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Darlene Geoghan

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Walden University

2012

Abstract

Exploring Factors Associated with Critical Care Nurse

Adoption of Evidence Based Practice

by

Darlene A. Geoghan

MS, Ball State University, 2006

BSN, Bethel College, 2003

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Education

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June 2012

Abstract

The purpose of this survey research study was to explore factors associated with the increased use of evidence based practice (EBP). The specific intervention involved the instillation of sterile normal saline prior to endotracheal suctioning. Instilling saline is not supported by current research; therefore, reported use of saline prior to endotracheal suctioning was not considered to be EBP. Rogers's diffusion of innovations theory and Knowles's theory of self-directedness served as the theoretical foundations for the study. Surveys were administered to nurses (n=99) employed in intensive care, cardiac recovery, and progressive care units at 3 hospital sites. Predictor variables considered included education level of nurses, scores on the Innovativeness Scale, scores on the Continuing Learning Scale, the extent to which journals and databases are used by nurses, and nurse access to a research facilitator. Logistic regression revealed that degree attainment and nurse access to a research facilitator were statistically significant predictors of adoption of procedures based on EBP. Educators should consider including a research or EBP component into the associate degree program to promote research awareness, and research facilitators can be included as an integral part of the healthcare team. Implications for positive social change include use of EBP to help achieve optimal patient outcomes consistent with research findings.

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Dedication

To my mother, Lydia Velma, an angel of a woman who loved the Lord Jesus Christ and shared that love with her children.

To my father, Kenneth Ray, who instilled in me a passion for reading and learning. He was a brilliant man who never got the opportunity to shine.

To Molly…simply because.

Acknowledgments

I would like to thank Gloria, Patricia, and Dr. Carol Dorough for their faithful prayers on my behalf. Many thanks to my doctoral committee: Dr. David Stein, Dr. Yixin Zhang, and Dr. Wade Smith. Dr. Stein: your steadfast belief that this could be accomplished was one of the reasons that this was accomplished.

To Janet: My first preceptor and nurse extraordinaire. You started me on this path many years ago simply by being the most wonderful mentor any person could want.

For my husband Sean: You are a man of quiet intelligence…your humbleness never ceases to amaze me. There are not words enough to say thank you adequately; you have been my support, my champion. Your love and confidence in my abilities have sustained me throughout this process.

God's word has been a strength and source of hope during this journey; Isaiah 50:7 has been a steadfast reminder of His help.

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Section 1: Introduction to the Study

Background of the Study

Evidence based practice (EBP) has been shown to have a positive impact on improving patients' outcomes, reducing healthcare costs, and promoting safe patient care (Agency for Healthcare Research & Quality [AHRQ], 2002; Beyea & Slattery, 2006; Newhouse, 2007). Yet, Spies, Bosse, Breuer, Schröder, and Kersten (2007) estimated that between 30-40% of patients are not receiving care based on current research evidence and that 20% or more of patients receive care that is superfluous or even potentially harmful. Although the concept of EBP is not new, the move toward EBP began in earnest within the medical profession in the early 1990s (Guyatt et al., 1992) and within the past decade, the concept of EBP has spread to nursing (Finkelman & Kenner, 2007). Although Spies et al. (2007) reported that about 40-50% of patients are receiving care based on current research evidence, more than two decades after the idea of EBP began to disseminate through healthcare channels, there remains a significant portion that do not. Falzer, Moore, and Garman (2008) termed this difference a "dissemination gap" (p. 2), a phrase used to describe the discrepancy between knowledge generated, and in many cases disseminated, yet not necessarily applied to practice. The challenge for nurse researchers is in identifying effective ways to close gaps in clinical practice and raised the question for this study: What factors may be associated with the adoption of evidence based practice among critical care nurses?

Within the past decade, nurse researchers such as Estabrooks et al. (2008),

Finkelman and Kenner (2007), Larrabee, Sions, Fanning, Withrow, and Ferretti (2007), and Titler (2010) have been encouraging nurses to apply research findings to clinical practice in order to move the profession from practices based on "tradition, gut-instinct, or personal preference" (Urden, Stacy, & Lough, 2010, p.3) to the adoption of EBP. Despite the efforts of nurse researchers to influence the incorporation of evidence based findings, also known as *best practices*, into clinical practice, at times the rate of adoption has been slow and inconsistent (Hanberg, Brown, Billings, & Kowalski, 2006). Identifying factors that may be associated with the adoption of EBP may assist nurses in acquiring and applying the safest and most effective care, and could help nurse managers and educators in deciding the most applicable, efficient, and economical ways in which to facilitate the knowledge adoption process within the nursing environment. Focusing on the importance of providing safe and cost effective care and improving patient outcomes has provided a strong impetus for adopting research evidence.

Some factors in individual studies that suggested a positive influence on adoption of research evidence were (a) education level (Aiken, Clarke, Cheung, Sloane, & Silber, 2003), (b) use of journals (Luby, Riley, & Towne, 2006), (c) electronic healthcare databases (Larrabee, 2009), and (d) the presence of a research facilitator on the nursing unit (Block & LeGrazie, 2006; Kleinpell, 2009). Two other factors that may play a role in the knowledge adoption process are the characteristics of adopters of an innovation as described by Rogers's diffusion of innovations theory (2003) and Knowles's (1975, 1990) self-directedness in learning; these theories will be discussed further in Section 2.

There is scant information in the literature, however, concerning adopter characteristics, self-directedness, electronic healthcare databases, and access to a research facilitator in relation to EBP. No single study has collectively considered adopter characteristics, self-directedness in learning, education level, use of journals, electronic healthcare databases, access to a research facilitator, and the association of these factors to the adoption of EBP in the critical care clinical setting. The focus of this study was to explore whether the above-mentioned factors were associated with critical care nurses' adoption of evidence practice.

Problem Statement

Multiple study findings have indicated that there are nurses who are not adopting EBP (Beyea & Slattery, 2006; Novak, Dooley, & Clark, 2008) and that, in some instances, EBP is not being adopted in a timely manner (Graham et al., 2006; McWilliam et al., 2009). The following exemplifies in the local setting what the aforementioned researchers have reported about the slow or nonexistent adoption of the evidence. It has been observed in the local setting that nurses continue to use sterile normal saline with endotracheal suctioning, despite recommendations that span well over 20 years that its use be discontinued (Ackerman & Mick, 1998; Akgül & Akyolcu, 2002; Celik & Kanan, 2006; Halm & Krisko-Hagel, 2008; Rauen, Chulay, Bridges, Vollman, & Arbour, 2008).

Endotracheal suctioning is a frequently performed procedure in acute-care settings in hospitals (Halm & Krisko-Hagel, 2008; Paratz & Stockton, 2009). The

procedure involves introducing one or more bolus amounts of 2.5 ml to 5.0 ml of sterile normal saline into an endotracheal tube (ETT) or artificial airway immediately prior to suctioning. Underlying the practice of using saline with suctioning is the assumption that saline aids in the thinning (liquefying) of secretions, thus making the retrieval of secretions more effective (Celik & Kanan, 2006; Schwenker, Ferrin, & Gift, 1998). Demers and Saklad (1973) found that "saline and mucus are not miscible" (p. 544) and therefore, saline has no effect on thinning tracheal secretions. Moreover, using saline with suctioning may not be a benign practice. Halm and Krisko-Hagel (2008) conducted a meta analysis of studies that reported the detrimental effects, such as decreases in oxygen saturation and heart rate, that can occur in this already health compromised population. Hagler and Traver's (1994) findings were that, with the use of saline, microorganisms could be flushed from the endotracheal tube into lower lung fields, potentially causing infection.

Because research spanning several years does not support this intervention, it is not clear why nurses continue this practice. Ackerman and Mick (1998) described the use of sterile normal saline with endotracheal suctioning as a "theoretically unsubstantiated nursing intervention" (p. 261). Rauen et al. (2008) reported that "resources for EBP are unanimous in their recommendations that instillation of normal saline should not be performed as a routine step with endotracheal suctioning" (p. 101). It was anticipated that this survey research study would shed some light on this "gap between knowledge and practice" (Falzer et al., 2008, p. 2) by, in part, gathering data about the critical care

nurse's knowledge and practice of endotracheal suctioning, educational level, nursing characteristics, and particular knowledge sources that the nurse uses.

Purpose of the Study

The purpose of this survey research study was to explore specific factors that may be associated with nurses' adoption of EBP. The specific factors addressed were the independent variables of adopter characteristics, self-directedness in learning, education level, use of journals, use of electronic healthcare databases, access to a research facilitator on the nursing unit, and the relationships among those independent variables and the dependent variable of adoption of EBP. Licensed and registered nurses practicing in the critical care units of intensive care, cardiovascular recovery, and progressive care were included. The survey was administered online through SurveyMonkey at two sites and on paper, per request, at the third site, to gather, among other information, demographic data and information about participants' endotracheal suctioning knowledge using questions adapted from Schwenker et al.'s (1998) Suctioning Survey Questionnaire.

Adopter characteristics were assessed using the shortened version of Hurt, Joseph, and Cook's (1977) Scales for the Measurement of Innovativeness (IS). Hurt et al. (1977) offered two versions of the scale, one containing 20 questions and a shorter version containing 10 questions. These scales were developed specifically to measure the adopter characteristics categories of innovator, early adopter, early majority, late majority, and laggard as described by Rogers and Shoemaker (1971). Some recent applications of Hurt

et al.'s (1977) IS have included studies on individual innovativeness related to technology adoption by teachers (Brahier, 2006; Vannatta & Fordham, 2004) and online shopping behaviors of Malaysian academicians (Mohd Suki & Mohd Suki, 2006). The instrument was adapted in Turkish for use in a study to measure innovation in preservice teachers (Kilicer & Odabasi, 2010).

For this study, nurses' knowledge and practice of aspects of endotracheal suctioning was assessed using the Suctioning Survey Questionnaire (Schwenker et al., 1998). Content validity for this instrument was established through expert opinion and then pilot tested to revise questions as needed; however, Schwenker et al. (1998) did not discuss validity and reliability statistics. For this current study, EBP was measured through nurses' responses to particular questions on the Suctioning Survey Questionnaire in conjunction with questions concerning knowledge sources about EBP, with the specific point of interest being the use of sterile normal saline prior to endotracheal suctioning to measure the dependent dichotomous variable of EBP.

Participants' personal perceptions of self-directedness in continuing learning were measured using Oddi's Continuing Learning Inventory (OCLI, 1984, 1986). For questionnaire purposes, the title *Approach to Learning* was used to avoid participant bias. The instrument consists of 24 questions and uses a 7-point Likert-type scale where 1= *strongly disagree* and 7 = *strongly agree*; five items on the scale are reverse-scored. Content validity for this instrument was established using an expert panel and a pilot study. Internal consistency was calculated using Cronbach's coefficient alpha and

reliability was estimated to be .875; test/retest reliability was .893. Further discussion of study instruments is presented in Section 3.

Nature of the Study

The study was constructed as a survey research design. An online questionnaire was made available through SurveyMonkey to a population of licensed and registered nurses practicing in the critical care settings of intensive care, cardiovascular recovery, and progressive care. Data were analyzed using various statistical methods: descriptive statistics to analyze the nominal data of gender and clinical unit, as well as, the ordinal data of age and years of nursing practice. Mean, standard deviation, and range were used for continuously scaled variables; frequency and percent were used for the categorically scaled variables. The analysis of the independent variables of adopter characteristics, self-directedness in learning, education level, use of journals, use of electronic healthcare databases, access to a research facilitator on the unit, and the dichotomous dependent variable of adoption of EBP was accomplished using logistic regression analysis. Research design and data analysis are discussed in further detail in Section 3.

Research Questions and Hypotheses

The overarching question for this study was as follows: What personal characteristics and knowledge sources are associated with the adoption of EBP, as measured by the non-use of sterile normal saline prior to endotracheal suctioning among critical care nurses? I addressed this general question by exploring particular factors through the following research questions:

1. How do adopter characteristics, self-directedness in learning, education level, use of journals, use of electronic healthcare databases, and access to a research facilitator relate to each other?

2. What is the relationship between adopter characteristics, self-directedness in learning, education level, use of journals, use of electronic healthcare databases, access to a research facilitator, and the adoption of evidence based practice as measured by critical care nurses' self-report that they do not use sterile normal saline prior to endotracheal suctioning?

The following two hypotheses were derived from the research questions and were tested using inferential statistics.

$H1_0$: There is no significant relationship among adopter characteristics, self-directedness in learning, educational level, use of journals, use of electronic healthcare databases, and access to a research facilitator.

H1a. There is a significant relationship among adopter characteristics, self-directedness in learning, education level, use of journals, use of electronic healthcare databases, and access to a research facilitator.

$H2_0$: There is no significant relationship between critical care nurses' adopter characteristics, self-directedness in learning, education level, use of journals, use of electronic healthcare databases, access to a research facilitator, and the adoption of evidence based practice, as measured by critical care nurses' self-report of non-use of sterile normal saline prior to endotracheal suctioning.

$H2_a$: There is a significant relationship between critical care nurses' adopter characteristics, self-directedness in learning, education level, use of journals, use of electronic healthcare databases, access to a research facilitator, and the adoption of evidence based practice, as measured by critical care nurses' self-report of non-use of sterile normal saline prior to endotracheal suctioning.

Theoretical Frameworks

Sales, Smith, Curran, and Kochevar (2006) wrote that a thoughtfully chosen theory is of utmost importance to undergird dissemination of research findings to the clinical setting. The authors hypothesized that it made the difference between success and failure in implementing EBP.

Diffusion theory and adult education theory, specifically Rogers's diffusion of innovations theory (2003) and Knowles's (1975, 1990) theory of self-directedness in learning provided guidance for the selection of the independent variables for this study. I viewed these two theories as complementary to each other in helping to explain why some nurses may adopt EBP and why some may not.

Rogers's Diffusion of Innovations Theory

Rogers's (2003) diffusion of innovations theory has been widely used and deemed reliable by researchers in disciplines including agriculture (Baig, Straquadine, Whiteman, & Naeem, 2005), education (Warford, 2005), and information technology (Mustonen-Ollila & Lyytinen, 2003). Nurse researchers have used Rogers's theory to address such diverse topics as continuing staff education and facilitated change (Bushy, 1992),

research adoption among medical-surgical nurses (Rodgers, 2000) and clinical nurse educators (Milner, Estabrooks, & Humphrey, 2005), nurses' knowledge adoption of policy and procedures (Squires, Moralejo, & LeFort, 2007), and of a computerized medical record system (Lee, 2004).

Rogers (2003) outlined diffusion as a 5-step process: (a) knowledge of an innovation, (b) persuasion, or having a positive attitude toward the innovation, (c) decision to adopt or reject the innovation, (d) implementing the innovation, and (e) intention to continue using the innovation, also known as confirmation.

Rogers suggested that three other components, the characteristics of the adopters of an innovation, the characteristics of the innovation itself, and how an innovation is communicated over time play a role in the knowledge adoption process, as well. Current research utilization models build upon diffusion theory by acknowledging that the contextual environment in which the nurse practices also plays a role in adopting an innovation, as do critical thinking skills and education background (Estabrooks et al., 2008).

Two concepts from Rogers's theory were used for this study:

1. Knowledge of an innovation: How one becomes aware of an innovation was operationalized by considering formal education, such as degree obtained through academic pursuit, and informal learning sources, such as journals, electronic healthcare healthcare databases, and access to a research facilitator on the nursing unit.

2. Characteristics of adopters: The interest of this study was concerned with assessing the characteristics of an *adopter*, rather than the characteristics of an *innovation* itself. Rogers's adopter categories of innovators and early adopters outline characteristics such as obtaining higher levels of education and using multiple sources of information, which reflect the chosen variables in this study.

Knowles's Self-Directed Learning Theory

Because this study involves practicing nurses in the critical care clinical setting, Knowles's (1975, 1990) SDL theory may help to explain how the process of learning outside the formal education setting occurs. Knowles (1975) described SDL as an endeavor "in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes" (p. 18). The variables in this study were viewed as elements of learning that suggest a degree of self-directedness, for example, "identifying material and human resources for learning" would be operationalized on the study questionnaire as nurses' use of journals and electronic healthcare databases, and accessing the research facilitator.

The usefulness of exploring SDL may be evident in a study by Grow (1991). Building on the SDL theories of Knowles (1975, 1990) and Candy (1987) and assimilating concepts from Hersey and Blanchard's (1988) theory of situational learning, Grow (1991) developed an SDL model. Grow suggested those persons who have a higher

degree of self-directedness in learning experienced increased anxiety when exposed to instructor led activities; conversely, those with a lower degree of self-directedness experienced a higher degree of anxiety with SDL learning tasks. Therefore, having an understanding of self-directedness in learning could help nurse managers in selecting personnel to be research facilitators and staff educators; staff educators in designing the most effective continuing education programs, and nurses in becoming aware of individual learning preferences, which may help in getting research findings applied to clinical practice.

Definition of Terms

I will use the following terms throughout the study:

Best practices: Interventions built upon research evidence; best practices are ideally the standard for patient care (Melnyk & Fineout-Overholt, 2005). For this study, the phrase is considered synonymous with EBP.

Cardiovascular recovery unit: Unit within the acute care hospital in which persons receive care after cardiac procedures, such as valve replacement or open-heart surgery. These units may be designated by names such as *surgical intensive care unit*, *cardiac care unit*, or *open-heart surgery unit*. Persons generally require 1:1 or 1:2 nursing care in these units during the immediate postoperative period.

Education Level: Learning that is obtained through formal education. Nurses have different levels of formal education, as several options are open for entry into practice. The *practical* or *vocational nurse* are interchangeable terms that describe

training in a 12-18 months program that allows one to be credentialed as either a licensed practical nurse (LPN) or licensed vocational nurse (LVN). Entry into practice for the registered nurse encompasses several educational track possibilities. The two most frequent points of entry into registered nursing practice are the 2-3 year training program resulting in an Associate Degree in Nursing (ADN) or Association of Science in Nursing (ASN) and the 4-year Baccalaureate of Science Degree in Nursing (BSN). The National League of Nursing (NLN, 2010) reported graduation statistics for prelicensure associate degree and baccalaureate degree programs for 2007-2008, as 61% and 36%, respectively. Other entry points for registered nurse practice are the 3-year hospital based diploma program, which comprised about 3% of prelicensure nursing students according to the 2007-2008 NLN (2010) statistics.

It was recognized that nurses recruited for this study might hold degrees higher than the baccalaureate degree. It was expected that some of the respondents would be in continuing education programs to obtain advanced degrees; however, even for nurses who are pursuing a Master of Science (MS) or Master of Science in Nursing (MSN), Doctor of Nursing Practice (DNP), Doctor of Nursing Science (DNS), or PhD in nursing, the licensure designation remains that of registered nurse.

Electronic healthcare databases: Knowledge sources used by professionals for initial learning and continuing education. Databases may be administered privately (JBI, 2009) or through government agencies (AHRQ, 2002).

EBP: Use of the best, current research evidence upon which healthcare practitioners build interventions (Sackett et al., 1996), along with the added components of clinical expertise and patient values (Sackett et al., 2000).

Intensive care unit: Unit within the acute care hospital setting that provides care to persons who are "highly vulnerable, [medically] unstable, and complex" (American Association of Critical Care Nurses [AACN], 2011, para. 2); these persons require close nursing supervision. Nurse-patient ratio is typically 1:1 or 1:2.

Progressive care unit: Unit within the acute care hospital that provides care for persons who are more medically stable. These persons "fall along a less acute continuum" (AACN, 2011, para. 4) than persons receiving nursing care in the intensive or cardiovascular recovery areas. These units may be designated as intermediate, step-down, telemetry, or transitional care units. Nurse patient ratio is typically between 1:3 and 1:5.

Self-directed learning: Encompasses the individual taking personal responsibility for learning opportunities but does not preclude the "need or desire to have others support the learning process" (Knowles, 1975, p. 18).

Assumptions

I assumed the following about this study:

1. Nurses are accountable to self and others to provide safe, competent care within the nurse's scope of practice.

2. Nurses are autonomous and self-determinant within their scope of practice.

3. Respondents were truthful and accurate in survey responses.

Limitations

Learning is a complex issue, and so how one learns was not addressed in this study. Rather the focus was on a specific segment of the nursing population to explore whether selected factors may be associated with the adoption of EBP in the clinical setting. Licensed and registered nurses who were employed in critical care areas were included in the study. The study was limited to one geographical area and solicited respondents from a population of nurses employed in three regional hospitals. Participation may have been limited for nurses who otherwise met inclusion criteria but did not have computer access or for those who were not comfortable using computer technology. While it was hoped that respondents were accurate and complete in their responses, it was realized that participants might have been less than candid in responses. Two surveys were not included in the analysis because the respondents did not have experience with endotracheal suctioning.

Scope and Delimitations

The study focused on nurses working full-time, part-time, or prn (as needed). These identify employment designations used by the hospital sites where the study took place. A fourth employment designation, per diem, was not used, as it identifies persons who are contracted from outside agencies to work within the hospital sites, and none of the chosen sites employed per diem nurses at the time of this study. Nurses who were employed in following critical care units were invited to participate in the study:

(a) intensive care, (b) cardiovascular recovery, and (c) progressive care. Critical care units were chosen for this study, and other units, such as orthopedic, oncology, or medical-surgical were excluded, as these are the units where nurses routinely perform endotracheal suctioning. I assessed nursing characteristics, knowledge sources used, and knowledge and practice of endotracheal suctioning as a component of EBP. An online survey service was used at 2 sites and a paper survey at 1 site to prepare, disseminate, and collect participant responses.

Social Significance of the Study

Exploring the factors that may be associated with critical care nurses' use of EBP will add to nursing's existing knowledge base in the area of knowledge adoption. Examining these variables could aid facility managers, nurse leaders, and staff educators in changing the facility or unit culture from an environment where practices are based on "ritual...unsystematic clinical experiences, ungrounded opinions, and tradition" (McEwen & Wills, 2011, p. 384) to an environment that embraces EBP.

While the targeted population for this study was a narrow segment of the total nursing population, the findings of this study may be of interest to other healthcare disciplines interested in methods to promote the use of EBP.

Summary

The study employed a survey research design to determine whether specific factors were associated with the adoption of EBP by critical care nurses. The study is significant to nursing for several reasons, among which include basing interventions on

best practices so that the promotion of safe patient outcomes and cost effective care can be more consistently achieved.

Section 2 will provide the review of the literature, expand on research related to the problem statement and variables, and discuss in more detail the theoretical concepts of the study from which the independent variables were derived. Section 3 will describe the methodology and design. Data analysis and research findings are presented in Section 4. Section 5 has a summary of the study, implications for nursing, significant findings, conclusions, and recommendations for future research.

Section 2: Literature Review

Several bodies of literature are relevant to this work. Studies that described and applied concepts contained in Rogers's diffusion of innovations theory (2003) and Knowles's self-directedness in learning theory (1975, 1990) are presented, as are selected studies related to the remaining variables. The section opens with a description of the literature search strategies, then aspects of Knowles's theory of self-directedness in learning and Rogers's diffusion of innovations theory are discussed. A brief background on the evolution of the EBP movement is next, followed by exploration of the four remaining variables of education level, use of journals, use of electronic healthcare databases, and access to a research facilitator on the nursing unit; in conclusion, a summary of the section is presented.

Strategies for Literature Search

The literature search has been ongoing since June 2010. The resources used included databases such as the Agency for Healthcare Research and Quality (AHRQ), Academic Search Premier (EBSCO), CINAHL (EBSCO), Cochrane Library, Education Resource Information Center (ERIC), Institutes of Medicine (IOM), Joanna Briggs Institute (JBI), Medline (EBSCO), PsycINFO (EBSCO), ProQuest Dissertations and Theses, and various online publications, websites, newspapers, and books. The following terms were used to search the databases: *evidence based practice, evidence based medicine, evidence based nursing, healthcare, patient outcomes, safe patient care, practice guidelines, registered nurses, baccalaureate degree in nursing, associate degree*

in nursing, nursing education, clinical competence, lifelong learning, research facilitator, self-directed learning, diffusion, knowledge-adoption, dissemination, information technology, clinical practice guidelines, best practices, and *nursing interventions*.

The results yielded information on how adoption of EBP occurs within various healthcare environments. The literature review uncovered factors that inhibited the adoption of healthcare practices and, to a lesser degree, factors that influenced the adoption of knowledge in the clinical environment. Two-hundred and six articles, 51 books, and several newspaper stories were reviewed, and 126 articles, 43 books, and one newspaper story were selected. The focus for this study centered on selected factors that may be associated with critical care nurses' adoption of EBP in the clinical environment. Two of the factors are exemplified by Rogers's (2003) diffusion of innovations theory and Knowles's (1975, 1990) theory of self-directedness in learning. These theories described personal characteristics that may be associated with knowledge adoption and could help explain how knowledge acquisition continues outside the formal academic setting.

Theoretical Frameworks and Knowledge Adoption

Determining ways to stay current in nursing knowledge and practice is challenging but important for at least two reasons. First, with the average age of the nursing workforce at 47 (HRSA, 2010), it is likely that a portion of nursing knowledge gained in school is outdated and, therefore, not likely to be evidence based (Estabrooks,

1999; Squires et al., 2007). Second, there is an abundance of information in healthcare that Adair and Vohra (2003) have termed a "knowledge explosion" (p. 15); Falzer et al. (2008) noted that knowledge might be produced and disseminated, but not necessarily applied to practice. For this current study, the concept of SDL seemed applicable in considering what factors might be associated with critical care nurses' use of EBP.

Self-Directedness in Learning

Associated with SDL, but not synonymous with it, is the concept of lifelong learning, which is briefly described here as continuous learning over one's lifetime (Hiemstra, 1976). Knowles's (1975, 1990) theory of self-directedness in learning may help to explain one way the process of learning outside the formal academic setting occurs. The nature of the nursing profession builds continuous learning into itself (Gopee, 2001) through various activities such as yearly skills evaluations on the hospital unit or the mandatory continuing education unit requirement in some states. Gopee (2001) stated that literature pointed to lifelong learning as a way to "bridge the transition from initial education to continuing education" (p. 609). SDL has been acknowledged as one way that the professional nurse can pursue continuous learning, and the literature supports the validity of this view (Gibbons et al., 1980; Xu, Martin, & Gribbins, 2010; Zadvinskis, 2008). One continuing education strategy used in nursing for more than 20 years is self-directedness in learning activities (Zadvinskis, 2008). One example of a SDL activity that educators and nursing managers have used to help staff stay current in knowledge and

skills is the continuing education learning packet (Xu et al., 2010). Gibbons et al. (1980) also suggested the importance of SDL as a way to continue to expand or update one's knowledge base. Gibbons et al. looked at characteristics of persons considered to be experts in her or his fields but who did not have formal education in her or his particular areas of expertise; these persons gained expert knowledge through the practice of "active…self-directed…situational learning" (p. 47). One conclusion drawn by the researcher was that one's ability to be self-directed in the informal learning environment might be, over the course of one's lifetime, more important than what one learns in the formal (academic) environment.

Once one is in professional practice, her or his learning opportunities are generally of a more informal nature, and so it would not be surprising to find those who are more self-directed in learning would be more likely to learn about new research. SDL is not for everyone; some persons need or prefer instructor led learning (Hiemstra & Sisco, 1990); however, SDL does not preclude that need or preference (Knowles, 1975, 1990). The SDL theory may be one educational strategy that could help nurses reduce or eliminate the knowledge-practice gap (Falzer et al., 2008). Additionally, Rogers's (2003) diffusion of innovations theory describes adopter characteristics that can enhance the adoption process, as well. The characteristics described in Rogers's adopter categories, especially the innovator and early adopter, may identify those members of a system who are able to disseminate innovations and apply them to practice.

Diffusion of Innovations Theory

Rogers (2003) described the basic idea of diffusion as a process whereby "an innovation is communicated through certain channels over time among the members of a social system" (p. 11). Rogers outlined a 5-step process: (a) knowledge of an innovation, (b) persuasion, or having a positive attitude toward the innovation, (c) decision to adopt or reject the innovation, (d) implementing the innovation, and (e) confirmation, which is the intention to continue using the innovation.

Rogers (1999, 2003) credited Tarde (1903) and Simmel (1908, 1971) with influencing his work in diffusion theory. He adapted the concept of *imitation* from Tarde, and termed it *adoption*. Tarde saw imitation somewhat like a domino effect, with one person in a system adopting an innovation, and then someone else imitating that behavior; the social system was primary to Tarde's view of diffusion. Rogers's theory reflects these concepts as well, through the explanation of adopter characteristics (opinion leaders and influencers) and his description of the social system as "interrelated units" (p. 37). Simmel influenced Rogers's development of his adopter characteristics categories through the concept of *the stranger*, that phenomenon described by Simmel of how one could be in a system but not strongly attached to the system. Rogers partly derived his innovator category from the idea of the stranger; Rogers surmised that the stranger's orientation outside of the group allowed him or her to import information from the wider society (Rogers & Shoemaker, 1971, p. 67). Added to Rogers's (2003) basic idea of diffusion were concepts related to how one perceives the innovation itself, the ways in

which adopters become aware of the innovation, and the characteristics of adopters. The aspects of Rogers's theory that are applicable to this study are the ways in which adopters become aware of an innovation, which are operationalized in this study as sources of knowledge, and the characteristics of adopters as outlined in Rogers's adopter categories of innovator, early adopters, early majority, late majority, and laggard.

Rogers's theory (2003) is one that has been widely used by diverse disciplines such as agriculture (Baig et al., 2005), education (Warford, 2005), information technology (Mustonen-Ollila & Lyytinen, 2003), and nursing (Squires et al., 2007). Rogers's diffusion theory has helped to explain how ideas are disseminated (diffused) and applied (adopted) in various settings. Tiffany and Lutjens (1998) described the theory as "one of the most popular change writings used by nurses" (p. 215).

Nurse researchers have used Rogers's theory to address a variety of topics such as continuing staff education and facilitated change (Bushy, 1992), research adoption among clinical nurse educators (Milner et al., 2005) and medical-surgical nurses (Rodgers, 2000), and nurses' knowledge adoption of policy and procedures (Squires et al., 2007). Bushy (1992) focused on the knowledge sources selected for diffusion, such as journal clubs and promotional materials, administered through continuing education; Squires et al. (2007) acknowledged that knowledge sources in the form of policies and procedures were valuable in the diffusion process. Milner et al. (2005) used Rogers's theory, in particular, the 5th phase of innovation theory, confirmation, to examine factors that influenced the "research utilization process among clinical nurse educators" (p. 899).

These studies used aspects of Rogers's diffusion theory and are discussed in the following paragraphs.

Bushy (1992) reviewed Rogers's (1971, 1983) diffusion of innovations theory and its relationship to nurses changing behavior toward the adoption of new ideas. Some key points that Bushy brought out concerning Rogers's theory were how awareness of an innovation is a flexible, but important, part of the change process, and that adoption might be contingent upon the methods used to bring about awareness of the desired change. Bushy's review of the literature revealed, "Professional literature, research utilization committees, journal clubs, and promotional literature…may be effective means of communicating about the innovation" (p. 199). I am interested in what methods (factors) bring about critical care nurses' awareness of innovation (desired change) as reflected in the explanatory variables of use of journals, use of electronic healthcare databases, and access to a research facilitator on the unit.

Milner et al. (2005) and Rodgers (2000) focused on researcher utilization practices of clinical nurse educators (CNE) and nurses in medical-surgical areas, respectively. Milner's et al. study used stratified cluster sampling and contained 14 independent variables that were evaluated in relation to the dependent variable of research utilization. Two of the variables were directly applicable to this study: knowledge (or awareness of an innovation) and education level. Milner et al. used three conceptual domains to differentiate types of research utilization; the material in quotes describes how these concepts were operationalized: *conceptual* "increased

awareness…changing the way an individual thinks," *instrumental* "concrete application of research findings," and *symbolic,* "to influence the opinions or views of others on a particular issue" (p. 901). Milner et al. grouped nurses according to role: clinical nurse educators, staff nurses, or managers. One hypothesis was that the "university prepared clinical nurse educators" (p. 901) would have more exposure to media sources and research (innovations), increased levels of "awareness, attitude, adoptiveness, localite, and cosmopolite (Simmel's stranger, Rogers's innovator) communication, "better access to technical sources" and "stronger social networks" (p. 901) and therefore, would have higher scores on the research utilization questionnaire. Milner et al. reported that CNE mean scores were higher than staff nurses and managers for all research utilization measures (instrumental, conceptual, and symbolic) and that CNE scores were higher on "awareness and adoptiveness" (p. 906). Milner et al. acknowledged that using research is an expectation of the clinical nurse educator role and thus may explain the difference in scores, but this finding strengthens the point of view that education level is important and suggests that education level may influence not only the awareness of an innovation, but the adoption of the innovation, as well. Not enough literature similar to the Milner et al. study exists that discusses educational level in relation to the adoption of EBP thus making this an important variable for inclusion in this present study.

Using stratified sampling, Rodgers (2000) surveyed 936 nurses from 25 hospitals to look at the degree to which research utilization occurred among nurses in general

medical and surgical areas. Rodgers evaluated 14 nursing interventions and for each intervention nurses were queried about "awareness, persuasion, or belief in use of the practice, and how often they applied this knowledge to clinical practice" (p. 187). Results indicated, "In general, most nurses used a practice at least sometimes once they believed in its use" (p. 189). This raises the question of why nurses, even when persuaded of the value of an innovation, were not applying EBP in a consistent manner; this question could be a focus for future studies. Rodgers's focus was on whether nurses were aware of these 14 nursing practices (evidence based interventions) and to what extent this awareness translated into application. The connection between awareness and application for this present study will not only use the concept of awareness as Rodgers did (i.e., knowledge of an innovation) of research-based nursing practices (for this study, endotracheal suctioning practice), but also specific characteristics and knowledge sources that may be associated with nurses' awareness and application of EBP.

The focus of Squires et al.'s study (2007) was to look at developing policies and procedures (P & Ps) as a viable way to facilitate diffusion of research findings to hospital-based nurses. The researchers chose a component of Rogers's diffusion theory, *decision process*, because no "theory or conceptual model currently exists to explain the role that P & Ps may play in promoting research use" (p. 2). Squires et al. (2007) wanted to determine whether P & Ps "guided nursing practice, the extent of adoption of eight specific research-based practices by nurses, and what factors influence nurses' use of research based practices" (p. 3). Although the instillation of sterile normal saline was not

among the eight research based practices contained in the study, several knowledge sources of interest that might influence adoption were. Education level was one of the knowledge sources, but not found to be a significant predictor of using the research based practices. A little over 62% of respondents held a diploma degree, which is a 3-year hospital-based degree, and 37.1 % held a baccalaureate degree. This is one of the few studies involving education level as a predictor of the use of EBP; more research involving this variable is needed. Knowledge sources that nurses reported that they frequently or always used were *policies and procedure manuals* (81.9%), *personal experience* (81.1%), *nursing school* (75.8%), *fellow nurse* (58.5%), *textbooks* (58 %), *way always done it* (32.6%), and *nursing journals* (28.2%).

Squires et al. (2007) acknowledged that one limitation of the study, and a possible reason for the high reported percentage of nurses' use of policy and procedures to inform practice, is that nurses were made aware of the importance of policy and procedures in the explanation letter supplied with the questionnaire. If the results were accurate concerning the use of policy and procedures by nurses as a knowledge source for best practices, it would follow that nursing facilities must be careful to ensure that policy and procedure manuals are evidence based and current. Additionally, the two-hundred and forty-eight nurse respondents (response rate of 53.5%) reported using personal experience, nursing school, and textbooks, 81%, 75.8% and 58% of the time, respectively. The researchers saw the nursing school result as an "interesting issue" (p. 9) in that the respondents had completed an educational program an average of 12.5 years

prior to this study; clinical practice recommendations can and do change as research is generated, thus making this knowledge source most likely to be outdated. Due to the frequency of publication, it would seem that journals would be an excellent and useful source of timely updates on research evidence in comparison to textbooks, but the nurses' responses indicated that textbooks were used about 48% more of the time than journals as an information source. Squires et al. (2007) discussed that the infrequency of using journals (28.2%) might have been related to the scarcity of research journals, access to computers, and internet availability on the units in some of the rural hospitals where the study took place. It would be of interest to explore what results might be obtained in nursing units where journals and computer access are more readily available, as in this current study.

Researchers van der Weide and Smits (2004) wondered if the "spectacular increase in professional literature" (p. 81) on the subject of health care quality actually gets disseminated to the audiences it is intended to reach. The researchers, using nurses in the specialty area of urinary incontinence care, addressed personal, work, and organizational characteristics and the adoption of professional information. Professional information was operationalized through nurses' knowledge and use of a nursing diagnosis and intervention book specializing in urinary incontinence issues and by reading a trade journal titled *Incourant.* The personal characteristics category contained two explanatory variables, educational level, and *information directedness* that were of interest, as variables similar to these are addressed in this current study. The researchers

hypothesized that "knowledge and use of the book will be higher among more highly educated nurses" and among nurses with "a more information directed attitude" (p. 83). Information directedness was described as "the degree to which an individual tends to actively seek and process information that may be relevant to their professional activities" (p. 83). This definition is reflected in Knowles's (1975, 1990) self-directedness in learning theory and lifelong learning, as well. While lifelong learning is not being addressed in this current study, it is a concept that seems to have a relationship with self-directedness in learning and will only be mentioned briefly in that context when discussing Knowles's (1975; 1990) self-directedness in learning theory.

Van der Weide and Smits (2004) used stepwise regression to analyze 20 variables, among which were the two variables of education level and journal use; three covariates had a positive effect on adoption of EBP guidelines: (a) innovative atmosphere on unit, (b) relevance of information to practice, and (c) entirely reading the *Incourant* journal. Reading the *Incourant* journal in its entirety was equated with nurses having a strong degree of information directedness, and was positively associated ($p < 0.05$) with adoption of evidence based incontinence guidelines. Education level was not discussed in the results, as only those variables that reached a significance level of $p < 0.05$ were included. However, van der Weide and Smits (2004) deemed it an important factor to include when studying knowledge adoption and there is reason to wonder whether education level would play a factor in the adoption of EBP in other clinical specialty areas.

Some of the studies used regression (Milner et al., 2005; Squires et al., 2007; van der Weide and Smits, 2004) to analyze relationships between research utilization and variables associated with the adoption process. The above studies used aspects of Rogers's diffusion of innovations theory (2003) as a framework. Various aspects of interest to this study were addressed, although only one study (Milner et al., 2005) touched upon the concepts of the localite or cosmopolite, which are considered communication behaviors, as well as, channels of communication, associated with Rogers's (2003) adopter categories. Channels of communication will not be addressed in this study, but Rogers's concepts of awareness of an innovation and adopter characteristics are two of the six variables contained in this present study and are addressed next.

Innovativeness and Adopter Characteristics

Rogers (2003) described innovativeness as the "degree to which an individual (or other unit of adoption) is relatively earlier in adopting new ideas" (p. 267) in relation to other persons within a given system over time. To standardize the concept of time of adoption, and to avoid the drawback of identifying the adopter characteristics of each individual in a system, Rogers developed five adopter categories that group members of a system according to shared innovativeness characteristics and values. Rogers (2003) observed and described an interesting phenomenon about the adopter categories: The categories tend to resemble a bell-shaped curve over time (an S-curve if one is tracking aggregate data over time). The adopter categories and observed frequencies are as

follows: (a) innovator (2.5%), (b) early adopter (13.5%), (c) early majority (34%), (d) late majority (34%), and (e) laggard (16%); The primary descriptive characteristic, as identified by Rogers and the adopter characteristics of each "ideal type" (p. 282) are described below.

Adopter Categories

Innovator. The category in which adoption of an innovation occurs first. The key characteristic is *venturesomeness*, described by Rogers (2003) as "almost an obsession with innovators" (p. 282). This group thrives on risk and others may view the innovator as "rash" and therefore, not "well-respected by members of the local system" (p. 283). The persons in this category are able to tolerate a higher level of uncertainty, are connected outside their own social group, and therefore, are able to import new ideas more readily. Rogers termed this communication behavior as "cosmopolite" (p. 282). Innovators are also well educated, have access to multiple sources of information, and could be described in current vernacular as being knowledgeable about what is *cutting edge*.

Early adopter. This is the category in which adoption of an innovation occurs second. Being integrated within the local system to a greater degree, behavior that Rogers has described as "localite" (p. 283), is a key characteristic of this group. The early adopter is "more discrete and judicious" (p. 283) in use of knowledge. The early adopter group tends to be the opinion leaders and role models within a system, and as such, are "respected and consulted" in the decision-making process (p. 283). The most influential

group in the diffusion process, the early adopter helps to decrease for others in the system the "uncertainty" (p. 283) about an innovation, which may pave the way for the success of an innovation.

Early majority. The category in which adoption of an innovation occurs third; deliberation is considered the hallmark of this category. Persons in this group are seldom the opinion leaders in the adoption process. This group is just a little ahead of the "average member of a system" (p. 283) in innovativeness.

Late majority. In the fourth category in which diffusion occurs, the main characteristic of this group is skepticism. The members must be "convinced to adopt" (p. 284); peer-pressure plays a larger role in this category in the decision to adopt. Adoption in this group generally does not occur until most of the uncertainty about an innovation has been eliminated.

Laggards. The category in which adoption of an innovation occurs last, if at all. Persons in this category tend to "be suspicious of innovation and change agents" (p. 284), possessing little or no opinion leadership. Laggards are the "most localite…in outlook" (p. 284), which means being very isolated from others within the system. Decisions tend to be based on previous ways of doing things. Nearly all risk or uncertainty must be eliminated before an innovation is considered.

All adopter categories were listed so that the reader would have a point of reference, however, the two adopter categories of interest to this study are innovator and

early adopter as the characteristics in these categories are seen as the most instrumental in getting new ideas adopted.

The Diffusion of Evidence Based Practice Concepts

Guyatt et al. (1992) acknowledged that a "paradigm shift" (p. 2420) occurred in medicine in the early 1990s; this change in thinking involved adopting clinical practices based on information supported by research. Guyatt et al. stated that evidence based medicine "de-emphasizes clinical practice based on intuition and unsystematic clinical experience…as sufficient grounds for clinical decision-making" (p. 2420). The authors identified that the previous values of "clinical experience and clinical intuition" were still of importance, but adding the "systematic search for knowledge" to those qualities was now seen as the "core of evidence based medicine" (Guyatt et al., p. 2423). Sackett, a colleague and fellow member with Guyatt in the Evidence Based Medicine Working Group at McMaster University Health Sciences Centre (Canada), developed (with other colleagues) a definition of EBP that was used for this present study; the definition incorporated the additional values of clinical intuition, clinical experience, and research evidence. According to Sackett, Rosenberg, Gray, Haynes, and Richardson (1996, p. 72) and Sackett, Strauss, Richardson, Rosenberg, and Haynes (2000): "Evidence based medicine is the conscientious, explicit, and judicious use of current best evidence, along with clinical expertise, and patient values in making decisions about the care of individual patients" (p. 1). The idea of grounding professional clinical practice in

research began to disseminate to other disciplines within and without the healthcare system.

Some examples of other disciplines that began adopting EBP are occupational therapy (Rappolt, 2003), physical therapy (Harting, Rutten, Rutten, & Kremers, 2009), speech therapy (Bennett, Townsend, Mancini, & Taylor, 2006; Johnson, 2006; Reilly, 2004), and psychiatry (Falzer et al., 2008; Torrey et al., 2001). Practitioners in healthcare management (Gautam, 2008), nursing (DiCenso, Guyatt, & Ciliska, 2005; Finkelman & Kenner, 2007; Larrabee, 2009; Melnyk & Fineout-Overholt, 2005, Titler, 2010), education (Comings, Beder, Bingham, Reder, & Smith, 2003; Merriam, Caffarella, & Baumgartner, 2007), social work (Gira, Kessler, & Poertner, 2004), and even manufacturing (de Treville, Bendehan, & Vanderhaeghe, 2007) have utilized EBP, as well. This list is but a sampling of the many areas of healthcare and other disciplines that have embraced the concept of EBP.

Some common themes shared among the disciplines were that research should be rigorous and theory should be used to guide research (DiCenso et al., 2005; Johnson, 2006; Torrey, et al., 2001). Johnson (2006) and Reilly (2004) advised that EBP should be applied in a stepwise manner using guidelines to facilitate use; the disciplines of speech therapy and education most resembled nursing's pattern of applying frameworks to disseminate research findings (DiCenso et al., 2005; Larrabee, 2009). The two most prevalent ideas brought forth from the review of the literature and important to this present study were that EBP should be a standard for professional practice, and that there

is a gap between what is known and what is practiced. As stated earlier, Falzer et al., (2008) phrased this as a "dissemination gap" (p. 2) or that discrepancy between knowledge that is generated, and in many cases dissemination, but not applied to practice. This application of research findings to clinical practice has, within the past decade and presently, been the central focus for some nurse researchers such as Beyea and Slattery (2006), Finkelman and Kenner (2007), Larrabee (2009), Larrabee et al. (2007), McEwen and Wills (2011), Titler (2010) and Upton and Upton (2006). Points from some of these studies are discussed in the following paragraphs.

Evidence Based Practice and the Nursing Environment

Within the past decade, the move toward the adoption of EBP has been present in the nursing profession. Nurse researchers such as Finkelman and Kenner (2007), Larrabee et al. (2007), and Titler (2010) have focused on developing *clinical practice guidelines*, also known as best practices, so that interventions would be based upon research evidence rather than, as characterized by Urden et al. (2010), the nonscientific traditions of "gut instinct, trial and error, or personal preference" (p. 3). A principle for healthcare disciplines to consider about EBP is that the application of current research evidence to clinical problems helps healthcare professionals to obtain safe and optimum patient outcomes, while containing costs (AHRQ, 2002; Beyea & Slattery, 2006; Finkelman & Kenner, 2007; Newhouse, 2007; Upton & Upton, 2005). The concepts of providing safe and cost-effective care, and improving patient outcomes, have provided a strong impetus for nurse researchers to explore how nurses adopt research findings for

application to clinical practice. As with medicine in the 1990s, McEwen and Wills (2011) viewed using research as one way to shift nursing practice from interventions based on "ritual…unsystematic clinical experiences, ungrounded opinions, and tradition" (p. 384) to nursing interventions based on the best available evidence. As indicated by Roberts, Belcher, and Jacobson (2004), Tilter, a nurse researcher who has promoted the use of EBP through the development of clinical practice guidelines, agreed and stated the desire that nurses be empowered to "practice by evidence, not tradition" (p. 102). DiCenso et al., (2005) shared McEwen and Wills's (2011) concern that nursing practice not be based on tradition and offered that nursing has a "social obligation of accountability" (p.14) that could be met through "grounding nursing practice in evidence" (p. 14). Sigma Theta Tau International, the Honor Society of Nursing (2005), drawing on input from Rycroft-Malone, Bucknall, and Melnyk (2004) stated this obligation in this way:

> What is clear is the responsibility of nurses to deliver care based on evidence, for nurses to be able to access, evaluate, integrate, and use the best available evidence in order to improve practice and patient outcomes. The imperative is to reduce the gap between knowledge development and knowledge use to improve the health of people. (para. 3)

Balas and Boren (2000) proposed that evidence based research undergird sound healthcare. Estabrooks et al. (2008) noted that "calls to make nursing practice more research based are common…"(p. 2) and Upton and Upton (2005) saw EBP as a

"framework for clinical problem solving" (p. 454). Block and Le Grazie (2006) offered that assimilating evidence based findings into practice is "critical for delivering quality nursing care and improving patient outcomes" (p. 37). Accrediting and regulatory agencies involved in setting standards for nursing practice and patient care are now identifying that patient care needs to be evidence based; this further attests to the importance of this concept.

The Joint Commission on Accreditation for Hospital Organizations (JCAHO) and third-party insurance payers have deemed that patient care needs to be evidence based; accreditation and reimbursement can be affected if it is not (Pierce, 2009; Pierson & Schuelke, 2009). The Centers for Medicare and Medicaid have initiated pay-for-performance guidelines based on patient outcomes; this change is affecting hospital reimbursement as never before, making evidence based patient interventions more crucial than ever (Krugman, 2008). Even consumers are now considering evidence based outcomes when making healthcare decisions (Pierson & Schuelke, 2009).

Acquisition of Information by Nurses

Beyea and Slattery (2006) stated that EBP adds to the knowledge base of professional nursing, prepares nurses to make informed clinical decisions, and fosters a "current and relevant" nursing practice (p. 9). Estabrooks (1999) and Pravikoff et al. (2005) addressed the issue of staying current in practice. Pravikoff et al. (2005) surveyed 1,097 randomly selected nurses working in clinical settings; the researchers looked at several factors, among them the use of journal articles, research reports, hospital libraries,

and nursing databases. The nurses reported rarely or never using "journal articles (12%), research reports (92%), or hospital libraries (82%)" as resources for acquiring updated knowledge (p. 46). Nurses also reported never searching CINAHL® (76%) and MEDLINE (58%) databases; the nurses' overall preference was to use other colleagues or the Internet for answers to clinical questions. Based on findings from Pravikoff et al. (2005), it is possible to draw the conclusion that unless colleagues are up-to-date on best practices, this resource can only perpetuate the knowledge-practice gap as practices based on tradition or personal preference could get disseminated rather than the research evidence.

Estabrooks's (1999) study of sources of knowledge used by nurses yielded rank-ordered information about the sources that the nurses reported using most often; the top three results were:

1. "Information learned about each patient/client."
2. "My personal experiences of nursing patients/clients over time."
3. "Information I learned in nursing school."

The first category above reflects one of the values in Sackett et al.'s (2000) EBP definition, patient values. Listening to, and taking into consideration the patient's point of view, is part of the first step in the nursing process, assessment, which is the process of information gathering (Urden et al., 2010). Item two in the list, *personal experiences*, could lead one to practice based on tradition (i.e., "this is how we've always done it"; Beyea & Slattery, 2006, p. 8). Given the information in item 3*, information I learned in*

nursing school, combined with the statistic that the average age of the nursing workforce is 47 (HRSA, 2010), it is very probable that areas of one's nursing knowledge and practice may be outdated and therefore, not likely to be evidence based. It is evident from the research that finding ways to foster a "current and relevant" (Beyea & Slattery, 2006, p. 9) nursing practice continues to be a challenge.

Despite the efforts of nurse researchers such as DiCenso et al. (2005), Estabrooks (1999), Finkelman and Kenner (2007), Larrabee et al. (2007), McEwen and Wills (2011), Pravikoff et al. (2005), and Titler (2010) to influence nurses to the apply evidence based findings to practice, the rate of adoption has been slow and inconsistent (Hanberg et al., 2006).

Knowledge Adoption and Evidence Based Practice

McWilliam et al. (2009) stated that incomplete research findings and slow adoption of evidence based findings "continue to challenge implementation scientists" (para. 5). Graham et al. (2006) described the dissemination of research findings as a "slow and haphazard process" (p. 13). The AHRQ (2002) concurred. Balas and Boren (2000), through a meta analysis of several clinical trial studies, discovered that it can take a decade or longer for research based findings to disseminate to bedside practice. One example of slow or incomplete application of research findings in nursing, and central to this study, is the practice of instilling sterile normal saline into an endotracheal tube or artificial airway prior to suctioning. As discussed in Ackerman and Gugerty's (1990) review of the literature, findings showed that this practice was "controversial and

inconsistent" (p. 14). Several subsequent studies have shown that using sterile normal saline with endotracheal suctioning had detrimental effects on heart rate and oxygen saturation measurements (Akgül & Akyolcu, 2002; Kinloch, 1999). Twenty years later, this intervention continues to be practiced in critical care areas (Halm & Krisko-Hagel, 2008) despite recommendations that this intervention not be used. Rauen et al. (2008) suggested that it was time to put this "sacred cow," (p. 98) along with several others, "out to pasture" (p. 98). Rauen et al. also suggested that nursing "has deeply rooted traditions" and "commonly held beliefs" (p. 98) but nursing must not let "traditions and beliefs" (p. 98) become barriers that prevent the assimilation of research findings into clinical practice.

McWilliam et al. (2009) reported that complete and timely dissemination of research findings was still a challenge faced by those interested in implementing change; Graham et al. (2006) saw the dissemination of research findings as a process that was neither consistent nor speedy. Looking at several studies, Balas and Boren (2000) determined that it could take years for research-based recommendations to reach the clinical bedside. Rauen et al. offered that nursing has "deeply rooted traditions" (p. 98) that may serve as barriers to timely knowledge adoption. Perhaps one way that the barriers of tradition and slow adoption can be overcome is by adopting the recommendation of Johnson (2006) and Reilly (2004) of applying EBP in a stepwise manner using frameworks and guidelines to facilitate use.

Barriers and Resistance to Adoption of Evidence Based Practice

Studies by Ashley (2005), Fink, Thompson, and Bonnes (2005), Myers and Meccariello (2006), Novak, Dooley, and Clark (2008), Parahoo and McCaughan (2001), Pravikoff et al. (2005), and Retsas (2000) have found that barriers and resistance in moving toward evidence based nursing practices still exist. Some of the identified reasons are (a) weak or nonexistent facility support (Fink et al., 2005; Parahoo & McCaughan, 2001; Retsas, 2000), (b) time constraints (Ashley, 2005; Myers & Meccariello, 2006; Parahoo & McCaughan, 2001; Pravikoff et al., 2005), and (c) staffing issues (Novak, et al., 2008). Another identified barrier was "ineffective education"; Waters, Rychetnik, Crisp, & Barratt's (2009, p. 829) discussed that scant research was available that addressed the education element as it related to EBP. Recognizing that barriers and resistance exist and being able to remove those barriers and resistance is part of the challenge of bridging the gap between evidence and practice. While it is not always feasible to eliminate these barriers, as hiring additional staff may not be possible and time constraints are an ongoing challenge for nurses, it is still important to pursue strategies that can support the adoption of EBP.

Additional reasons that have been identified as possibly playing a role in the slow or incomplete adoption of the evidence are nursing practices still based upon "ritual... unsystematic clinical experiences, ungrounded opinions, and tradition" (McEwen & Wills, 2011, p. 384) or nonscientific traditions of "gut instinct, trial and error, or personal preference" (Urden et al., 2010, p. 3). Adhering to practices based upon "this is the way

we've always done it" (Beyea & Slattery, 2006, p. 8) could be one reason that access to research does not necessarily mean that research findings will be applied, in a timely manner, to clinical practice (Institute of Medicine, 2001). Estabrooks et al. (2008) surmised that one reason for the knowledge-practice gap is the "failure to systematically account for factors that influence nurses' use of research, or stated another way, the failure to systematically account for the determinants of research utilization behavior within the work context…of nurses" (p. 2).

Identifying barriers and resistance is an integral part of the adoption process as is identifying factors that facilitate adoption. While it is important to understand that barriers and resistance to adopting EBP exist, Estabrooks et al. (2008) issued a challenge that research be focused on "determinants or factors of research utilization behavior" (p. 2). In response to that challenge, I looked at the selected factors of adopter characteristics from Rogers's (2003) diffusion of innovations theory, self-directedness in learning (Knowles, 1975, 1990), education level, use of journals, use of electronic healthcare databases, access to a research facilitator on the nursing unit, and critical care nurses' adoption of EBP. The following paragraphs will address the variables of this study mentioned above.

Knowledge Sources Used for Disseminating Innovations

Tannery, Wessel, Epstein, and Gadd (2007) noted that in comparison to nursing students, "fewer studies have been published discussing hospital nurses' access to and use of information resources" (p. 15). This present study will look at factors associated

with critical care nurses' adoption of evidence practice. Self-directed learning and adopter characteristics have been previously discussed; the remaining four variables addressed below are the knowledge sources of education level, use of journals, use of electronic healthcare databases, and access to a research facilitator on the nursing unit.

Education Level

BSN in 10 is the current stance taken by nursing associations in New Jersey and New York. The North Shore-LIJ hospital system in New Jersey is requiring, beginning September 1, 2010, that all newly hired nurses will hold a BSN degree or agree to obtain one within *five* years; the Great Neck-New York hospital system will require a BSN within *10 years* of hire. Michael Dowling, president/CEO of the Great Neck, NY-based 15-hospital health system, stated "As patient care becomes more complex and high-tech, there is growing evidence that developing a more highly educated nursing workforce improves patient safety and leads to higher quality, more cost effective patient care," (Commins, 2010). The American Nurses Association's (ANA, 2010) position since 1960, reaffirmed in 2000, is that the BSN should be the entry level degree for professional nursing practice. "Data show that patients have better outcomes with nurses who hold baccalaureate or higher degrees" (AACN, 2010, para. 26). It is not the purpose of this study to debate the merits of one particular education level over another, but the above statement does suggest that education level matters. This situation raises the question:

"Does education level matter because it means that nurses are adopting research evidence?"

Researchers such as Blegen, Vaughn, and Goode (2001), Johnson (1988), and Phillips, Palmer, Zimmerman, and Mayfield (2002) examined the variables of education level and nursing characteristics between the ADN and BSN (or higher) degree levels. These studies have focused mainly on professional nursing behaviors such as communication, organizational, leadership, and critical thinking skills as well as, personal perceptions of nursing as a profession and not educational degree, *per se*, except for Blegen et al. (2001). Ingersoll, Olsan, Drew-Cates, DeVinney, and Davie (2002) reported that BSN and MSN prepared nurses have a greater level of job satisfaction and Johnson (1988) stated that BSNs had improved problem solving and communication skills. Phillips et al. (2002) measured professional development in ADN to BSN transition students and found that significant changes ($p < 0.000$) were present pre and posttest in the areas of "leadership, nursing practice/process, professional integration, communication/collaboration, and research/evaluation" (p. 283). Goode et al. (2001) found that nurse managers held the perception that BSN educated personnel were, among other things, less task-oriented, better communicators, and had better critical thinking skills. As discussed in Section 1, only a few studies exist (Aiken et al., 2003; Estabrooks, Midodzi, Cummings, Ricker, & Giovannetti, 2005) that have shown that higher degree levels resulted in improved patient outcomes.

Aiken et al. (2003) acknowledged that "surprisingly little is known about the benefits, if any, of the substantial growth in the numbers of nurses with bachelor's degrees" (p.1617) and so designed a study to examine, among other things, the relationship between education levels of staff nurses and the patient outcome of 30-day postoperative mortality rates. Aiken et al. showed that in hospitals with more BSN or higher degree prepared nurses, the 30-day post-operative mortality rate was lower; education level was statistically significant ($p = .008$) for this patient outcome, OR, 0.95 (95% CI [0.91, 0.99]). One potential criticism of the study was that mortality rates could be attributed to multiple factors. However, Aiken et al. noted that after accounting for 133 patient variables related to risk of death, the study results showed that education effect was still a statistically significant factor.

Estabrooks's et al.'s (2005) multisite study also looked at the patient outcome of 30-day mortality rate, along with several independent variables, among them education level. Estabrooks et al. found that a statistically significant relationship ($p < .021$) existed between BSN and higher degree levels and decreases in death rates, OR, 0.81, (95% CI [0.68, 0.96]).

The findings from these studies by Aiken et al. (2003) and Estabrooks et al. (2005) were that BSN and higher degree level prepared nurses had better patient outcomes than associate degree (ADN) and diploma prepared nurses. The authors did not discuss whether BSN or higher prepared nurses used EBP more often than the ADN prepared nurses did. One might presume that the higher the educational degree the more

one would use research evidence given that the curriculum for the baccalaureate degree typically contains a research component while the associate degree normally does not (American Association of Colleges of Nursing, [AACN], 2010); however, this presumption may be incorrect. Sixty-one percent of nursing students in 2007-2008 graduated from associate degree programs, while 36% graduated from baccalaureate programs (NLN, 2010). This represents a large percentage of the nursing population who has possibly not been exposed to research related content during the education process. It begs the question "Is there a relationship between nurses' use of EBP and education level?" It is not clear from the literature if there is a connection; one aspect of this study was to look at whether degree level is associated with critical care nurses' the use of EBP.

Journals

Pravikoff et al. (2005) acknowledged that being able to use the best available research information involves the process of "tracking down the best evidence" (p. 49). One way to get to the best evidence may be through using nursing journals. However, according to study findings by Squires et al. (2007), nurses used "nursing school… textbooks…tradition" (p. 5) as knowledge sources considerably more often than nursing journals. Yet, in comparing the knowledge sources of nursing school, textbooks, tradition, and nursing journals, the nursing journal is the resource that is likely to be the most current, evidence based knowledge source.

Frace (2010) encouraged nurses, in regards to EBP, to "walk the walk" (p. 77).

Rather than being disgruntled about nursing practices, he suggested that nurses use resources to learn about EBP; his recommendation is that nurses "stop…complaining and pick up a journal" (p. 77). Goodfellow (2004) stated, "A journal club helps foster an environment conducive to EBP" and "a journal club helps bridge the gap between practice and research" (p. 110) through awareness of research and through learning to effectively critique articles. As the nursing profession continues to embrace EBP, journal clubs may be considered a viable way for research findings to be disseminated (Milbrandt & Vincent, 2004).

The journal club has a long record of usefulness in the medical profession. Campbell-Fleming, Catania, and Courtney (2009) reported that journal clubs have been a lifelong learning strategy in the medical system and that physicians have used the journal club as a medium for teaching and professional growth for well over 100 years.

Practice changes can result from using journals and journal clubs. One example, documented in *Advance for Nurses* (Palcko, 2008) described how nurses working in the Women's and Children's Services of BroMenn Regional Medical Center, Normal, IL changed umbilical cord-care practice. According to what the nurses had always done, the protocol was to apply triple-dye antibiotic one time, followed by an alcohol application to the newborn's umbilicus with each diaper change. Someone noticed an inconsistency in practice among agencies in this region; nurses decided to explore what the literature showed about cord-care best practice. The nurses participated in a unit based journal club and through a review and critique of literature discovered that applying alcohol to the

umbilicus with each diaper change did not decrease infection rates or facilitate cord separation; in fact, cord separation was more rapid when the alcohol application was discontinued. A change in newborn cord-care practice was the result of knowledge obtained from journal reviews and disseminated through the journal club.

A drawback in using the journal club is the ubiquitous "I don't have enough time!" but with planning and dedication, this continuing education strategy is relatively inexpensive to implement. The journal club can be an effective medium for the dissemination of information to assist nurses in applying research findings to practice (Lizarondo, Kumar, & Grimmer-Somers, 2010).

The journal club can help staff to make the paradigm shift from thinking, "This is the way we have always done it" to thinking "What does the evidence say?" What is not known from the literature is how prevalent the use of journals or journal clubs are among nurses. Squires et al.'s (2007) study included 248 nurses who responded that journals were used only 28% of the time as a resource for evidence based information. Therefore, it is seen as an important variable to include in this study as part of the process of assessing if selected factors are associated with the adoption of EBP.

Electronic Healthcare Databases

Grimshaw, Santesso, Cumpston, Mayhew, & McGowan (2006) surmised that "knowledge translation (KT) activities will only lead to improved health outcomes if they are based on the best available evidence" (p. 55) but one of the main obstacles to KT is the massive amount of information that is generated each year. One way to manage this

overabundance of information is through databases. The following are examples of the quantity of information that databases manage.

Rycroft-Malone reported in 2004 that 10,000 random controlled trials were listed in the MEDLINE database and 350,000 were listed in the Cochrane Collaboration database. MEDLINE is a national database available to members of healthcare services; the database maintains over 17 million references to articles from 5,200 journals. MEDLINE adds 10,000-20,000 references to its database weekly; in 2010, there were almost 700,000 total references added (MEDLINE Fact Sheet, 2011). The Cochrane Collaboration offers free access to abstracts and summaries of systematic reviews (Cochrane Collaboration, 2010). CINAHL® *Plus* database, a collection of journals for nursing and allied health, contains citations for 1,360 journals (EBSCO, 2012). Much information is available to nurses, indeed, which makes electronic healthcare databases a rich source of knowledge from which to glean EBP information.

The literature contained mainly articles describing available databases (Grimshaw, et al., 2006; Rycroft-Malone, 2004). Electronic healthcare databases that may be of interest to nurses are the Agency for Healthcare Research and Quality (AHRQ), CINAHL® *Plus*, The Cochrane Collaboration, Joanna Briggs Institute (JBI), and MEDLINE. The AHRQ is a database maintained by the U.S. Department of Health and Human Services. AHRQ's primary focus is on quality and patient safety care; among the services available are evidence based updates, research funding, and public health preparedness. CINAHL® *Plus* is "the most comprehensive resource for nursing and allied

health literature" (EBSCO, 2012). MEDLINE is a medical healthcare database under the auspices of the National Institutes of Health and services healthcare providers and the public. The Cochrane Collaboration is a worldwide, not-for-profit database that contains systematic reviews of research evidence (Grimshaw et al., 2006). The JBI is an evidence based nursing center with 28 centers located throughout the world and offers free access to some services, as well as, membership for access to expanded services. The JBI reviews nursing research to help determine its feasibility of use and applicability to nursing practice. The organization offers many benefits, among them best practice guidelines, a library of systematic reviews, evidence based care bundles, and online journals.

Scant research was found that discussed nurses' use of electronic healthcare databases and EBP. Pearson et al. (2005) talked about the JBI "model of evidence based healthcare" (p. 207) which included a rich conceptual description of EBP. Pravikoff et al. (2005) conducted an exploratory survey of 760 nurses; one focus of the study was resource availability and use. Seventy-two percent of respondents affirmed that they had access to a computer either at work or home yet, seventy-six percent of nurses stated that they have never searched CINAHL and 58% had never searched MEDLINE (p. 45). The authors further explained, "Of those persons with computer access, 18% stated access to CINAHL, 40% to MEDLINE, and 98% to the Internet and World Wide Web" (p. 47). Seventy-four percent of respondents reported that their employers did not supply access to electronic databases. Something that is not completely understandable about these

statistics is, if respondents reported a 98% access to the Internet (either at work or at home), and some of these databases are free of charge and accessible from the Internet, why such a low report of access? Lack of instruction in using electronic databases was reported by 27% of the nurses; perhaps lack of ability in using databases and not access accounted for the difference.

There are national and international healthcare database resources available to nurses as well as, information resources maintained by nursing credentialing centers such as American Association of Critical care Nurses (AACN, 2010). A rich source of knowledge is contained within the databases that are available to nurses for application to practice; however, this knowledge source may be one that is greatly underutilized.

Research Facilitator

As stated by Dogherty, Harrison, and Graham (2010), "Facilitation is emerging as an important concept in evidence uptake in clinical nursing practice" (p.77). Polit and Beck's (2008) position was, "It is every nurse's responsibility to become consumers of nursing research" (p. 4). Freshwater and Bishop (2004) essentially agreed but acknowledged that nurses have varying degrees of "practice-based inquiry" (p. 3). Freshwater and Bishop described two levels of practice engagement, a "general level" (p. 3) where the nurse is personally responsible to have a practice that is evidence based, and a "facilitative level" (p. 3) where nurses who have adeptness for research are supported in that role so that research skills can be used to the benefit of the organization. Lusardi (2012) suggested that supporting staff was an important EBP component and that

"clinical experts must be available to guide and mentor staff from the identification of a practice issue to the channeling of those ideas that will ultimately improve patients' outcomes" (p. 56).

Concepts of Facilitation

Although the concept of facilitation has been defined in different ways by researchers, a common component of facilitation is support. Kitson, Harvey, and McCormack (1998) called facilitation a "technique" (p. 152), as did Dogherty et al. (2010), while Harvey et al. (2002) and Stetler et al. (2006) referred to facilitation as a process. Kitson et al. (1998) maintained that the "successful implementation of research into practice is a function of…how the process is facilitated" (p. 149). Kitson et al. (1998) defined facilitation, as a "technique by which one person makes things easier for others" (p. 152). Concerning the adoption of EBP, Kitson et al. saw the role of the facilitator as one in which the facilitator assisted others to "understand what they have to change and how they can change to achieve the desired outcome" (p. 152).

Kitson et al. (1998) developed a conceptual framework in order to analyze the relationship between facilitation and adoption of EBP. Three main concepts of the framework were the *nature of the evidence*, *context*, and *facilitation*. In the process of developing the framework, the researchers gleaned the literature to learn whether facilitation was "conceptually discrete from change agent strategies described as…educational outreach and use of local opinion leaders" (p. 583). Some important points emerged and a few are mentioned. Kitson et al. stated that the analysis "reinforced

the view that the facilitator role is about support," that the facilitator role is "an appointed role," as opposed to a role that one takes upon himself or herself. Furthermore, the facilitator role is either internal (within the organization) or external (without the organization), and the facilitator role "is about helping and enabling rather than telling and persuading" (p. 585). These concepts were helpful when preparing survey questions for this present research study; the facilitator was designated as one who is present on the unit (internal facilitator). The facilitator may be in a formal role (paid, facility designated position) or an informal role (non-paid, non-designated); the informal facilitator is designated as one who is recognized or appointed, as Kitson et al. advised, by others on the unit as being in that role. For this study, the role will not be self-designated (i.e., respondents will not be asked to identify themselves as an informal research facilitator).

Johnson (2006) and Reilly (2004) advised that EBP should be applied in a stepwise manner using guidelines to facilitate use; a research facilitator would be a key person in identifying appropriate frameworks, developing specific evidence based guidelines, and assisting others in applying the guidelines to practice.

In summary, concerning the six variables used in this study, not much is known about the impact the role of the research facilitator has on the adoption of EBP. Little research exists, as well, of the influence that electronic healthcare databases have on the adoption of EBP. Several studies (Aiken et al., 2003; Goode, 2001; Ingersoll et al., 2002; Milner et al., 2005; Phillips et al., 2002; Tourangeau et al., 2006) are available that discuss the improved patient outcomes with nurses who are educationally prepared

beyond the associate degree level, however, those studies did not explicitly state that the improved patient outcomes are due to the application of EBP. Aiken et al. (2003) noted, "Surprisingly little is known about the benefits…of nurses with bachelor's degrees" (p. 1617). Research-based nursing journals and journal clubs show promise as excellent ways to disseminate information upon which to base best practices (Goodfellow, 2004); however, Pravikoff et al. (2005) found that nurses used "nursing school…textbooks…and tradition" (p. 5) more often as sources of knowledge than nursing journals. Exploring the factors of nurse education level, use of journals, use of electronic healthcare databases, and access to a research facilitator, as well as, nurse characteristics, in relation to the application of EBP, will help aid understanding of whether these factors are associated with nurses' knowledge adoption.

Summary

What is supported from the literature is that nurses have a responsibility to deliver care based on evidence and for nurses to be able to access, evaluate, integrate, and apply the best available evidence in order to improve practice and patient outcomes (Sigma Theta Tau, 2002). According to Polit and Beck (2008), "All nurses have the responsibility to be consumers of research" (p. 4) so that we can help lessen or eliminate the "knowledge-practice gap" (Falzer, et al., 2008, p. 2). Estabrooks et al. (2008) maintained that one reason for the knowledge-practice gap was the "failure to systematically account for the determinants of research utilization behavior within the work context…of nurses" (p. 2) and challenged nurse researchers to explore those

factors. This study is in response to that challenge.

McWilliam et al. (2009) and Graham et al. (2006) have found that complete and timely dissemination of research findings was still a challenge faced by those interested in implementing change; looking at several studies, Balas and Boren (2000) noted that it could take years for research based recommendations to reach the clinical bedside. Rauen et al. (2008) offered that nursing has "deeply rooted traditions" (p. 98) that may serve as barriers to timely knowledge adoption. More is known about the various barriers that impede the adoption process than what is known about what facilitates the adoption process.

Available resources, such as peer-reviewed journals, hospital libraries, research reports, research facilitators, and healthcare databases, continue to be underutilized by nursing personnel (Estabrooks, 1999; Estabrooks et al., 2008; Pravikoff et al., 2005), which may be a contributing factor to the slow and inconsistent adoption of research (Hanberg et al., 2006). When comparing nursing students to hospital nurses, Tannery et al. (2007) pointed out that not as much information is known about hospital-based nurses' "access to and use of information resources" (p. 15). Exploring the characteristics of nurses and the resources that nurses use, and whether there is a strengthened association in the combined use of those characteristics and resources, may help to reduce the gap in our understanding of how nurses adopt and apply research and add to what is lacking in our knowledge base concerning the adoption of EBP. Therefore, the purpose of this study was to assess whether there are relationships among the selected factors of adopter

characteristics, self-directedness in learning, education level, use of journals, use of electronic healthcare databases, access to a research facilitator on the unit, and critical care nurses' adoption of EBP. Section 3 will contain information related to methodology and instrumentation.

Section 3: Research Method

Introduction

The purpose of this survey research design study using correlation statistical methods was to explore if there are relationships among the factors of adopter characteristics, self-directedness in learning, education level, use of journals, use of electronic healthcare databases, access to a research facilitator on the unit, and critical care nurses' use of EBP. Section 3 is divided into the following sections: setting and sample, research design and approach, research questions, instrumentation and materials, data collection and analysis, limitations, and protection of human participants.

Setting

The study included nurses working in the critical care areas of intensive care, cardiovascular recovery, or progressive care units, at three Midwestern hospitals located within a 35-mile radius. Inclusion criteria were nurses who were employed in the aforementioned units, worked full-time, part-time, or prn (as needed), who had performed endotracheal suctioning, and had computer access at 2 of the sites; a paper survey was administered at the third site. The survey was open to all licensed or registered nurses that met the above criteria.

Population and Sample

The accessible population consisted of 126 nurses employed in critical care, cardiovascular recovery, or progressive care units at the three hospital sites. Using a straightforward calculation tool obtained from MaCorr Research, Inc. (2010), sample size

was determined. The rationale for determining the appropriate sample size is discussed next.

Sample Size Justification

Hair, Black, Babin, Anderson, and Tatham (2006) and Halinski and Feldt (1970) offered guidance to researchers using regression analysis. Obtaining an appropriate sample size is necessary to measure adequately the study variables, and to determine statistical significance and power; as stated by Hair et al. (2006), "sample size affects all results" (p. 23). For regression analysis, Hair et al. recommended a ratio of no fewer than five observations (or participants) for each independent variable to avoid the possibility of overfitting, that is, of "making the results too specific to the sample, thus lacking generalizability" (p. 112). Halinski and Feldt (1970) recommended a minimum of 10 observations per independent variable. This current study contains six independent variables: adopter characteristics, self-directedness in learning, education level, use of journals, use of electronic healthcare databases, and access to a research facilitator on the unit. Therefore, a minimum sample size of 60 was desired as per Halinski and Feldt's recommendation. However, calculations that were more specific were used in this study to determine sample size. The formula for calculating sample size is as follows: Sample size = $Z^2 * (p) * (1-p)/C^2$; Description: where $Z = Z$ value (e.g., 1.96 for 95% confidence level) and p = percentage picking a choice, expressed as a decimal (.5 used for sample size needed), and c = confidence interval, which is expressed as a decimal (e.g., .04 = ±4).

Using software obtained from MaCorr Research, Inc. (2010), the desired sample size for a population of 126, with a confidence level of 95%, and a confidence interval of .05, the minimum sample size needed was 95. While it is useful to understand the concept of determining sample size for an unknown population, for this study I will have access to and use the known population of 126.

Research Design and Approach

Researchers can gather survey information through several ways, among them the self-administered questionnaire (Fink, 2003, p. 22). The survey is useful for collecting data about "knowledge, attitudes, and behaviors" (Fink, p. 1) and "interrelations of variables within a population" (Polit & Beck, 2008, p. 323). The following paragraphs describe the research design and sampling procedures that were used in this study.

Survey Design

I used a cross-sectional survey research design that included correlational analysis; at 2 sites, the survey was continuously available to respondents and the data were collected over 2 weeks through an electronic questionnaire via SurveyMonkey. A wave pattern was anticipated for survey responses; that is, some nurses were expected to respond to the survey immediately, others within a few days, still others within the first week, until no more responses would be received. Advantages of the electronic survey are the quickness of the data collection process and its relative inexpensiveness (Creswell, 2009). The questionnaire design capabilities of SurveyMonkey allow researchers to use skip patterns; respondents can bypass questions that are not applicable

to them, which may help to ensure the completion of the questionnaire. Some drawbacks to the electronic survey are not having access to a computer and computer access speeds; connections can be lost with dial-up mode, especially for longer surveys. At the third site, a paper questionnaire was given to nurses at various unit meetings over a 2-week period.

Sampling Procedure

Institutional Review Board (IRB) approval was obtained from each hospital. I collaborated with a designated contact person from each site. At 2 of the hospital sites, the contact person helped facilitate access to the nurses through the corporate email system. An invitation to participate in the study was extended to nurses meeting the study's criteria via the 2 hospitals' email system. At the third site, the contact person shared information about the study, and offered reminders to participate, at several unit meetings. Two weeks were allowed for data collection. For respondents who accessed the online survey, an email was sent 1 week after the initial invitation to thank those who had responded to the survey and to extend a second request to those nurses who had not responded.

Research Questions and Hypotheses

I examined whether selected factors were associated with critical care nurses' adoption of EBP. For the purpose of this study, the categorical dependent variable, EBP, was considered present when critical care nurses responded on the *clinical practice*

portion of the survey that they never use sterile normal saline prior to endotracheal suctioning. I explored particular factors through the following two research questions.

RQ 1. How do adopter characteristics, self-directedness in learning, education level, use of journals, use of electronic healthcare databases, and access to a research facilitator relate to each other?

RQ 2. What is the relationship between adopter characteristics, self-directedness in learning, education level, use of journals, use of electronic healthcare databases, access to a research facilitator, and the adoption of evidence based practice, as measured by critical care nurses' self-report that they do not use sterile normal saline prior to endotracheal suctioning?

The following hypotheses were derived from the research questions and were tested using inferential statistics.

$H1_0$: There is no significant relationship among adopter characteristics, self-directedness in learning, educational level, use of journals, use of electronic healthcare databases, and access to a research facilitator.

$H1_a$: There is a significant relationship among adopter characteristics, self-directedness in learning, education level, use of journals, use of electronic healthcare databases, and access to a research facilitator.

$H2_0$: There is no significant relationship between critical care nurses' adopter characteristics, self-directedness in learning, education level, use of journals, use of

electronic healthcare databases, access to a research facilitator, and the adoption of evidence based practice, as measured by critical care nurses' self-report of non-use of sterile normal saline prior to endotracheal suctioning.

$H2_a$: There is a significant relationship between critical care nurses' adopter characteristics, self-directedness in learning, education level, use of journals, use of electronic healthcare databases, access to a research facilitator, and the adoption of evidence based practice, as measured by critical care nurses' self-report of non-use of sterile normal saline prior to endotracheal suctioning.

The questionnaire created for this present study contained the research instruments that measured the variables within this study as well as a demographics section. Each variable and the instrument that measured the variable are presented next. The following 3 instruments were used with permission in this study.

Instrumentation

Three preexisting instruments were used to measure the variables in this survey research study: (a) Hurt et al.'s (1977) Scales for the Measurement of Innovativeness, (b) Oddi's Continuing Learning Inventory (OCLI, 1984, 1986), and (c) Schwenker et al.'s (1998) Suctioning Survey Questionnaire. These assessments and the variables the assessments measured are discussed in later paragraphs.

The above-mentioned instruments were incorporated into a questionnaire that was administered online through SurveyMonkey at 2 sites; respondents needed a computer to gain access to the Internet to complete the survey. At the third site, a paper questionnaire

was administered. A demographics section was included to gather information about age, gender, unit of practice, educational level, position held on the unit, plus years of nursing practice.

The two concepts of Rogers's (2003) diffusion of innovations theory that were incorporated into the questionnaire were knowledge of an innovation and characteristics of adopters. Knowledge of an innovation was operationalized as the sources of knowledge as outlined in the variables; specifically, formal knowledge sources (education) and informal knowledge sources (use of journals, use of electronic healthcare databases, and access to a research facilitator on the nursing unit). Assessing the characteristics of the *adopter*, rather than the characteristics of an *innovation* itself, was the concept of interest for this study. Rogers's adopter categories of innovator and early adopter describe characteristics, such as obtaining higher levels of education and using multiple sources of information, that reflect the chosen variables in this study. How these variables were measured is discussed in further detail in this section. Next, the instruments that I incorporated into this present study are discussed.

Scales for the Measurement of Innovativeness

Permission to use material from Hurt et al.'s Scales for the Measurement of Innovativeness (IS) was granted through Rightslink Copyrights Clearance Center, Inc., "Copyright (1977) Wiley; used with permission from (Hurt, Joseph, and Cook, Scales for the Measurement of Innovativeness, Human Communication Research, John Wiley & Sons, Inc.)."

Goldsmith (1986) called innovativeness "an elusive construct that is operationalized differently by various researchers" (p. 81). Goldsmith conducted two studies that assessed the convergent validity of the construct*, innovativeness*, by comparing four innovativeness scales: The Open Processing Scale (OPS, Leavitt & Walton, 1983), Innovativeness Scale (IS, Hurt, Joseph, & Cook, 1977), the Innovation subscale, which is part of the Jackson Personality Inventory (JI, 1976), and the Kirton Adaption-Innovation Inventory (KAI, Kirton, 1976). Reliability and validity coefficients for the four scales ranged from .28 to .81. Goldsmith (1986) found that even though innovativeness was approached differently in each of the above scales, the scales were measuring "similar or near similar traits" (p. 85).

Hurt et al.'s (1977) instrument was initially developed as a 53-item scale to measure the concept of innovativeness, which Hurt et al. saw as a personality contruct embodied in the idea of "willingness to change" (p. 59). Willingness to change contributes to the "adoption or rejection of new ideas" (Goldsmith, 1986) and as such, is an appropriate measure for this study. The instrument was pilot tested on 231 college students and 431 public school teachers. Through pilot testing, Hurt et al. reduced the instrument to a 20-item scale; the authors acknowledged that a 10-item version of the scale (containing the items that demonstrated the highest item-total correlations) could be used as a shortened version of the scale. The shortened version of the Innovativeness Scale contains 10 questions and items are measured using a 7-point Likert-type scale; question measurement ranges from 1 = *strongly disagree* to 7 = *strongly agree*. Several

items on the scale are reversed scored. Internal reliability for the shortened version was deemed "excellent (Nunnally's r = .89); its correlation with the 20-item innovativeness scale is .92" (p. 61). The brevity of the shortened version of the instrument, coupled its reliability, were the reasons the Innovativeness Scale was chosen for this study.

The Oddi Continuing Learning Inventory (OCLI)

Permission to use the 1986 OCLI material was granted through email correspondence as follows: "For the purposes of this research, a royalty-free copyright license for use of the OCLI was granted by Lorys F. Oddi" (Dr. L. F. Oddi, personal communication, July 29, 2010). Permission to use the 1990 OCLI material was granted through Rightslink Copyrights Clearance Center, Inc., "Copyright (1990) Sage; used with permission from (Oddi, Ellis, & Roberson, Construct Validation of the Oddi Continuing Learning Inventory, Adult Education Quarterly, Sage Publications.)."

The first and second most frequently used SDL assessment tools in dissertation studies from 1966-1991 were Guglielmino's (1977) Self-directed Learning Readiness Scale (SDLRS) and the OCLI (Oddi, 1984, 1986), respectively (Long, 1993). Straka (1996) noted that these assessments were the "two leading instruments" (p. 65) for evaluating readiness for learning. In selecting an instrument to measure the underlying construct of self-directedness, the interpretations from West and Bentley, Jr. (1991) and Gabrielle (2003) were helpful. West and Bentley, Jr. (1991) thought that the SDLRS detected "an enthusiasm or excitement for learning" as opposed to the OCLI's focus of "a

proactive approach to learning" (p. 76). Gabrielle (2003) thought that the SDLRS focused on the concept of readiness for learning in general, while the OCLI focused on lifelong learning. Three other things were considered in the decision process on which instrument to use for this present study: (a) availability, (b) length of the instrument, and (c) cost. Both questionnaires were readily available, but the SDLRS was 53-items versus 24-items for the OCLI. Although external scoring is available for both the SDLRS and the OCLI, there is a cost for the SDLRS instrument itself, whereas, I was able to obtain a non-fee license from Dr. L. F. Oddi to use the OCLI.

Oddi (1984, 1986) developed the Oddi Continuing Learning Inventory (OCLI) during her doctoral studies to measure self-directed continuing learning. Oddi's interest in SDL focused more on the "personality characteristics which impel an individual to continue learning over time through various means" (p. 7) rather than on the process or means by which one learns. She gleaned three concepts from the literature that helped to describe the personality characteristics of self-directedness: (a) *proactive drive versus reactive drive*, (b) *cognitive openness versus defensiveness*, and (c) *commitment to learning versus apathy or aversion to learning* (Oddi et al., 1990, p. 139-140). The particular concept, *cognitive openness*, is the construct useful to this present study; it shares a similarity with Rogers's (2003) adopter categories in that the characteristics of cognitive openness describes "openness to new ideas and activities, ability to adapt to change, and tolerance of ambiguity (Oddi, 1986, p. 99)."

Oddi was influenced by the work of Houle (1980) who believed that SDL was imperative to staying current in knowledge. The consensus of "numerous authors" (Oddi, 1987, p.21) was that being self-directed in learning was "a requirement for all adults in a rapidly changing, technologically complex society" (p. 21).

The leadership of two key nursing organizations, the American Association of Colleges of Nursing (AACN, 2002) and the National League of Nursing (NLN, 2003) recognized that the healthcare environment is part of this societal change. The AACN (2003) characterized the healthcare environment as changing "dramatically and rapidly" (para. 4), and the NLN has called for nursing education reform because of "significant changes in the healthcare system" (para. 1). In the current environment of healthcare change and technological development, it was of interest to me to explore what role self-directedness in learning might play in the adoption of EBP as the very concept of staying current and relevant in knowledge is embodied in self-directed learning.

Oddi et al. (1990) stated that the intent for developing the OCLI was to create an instrument to "identify the personality contruct, self-directedness in learning" (p. 139). The rudimentary study instrument contained 100 items. The pre pilot study instrument was reduced to 65 items that were then reviewed by a panel of three experts; one of the panel experts was described by Oddi as a professor who was "noted for his contribution in the area of self-directed learning" (1984, p. 90). The members of the expert panel were asked to evaluate the item questions against the three dimensions of proactive drive versus reactive drive, cognitive openness versus defensiveness, and commitment to

learning versus apathy or aversion to learning, to determine if the chosen item questions accurately and completely represented the described concepts.

Oddi conducted pre pilot and pilot studies of her instrument. The resultant OCLI, containing 26 items, was used for the validation study to determine discriminate and convergent validation of the instrument. Oddi used Litchfield's (1965) Leisure Activity Survey (LAS), which actually measures the degree in which adults choose to participate in educational activities, to validate the Commitment to Learning dimension. Rotter's (1966) Internal-External Scale (I-E Scale), which measures differences in locus of control, was used to validate the Cognitive Openness dimension. Four subscales of Gough and Heilbrun's (1983) Adjective Check List (ACL) were used to describe personality characteristics; the ACL Self-Confidence subscale was used to validate the Proactive Drive dimension. Because the literature did not support that intelligence or intellectual achievement were associated with being self-directed in learning (Chickering, 1964; Gunzburger, 1980), the Shipley Institute of Living Scale (SILS) was chosen to measure adult intelligence in order to provide discriminate validity.

Oddi administered the 26-item instrument to 271 graduate students in law (n=110), adult education (n=83), and nursing (n=78). During analysis for reliability, two items failed to load (criterion $\geq$ .50) to any factor and were eliminated. Analysis of the remaining 24 items showed an internal consistency (alpha) of .875; test/retest reliability was .893. Three factors were identified through oblique rotation that accounted for 45.7% of total variance. Factor 1, *A General Factor*, contained 15 items that related to the

proactive vs. reactive dimension, and accounted for 30.9 % of the variance.

Factor II, *Ability to be Self-regulating*, contained three items that explained 8 % of the variance; Factor III, *Avidity for Reading* (four items) accounted for 6.8% of the variance. The range of scores was 44 to 161 (minimum and maximum possible, 24 and 168, respectively). The normative mean score was 123.627, median score was 126, with a standard deviation of 19.026. Validity was established by using total OCLI scores. Scores on the OCLI were significantly correlated with scores on the LAS ($r = .363$, $p < .004$). Scores on several of the ACL subscales also showed significant correlation with the OCLI: ACL-S-Cfd, ($r = .551$, $p < .0001$); ACL-End, ($r = .539$, $p < .0001$); ACL-Aff ($r = .265$, $p = .04$) which were indicative of convergent validity. Discriminate validity was given when no significant correlation of scores ($r = .040$, $p < .754$) between the OCLI and SILS were found. Next, Oddi conducted a study with colleagues Ellis and Roberson (1990) to assess construct validity of the OCLI.

For the 1990 study, Oddi et al. chose the Job Activity Survey (JAS, Bevis, 1972) to accomplish the following. Oddi et al. (1990) wanted to measure the relationship between total scores on the JAS and the OCLI instrument, to explore the relationship between the OCLI and voluntary attendance (the dependent variable was "voluntary attendance at continuing education programs" [p. 143]), and to determine whether OCLI scores and scores on the JAS subscales correlated. The JAS (1972) was developed by Bevis to assess registered nurses' participation in job-related learning and was later revised by Cervero and Dimmock (1987) to include Houle's (1980) three modes of

learning (i.e., inquiry, instruction, and performance). The findings from Cervero and Dimmock's study yielded results that separated Houle's mode of instruction into two distinct factors: self-instruction and group instruction, thus producing the four factors of *learning through inquiry*, *performance*, *self-instruction*, and *group instruction*.

A questionnaire was distributed to a convenience sample of 256 nurses; 129 questionnaires were returned for a response rate of 50.4%. Scores ranged from 53 to 158, with a mean of 126.1. Findings showed no correlation between the OCLI or JAS scores and demographic variables. The Inquiry subscale's reliability was .75, the Performance subscale, .87, Self-instruction subscale, .74, and Group Instruction subscale, .74. No correlation existed between the OCLI scores and voluntary attendance, but significant positive correlation ($p < .001$) was shown between the total scores on the OCLI and the JAS instruments. For the subscales of Inquiry, Performance, and Self-instruction, scores were significantly correlated at $p < 0.21$, $p < .035$, and $p < .001$, respectively. Cronbach's alpha for the OCLI and the JAS was .90 and .89, respectively, suggesting convergent validity of the OCLI's ability to appraise "self-directed continuing learning among nurses" (p. 144), although Oddi et al.(1990) did acknowledge that the strength of the relationship was low ($r = .33$).

Six's (1989) study looked at the three factors that Oddi (1984, 1986) generated from her initial work in developing an instrument to measure SDL. Six was interested in evaluating whether the OCLI was generalizable, that is, whether its measures maintained stability using different samples. Six used Gorsuch's (1983) three-sample model;

Gorsuch's stance was that factor scores between samples could not be directly correlated. He suggested applying the factor-score coefficients of the two samples selected for comparison to a third sample, then if an obtained correlation is high, "it implies a factor match" (Gorsuch, 1983, p. 289). Alpha was set at .90 because Gorsuch recommended the higher value to help minimize the possibility of "chance related factors" (Six, 1989, p. 45).

The three samples that were used came from Oddi's (1984) initial sample (*n*=271), Landers's (1989) dissertation that compared the OCLI to Guglielmino's (1977) Self-directed Learning Readiness Scale (SDLRS); sample size for Landers's study using adult education students was (*N*=98), and Six's (1989) study sample (*n*=328) of students majoring in business administration and secretarial science.

Due to the smaller sample size, Landers's factor scores were calculated as *z* scores. Six's results did not yield evidence that the three factors were related as Oddi maintained in her 1984 study perhaps due to the oblique factor analysis that Oddi used. Six did derive the same factors as Oddi had in her study, although other smaller inter-factor correlations were noted. Six suggested using orthogonal rotation rather than oblique rotation analysis for future studies. The findings did support the stability of the OCLI across samples; covariance for Factor I was .99, Factor II, .96, and Factor III, .93, which implies, as Six acknowledged, that Oddi's three factors "replicate across populations" (p. 50). The OCLI had been used with nursing, law, education, business,

and secretarial science students; Harvey, Rothman, and Frecker's (2006) study sample used undergraduate medical students.

The OCLI underwent confirmatory factor analysis, as suggested by Oddi (1984, 1986) and Six (1989), by Harvey et al. (2006) using a sample of 250 undergraduate medical students. Harvey et al.'s study incorporated oblique factor analysis as well as, using Six's suggestion of applying orthogonal rotation for exploratory factor analysis of the OCLI. Statistical test measures used for exploratory factor analysis were the "chi-square/degrees of freedom ratio, incremental fit index, standardized root mean square residual, and the chi-square goodness-of-fit test" (p. 192). The goodness-of-fit test was chosen for confirmatory factor analysis to obtain the degree of fit between the oblique and orthogonal data.

Some findings were: the mean OCLI score was 126.1, comparable to Oddi's 123.6, standard deviation was 13.4, compared to Oddi's 19.0., and Cronbach's alpha was .66 compared to Oddi's .87. Harvey et al.'s (2006) findings also showed a three-factor solution agreeing with Oddi's (1984, 1986), although their confirmatory factor analysis indicated a "four-factor, obliquely rotated solution as the simplest and most interpretable for this set of student responses" (p. 197). Harvey et al.'s four-factor solution reflected the OCLI's three dimensions and strengthened Oddi's (1986) assumption that the self-directed continuing learner's personality characteristics would be "interrelated and mutually reinforcing" (p. 99). Oblique, rather than orthogonal testing, offered a better fit for the data, contrary to what Six (1989) had thought. Harvey et al. stated that Oddi's

"guiding dimensions are quite similar" (p. 199) to the constructs presented in SDL models (Boekaerts, 1999; Garrison, 1997; Zimmerman, 2000) developed subsequent to the OCLI. Some of these similar concepts were the inclination to begin and continue learning, internal and external controls, and social and environmental considerations in the learning process. Although there are similarities, one weakness of the OCLI, which Harvey et al. (2006) and Six (1989) mentioned, was the OCLI's coefficient measurement of less than 50%; both suggested further refinement and testing of the instrument. Oddi (1986) acknowledged this as well in her initial development of the instrument and advised that the "OCLI is a valid instrument when used in its entirety" (Oddi, 1986, p. 104).

The OCLI has been used with varied populations, among them education, nursing, law, and medical students. Overall, the OCLI has been shown to be valid and replicable across different samples of learners (Bartlett & Kotrlik, 1999; Harvey et al., 2006; Oddi et al., 1990; & Six, 1979).

Suctioning Survey Questionnaire

Permission to use and modify as needed, the Schwenker, Ferrin, and Gift (1998) Suctioning Survey Questionnaire was granted through email correspondence (Dr. A. Gift, November 2, 2008).

Schwenker et al. (1998) developed a questionnaire to assess nurses' and respiratory therapists' knowledge and use of normal saline prior to suctioning. Schwenker et al. reviewed the literature on the use of saline before suctioning to gain understanding

of the "indications for use…myths associated with instillation of saline, and advantages of using saline" (p. 257). The questionnaire was specifically designed to assess what knowledge nurses and respiratory therapists had about the literature and to ascertain what practices existed in regards to saline use. The concise survey consisted of five questions about how often saline was used and the reasons for respondents' use of saline before suctioning. One demographic question was included in the survey; the question pertained to the unit in which the respondent worked but this information was not reported in the findings. Content validity was provided through three nurses with expertise in endotracheal suctioning practices reviewing the questions. The instrument was also pilot tested with 10 nurses to check for clarity of the questions and revised accordingly.

IRB and managerial approval from nursing and respiratory therapy department managers was obtained. Paper questionnaires were given to 322 nursing and respiratory therapy staff. Total response rate was 58% (n=187); of the respondents, 138 were nurses and 49 were respiratory therapists.

Schwenker et al. presented the study findings in tables. All obtained data were at the nominal level, therefore, Schwenker et al. used chi-square for analyses. Although not explicitly stated in the study purpose or design, nurses' responses were compared with respiratory therapists' responses. Some findings were as follows: 64% of nurses reported rarely using saline compared to 71% of respiratory therapists (chi-square = 52.9, p <.01). Overall, the results for frequency of saline use by nurses were 18 (13%) *never*, 88

(63.8%) *rarely*, 26 (18.8%) *frequently*, 2 (1.5%) *always*, and 4 (2.9%) in the category of *other*. While 88 nurses (63.8%) did report rarely using saline, it would have been helpful to know what frequency *rarely* represented to them. The most frequently chosen reason by both nurses and respiratory therapists chose for using saline was for thick secretions; 118 nurses (85.5%) and 44 respiratory therapists (89.8%) chose that response (chi-square=4.4, $p<.05$). Benefits of saline instillation chosen most frequently was retrieval of more secretions; this response was chosen by 102 nurses (74%) and 31 respiratory therapists (63%). One hundred and thirty-two (41%) of all respondents selected patient comfort as the main adverse effect of saline use. Nurses identified oxygen saturation and risk of pulmonary infection as adverse effects more often than respiratory therapists did (chi-square=5.4, $p<.05$ and chi-square 22.5, $p<.01$, respectively).

It is the conclusion of Schwenker et al. (1998) that, "Questions have been raised for more than two decades about the comfort, efficacy, and safety of instilling saline into artificial airways" (p. 258) therefore, "healthcare providers should question…whether instillation of normal saline should be occurring at all" (p. 259). The practice continues as noted by direct observation and as reported in the literature (Halm & Krisko-Hagel, 2008; Rauen et al., 2008). Therefore, the Survey Suctioning Questionnaire was useful to this study as a means to solicit information about critical care nurses' knowledge and use of endotracheal suctioning practice with the specific point of interest being the use of saline prior to endotracheal suctioning.

Data Collection and Analysis

This survey research design used logistic regression analysis. According to Rubin (2008), the use of multivariate statistical analysis can "offset problems connected to representativeness" (external validity, p. 190). Logistic regression analysis was used to determine if relationships existed among the independent variables of adopter characteristics, self-directedness in learning, education level, use of journals, use of electronic healthcare databases, access to a research facilitator on the unit, and critical care nurses' adoption of EBP. Logistic regression was used because the dependent variable, adoption of EBP, is categorical (dichotomous); however, the independent variables may be continuous or categorical (Hair et al., 2006). Field (2009) outlined the theoretical assumptions of logistic regression: "(a) there is a linear relationship between continuous independent variables and the logit of the outcome variable (linearity), (b) data cases will not be related (independence of errors), and (c) independent variables will not be too highly correlated [multicollinearity]" (p. 273). Typically, what is checked prior to analyzing data for logistic regression are tests for multicollinearity and outliers.

All data analyses were performed using SPSS version 19; the formula for logistic regression is as follows:

$z = b_0 + b_1X_1 = b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_{6...}b_kX_k$, where z describes the log odds of the dependent variable, b_0 is the constant (parameter estimates), and X represents the dependent variables, with k denoting the possibility of multiple independent variables (Garson, 2010). This study contained six independent variables. SPSS version 19

incorporates several tests of significance within its data analysis program in which to test the assumptions of the regression model. The SPSS version 19 program uses the Omnibus Tests of Model Coefficients to indicate how efficiently the regression model delivers results before the entry of predictors; significance values of less than .05 are desired for this test (Pallant, 2010). The Hosmer-Lemeshow Goodness-of-Fit Test is used to assess whether the expected frequencies and the observed frequencies coincide as determined by a preselected probability; for this test, Kinnear and Gray (2010) suggested a statistical value of greater than .05 is desired. Next, a Model Summary is given which contains the pseudo *r*-squared tests, the Cox & Snell $R^2$and the Nagelkerke R^2, which both measure the null model before the independent variables are fitted into the model. These tests help to explain the variability that is contributed by the independent variables (Kinnear & Gray, 2010). While the SPSS program uses both of these tests in its statistical analysis, the advantage of the Nagelkerke R^2 over the Cox & Snell R^2 is that the Cox & Snell R^2 cannot reach the theoretical maximum of 1, while the Nagelkerke R^2 test can (Field, 2009). The Wald statistic, which is a chi-square distribution, is also used in SPSS output and is useful for assessing individual predictor contribution to the model. The Wald statistic determines whether "the *b* coefficient for a particular predictor is significantly different from zero" (Field, 2009, p. 270).

For this study, EBP was measured by nurses' response of *never* to the survey question "Do you instill sterile normal saline prior to endotracheal suctioning?" Two independent variables, adopter characteristics and self-directedness in learning, were

measured through obtaining the mean of the scores on the Innovativeness Scale and the OCLI, respectively. The education variable was an ordinal measurement, categories included on the questionnaire were licensed practical nurse (LPN) or licensed vocational nurse (LVN), associate degree in nursing (ADN) or associate of science in nursing (ASN), baccalaureate in nursing (BSN), master of nursing (MSN) or master of science (MS), and doctorate. The independent variables of use of journals, use of electronic healthcare databases, and access to a research facilitator on the unit were dichomtomously measured. Significance level for the logistic regression analysis was acceptable at $p > .05$ and power analysis at .80.

Demographic data, such as years on the job, age, gender, and unit of practice were collected from the respondents, as well. The nominal data were analyzed using descriptive statistics such as frequencies, to describe sample characteristics. Data analysis tables are located within the Results section of this document.

Protection of Human Participants

I gained approval to conduct the study from the Institutional Review Boards (IRBs) of Walden University and the participating hospitals before data collection began. The Walden University IRB approval number is 05-26-11-0057286. A consent form and brief explanation of the study were provided to the participants at the beginning of the survey. Participation in the study was anonymous; no personal information that could identify respondents was collected or stored. Collected data are stored on a flash drive

and will be kept in a fireproof lockbox for a minimum of 5 years in accordance with Walden University's research guidelines.

Dissemination of Study Findings

Study findings will be initially shared with staff in the participating units. I am an ex-officio for a local nursing consortium that supports and disseminates research findings throughout the northern part of the state where I live; it is anticipated that this will be an additional venue for the dissemination of findings.

Summary

Section 3 explained the method and rationale for the research design, the setting, sample, and instrumentation. Section 3 also contained the research questions and a description of the data collection and analysis of variables, as well as, a plan for the dissemination of study findings. An explanation of human participant safeguards was also provided. Section 4 contains information related to the data analysis process.

Section 4: Results

The purpose of the study was to examine whether the independent variables of adopter characteristics, self-directedness in learning, education level, use of journals, use of electronic databases, and access to a research facilitator are associated with nurses' adoption of EBP. The dichotomous dependent variable, EBP, was measured as the likelihood that nurses report that they do or do not use sterile normal saline prior to endotracheal suctioning.

Details related to population and sampling, data collection, descriptive statistics that describe participant demographics, use of knowledge sources, and endotracheal suctioning practices are presented next. The analysis of the scales used in the study follows, along with a discussion that includes the parametric testing and logistic regression analyses that were conducted to address the research questions and hypotheses; the section concludes with a summary of study findings.

Population and Sampling

The accessible population consisted of 126 nurses employed in critical care, cardiovascular recovery, and progressive care units at three hospital sites. Hair et al. (2006) observed that obtaining an appropriate sample size is necessary to measure adequately the study variables, and to determine statistical significance and power. Using MaCorr Research, Inc. (2010) software, with a population of 126, using a confidence level of 95%, and a confidence interval of .05; the desired sample size was determined to be 95; the suggested sample size was met, as 99 completed surveys were obtained.

An invitation to participate in the study was extended via the respective hospital's email system to the nurses who met the study's criteria at the two sites where the nurses had access to the web-based SurveyMonkey questionnaire. A subsequent email was sent 1 week after the initial invitation to thank those who had responded to the survey and to extend a second request to those nurses who had not responded. At the third site where the paper surveys were administered, a contact person extended the invitation and reminder for study participation at several unit meetings.

A flash drive containing the electronic survey responses along with the hard copies of the paper survey results will be stored in a fireproof lockbox for 5 years in accordance with Walden University policy.

Data Collection

During 2 weeks in the summer of 2011, 126 nurses at three hospital sites were invited to participate in the study. The study was administered at two hospitals through SurveyMonkey; the third hospital site preferred that a paper survey be administered. The Walden Institutional Review Board (IRB) granted permission for the requested survey administration change at the third site. Two surveys were excluded from the 101 received due to respondents' reports of never having performed endotracheal suctioning; this reflected a net response rate of 78.6%.

Descriptive Statistics of Categorical Variables

The following is a description of the frequencies and percentages for gender, age, education level, years of nursing practice, primary position, practice setting, and

participants' use of knowledge sources.

Participant Demographics

The data were entered into SPSS 19.0. Ninety-nine participants took part in the study. The majority of the participants were female (88.9%). There was a wide age range for participants, with the majority between 40 and 59 (54.6%). There were 48.5% of the participants who reported having a BSN degree. No respondents reported having a doctoral degree; therefore, this category was excluded from analysis. Approximately 34% of the participants had 21 or more years in nursing experience. The participants were primarily staff nurses (88.9%) practicing in the ICU (66.7%). Frequencies and percentages for gender, age, education level, and years of nursing practice, primary position, and practice setting are presented in Table 1.

Table 1

Frequencies and Percentages for Participant Demographics

Demographic	*n*	%
Gender		
Female	88	88.9
Male	11	11.1
Age		
20-29	12	12.1
30-39	22	22.2
40-49	28	28.3
50-59	26	26.3
60 or above	11	11.1
Education Level		
LPN or LVN	8	8.1
ADN or ASN	38	38.4
BSN	48	48.5
MSN or MS	5	5.1
Years of Nursing Experience:		
1-5	21	21.2
6-10	11	11.1
11-15	19	19.2
16-20	14	14.1
21 or more	34	34.3
Primary Position		
Staff Nurse	88	88.9
Charge Nurse	8	8.1
Unit Supervisor	2	2
Other	1	1
Practice setting		
ICU	66	66.7
SICU/CCU	7	7.1
PCU/ACUTE CARE	26	26.3

Note. $n = 99$

The majority of the approximately 3 million registered nurses in the United States are women (slightly under 94%); men comprise a little less than 6% of the nursing population (HRSA, 2010). While the current study's age range was widely spread out, the majority of the nurses (54.6%) were in the age range of 40 through 59. The national average of the registered nurse in the United States is 47 years (HRSA, 2010).

The American Association of Critical Care Nurses is a representative organization for approximately 500,000 critical care nurses and has a membership of about 80,000 (AACN, 2011). The organization compiles information about constituent demographics every year or so; the most recent data available is from 2010. The data obtained from this current study closely reflect statistics obtained from the membership data of the AACN nurses. As of January 2010, there were approximately 84,000 AACN members; it is estimated that between 88% to 94% of the members supplied demographic information for gender, area employed, primary position, years of experience, and age, although it is noted that age is reported somewhat less frequently (L. Fertado, personal communication, November 2, 2011). Sixty percent of the nurses who provided demographic information to AACN were between the ages of 40 and 59, with 21 or more years of nursing experience (25%), and practicing at the bedside (67%) in intensive care units (18%). Forty-seven percent of AACN members reported having a BSN degree. The gender breakdown for AACN members was female (89%) compared to male (11%), which mirrors the gender data obtained from the current study.

Demographic nursing data collected in 2008 by the U. S. Department of

Health and Human Services (HHS) through HRSA (2010) reflected that male nurses comprised 6.6% (n = 33,179) of the sample. That this percentage is almost doubled in the current study most probably is accounted for by the extremely large difference between samples sizes of the two studies (n = 33,179 vs. n = 99). The BSN accounted for 47.2% of nursing degrees, followed by 37.2% for the ADN, which closely reflects the findings of the current study. The average age for nurses in the HRSA (2010) study was 47; the largest age range group identified by HRSA was 50-54 (16.2%), followed by 45-49 and 40-44 (14.4, 11.4, respectively). The age of the nurse becomes important when viewed as an indicator of how long the nurse may be from the initial nursing program, especially when considering that information learned in nursing school could be one of the primary knowledge sources the nurse relies upon (Squires et al., 2007). HRSA stated that 40.9% of surveyed nurses (n = 33,179) graduated from an initial nursing program in 1984 or earlier. Approximately 20% of the nurses reported returning to complete higher degrees. The average length of time between graduating from the initial associate degree nursing program and obtaining a BSN degree was 7.5 years; there was an average gap of 8.2 years when going from the BSN to the MSN degree level. Squires et al.'s (2007) study, which surveyed 464 advanced practice nurses, reported an average of 12.5 since respondents reported completing an educational program prior to participating in that study. The years between initial licensure and obtaining a subsequent degree becomes important when considering how current the nurse's knowledge base may be. However, educational degree is only one factor in the continuing education

equation, because even though a terminal degree may be obtained, the need for updated knowledge continues throughout one's career.

As recognized by the American Nurses Association (ANA, 2001), "Continuing professional growth, particularly in knowledge and skill, requires a commitment to lifelong learning. Such learning includes, but is not limited to, continuing education, networking with professional colleagues, self-study, professional reading, certification, and seeking advanced degrees" (sec 5.2).

Using additional knowledge sources, such as journals and databases, may be a vital part of the process of staying current in knowledge and best practices. Next is a description and frequencies of the knowledge sources that the respondents reported using.

Participant Use of Knowledge Sources

The majority of the participants *sometimes* use journals (53.5%), 22.2% use journals *often,* and 82.8% have access to healthcare databases through either home or work. Slightly more than half of the participants do not have access to a research facilitator (55.6%). Frequencies and percentages for participant use of the knowledge sources of journals, healthcare databases, and research facilitator are presented in Table 2.

Table 2

Frequencies and Percentages for Participant Use of Knowledge Sources

Knowledge Source	*n*	%
Use of Journals		
Never	7	7.1
Rarely	17	17.2
Sometimes	53	53.5
Often	22	22.2
Use of Healthcare Databases		
No	17	17.2
Yes	82	82.8
Access to research facilitator		
No	55	55.6
Yes	44	44.4

Note. $n = 99$

The question related to journal use asked participants how often they read nursing journals; for the current study, 53% of respondents reported reading journals every 2 to 3 months and 22% read journals monthly. Additional interest to me, however, was whether or not the units where the participants worked had a journal club. The overwhelming response to the question "Does your unit have a journal club?" was *no* (98%). The literature revealed that journal clubs, and by extension, journals, might be used to "bridge the gap between research and practice" (Goodfellow, 2004, p. 107) through supplying nurses with current information (Luby et al., 2006; Pravikoff et al., 2005). Additionally, participation in a journal club might help nurses to learn to critically review and critique research studies (Dyckoff, Manela, & Valente, 2004). The journal club is also seen as a "medium to educate clinicians about the process of EBP" (Lizarondo et al., p. e-17). The journal club appears to be an underutilized information resource for nurses; it could be helpful in supporting those nurses who reported never or rarely using journals (24.3%). For this current study, use of journals was not a significant predictor of non-use of sterile normal saline (B = -0.01, p =.983*)*. Further research is needed to explore how the nurses who do read journals effectively use this resource to apply findings to clinical practice.

Eighty-two (82.8%) of the respondents reported accessing electronic healthcare databases with 33.3% reporting using databases *sometimes* (2-3 times per year) and 30.3% using databases *often* (4 or more times per year). Although slightly under 64% of nurses reported using electronic healthcare databases at least 2 or more times per year,

there was not a significant relationship (B = -0.89, p = .111) between use of electronic databases and non-use of sterile normal saline.

Twenty-one of the 44 nurses who identified having access to a research facilitator reported using this resource often (47.7%), while sixteen reported using the research facilitator sometimes (36.4%). The level *sometimes* was rated as accessing the research facilitator 2 to 3 times per year and the level *often* was rated as 4 or more times per year. Frequencies and percentages for research facilitator assistance with EBP questions are presented in Table 3.

Table 3

Respondents Report of Research Facilitator Assistance with EBP Questions

	Level	*n*	%
Valid	1.00 never	3	6.8
	2.00 rarely	4	9.1
	3.00 sometimes	16	36.4
	4.00 often	21	47.7
	Total	44	100.0

Note. n = 44

The concept of facilitator could be seen as important as, of those nurses who identified having a research facilitator available ($n = 44$), 84.1% of those nurses responded that they access a research facilitator as a source to answer practice questions. Along with education level, which will be discussed under logistic regression, use of the research facilitator was a statistically significant predictor ($p < .001$) of critical care nurses classification into the group that did not use sterile normal saline prior to endotracheal suctioning. One reason that the research facilitator may be important to the knowledge adoption process is that there are "exponential increases in healthcare knowledge"… (Hamric, 2002, p. 68). As stated by Kavan (1998), "Knowledge for the sake of knowledge is self-defeating. Knowledge that can be applied…is critical" (p. 22). One of the monumental tasks in sharing knowledge so that it can be applied to practice involves the process of (a) searching for the best evidence, (b) narrowing the results to useable information, (c) critiquing the information, and (d) deciding the best formats for disseminating the information (Schulmeister & Vrabel, 2002; Stetler, 2001). The findings of the present study suggest the research facilitator may be perceived by nurses as a vital link in this process.

Rycroft-Malone et al. (2002) expressed in regards to the role of facilitation that, "You need champions out there" (p. 40). The research facilitator can be the strategically positioned professional, with the necessary skill set, to help staff apply updated knowledge to practice (Harvey et al., 2002; Milner et al., 2005).

Clinical Practice

The focus of this study related to the particular clinical practice of instilling sterile normal saline prior to endotracheal suctioning. Therefore, an in depth discussion of endotracheal suctioning practices is outside the scope of this work. Best practice guidelines will be mentioned briefly for context. A complete list of the guidelines may be obtained from the American Association of Respiratory Care (AARC, 2010) website.

Recommendations for best practice guidelines for endotracheal suctioning of adults with artificial airways are outlined by the AARC (2010). The AACN (2010) adopted these guidelines for use in development of EBP for critical care nurses. Based on the AARC recommendations, basic best practice guidelines for endotracheal suctioning, overall, is that it should no longer be performed as a set routine, but only when necessary. Hyperoxygenation may be performed based on the patient's presuctioning status; for the current study, 38% of nurses reported using hyperoxygenation if the biox measurement was less than 90% and 47.5% reported always using hyperoxygenation prior to the suctioning event. In 1993, the AARC advised that saline instillation could be used "if desirable" (AARC, Respiratory Care, 1993, p. 502). An update to this practice occurred in 2010 based on reviewing data from 114 clinical trials and 6 meta-analyses conducted between 1990 and 2009. The updated recommendation from the AARC in 2010 was based on "the great majority of the references used to update this guideline indicate that normal saline instillation is unlikely to be beneficial, and may in fact be harmful; therefore, saline should not be routinely instilled prior to performing endotracheal

suctioning" (p. 759).

Endotracheal Suctioning

Respondents were asked six questions related to the clinical practice of endotracheal suctioning:

1. Have you ever performed endotracheal suctioning?

2. Do you use hyperoxygenation prior to endotracheal suctioning?

3. Which most accurately describes your clinical practice related to the use of hyperoxygenation?

4. How often do you use sterile normal saline prior to endotracheal suctioning?

5. What is your knowledge of the benefits of saline instillation prior to endotracheal suctioning?

6. Saline instilled prior to endotracheal suctioning has adverse effects on what patient parameters?

The first question was asked to identify any respondents from the study who have never performed endotracheal suctioning. One hundred and one surveys were returned; two respondents were eliminated based on a *no* response to this question. The answer option for question 2 was either *yes* or *no*, and the majority of the participants responded that they use hyperoxygenation prior to suctioning (84.8%). Question 3 related to saline use: How often do you use sterile normal saline prior to endotracheal suctioning? The majority of the participants never use saline prior to suctioning (57.6%), which is an encouraging finding, as the majority of the literature does not support the use of sterile

normal saline prior to endotracheal suctioning. Frequencies and percentages for questions 2 and 3 are presented in Table 3. Question 3 is also the basis for the dependent variable measurement and will be discussed in more detail in the logistic regression portion of this section.

Question 5 asked respondents to share their knowledge of the benefits of saline instillation: (a) *no benefits*, (b) *stimulation of cough*, (c) *retrieval of more secretions*, and (d) *thins* (i.e., liquifies) *secretions*. The final question offered multiple selection for the patient parameters that saline instillation might have adverse effects upon. The choices were: (a) *no adverse effects*, (b) *oxygen saturation*, (c) *blood pressure*, (d*) heart rate*, (e) *lower lung parenchyma*, (f) *patient comfort*. Questions 2 and 3 are not all-inclusive related to endotracheal suctioning best practices but were included in the survey as informational gathering questions, and to make it less obvious what was actually being measured in this part of the survey to avoid participant bias. The primary interest for this section was to gather information related to nurses' practice of using sterile normal saline prior to endotracheal suctioning. Questions 4, 5, and 6 were adapted with permission from Schwenker et al.'s (1998) Suctioning Survey Instrument. Frequencies and percentages for participant endotracheal suctioning practice and for participant knowledge and practice of endotracheal suctioning are given in Tables 4 and 5, respectively.

Table 4

Frequencies and Percentages for Participant Endotracheal Suctioning Practice

Clinical Practice	*n*	%
Do you use hyperoxygenation prior to suctioning?		
No	15	15.2
Yes	84	84.8
Use of saline prior to suctioning		
Never	57	57.6
Rarely	0	0
Sometimes	23	23.2
Often	8	8.1
Always	11	11.1

Note. $n = 99$

Table 5
Frequencies and Percentages for Participant Knowledge and Practice of Endotracheal Suctioning (ETS)

Variable	Level	Frequency	%
Which most accurately describes your clinical practice of hyperoxygenation?	I only perform hyperoxygenation if specifically ordered	7	7.1
	I never perform hyperoxygenation before suctioning	8	8.1
	I only perform hyperoxygenation if biox < 90%	38	38.4
	I always perform hyperoxygenation before suctioning	47	47.5
Your knowledge of the benefits of saline instillation are (check all that apply):	No benefits	24	24.2
	Stimulation of cough	13	13.1
	Retrieval of more secretions	39	39.4
	Thins secretions	58	58.6
Saline prior to ETS has adverse effects on (check all that apply)	No adverse effects	17	17.2
	Oxygen saturation	44	44.4
	Blood pressure	18	18.2
	Heart rate	27	27.3
	Lower lung parenchyma	41	41.4
	Patient comfort	61	61.6

Note. $n = 99$. The cumulative percent for the items with the prompts: *Your knowledge of the benefits of saline instillation are (check all that apply)* and *Saline instilled prior to endotracheal suctioning has adverse effects on (check all that apply)* do not add up to 100% because participants were able to select more than one option.

Next, statistics related to the study scales, Hurt et al.'s (1977) Scales for the Measurement of Innovativeness (IS) and Oddi's Continuing Learning Inventory (OCLI, 1984, 1990) are presented.

Statistical Analyses of Study Scales

Scales for the Measurement of Innovativeness

Adopter characteristics were assessed using the 10-item version of Hurt et al.'s Scales for the Measurement of Innovativeness (IS). An adopter characteristics score was created by taking the mean of survey questions 7 through 16. Adopter characteristics mean scores ranged from 4.00 to 6.40 (M = 5.44, SD = 0.61). Hurt et al. reported an internal reliability for the 10-item scale (Nunnally's r = .89); the Cronbach alpha for the present study was r = .70.

Oddi's Continuing Learning Inventory

Participants' personal perceptions of self-directedness in learning were measured using Oddi's Continuing Learning Inventory (OCLI, 1984, 1990). A SDL score was created by taking the mean of survey questions 18 through 40. SDL mean scores ranged from 3.83 to 6.71 (M = 5.47, SD = 0.55). The normative scores for the OCLI using 271 graduate students in law (n=110), adult education (n=83), and nursing (n=78) were a mean score = 123.6, with a standard deviation = 19.0, and a range = 117; Cronbach alpha was .875. The mean score for the current study using critical care nurses (n = 99) was 131.2, with a standard deviation of 13.2, a range of 63; Cronbach alpha was .74. The scores for the critical care nurses were clustered within a narrow range, suggesting

that this group, as a whole, is highly self-directed.

According to George and Mallery's guidelines (2003), both scores had an acceptable reliability of .70 or over. Reliabilities, means, and standard deviations for adopter characteristics and SDL are presented in Table 6.

Table 6
Reliability, Mean, and Standard Deviation for Adopter Characteristics and Self-Directed Learning

Score	Number of items	Cronbach's α	*M*	*SD*
Adopter characteristics	10	.70	5.44	0.61
Self-directed learning	24	.74	5.47	0.55

Note. Minimum and maximum scores for adopter characteristics were 40 and 60, respectively. Minimum and maximum scores for SDL were 92 and 161, respectively.

The following analyses addressed the study's research questions and hypotheses and included parametric testing and logistic regression analyses. A Pearson correlation was conducted between the continuous variables and point biserial correlations were conducted for dichotomous variables for research question 1 and its related hypotheses. Logistic regression analysis was performed for research question 2 and its related hypotheses.

Prior to analyzing the research questions and hypotheses, data hygiene and data screening were undertaken to ensure the variables of interest met appropriate statistical assumptions. Thus, the following analyses followed a similar analytic strategy in that the variables were first evaluated for integrity and continuity of data. Subsequently, frequency statistics and correlation analyses were run for H_1 to determine if any relationships existed between variables of interest. Finally, logistic regression was run to test if any of the variables were predictive of the non-use of sterile normal saline prior to endotracheal suctioning among critical care nurses. The assumptions of logistic regression analysis will be discussed just prior to presenting the statistical analysis of research question 2.

Research Questions and Hypotheses

The overarching research question for this study was as follows: What personal characteristics and knowledge sources are associated with the adoption of evidence based practice, as measured by the non-use of sterile normal saline prior to endotracheal suctioning among critical care nurses? I addressed this general question by exploring

particular factors through the following two research questions and corresponding hypotheses.

Research Question 1 and Hypothesis

RQ 1. How do adopter characteristics, self-directedness in learning, education level, use of journals, use of electronic healthcare databases, and access to a research facilitator relate to each other?

$H1_0$: There is no significant relationship among adopter characteristics, self-directedness in learning, educational level, use of journals, use of electronic healthcare databases, and access to a research facilitator.

$H1_a$: There is a significant relationship among adopter characteristics, self-directedness in learning, education level, use of journals, use of electronic healthcare databases, and access to a research facilitator.

A correlation matrix was constructed of Pearson and point biserial correlations from adopter characteristics, self-directedness, education level, use of journals, use of healthcare databases, having a research facilitator, and the non-use of sterile normal saline to examine Research Question and Hypothesis 1. Education level was considered an interval level variable as the levels of degrees are spaced out in equal intervals for the amount of time it takes to receive them. Equal intervals of 1.5 years were selected to represent the estimated time of completion for each degree program. The licensed practical or vocational nursing degree (LPN, LVN) was estimated to take 1.5 years, associate degree or associate of science in nursing (ADN, ASN) was estimated at 3 years,

baccalaureate in nursing (BSN) was estimated at 4.5 years, and master of science (MS) or master of science in nursing (MSN) was estimated at 6 years. Use of journals and use of healthcare databases was dichotomized to be 0 = *never, rarely* and 1 = *sometimes, often*. Use of sterile normal saline was dichotomized into 1 = *never* and 0 = *rarely or more*. A Pearson correlation was conducted between the continuous variables. Point biserial correlations were conducted for any dichotomous variables.

The assumption of multicollinearity was tested by calculating correlations between the predictor variables. Variable pairs with correlations larger than .70 are considered to be multicollinear (Tabachnick and Fidell, 2007). No pairs exceeded the .70 criterion, thus the assumption was met.

The results of the correlation matrix showed that education level was significantly positively correlated with adopter characteristics, use of healthcare databases, and non-use of sterile normal. Adopter characteristics were significantly positively correlated with SDL. No studies have been done correlating adopter characteristics with self-directed learning, but the two theories share a common view of how resources are important to the knowledge adoption process. For Rogers (2003), knowledge sources such as journals, databases, and opinion leaders were seen as ways to learn of, as well as diffuse, new information. It was not surprising to find a correlation between the two as those who are more likely to discover and adopt information sooner are those persons who are more likely to be self-directed. SDL was significantly positively correlated with use of journals and use of healthcare databases; this finding supports one of the premises of Knowles's

(1975) self-directedness in learning theory in that persons who are more self-directed are those who identify "human and material resources for learning" (p.18). Use of journals was significantly positively correlated with use of healthcare databases. Lastly, having a research facilitator was significantly positively correlated with non-use of sterile normal saline. Knowles (1975) described SDL as an endeavor "in which individuals take the initiative, with or without the help of others…" (p. 18); his theory does not preclude the input and help of others in the system, or as Rogers describes those other persons, *opinion leaders*. The research facilitator may be viewed as that support, that opinion leader. More research is needed to assess and describe the ways in which the research facilitator supports the staff nurse in the knowledge adoption process.

For a significant positive Pearson correlation, when one variable increases, the other variable is also likely to increase. For example, when the adopter characteristics score increases, SDL is also likely to increase. For a significant positive point biserial correlation, when one variables increases (or goes from 0 to 1), the other variable is more likely to go from 0 to 1. For example, when the SDL score increases, the use of healthcare databases is more likely to go from 0 (does not use) to 1 (does use). The correlations do show that relationships exist among the variables; therefore, we reject the null hypothesis in favor of the alternative hypothesis. Results of the correlation matrix are presented in Table 7.

Table 7
Correlation Matrix between Personal Characteristics, Knowledge Sources, and Non-Use of Saline

	Education level	Adopter characteristics	Self-directed learning	Use of journals	Use of healthcare databases	Has a research facilitator
Adopter characteristics	.24*					
Self-directed learning	.13	.35**	-			
Use of journals	.17	.01	.41**	-		
Use of healthcare databases	.21*	.01	.33**	.41**	-	
Has a research facilitator	.16	-.01	.11	.13	.13	-
Saline non-use	.33**	.19	.07	.03	-.07	.29**

Note. * $p < .05$. ** $p < .01$.

Logistic Regression Analysis

Assumptions of Logistic Regression

A basic assumption of logistic regression, and inherent in the statistical test itself, is that the dependent variable is categorical (dichotomous); however, the independent variables may be continuous or categorical (Hair et al., 2006). Typically, the data are checked prior to running analyses to assess for multicollinearity and outliers. Prior to analyzing Hypothesis 2, data hygiene and data screening were undertaken to ensure the variables of interest met appropriate statistical assumptions.

Multicollinearity. The assumption of multicollinearity was tested by calculating correlations between the predictor variables. Correlations between criterion and predictor variables were not too low and correlations between predictor variables did not exceed .70. The presence of multicollinearity was not assumed.

Univariate Outliers. A test for univariate outliers was conducted and no outliers were identified. Frequency statistics were run for the one predictor variable that was nominally scaled (IV6- Facilitator) to determine if the variable had a large uneven split. Variables with a 90/10 split induce instability when running correlation analysis (Tabachnick & Fidell, 2007). Based on the review of the analysis, the split was only slightly uneven *No* = 53, and *Yes* = 46.

Research Question 2 and Hypothesis

RQ2. What is the relationship between adopter characteristics, self-directedness in learning, education level, use of journals, use of electronic healthcare databases, access to

a research facilitator, and the adoption of evidence based practice, as measured by critical care nurses' self-report that they do not use sterile normal saline prior to endotracheal suctioning?

$H2_0$: There is no significant relationship between critical care nurses' adopter characteristics, self-directedness in learning, education level, use of journals, use of electronic healthcare databases, access to a research facilitator, and the adoption of evidence based practice, as measured by critical care nurses' self-report of non-use of sterile normal saline prior to endotracheal suctioning.

$H2_a$: There is a significant relationship between critical care nurses' adopter characteristics, self-directedness in learning, education level, use of journals, use of electronic healthcare databases, access to a research facilitator, and the adoption of evidence based practice, as measured by critical care nurses' self-report of non-use of sterile normal saline prior to endotracheal suctioning.

In order to examine research question and hypothesis 2, a multiple logistic regression was conducted to assess if adopter characteristics, self-directedness in learning, education level, use of journals, use of healthcare databases, and having a research facilitator predicts the non-use of sterile normal saline. The first logistic regression used the Enter method of inserting all of the variables at the same time and running the full model. The second logistic regression used the Forward stepwise method in which SPSS inserts variables into the model one at a time until the only predictors in the model are the significant ones. The third logistic regression used the Backward

stepwise method in which SPSS enters in all of the variables into the model at once and removes the nonsignificant predictors at each step until the model only has significant predictors.

Enter Method

The results of the Enter method logistic regression were statistically significant, χ^2 (6) = 22.93, $p < .001$, suggesting that all of the personal and knowledge characteristics accounted for (Nagelkerke R^2) 27.7% of the variance in use of sterile normal saline. Education level was a statistically significant predictor of non-use of sterile normal saline, B = 1.01, p = .005, OR = 2.75, suggesting that for every degree higher the participant has obtained, they are 2.75 times more likely to not use sterile normal saline. Nurses are exposed to more research-based concepts and opportunities for application of those concepts, as higher degree levels are obtained. Further research looking at the qualitative differences between the degree levels would be helpful in adding to a deeper understanding and appreciation for educational advancement and in what ways in may help to promote knowledge adoption activities.

Having a research facilitator was also a significant predictor of use of sterile normal saline, B = 1.29, p = .007, OR = 3.63, suggesting that if the participant had a research facilitator, they were 3.63 times more likely to not use the sterile normal saline. Results of the enter method logistic regression are presented in Table 8.

Table 8
Enter Method Logistic Regression with Personal and Knowledge Characteristics Predicting the Non-Use of Sterile Normal Saline

Source	*B*	*SE*	Wald (1)	*p*	OR	95% CI for OR
Education	1.01	0.36	7.90	.005	2.75	[1.36, 5.58]
Adopter characteristics	0.49	0.41	1.40	.238	1.63	[0.73, 3.67]
Self-directed learning	0.11	0.51	0.05	.827	1.12	[0.41, 3.03]
Use of journals	-0.01	0.63	0.00	.983	0.99	[0.29, 3.40]
Use of healthcare databases	-0.89	0.56	2.54	.111	0.41	[0.14, 1.23]
Has research facilitator	1.29	0.48	7.17	.007	3.63	[1.41, 9.31]

Note. Education*:* $p = .005$; Has research facilitator: $p = .007$

Forward Stepwise

The results of the Forward stepwise method were statistically significant at the final model, χ^2 (2) = 17.83, $p < .001$, suggesting that the Forward stepwise method found two significant predictors for sterile normal saline and accounted for (Nagelkerke R^2) 22.1% of the variance in saline non-use. Education level was a significant predictor for saline non-use, $B = 0.96$, $p = .004$, OR = 2.60, suggesting that for every degree higher the participant had they were 2.60 times more likely to not use the sterile normal saline. Having a research facilitator was also a significant predictor, $B = 1.12$, $p = .014$, OR = 3.06, suggesting that those that had a research facilitator were 3.06 times more likely to not use the sterile normal saline. Results of the Forward stepwise method are presented in Table 9.

Table 9
Forward Stepwise Method Logistic Regression with Knowledge Characteristics Predicting Non-Use of Sterile Normal Saline

Source	*B*	*SE*	Wald (1)	*p*	OR	95% CI for OR
Education	0.96	0.33	8.18	.004	2.60	[1.35, 5.00]
Has research facilitator	1.12	0.45	6.06	.014	3.06	[1.26, 7.46]

Note. Education*:* $p = .004$; Has research facilitator: $p = .014$

Backward Stepwise

The results of the Backward stepwise method were statistically significant at the final model, χ^2 (3) = 21.07, $p < .001$, suggesting that the Backward stepwise method found two predictors for sterile normal saline and accounted for (Nagelkerke R^2) 25.7% of the variance in saline non-use. Education level was a statistically significant predictor for saline non-use, $B = 1.10$, $p = .002$, OR = 2.99, suggesting that for every degree higher the participant had they were 2.99 times more likely to not use the sterile normal saline. Having a research facilitator was also a statistically significant predictor, $B = 1.24$, $p = .008$, OR = 3.45, suggesting that those that had a research facilitator were 3.45 times more likely to not use the sterile normal saline. Even though use of healthcare databases was included in the model, it was not, on its own, a significant predictor for saline use. Results of the Backward stepwise method are presented in Table 10.

Table 10
Backward Stepwise Method Logistic Regression with Knowledge Characteristics Predicting Non-Use of Sterile Normal Saline

Source	*B*	*SE*	Wald (1)	*p*	OR	95% CI for OR
Education	1.10	0.35	9.69	.002	2.99	[1.50, 5.96]
Use of healthcare databases	-0.87	0.50	3.07	.080	0.42	[0.16, 1.11]
Has research facilitator	1.24	0.47	6.93	.008	3.45	[1.37, 8.66]

Note. Education: $p = .002$; Has research facilitator: $p = .008$

While the primary method selected for data analysis was the Enter method, it was subsequently decided to include the Forward: LR and Backward: LR methods to look at the data as completely and accurately as possible as the Forward: LR and Backward: LR are sometimes used for smaller sample sizes. All three methods of the logistic regression produced statistically significant models. In all three models, the knowledge sources of education level and research facilitator were statistically significant predictors for that model. Overall, the Forward stepwise method produced the best model, correctly classifying 70.7% of the cases; the Enter method and the Backward stepwise method both correctly classified 69.7% of the cases, while the constant only model correctly classified 56.6% of the cases. The results related to education level and research facilitator support the alternative hypothesis that these two independent variables were statistically significant findings associated with nurses' non-use of sterile normal saline prior to endotracheal suctioning; therefore, we reject the null hypothesis in favor of the alternative hypothesis.

Summary

The purpose of this section was to assess findings gathered from the *Personal Characteristics, Knowledge Sources, and Approach to Learning Survey* administered to 99 critical care nurses; relationships among the factors of personal characteristics and knowledge sources and nurses' clinical practice were explored. Two hypotheses were tested in the study. Hypothesis 1 showed statistically significant relationships among the study variables, therefore, the null was rejected in favor of the alternative hypothesis.

Hypothesis 2 showed, for all three logistic models, that education level and access to a research facilitator were statistically significant predictors, with a moderate effect size of 27.7%, for non-use of sterile normal saline prior to endotracheal suctioning.

These findings support the theoretical frameworks for this study as Rogers's (2003) diffusion theory and Knowles's (1975, 1990) self-directedness in learning share a common view of how resources are important to the knowledge adoption process. For Rogers, knowledge sources such as journals, databases, and opinion leaders were seen as ways to learn of, and diffuse, new information and for Knowles, persons who are more self-directed are those who identify "human and material resources for learning" (p.18). It was not surprising to find a correlation between the two as those who are more likely to discover and adopt information sooner are those persons who are more likely to be self-directed.

For Hypothesis 2, the null was also rejected in favor of the alternative hypothesis as findings support the alternative hypothesis that education level and access to a research facilitator are significantly associated with nurses' non-use of sterile normal saline prior to endotracheal suctioning, while adopter characteristics, self-directedness in learning, use of journals, and use of electronic healthcare databases were not significant predictors in the models. Further research looking at the qualitative differences between the degree levels would be helpful in adding to a deeper understanding and appreciation for educational advancement and in what ways it may help to promote knowledge adoption activities. The research facilitator may be viewed as a support, or as Rogers described, an

opinion leader. More research is needed to assess and describe the ways in which the research facilitator supports nurses in the clinical setting in the knowledge adoption process. Section 5 will provide a summary of findings, conclusions, and recommendations for future research.

Section 5: Summary, Conclusions, and Recommendations

Overview of the Study

Using research findings to inform nursing practice in the clinical setting has been shown to improve patient outcomes, reduce costs, and promote safe patient care (AHQR, 2002; Beyea & Slattery, 2006; Block & Le Grazie, 2006; Newhouse, 2007; Pearson et al., 2005). Additionally, research can help add to nurses' knowledge base, and support the process of staying current and relevant in practice (Beyea & Slattery, 2006). Discovering ways in which to get research findings adopted into clinical practice has been a challenging task for nurse researchers.

A review of the literature identified studies that considered the barriers and resistance that still exist in moving toward evidence based nursing practices (Ashley, 2005; Fink, et al., 2005; Myers & Meccariello, 2006; Novak et al., 2008; Parahoo & McCaughan, 2001; Pravikoff et al., 2005; Retsas, 2000). Granger (2008) stated that it is as though "we have wallowed in the pit of barrier identification" (p. 314) in trying to find ways to make research use a practical reality. While it is important to understand the barriers and resistance to adopting EBP, Estabrooks et al. (2008) issued a challenge that research also be focused on "determinants or factors of research utilization behavior" (p. 2). What has not been fully addressed to this point is an examination into what factors may influence the adoption of EBP in the critical care setting. The overall focus of this study was related to investigating personal characteristics and knowledge sources that may support the process of learning within the contextual environment of the adult

learner. Examining these variables may help facility managers and nurse leaders to make informed decisions about the best use of resources when planning and implementing knowledge adoption activities, and to develop workplace strategies to support nurses in the knowledge acquisition and application process.

The purpose of this study was to explore factors that may be associated with nurses' adoption of EBP. When comparing nursing students to hospital nurses, Tannery et al. (2007) noted that not as much information is known about hospital-based nurses' "access to and use of information resources" (p. 15). This study looked at personal characteristics as well as, factors related to the use of information resources by critical care nurses. The specific factors under study were the independent variables of adopter characteristics, self-direction in learning, education level, use of journals, use of electronic healthcare databases, access to a research facilitator on the nursing unit, the relationships among those independent variables, and the dependent variable of adoption of EBP. The research questions that framed this study were as follows:

1. How do adopter characteristics, self-directedness in learning, education level, use of journals, use of electronic healthcare databases, and access to a research facilitator relate to each other?

2. What is the relationship between adopter characteristics, self-directedness in learning, education level, use of journals, use of electronic healthcare databases, access to a research facilitator, and the adoption of evidence based practice, as measured by critical care nurses' self-report that they do not use sterile normal saline prior to

endotracheal suctioning?

These questions were answered through a survey research design that solicited responses from nurses working in the critical care settings of intensive care, cardiovascular recovery, and progressive care. Ninety-nine nurses completed the *Personal Characteristics, Knowledge Sources, and Approach to Learning Survey* that incorporated Hurt et al.'s (1977) Scales for the Measurement of Innovativeness, Oddi's (1984) Continuing Learning Survey, and questions adapted from Schwenker et al.'s (1998) Survey Suctioning Questionnaire. Section 4 provided a full account of the data and results of the survey. The following section provides a review of the findings.

Review of Findings

Relationships Among the Independent Variables

Research Question 1, Description of Findings. Pearson correlations were conducted between the continuous variables and point biserial correlations were conducted for any dichotomous variables. The results of the correlation matrix showed that education level was significantly positively correlated with adopter characteristics, use of healthcare databases, and non-use of sterile normal. Adopter characteristics were significantly positively correlated with SDL. SDL was significantly positively correlated with use of journals; use of healthcare databases and use of journals was significantly positively correlated with use of healthcare databases. Lastly, access to a research facilitator was significantly positively correlated with non-use of sterile normal saline. These findings support the alternative hypothesis that education level and having a

research facilitator available are significantly associated with nurses' non-use of sterile normal saline prior to endotracheal suctioning, therefore, the null hypothesis is rejected in favor of the alternative hypothesis.

Relationship between the Independent Variables and the Adoption of Evidence Based Practice

Research Question 2. All three methods of the logistic regression produced statistically significant models. In all three models, the knowledge sources of education level and research facilitator were statistically significant predictors for that model. Overall, the Forward stepwise method produced the best model, correctly classifying 70.7% of the cases; the Enter method and the Backward stepwise method both correctly classified 69.7% of the cases, while the constant only model correctly classified 56.6% of the cases. While the primary method selected for data analysis was the Enter method, it was subsequently decided to include the Forward: Likelihood Ratio (LR) and Backward: LR methods to look at the data as completely and accurately as possible as the Forward: LR and Backward: LR are sometimes used for smaller sample sizes. These findings support the alternative hypothesis that education level and access to a research facilitator had a statistically significant association with nurses' non-use of sterile normal saline prior to endotracheal suctioning; therefore, the null hypothesis is rejected in favor of the alternative hypothesis.

Interpretation of Findings

Two research questions and hypotheses were used to evaluate critical care nurses'

personal characteristics and use of knowledge sources to support the ongoing process of knowledge adoption. The broad concept of EBP was refined through operationalizing EBP as the use of sterile normal saline prior to endotracheal suctioning. Endotracheal suctioning, as a common critical care nursing practice, provided a useful illustration on the relationship between the independent variables and EBP. While the broad concept of EBP has been operationalized in terms of a very specific practice, the general principle of interest is still applicable and is as follows: What factors may be associated with supporting the knowledge adoption process in the contextual environment of the critical care nurse?

Research Question and Hypothesis 1

Research Question and Hypothesis 1 examined the relationships between the independent variables of adopter characteristics, self-directed learning, education level, use of journals, use of healthcare databases, and access to a research facilitator. Rogers's (2003) and Knowles's (1975, 1990) theoretical suppositions were used to guide the selection of the independent variables, such as the selected knowledge sources and the personal characteristics of adult learners; therefore, it was expected that relationships would exist.

Research Question and Hypothesis 2

The adopter characteristics mean scores were at the higher end of the scale, but were not statistically significant. Due to the length of the study questionnaire, Hurt et al.'s (1977) 10-item scale was used instead of the 20-item scale. Perhaps the smaller scale

was not able to discriminate the construct as well as the larger scale. It would be of interest to do a future study using the 20-item scale for comparison.

The statistically significant findings were that higher education levels and access to a research facilitator were associated with nurses' self-report of non-use of saline prior to endotracheal suctioning. This indication supports findings obtained by Milner et al. (2005) in a study of research utilization among clinical nurse educators, staff nurses, and managers. Using concepts from Rogers's (1995) diffusion theory, Milner et al. (2005) hypothesized that clinical nurse educators, whose roles could be seen as comparable to the research facilitator, would have "increased exposure to mass media and innovation (research)…be involved in higher levels of research use…have better access to technical sources" and, therefore, have higher research utilization scores (p. 901). Milner et al. found statistically significant differences in utilization scores between the three groups, with clinical nurse educators demonstrating higher scores, signifying higher research utilization. Milner et al. dichotomized education level as diploma trained or degree, with degree being synonymous with university-trained; this current study looked at licensed practical or vocational nurse (LPN, LVN), associate degree in nursing or associate of science in nursing (AND, ASN), master of science in nursing (MS or MSN), and doctoral education levels; for the current study, no nurses reported having a doctoral degree and eight nurses reported having an LPN degree. The findings from the Milner et al. study suggested that education level and exposure to technical sources such as mass media are associated with using research more often. The findings of the current study suggest that

education level and exposure to a research facilitator, who is most likely an individual using these technical sources, are associated with using research more often, as well. The findings also refine the idea of Rogers's (2003) opinion leader, contained within the early adopter category, to include a specific role: research facilitator. The particular nursing intervention that was chosen as the dependent variable to be representative of EBP, the use of sterile normal saline prior to endotracheal suctioning, was chosen because of its resistance to adoption in clinical practice. The current study finding are encouraging in that the results indicated that nurses who had access to a research facilitator used EBP concerning the use of saline 3.6 times more than those nurses who did not have access to a facilitator.

The research facilitator role may be a viable option in lessening or eliminating the "gap between knowledge and practice" (Falzer et al., 2008, p. 2). Certainly, the influence of the research facilitator needs to be explored more thoroughly to evaluate further what ways the research facilitator can support the knowledge adoption process.

While not the focus of this study, being aware of the barriers to knowledge adoption in the clinical setting does help in broadening our understanding of why it is important to look at factors that may facilitate the "multifaceted process" (Rycroft-Malone, 2010, p. 57) of knowledge adoption. One impediment, as stated by Hamric (2002) is "the exponential increases in healthcare…resulting in a mind-boggling amount of information to be absorbed and used in patient care" (p. 68). Xu et al. (2010) described the current healthcare environment as "dynamic and complex…with knowledge and

technologies rapidly changing" (p. 164). Other barriers to knowledge adoption have been identified as (a) weak or nonexistent facility support (Fink et al., 2005; Parahoo & McCaughan, 2001; Retsas, 2000), (b) time constraints (Ashley, 2005; Myers & Meccariello, 2006; Parahoo & McCaughan, 2001; Pravikoff et al., 2005), (c) staffing issues (Novak, et al., 2008), and (d) "ineffective education" (Waters et al., p. 829). The research facilitator could play a pivotal role in augmenting the impact of most of those barriers. As one educated in the handling of research findings, the research facilitator can function as the person who analyzes research findings for pertinent evidence based updates for purposes of staff education, policy guideline updates, and procedure revisions.

Limitations

A variety of limitations naturally constrain the conclusions drawn from this research. The focus was on a narrow segment of the nursing population performing one particular nursing intervention to measure EBP to explore whether selected factors might be associated with the adoption of EBP in the clinical setting. The study was limited to one geographical area and solicited respondents from a population of nurses employed in three regional hospitals. Participation may have been limited for nurses who otherwise met inclusion criteria but did not have computer access at the 2 sites or who were not comfortable with using computer technology. Three additional limitations are noted below.

One limitation was not knowing the qualitative differences between the degree programs. Due to the length of the LPN (12-18 months) and ADN programs (2-3 years), a research component is typically not included in the nursing curriculum (NLN, 2010). It would be informative to look at what qualitative differences actually exist between, in particular, the associate and baccalaureate degrees.

A limitation may have existed with the use of the shorter version of Hurt et al.'s (1977) innovativeness scale. Due to the length of the questionnaire, a decision was made to use the shortened version of the scale, which may have made the results for this score less accurate.

Another limitation was that differentiating among the three hospital sites was not done to preserve anonymity, but this generates a question for a future study: Is there some characteristic difference at the hospitals where there is a research facilitator than where there is not? There was no significant correlation between Rogers's adopter characteristics categories, Knowles's SDL, and the use of EBP. It is acknowledged that this is a statistical test and does not prove that these personal characteristics do not make a difference; however, it is recognized from the findings of this study that education level and access to a research facilitator had a much stronger relationship to the difference. These findings could suggest that it is not so much the individual characteristics of the nurses in question, but a possible cultural variable endemic to the hospital in which the nurses work. It would be informative to look at the qualitative differences between the hospital cultures that have a research facilitator versus those hospitals that do not.

As with any research, it is important to recognize the limitations associated with the research design and analysis, but they should not diminish the value of the research. With these limitations noted, the following section considers the implications and recommendations stemming from this study.

Implications for Social Change

This research study on EBP suggests a need for policy changes at the facility and nursing unit levels and can potentially benefit healthcare facility managers and nursing leaders, nurses, nursing schools, and the general public. Facilities and nursing leaders can benefit from the reduced costs associated with the use of EBP. Nurses benefit from continued growth in clinical practice.

The implication for nursing schools are potential changes in curriculum, especially at the associate degree level, through including research or EBP not as a peripheral concept, but as a core concept. Academic educators can be encouraged to look at curriculums and add a research or EBP component to the course of study. Although this study took place within the contextual environment of the critical care nurse, curriculum changes for prelicensure nursing students can be supported by the findings. The recommendation for academic education would be the inclusion into the associate degree program of a research or EBP component. Waters et al. (2009) identified "ineffective education" (p. 829) as a barrier to adoption of EBP. One way that academicians could introduce EBP into the associate degree program, in the classroom and clinical setting, would be through the use of EBP tools, such as the PICO tool. PICO

stands for “patient problem or population of interest, intervention of interest, comparison of interest, and outcome of interest” (Melnyk & Fineout-Overholt, 2005, p. 29). Working individually or collaboratively, the student or group would identify a clinical problem, search the literature for information concerning the problem of interest, and then develop a plan of action based on the information gathered. This educational strategy would help to acclimate students to the concept of EBP. A variation of this strategy would be to integrate the use of the PICO or similar EBP tool with patient simulation in the clinical nursing lab. The educator would develop a clinical scenario with a particular issue related to EBP included within the scenario; the student or the group would be directed to investigate the designated issue to discover what is in the literature and what recommendations are made for best practices related to the clinical issue. Using these proactive educational strategies, it is anticipated that the student would develop an appreciation and familiarity with the concept of EBP. In addition to these strategies, it would also be useful to look at research components of the baccalaureate degree to determine which of those components could effectively be transported into the associate degree nursing program.

The general public benefits from a more informed and supported nursing staff that is better prepared to competently and safely provide care. The social implications for using EBP will involve policy changes and, in varying degrees, a culture change through re-evaluating practice-setting educational components and the commitment to including, as an integral part of the healthcare team, the research facilitator or educator with a

research background. Ways in which these policy changes would be initiated is contained in the recommendations for action section below.

The study findings indicated that education level and access to a research facilitator were associated with an increase in the use of EBP. The data from this study suggests that the stronger routes for reinforcing the use of EBP would be to bolster education and bring facilitation to the forefront of nursing. Facilitation, as an ongoing support system, is seen as central to the knowledge adoption process.

The findings from this study can provide the basis for facility managers, nurse leaders, nurses, and nurse educators to consider the variables that showed a statistically significant correlation between educational level, access to a research facilitator, and the adoption of EBP. However, it should be noted that further research should be done with larger sample sizes and in different clinical settings to confirm these findings. Based on the current study findings, the following preliminary recommendations are made.

Recommendations for Action

Facility managers and nurse leaders need to consider making the research facilitator role an integral part of the healthcare team, ideally by embedding the facilitator within the clinical practice setting. This recommendation may mean the hiring of a facilitator or the restructuring of the educator role, which will subsequently be referred to here as the *research-focused educator*, to include a component that is dedicated to the facilitation of the adoption of EBP. It is recommended that EBP be supported beginning with the orientation process in order to promote a culture conducive to the consistent

application of the best and most current research. What is needed also is the unit or service-line specific research facilitator or research-focused educator who can be the pivotal person to bring cohesiveness to the process of knowledge adoption through ensuring that current research is incorporated into clinical educational programs. The research facilitator or research-focused educator would be instrumental in gleaning research studies for ongoing updates, using them to set the standards for evidence based unit practices so that practices are not based on mere preference, instinct, or tradition. While currently there are unit and hospital practice councils that are in place in some facilities and have the role of setting practice guidelines, the ideal role of the research facilitator or research-focused educator is envisioned as one providing a mentoring partnership with direct support to the nursing staff.

The recommendation for academic education would be the inclusion into the associate degree program of a research or EBP component. As previously mentioned, it would also be useful to look at research components of the baccalaureate degree to determine which of those components could effectively be transported into the associate degree nursing program.

In addition to the recommendations outlined above, the findings will be disseminated in summary form to the community partners at each of the three facilities, study participants, and a local research consortium.

Recommendations for Further Study

Several recommendations for future research in this area can be suggested.

Specifically, there are eight recommendations that might be considered as natural extensions to this study and hold the potential to advance further findings in this area.

The first recommendation is to obtain larger sample sizes and conduct research in other clinical settings in evaluating whether adopter characteristics, self-directed learning, education level, use of journals, use of electronic healthcare databases, and access to a research facilitator are statistically significant predictors of use of EBP to confirm or dispute the findings of this study. The second recommendation would be to use Hurt et al.'s (1977) 20-item Scale for the Measurement of Innovativeness rather than the 10-item scale to determine if the larger scale is better able to capture the construct of innovativeness. The third recommendation would be to consider the educational preparation between the associate and baccalaureate degrees through looking more closely at the qualitative differences. The fourth recommendation would be the development of a study design that includes examination of factors such as years of experience, degree level, and years out of college, which may help add to understanding of what facilitates knowledge adoption. The fifth recommendation is to look specifically at the research facilitator role, quantitatively and qualitatively, to enrich our understanding on how this position may encourage knowledge adoption. The sixth recommendation is to explore the characteristics of the hospital cultures that have a research facilitator versus those hospitals that do not. The seventh recommendation would be to do a repeat study in 5 to 10 years to capture changes in the study factors

related to critical care nursing, nurse education, and EBP such as is exemplified in the following study. Caruso, Denari, Ruiz, Demarzo, and Deheinzelin (2010) compared rates of ventilator associated pneumonia (VAP) in oncology patients receiving tracheal suctioning. Comparisons were made between the group (n = 132) that was instilled with an 8-ml bolus of sterile normal saline prior to tracheal suctioning versus the group (n = 130) that did not receive a saline bolus in the tube prior to tracheal suctioning. Findings were that the saline group had a statistically significant ($p < .008$) lower incidence of microbiologic proven VAP. While the preponderance of evidence to this point recommends that saline not be routinely used prior to endotracheal suctioning, more studies looking at the use of sterile normal saline prior to endotracheal suctioning in diverse populations will need to be done so that today's best practices can avoid becoming tomorrow's "sacred cows" (Rauen et al., 2008, p. 98).

Lastly, while it was expected that the SDL scores would be associated with the use of EBP, the SDL scores were not statistically significant for this study; however, the mean SDL scores were high in this respondent group, suggesting a higher level of self-directedness and not much variation in which to pick up differences. It would be of interest to conduct further studies to examine self-directedness. The usefulness of further exploration of SDL may be seen by looking at a study by Grow (1991). Building on the self-directed learning theories of Knowles (1975; 1990) and Candy (1987), and assimilating concepts from Hersey and Blanchard's (1988) theory of situational learning, Grow developed an SDL model. Grow suggested those persons who have a higher degree

of self-directedness in learning experienced increased anxiety when exposed to instructor led activities; conversely, those with a lower degree of self-directedness experienced a higher degree of anxiety with SDL. The current study findings were that high levels of self-directedness were not an impediment to accessing the research facilitator; one reason may be because the assumption of the question on use of research facilitator was that access was under the control of the individual nurse. As suggested by Grow's (1991) study, increased anxiety may be seen in persons with high self-directedness in relation to planned educational activities. Therefore, it may still be helpful to assess nurses' self-directedness when planning educational programs to facilitate optimal knowledge adoption practices.

Concluding Remarks

The call for EBP is most likely here to stay; Gawlinksi and Rutledge (2008) observed that "factors related to patient safety, quality, and EBP are driving changes in healthcare" (p. 291). As noted by Hamric (2002), knowledge generation is not likely to decrease but continue to increase at exponential rates, therefore, finding effective ways to translate knowledge into practice should continue to be a priority for nurse researchers, and of interest to facility managers, nurse leaders, and nurses who want to provide the best care possible based on current, relevant research findings.

We need a different kind of culture within the nursing profession, one that is not based on the nonscientific traditions of "gut instinct, trial and error, or personal preference" (Urden et al. 2010, p. 3). The research facilitator or researcher-educator can

be a pivotal role in transitioning the profession of nursing to a culture that embraces the adoption of EBP. This transition will require a commitment on the part of facility managers, nurse leaders, nurse educators, and nurses, as well as, researchers who will continue to explore factors that can positively influence the adoption of EBP within the clinical practice setting.

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Appendix A: Study Questionnaire

Personal Characteristics, Knowledge Sources, and Approach to Learning Survey

*Hurt et al.'s Innovative Scale (IS), **Oddi's Continuing Learning Inventory (OCLI), ***Schwenker et al.'s Suctioning Survey Instrument (SSI)

Demographics: Please share some information about yourself.

1. Position

- Staff nurse
- Charge nurse
- Unit supervisor
- Other

2. Practice setting: Please enter the area where you predominately work.

- ICU (Intensive Care Unit)
- CVRU (Cardiovascular Recovery Unit)
- PCU (Progressive Care Unit)
- Other

3. Age range:

- 20-29
- 30-39
- 40-49
- 50-60
- 60 or older

4. Gender

- Female
- Male

5. Education: Highest degree completed at present time.

- LPN, LVN
- ADN, ASN
- BSN
- MSN
- Doctorate

6. Years of Nursing Experience:

- <1
- 1-5
- 6-10
- 11-15
- 16-20
- 21 or more

Legend: SD=strongly disagree, D=disagree, MD=moderately disagree,

U = undecided, MA = moderately agree, A = agree, SA = strongly agree.

II. *Hurt et al.'s Innovative Scale (IS).

Permission to use material from Hurt et al.'s Scales for the Measurement of Innovativeness (IS) was granted through Rightslink Copyrights Clearance Center, Inc.

For this section, please select the response that best describes you.

*7. I am generally cautious about accepting new ideas (reversed score).

SD	D	MD	U	MA	A	SA

*8. I rarely trust new ideas until I see colleagues and peers accept them (reversed scored).

SD	D	MD	U	MA	A	SA

*9. I find it stimulating to be original in my thinking and behavior.

SD	D	MD	U	MA	A	SA

*10. I am challenged by ambiguities and unsolved problems

SD	D	MD	U	MA	A	SA

.

*11. I am aware that I am usually one of the last people in my group to accept something new (reversed scored).

SD	D	MD	U	MA	A	SA

*12. I am reluctant about adopting new ways of doing things until I see them working for people around me.

SD	D	MD	U	MA	A	SA

*13. I am challenged by unanswered questions.

SD	D	MD	U	MA	A	SA

*14. I often find myself skeptical of new ideas (reversed scored).

SD	D	MD	U	MA	A	SA

*15. I tend to think that the old way of doing things is the best way (reversed scored).

SD	D	MD	U	MA	A	SA

*16. I must see other people using innovations before I will consider them (reversed scored).

SD	D	MD	U	MA	A	SA

III.** Oddi's Continuing Learning Inventory (OCLI).

Permission to publish instrument not granted. Questions 17 through 40 not included in this appendix.

IV. The next several questions pertain to knowledge sources that you use to answer practice questions, specifically journals, electronic healthcare databases, and research facilitator.

Please supply information related to your use of journals or participation in a journal club.

41. How often do you read nursing journals?

    - Never (I do not read nursing journals)
    - Rarely (I read nursing journals a few times per year)
    - Sometimes (I read nursing journals every 2-3 months)
    - Often (I read nursing journals monthly)

42. Does your unit have a journal club?

    - Yes
    - No

43. If your unit has a journal club, how often do you participate in the journal club?

    - Never=I never participate in a journal club
    - Rarely=a few times per year
    - Sometimes=every 2 or 3 months
    - Often=monthly
    - N/A (my unit does not have a journal club)

44. Do you have access (at home or work) to national healthcare databases that support nursing research for EBP, (Examples would be Joanna Briggs Institute (JBI), National Institutes of Health (NIH), and the Agency for Healthcare Research and Quality (AHRQ).

    - Yes
    - No
    - Don’t know

45. How often do you access electronic healthcare databases to find answers for practice questions?[Examples would be Joanna Briggs Institute (JBI), National Institutes of Health (NIH), Agency for Healthcare Research and Quality (AHRQ)].

- Never=I do not access electronic healthcare databases
- Rarely=I access electronic healthcare databases a few times per year
- Sometimes=I access electronic healthcare databases every 2-3 months
- Often=I access electronic healthcare databases monthly

46. Do you have a research facilitator on the unit?

[This could be a person in a formally designated role (paid position, such as a CNS), or a person in an informally designated role (non-paid position).

- Yes
- No

47. How often would you say the research facilitator helps you with evidence based practice questions?

- Not applicable
- Never
- Rarely
- Sometimes
- Often

V.***Schwenker et al.'s Suctioning Survey Questionnaire

Instrument is in the public domain.

The following questions relate to the clinical practice of endotracheal suctioning:

***48. Have you ever perform endotracheal suctioning?

- Yes
- No

If your answer is 'no', please select the 'NEXT' button at the bottom of the page.

***49. Do you perform hyperoxygenation prior to suctioning?

- Yes
- No

***50. If yes, please select the choice that most accurately describes your clinical practice related to suctioning:

- I never perform hyperoxygenation before suctioning
- I only perform hyperoxygenation if biox < 90%
- I only perform hyperoxygenation if specifically ordered
- I always perform hyperoxygenation before suctioning

***51. How often do you use sterile normal saline prior to endotracheal suctioning?

- never
- rarely
- sometimes
- often

- always

***52. Your knowledge of the benefit(s) of saline instillation with endotracheal suctioning is/are:

- no benefits
- stimulation of cough
- retrieval of more secretions
- 'thins' secretions:

***54. Saline with endotracheal suctioning has adverse effects on (choose all that apply):

- blood pressure
- heart rate
- oxygen saturation
- lower lung parenchyma
- patient comfort
- Other (please specify)

You have completed the survey. Thank you for sharing your valuable time, knowledge, and expertise.

Appendix B: Schwenker et al. Permission

Original Message -----

From: Audrey Gift

To: dagrn15@comcast.net

Sent: Sunday, November 02, 2008 6:28 PM

Subject: RE: permission to use tool

Darlene,

I am so sorry to hear that the practice of saline instillation continues. That which is published in a journal is in the public domain so you can legally use it even if I did not approve. However, I fully support anything you might do to get practice to follow the research findings. You have my full support for the use of the survey tool.

Best of luck with your project.

Audrey G. Gift, Ph.D., RN, FAAN

Professor Emeritus

Michigan State University

College of Nursing

East Lansing, MI 48824

Appendix C: Hurt et al. Permission

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Jul 21, 2010

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AGREED July 29, 2010.

Lorys F. Oddi 8/2/10

Lorys F. Oddi (Licensor)

Darlene A. Georgian

(Licensee)

Licensee's research proposal attached.

Curriculum Vitae

Darlene A. Geoghan

EDUCATION

Doctor of Education Candidate	Walden University-Minneapolis, MN
	Specialization: Teacher-Leadership
Master of Science, 2006	Ball State University-Muncie, IN
	Major: Nursing
Bachelor of Science, 2003	Bethel College-Mishawaka, IN
	Major: Nursing
Associated Degree, 1999	Ivy Tech State College-South Bend, IN
	Major: Nursing
Applied Associate in Science, 1995	Ivy Tech State College-South Bend, IN
	Major: Medical Assisting

PROFESSIONAL EXPERIENCE

Bethel College- Assistant Professor of Nursing

2004-present

- Perform instructional-related duties and responsibilities in accordance with the institution's mission, policies, and procedures
- Serve as teacher, mentor, advisor, and facilitator of learning

- Collaboratively contributed to the Nursing Department's BSN accreditation process in the capacity of committee chair for Standard 5.
- Supportive collaboration and learning as clinical instructor for BSN program

Our Lady of Peace Hospital- Staff Nurse

2006-2010

- Worked collaboratively with other healthcare providers caring for patients with multiple co-morbidities and health challenges

Elkhart General Hospital- Staff Nurse

2002-2006

- Provided direct care, in collaboration with other healthcare providers, to patients experiencing disruptions in cardiac, pulmonary, renal, and metabolic systems.
- Occasional relief charge nurse duties, including staffing, bed management, and central telemetry monitoring as needed
- Participated in Unit Education Council to bring updated, research-based information to nurses

Certifications

Certified in Critical Care Nursing (CCRN)

Licensure

Nursing licenses in Indiana and Michigan

Memberships and Associations

American Association of Critical Care Nurses (AACN)

American Nurses Association (ANA)

Sigma Theta Tau

National League of Nursing (NLN)

National Student Nurse Association (NSNA)

Nursing Research Consortium of Northern Indiana (NRCNI)

Healthcare Information and Management Systems Society (HIMSS)

Joanna Briggs Institute (JBI)

Publications

Understanding Palliative Care Nursing

The Journal of Practical Nursing

Spring 2008