integrity & Assurance (ORIA) has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations.

Please remember that all research must be conducted as described in the submitted materials.

Please note that any revision to previously approved materials must be submitted to the ORIA prior to initiation. Please use the appropriate revision forms for this procedure.

If you have any questions, please contact Bess Dieffenbach at 703-993-4121 or edieffen@gmu.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within George Mason University IRB's records.

[redacted]

[redacted]

CERTIFICATE OF EXEMPTION

DATE:	01/02/2014
TO:	Fehr, Susanne[redacted] Gaffney, Kathleen, Nursing , Friesen, Mary Ann, PhD, RN, CPHQ, Nursing
FROM:	Ababio, Kathy, IRB Coordinator, IRB Group B
PROTOCOL TITLE:	Examining the Relationship between Nursing Informatics Competency and Evidence-Based Practice Competency among Acute Care Nurses
FUNDING SOURCE:	NONE
PROTOCOL NUMBER:	13-1491

The Institutional Review Board (IRB) for the protection of human subjects has reviewed the protocol entitled: Examining the Relationship between Nursing Informatics Competency and Evidence-Based Practice Competency among Acute Care Nurses. The project has been found to meet the requirements under 45-CFR-46 as being exempt from the requirement of IRB review.

Since this study as submitted does not require IRB review, further review and approval by the Inova IRB is not required. If there are any significant changes to the study, they should be submitted to the IRB for review prior to initiation to ensure continued compliance with human subjects' protections regulations.

This determination is issued under Inova Health System's Federal Wide Assurance 00000573 with the Office for Human Research Protections (OHRP). If you have any questions regarding your obligations under Committee's Assurance, please do not hesitate to contact us.

Please direct any questions about the IRB's actions on this project to the[redacted] IRB at [redacted] or Email: HRPP@[redacted]

Laura Miller

Miller, Laura C.

Exempt per 45-CFR-46 101 (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation. Waiver of signed consent form granted per Section 46.117(c) Research presents no more than minimal risk of harm to subject and involves no procedures for which written consent is normally required outside of research context.

Review Type:	EXEMPT
IRB Number:	IRB00001101

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BIOGRAPHY

Susanne Tacaraya Fehr graduated from James Madison University in 1998 with a Bachelor's of Science in Nursing. She graduated from the University of Maryland at Baltimore in 2002 with a Master's of Science in Nursing Informatics. She is a board certified nurse through ANCC in Nursing Administration (2006), Nursing Informatics (2007), and Professional Development (2009). She also received a post-baccalaureate Certificate in Nursing Education from George Mason University in 2009. In 2010, she won the Nursing Spectrum Excellence Award for Mentoring. Her poster "Zero Pressure Ulcers" won 2012 Best EBP Poster at the National Gerontology Nurses Association Conference. Also in 2012, Susanne presented at the International Nursing Informatics Conference in Montreal, Canada. Her presentation was "Application of data visualization in nursing: Graphical presentation of Nurse Sensitive Quality outcome data." She also received manager of the quarter in 2013 for her coordination of SuperUsers for the implementation of EPIC at IAH. Her professional nursing experiences have included medical-surgical nursing, neurocare ICU, and float pool.