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The Effect of Repetitive Text Messages on the Retention of Knowledge Among Clinical Staff

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THE EFFECT OF REPETITIVE TEXT MESSAGES ON RETENTION OF KNOWLEDGE AMONG CLINICAL STAFF

by

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ABSTRACT

Nurses have the responsibility to provide care that meets professional standards. To meet these standards, nurses must keep up with frequent changes within health care. The challenge is the rapid pace with which new information is developed. The purpose of this quantitative study was to explore the influence of repetitive text messages on the retention of knowledge among clinical staff. Kolb's Experiential Learning Model provided the framework for the study. The study population was 142 nurses and clinical partners who work in the clinical setting of an acute care hospital in Southeast Florida. The participants attended a short class and completed a post-class exam. The subjects were then randomly placed into an experimental group or a control group. The experimental group received text messages for six days containing important ideas from the class and the control group did not receive repeated text messages. Both groups then took the exam again. The study compared the change in scores between the two groups to determine the influence of text messages on the retention of information. The findings showed a statistically significant improvement in the scores of the experimental group but no significant difference in the scores for the control group. The study also revealed no significant relationship between the level of education and retention of knowledge but did show a strong relationship between years of experience and retention of knowledge. While further studies are needed, the implication is text messages can be used to enhance retention of information.

DEDICATION

First, to my Heavenly Father and his son, Jesus Christ, for implanting the desire to pursue this journey and the strength and support to complete the trip. Secondly, to my husband and best friend, who encouraged me when I was frustrated and who held everything together while I studied. Thank you for your love and support throughout the journey to obtain my PhD. Third, I would like to dedicate this project to the clinical nurse educators, bedside nurses, and clinical partners whose participation was essential to this research study.

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Introduction

Nursing is a service industry with a responsibility to protect, promote, and optimize the health of members of society (American Nurses Association, 2013). Part of this responsibility is the delivery of patient care based on current knowledge and skills. This duty presents quite a challenge for nurses due to the brisk influx of new information. Barnard, Nash, and O'Brien (2005) estimated information pertinent to nursing doubles every five years and expect the rate of change to increase. Nurses need the ability to integrate research findings and evidence-based practice into the daily care of the care to meet the obligation of providing the best care possible.

Nurses perform numerous duties during their work hours. Providing patient care is the primary duty but nurses are responsible for teaching the patient and family members about new medications, reviewing upcoming procedures and treatments, offering comfort during difficult events, and coordinating patient care with other disciplines while acting as a patient advocate. Nurses frequently have numerous requests for help from several patients at the same time and need the ability to deal with those requests quickly and accurately. Because of the demanding environment of the clinical setting, few nurses have time to search the literature for research studies that apply to the situation at hand. Some health care organizations provide updated information for the nurses in the form of classes, seminars, or online self-study modules to help nurses keep abreast of new developments in health care. Nurses may attend these classes but often do not incorporate the information into their clinical practice (Orr & Davenport, 2015).

Failure to keep up with new developments in health care, either by not staying informed or by not using the information, results in nurses using old information (Omer, 2012). Using outdated information can be detrimental to the patient and may even jeopardize the patient's

safety (Orr & Davenport, 2015). The use of up-to-date technology, such as text messaging, could offer an alternative to help nurses retain new knowledge provided by the organization. This study explores the use of repetitive text messages to improve the retention of information in the clinical area.

Chapter 1 deals with the background of the study and why retention of new knowledge is a problem, and why the topic is important. The chapter also examines the purpose of the research study as well as how the study is important to nursing. The nature of the study is explained and the research questions and hypotheses are identified. The theoretical framework, definition of terms, scope, limitations, and assumptions are presented in this chapter as well. A summary of the chapter concludes this section and offers an introduction for Chapter 2.

Background

Nursing started as a tradition of caring for the sick and injured. Family members with little or no training often performed this service. Those who did well healing the sick had little acknowledgement and some were even called witches (Judd & Sitzman, 2014). Florence Nightingale did much to change this view of nursing by her diligent work caring for wounded soldiers but also by studying cause and effect—a key component of research (Nightingale, 1969). Initially, nursing duties involved sitting with the sick, doing whatever could make the patient more comfortable, and carrying out physician orders such as administrating medications and performing treatments. As nursing separated to become an independent discipline, research on the actions of nurses became more important.

Nursing Research Utilization

Nursing has progressed into a well-established, distinct discipline in which nurses no longer follow physician orders without questions. Nursing has a responsibility to the public to

provide the best care possible (American Nurses Association, 2013). To provide this high level of care, nurses must base their actions on up-to-date information derived from rigorous research. Even though Florence Nightingale was a keen observer and researcher, the rest of the nursing community was slow to follow her example. It was not until the 1950's that nursing research gained momentum. Research was a critical element to establishing nursing as a scientific discipline and presented a view of the profession different from the traditional hands-on vocation (Cantelon, 2010).

Regrettably, due to a variety of reasons, some nurses continue to use outdated information as the basis of their practice (Omer, 2012). Despite the abundance of new information, nurses are slow to discover and incorporate new knowledge into practice (Bostrom, Kajermo, Nordstrom, & Wallin, 2008). Lundeen (2013) studied how nurses practice and found many of the nurses in his study used the same information and skills they were taught in nursing school. Few nurses in his study read journal articles and even fewer read research articles. The lack of interest in the literature leads one to question where nurses do get their information. Lundeen (2013) demonstrated that when confronted with a new situation, nurses usually asked a colleague for help instead of searching the literature.

Barriers to using Research

Funk, Champagne, Wiese, and Tornquist (1991) developed the Barriers Scale to identify obstacles preventing nurses from integrating findings from research into clinical practice. The authors felt the identification of the barriers would allow organizations and investigators to develop ways to overcome the barriers and therefore promote the use of research findings. Hutchinson and Johnston (2006) surveyed nurses to validate the Barriers Scale and to identify ways to overcome those barriers and obtained results similar to those of Funk's team. Kajermo

et al. (2008) and Grant, Stuhlmacher, and Bonte-Eley (2012) also used the Barriers Scale to identify reasons why nurses did not use research results in their practice. Each of these studies found similar results but made few practical recommendations to improve practice. The recommendations from the studies have not been adequate to change the practice into using up-to-date information.

Need for Up-to-date Information

With the many changes within health care, nurses struggle to keep up with the influx of information now available through the internet. Searching through the vast number of sources to find reliable information can be time consuming (Badke, 2009). With the heavy use of technology, such as tablet computers, smart phones, and smart watches, nurses have easy access to information. Mobile application, such as Micromedex and Epocrates, have decreased, but not eliminated, the need to memorize information. Situations still arise when problems happen that do not allow time to look up information or even to call a colleague before action is required. In these situations, nurses need to swiftly recall information to respond quickly and accurately when the need arises.

Problem Statement

The problem this research study addresses is the challenge staff nurses and clinical partners face each day in providing the best care possible to the patients. The test is to provide patient care based on timely research findings and to provide the best evidence-based care. The research and the evidence must align with the rapid changes in technology and scientific discoveries (Porter-O'Grady & Malloch, 2011). Studies have addressed the topic of research-to-practice gap but have provided few practical suggestions to overcome the identified barriers (Estrabrooks et al., 2011; Kajermo et al., 2008; Omer, 2012). This leaves clinical staff nurses on

their own with the mandate to deliver safe and effective care (American Nurses Association, 2010). If nurses do not use current information as a basis for their practice, the care they provide may be ineffective or even dangerous.

Nurses are caught in a paradox of needing updated information to provide patient care based on rapidly changing information. Although knowledge acquired in nursing school provides a strong foundation, nursing requires life-long learning and the ability to retain and apply new knowledge in clinical practice (Lundeen, 2013). Clinical staff need to discard old information, receive and assimilate new information to keep up with the changes. Compounding this dilemma is the limited amount of time they have available to access new information. The ability to keep up with changes has always been important and will become an even greater challenge as nurses face increasing demands for their time. The specific problem this research study addresses is the ability of clinical nursing staff to retain the knowledge.

One method used to increase the retention of information is the use of repetition. Used successfully with children, this method has also been used successfully with adults for learning a new language and for learning music (Saville, 2011; Service, Yli-Kaitala, Maury, & Kim, 2014). Actors and actresses also use repetition to memorize passages of dialogue. This research study used technology, text messaging, as a source of repetition to assist nurses in improving the retention of information in the clinical area.

Purpose of Study

The purpose of this research study was to explore the effect of repetitive text messages on the retention of knowledge among clinical staff. Previous researchers identified barriers that prevent nurses from using research findings but offered few recommendations to overcome these barriers (Chen, Shao, Hsiao, & Lee, 2013; Funk et al., 1991; Kajermo et al.,

2008; Lundeen, 2013; & Schoonover, 2009). Other studies focused on how instructors delivered information but did not address the retention and the use of the information (Lisko & O'Dell, 2010; Riggs, 2010). Even fewer studies employed the use of technology to enhance retention of information (Zurovac et al., 2011).

Significance of Study

Nurses have an obligation to the public to provide the best care possible (American Nurses Association, 2010). To meet this obligation, nurses need to keep their skills and knowledge up to date even though that knowledge changes frequently because of new discoveries in science and technology. Nurses and clinical partners may learn new information from a class, an in-service, a seminar, or an online self-study module but still need the ability to retain that information to put it into practice. If clinical staff are not incorporating new information into practice, the logical conclusion is they are using old, possibly outdated, information as the foundation for their patient care. A review of the literature revealed studies that supported this concept and identified some problems associated with using outdated information (Kajermo et al., 2008; Lundeen, 2013). Other studies identified barriers preventing nurses from using research findings (Funk et al., 1991; Schoonover, 2009), and others that specifically addressed the research-to-practice gap (Chan et al., 2011; Strickland & O'Leary-Kelley, 2009). These studies offered recommendations to overcome barriers to research utilization that hopefully would result in nurses using research findings more frequently. However, none of the studies offered a satisfactory approach to assist clinical nursing staff in keeping up to date with the frequent changes and the new information.

The significance of the research study is the potential to help nurses and clinical partners retain information for use in the clinical area and thereby decreasing the theory-to-practice gap.

The study may identify a method to help clinical staff remember retain and incorporate new information and therefore allowing the staff members to respond to changes in the scientific knowledge more efficiently and efficiently. The development of a timesaving process that can help staff retain and apply information in their practice also has the potential to help other disciplines that have rapidly changing informational environments. To keep up with future changes, health care disciplines need a way to incorporate this information into clinical use for the benefit of the patient.

Nature of the Study

The quantitative, experimental study will be conducted within a multi-hospital system in Miami, Florida. Quantitative research was chosen as the best approach to answer the research question and hypothesis. The experimental design will permit the demonstration of the effect of repetitive text messages on the retention of knowledge among clinical staff. A qualitative design, specifically action research, was investigated as a possible approach but was rejected. The research questions do not involve describing the learning from the participants' perspective but will require measurements of the data to support or reject the research questions and hypotheses.

The convenience sample will consist of clinical registered nurses and clinical partners (certified nursing assistants or CNAs) working in two acute care hospitals within the system. Participants were placed randomly into one of two groups. The experimental group received text messages for six consecutive days while the control group did not receive the daily text messages. A power analysis was used to determine the number of participants necessary for strong study results. The Statistical Package for the Social Sciences (SPSS) was used to help

analyze the data collected to determine if text messages influence the retention of knowledge among clinical staff.

Theoretical Framework

Historical

The purpose of a theoretical framework is to provide guidance, structure, and set limitations to the study. The topic for this study is the effect of repeated text messages on the retention of knowledge among clinical nurses and clinical partners. The subject involves how adults learn, how adults adjust to change, the research to practice gap, research utilization, and barriers to utilization. Experiential learning model (ELM) (Kolb, 1984) embodies many of the elements of adult learning and therefore was used as the framework for the research study.

Experiential Learning

A leader in the field of education, David Kolb, developed the experiential learning model (Kolb, 1984). Influenced by the work of John Dewey (1859-1952) on progressive education and Jean Piaget (1896-1980) on children's education, Kolb developed a holistic model for adult learners. Experiential learning is the process of learning though reflection on one's experiences (Kolb, 1984). This basic belief that knowledge comes from experience makes the model very useful in practice disciplines such as nursing (Lisko & O'Dell, 2010).

The experiential learning model (ELM) is composed of two major components—the four stages of learning and the four learning styles based on the stages of learning. First, learning is continuous and cyclic, with the learner able to go through the four stages as needed. A student can enter the cycle at any point but then must follow the stages in sequence (St. Onge, Hodges, McBride, & Parnell, 2013). The four stages include the areas of tangible experience, thoughtful observation, conceptual conceptualization, and functional experimentation.

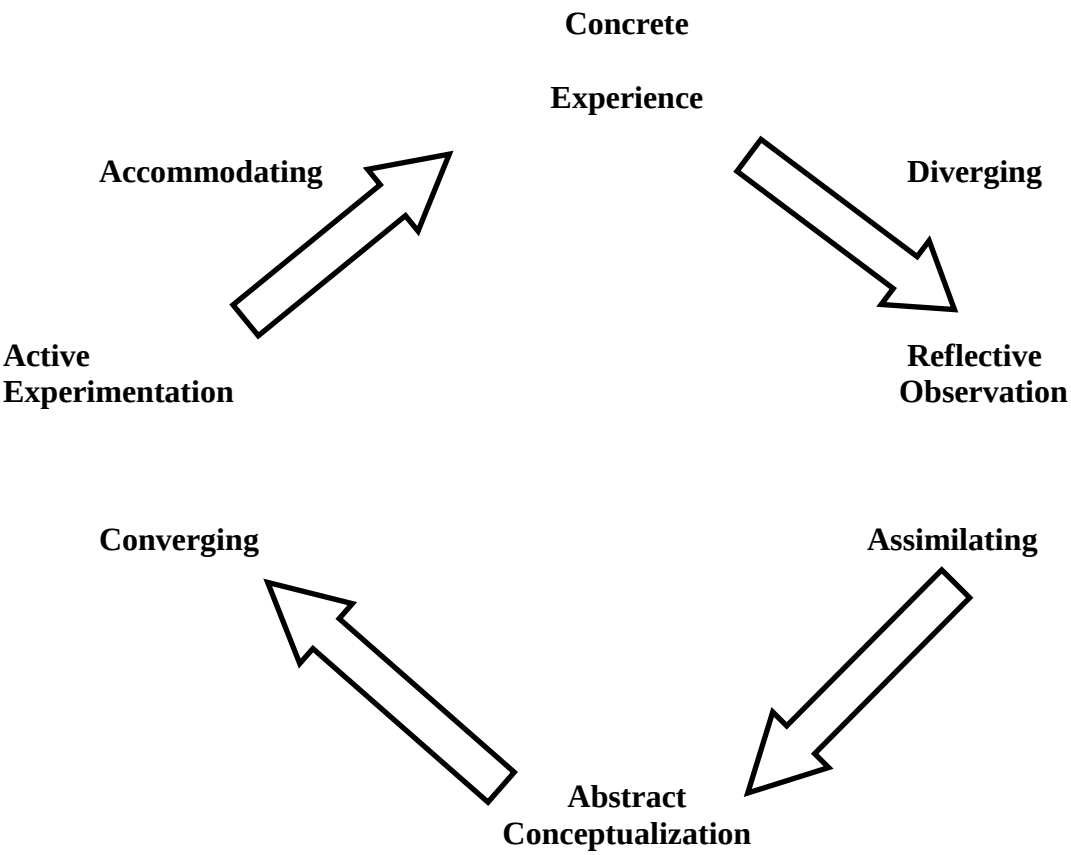


Figure 1

Kolb's cycle (1984)

The concrete experience refers to an action that the person is required to perform. This is the doing portion of the model and active participation is viewed as a critical component instead of simply watching or reading. The next step, reflective observation, is a time to step back and look at the progress to date. The third phase, abstract conceptualization, is the time for thinking about what has happened and analyze the situation. The final stage is active experimentation. The learner considers how the information can be used in new or unfamiliar situations that are relevant to the person (Chan, 2012).

Kolb also identified four learning styles that he based on the four stages of learning. These include assimilators, convergers, accommodators, and divergers (St Onge et al., 2013).

Assimilators learn best when given logical theories to consider. Convergers know best when given practical applications for the information. Accommodators grasp best when allowed hands-on experience. Divergers understand best when they can watch and collect a wide range of information. An investigator can minimize the effects from the different learning styles by using a variety of educational techniques to enhance the learning of each style.

This model is a good fit for the process of nurses learning and retaining information. The concrete experience is analogous to new information a nurse is required to learn. The class will involve interactive activities. This involves an action on the part of the nurse, not just listening to a lecture or reading an online module. An example might be the nurse attends a class on a new medication machine on the nursing unit (do or concrete stage). The nurse then demonstrates the use of the equipment as shown by the facilitator. The nurse must observe and reflect on the information and take an active role in the process (reflection observation). The participants then progress to the abstract conceptualization phase where the staff members contemplate how the information was used. The participants may also discover other ways to use the information, such as accessing the machine early so not to wait in line during peak usage times. The staff may spend as much time in a phase as needed then advance to the next phase, active experimentation. During this phase the nurse plans how to use the information and performs small tests to confirm the information and its use.

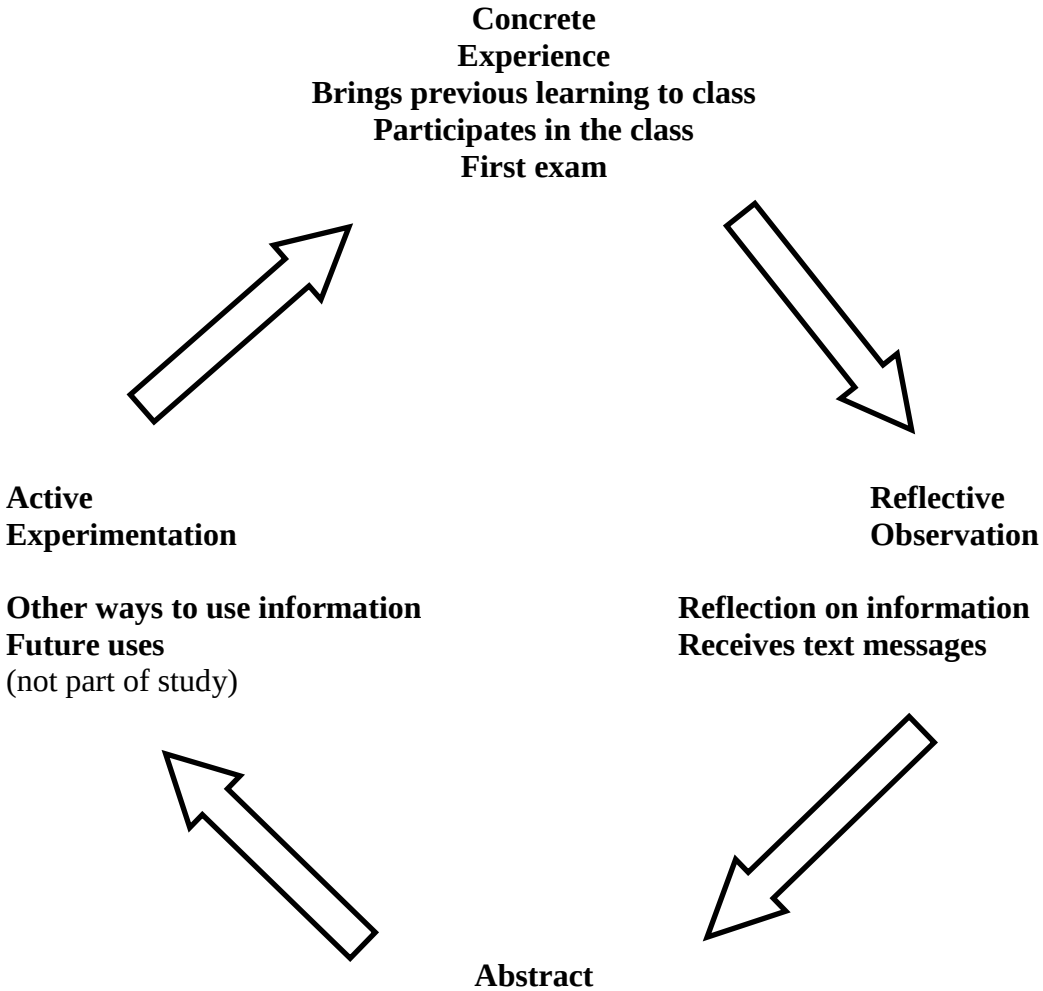


Figure 2

Retention of New Knowledge Cycle

Research question #1

The primary research question for the investigation is as follows:

What is the effect of repetitive text messaging on the retention of knowledge among clinical staff?

Hypotheses.

H0: There is no difference in the retention of knowledge for clinical staff who receive repetitive text messages for six consecutive days as compared to the retention of knowledge for clinical staff who do not receive repetitive text messages.

HA: There is a difference in the retention of knowledge for clinical staff who receive repetitive text messages for six days as compared to the retention of knowledge for clinical staff who do not receive repetitive text messages.

The variables associated with this research question are the scores for exam 1 and 2 for both groups of participants (experimental and control). Both variables are continuous with ratio level measurement. The Wilcoxon Signed Rank Test is the statistical test used for the data analysis (Pallant, 2013).

Research question #2

What is the effect of a staff member's level of education on the retention of knowledge among clinical staff?

Hypotheses.

H0: The level of education has no effect on the retention of knowledge among clinical staff who receive repetitive text messages for six consecutive days.

HA: The level of education influences the retention of knowledge among clinical staff who receive repetitive text messages for six consecutive days.

The variables associated with this research question are the level of education, a categorical variable with ordinal level measurement, and the scores for exam 2, which are continuous variables with ratio level measurement. Kruskal-Wallis Test is the statistical test used for the analysis with this data (Pallant, 2013).

Research question #3

What is the effect of a staff member's years of experience on the retention of knowledge among clinical staff?

Hypotheses.

H0: The years of experience have no effect on the retention of knowledge among clinical staff who receive repetitive text messages for six consecutive days.

HA: The years of experience influence the retention of knowledge among clinical staff who receive repetitive text messages for six consecutive days.

The variables associated with the third research question are the years of experience and the scores on exam 2. Both are continuous variables with ratio level measurement. This question concerns the relationship between two continuous variables. Therefore, Pearson's product-moment correlational coefficient (r) is used to examine the strength and direction of the relationship (Salkind, 2013).

Definition of terms

Clinical Nurses

The term clinical refers to observations and treatments of actual patients instead of theoretical or home settings (Taylor & Lillis, 2011). Based on this definition the term clinical nurses are used in this study to refer to those nurses who work in areas where patients receive direct care. Examples of clinical nurses are those working in intensive care unit, medical-surgical nursing unit, or emergency department. Non-clinical areas refer to locations where patient care is not a direct service, such as offices, the cafeteria, or registration areas.

Clinical Partners

Clinical partner is the term used by the organization for certified nursing assistants. Nursing assistants are health care workers who perform limited tasks as allow by training and by the state's regulatory board, such as obtaining vital signs, weighting patients, and bathing (Sorrentiono & Remmert, 2012). Nursing assistants may work in many different areas so the term clinical denotes those working in areas where direct patient care is provided. Clinical partners have successfully completed an approved training course and are registered with the Board of Nursing in the state of Florida.

Electronic Text Messaging

Short Message Service (SMS) is the process is of sending or receiving several short electronic written messages (text) to or from a mobile phone, fax machine, or an IP address. The written text must be less than 160 characters (Spagnoli, 2012). Multimedia Messaging Service (MMS) is another format to send text messages that allows greater content and images to be sent. Most mobile telephone carriers support the use of this format as well as SMS.

Retention of Knowledge

Retention is the act of keeping something. Prabhakaran, Chee, Earnest, and Salley (2012) used the term to refer to a person remembering information learned in a class. For this study, retention refers to knowledge acquired during a class and retained over a time. Retention can be short or long so for the purposes of this study, the clinical staff will need to retain the information for at least one week to answer test questions administered one week after the class. Retention of knowledge will be measured using an exam on the material covered in the class. The topic for the class is preventing patient falls.

Assumptions

The study to explore the effect of repetitive text messages on nurses' and clinical partners' ability to retain information makes several assumptions. The primary assumption is that as adult learners, the participants are motivated to learn and use the information provided during the class. Another assumption of the study was the participants have the necessary knowledge and means to receive and understand text messages. An additional assumption is that nurses and clinical partners will read the text messages that they receive.

Scope

The population involved with this study will be registered nurses and clinical partners working in two adult, acute care hospitals. The study will explore the effect of repetitive text messages on the retention of knowledge among clinical nurses and clinical partners. Retention of information was measured using tests based on a class on preventing patient falls. Although one goal for the research study is to improve patient care, this would be an indirect affect and the study does not directly involve patients.

Delimitations

The initial terms listed for the literature review included research utilization, barriers to research utilization, research-to-practice gap, theory-to-practice gap, incorporation of new knowledge, and adult learning with the idea of pursuing how nurses incorporate new knowledge into daily practice. The impracticality of measuring how nurses incorporate new knowledge became apparent. The unfeasibility led to considering how information presented to clinical staff could be reinforced to help the staff retain and use the information. These considerations led to the idea of reinforcing information using technology that is used frequently in everyday activities—texting.

Several theoretical frameworks were considered for the study. These included experiential learning, adult learning and change theory. Adult learning theory was too broad to cover adequately for the timeframe and was narrowed to experiential learning model (Kolb, 1984). Lewin's theory on change (Sullivan & Decker, 2009) was also initially included because nurses must deal with change frequently. The use of two theories for the framework did not support a focused study so change theory was eliminated. Therefore, the Experiential Learning Model (ELM) was used as the framework for the study.

A relatively new field of study, dissemination and implementation, was added to the literature review. This field included sustainability of new changes as part of the implementation segment and held strong possibilities to be included in the study. The study of how programs or initiatives are best implemented and sustained was appealing. However, the information distracted from the focus on retention of information so the category was removed.

Limitations

The research study to explore the effect of text messages on nurses' and clinical partners' ability to retain information has several limitations. The first limitation is individuals learn best with specific learning styles (Kolb, 1984). However, the focus of this study is the retention of information so the study will use a combination of delivery methods to engage the participants, including lecture, interactive question and answer sessions, and a return demonstration. The same facilitator will present the information for each class to ensure consistency. A second limitation is the inability to restrict participants from one group talking and exchanging information with members of the other group.

Summary

Nurses and clinical partners have the obligation to give their patients quality care by using the best evidence available at the time. Research has revealed that nurses often use information gained during nursing school as the basis for patient care rather than use current evidence from research (Lundeen, 2013). This practice is unfortunate since patient care may be ineffective if based on old and outdated information. Research-to-practice and theory-to-practice gaps are common topics addressed in the literature but researchers have not identified practical solutions to close these gaps and increase the incorporation of information into the clinical practice.

The purpose of this research study was to study the effect of repetitive text messages among clinical staff. The background of the study provided the reason why this topic is important and why the topic was chosen for research. The research questions and hypotheses posed the topic and path while the theoretical framework guided the study through the numerous aspects of conducting research using the experiential learning model (Kolb,1984). Kolb's experiential learning model describes four stages a person must pass through while learning and described four learning styles based on the four stages of learning which provided the backdrop for how clinical staff learn on the units. The convenience sample of study participants were recruited from two acute care hospitals and randomly placed into one of two groups. One group served as the control group and the second group, or the experimental group, received the study intervention, namely text messages for six consecutive days. Chapter 2 will present an overview of the process to conduct the literature search and presents and in-depth literature review that pertains to research utilization, barriers to research utilization, and experiential learning.

Chapter 2

Review of the Literature

Chapter 1 presented an introduction to the research study, including the background of the problem, the research questions and study hypotheses. The purpose of the study was to explore the effect of repetitive text messages on the retention of knowledge among clinical staff. The significance of the study and the theoretical framework were also stated. Chapter 2 presents an overview of the process used to conduct the literature search and an in-depth literature review that relates to experiential learning, retention of information, use of text messages, and barriers to research utilization.

Porter-O'Grady and Malloch (2011) noted the rapid pace of changes within health care and the demands these changes place on clinical staff. Many sources dictate change within health care, including scientific discoveries, technology, and regulations from authoritative bodies, such as The Joint Commission and the Center for Medicare and Medicaid. Scientific discoveries, such as the discovery of antibiotics or development of a new way to make a patient comfortable after surgery, stem from research (Brown, 2010). Technological developments occur quite frequently and exert a strong impact on health care. Regulations from federal, state, and local government as well as other regulatory bodies, such as The Joint Commission (TJC) (2015) and Center for Medicare and Medicaid Services (CMS) (2014) also dictate changes in the delivery of health care. Because healthcare falls under many agencies and hospital policies change with the new requirements, changes happen frequently in the clinical setting. Johnson (2016) estimated medical knowledge doubles every five to eight years. Clinical staff are challenged by the amount of new material to learn.

To deliver patient care that meets or exceeds standards nurses need to keep up with the changes. Nursing school provides a great foundation to prepare nurses to provide patient care but that information becomes outdated within five to ten years. To maintain delivery of excellent nursing care, nurses need to continue learning throughout their career to keep their knowledge and skills current. Up-to-date information is available through seminars, conferences, symposiums, and classes. This current information may come from colleges and universities or may come from educators within the organization who search for ways to improve patient care and provide the latest information on equipment or changes in policies. Professional organizations are another source that offers ways to keep up with the latest developments in nursing. Different areas of nursing have developed their own professional organization, such as the Emergency Room Nurses or the Oncology Nurses Society. Another example is the American Nurses Association (ANA). This organization sponsors numerous online modules, books, and conferences to help nurses stay abreast of the latest information in their field (ANA, 2010). Research is often a source of new information presented at conferences and in-service training and is an essential component of evidence-based practice.

Reflecting on the process discussed above, the question arises about how nurses learn. This topic combines nursing and education and many theories and methods of teaching have been developed over the years, such as the learning theory, the forgetting theory, problem-based learning, and learner-based learning. One such model, the Experiential Learning Model, developed by Kolb (1984), provides insight into how people learn and emphasizes the role hands-on experience plays in the learning process. Because of the emphasis on experience, the Experiential Learning Model served as the theoretical framework for this research study.

Other considerations in the study design were the use of repetition and the use of text messages. Repetition has been used in education for many years, especially in the areas of music and language. Saville (2011) noted infants use repetition when imitating actions around them. Their first responses are sometimes crude and inaccurate but improve with practice. Sandberg et al. (2008) demonstrated how using text messages to send physicians reminders to document patient allergies improved compliance. Zurovac et al. (2011) used text messaging to improve health care workers' compliance with treatment protocols.

Barriers to research utilization was another concern for this study and therefore included in the literature review. Funk et al. (1991) gave nurses an opportunity to identify reasons why research findings were poorly used in clinical practice. The authors developed the Barriers Scale to identify those barriers and subsequently became the standard in research studies conducted around the world. These included Saudi Arabia (Omer, 2012), Sweden (Florin, Ehrenberg, Wallin, & Gustavsson, 2011), Taiwan (Chen et al., 2013) and the United States (Chan et al., 2011). Researchers such as Kajermo et al. (2008), McCloskey (2008), and Schoonover (2009) used the Barriers Scale to identify nurses' perception of the barriers preventing the use of research findings under different circumstances and found results like those of Funk et al. (1991).

Understanding how nurses and clinical partners learn will support the development of tools to help them retain that information. Identifying barriers that prevent clinical staff from using research findings may lead to ways to overcome these barriers and increase the use of research findings in nursing.

Literature review process

The literature review included use of the databases Cumulative Index to Nursing and Allied Health Literature, (CINAHAL), Education Resources Information Center (ERIC),

EBSCOhost, and Nursing@Ovid provided by the University of Phoenix and Baptist Health South Florida for the literature review. The initial search included the key words research-to-practice gap, retention of knowledge, knowledge translation, adult learning, theory-practice gap, knowledge utilization, evidence-based practice implementation, and learning using text messaging. The search included the field of nursing and allied health disciplines, such as occupational therapy and medicine and was limited to the English language. A search of the literature revealed over 100 peer-reviewed journals, dissertations, and research studies.

With such a large amount of information available, inclusion criteria were developed to filter articles pertinent to this study. The inclusion criteria for articles were research studies on adult learning, experiential learning, research utilization, and barriers to research utilization. As the literature search proceeded, repetition and text messaging were added to the inclusion criteria and adult learning was narrowed to experiential learning. The final topics for the literature review included experiential learning, repetition, text messaging and education, research utilization, and barriers to research utilization. The focus was on articles published within the past 10 years but seminal studies were included such as the Barriers Scale by Funk et al. (1991). Performance improvement studies were not included and studies in fields other than health care, such as business or mathematics, were also excluded.

Experiential Learning

Experiential learning embraces experience as the major component of learning. Dewey (1938), Lewin (1940), and Knowles (1980) laid the groundwork for Kolb (1984) to later develop the Experiential Learning Model (ELM). Kolb's model identified four stages of knowledge and advocated learners performed best when they involved all four stages. Experiential learning has proven useful in a variety of disciplines, including nursing and occupational therapy.

Researchers have used experiential learning to study the experiences of nursing students in clinical research (Henoch et al., 2014). Investigators have also used experiential learning to study simulation experiences (Chmil, Turk, Adamson, & Larew, 2015) and to serve as the basis for interventions with occupational therapy students to use during home visits (Knecht-Sabres, 2013).

Kolb (1984) is often associated with experiential learning but other scientists, such as John Dewey (1938), Kurt Lewin (1940), and Malcolm Knowles (1980), laid the ground work for Kolb's work. John Dewey (1938) recognized that experience played a major role in education. How one interacts and learns from the surroundings helps one learn applied knowledge rather than theoretical (Yardley, Teunissen, & Dornan, 2012). Dewey also recognized the importance of learners being able to relate information to prior experiences. These views laid the ground work for the experiential learning model.

Kurt Lewin studied group dynamics and how action research influenced change (Yardley et al., 2012). His work addressed how learners can conceptualize learning from concrete experiences which influenced Kolb's experiential learning paradigm. Malcolm Knowles (1980) distinguished the difference between how children learn (pedagogy) and how adults learn (andragogy). Adults are self-directed, practical, and learn better when the information is relevant to the existing material (Horii, 2007). Yardley et al. (2012) noted that sometimes "adult" learning and "child" learning methods need to be switched. When a graduate student needs to learn a new language, the delivery methods may be closer to child education than adult, such as repetition or use of mnemonics. A child learning by discovery may demonstrate greater adult learning processes rather than child learning processes.

David Kolb (1984), building on the work of Dewey, Lewin, and Knowles, developed the Experiential Learning Model (ELM). Kolb wrote *Experiential Learning: Experience* and held that knowledge is created through experiences. He identified the four stages of knowledge, as described in Chapter 1, as concrete experience (feeling), reflective observation (watching), abstract conceptualization (thinking), and active experimentation (doing) (Kolb, 1984, p. 40). These stages are cyclic and learners may enter the cycle at any point but learn best if one practices all four stages. Kolb's cycle can be applied to this research study as follows:

- Abstract conceptualization—listening to the explanation of why inpatients fall.
- Concrete experience—going through step by step of a patient falling simulation
- Active experimentation—practicing skills developed using critical assessment to keep patients from falling
- Reflective observation—think about how new information can be used to prevent patient falls.

Experiential learning was incorporated into the educational approach for several studies (Chmil et al., 2015; Henoch et al., 2014; Knecht-Sabres, 2013) and represents some of the different areas in which the ELM proved useful. Henoch et al. (2014) used experiential learning to study nursing students' experiences with research. Specifically, the students attitude toward research when involved in clinical research, their approach to learning, and their interest in nursing research. Chmil et al. (2015) used experiential learning to design a simulation experience to help the development of clinical nursing judgment. A study by Knecht-Sabres (2013) examined students' confidence to perform multiple occupational therapy-related skills. Experiential learning was used as the basis of the intervention for the students as they went into client homes at the end of their education program.

Henoch et al. (2014) used a mixed methods approach to study 70 nursing students who collected data in the research study. The study used a questionnaire with seven questions to determine the students' knowledge prior to their participation in the study and any change in interest in nursing research during the project. Descriptive statistics were used to analyze the results of the quantitative section. The nursing students reported greater interest in research and conveyed a positive perception of the experience.

The study exemplified experiential learning by basing the educational event on practical experience. Even though the questionnaire was a self-reporting survey and the sample size was small, the use of other appropriate statistical tests, such as Mann-Whitney U-test and Student's t-test, added strength to the study results. The researchers followed the strict process of documenting the transcripts verbatim and coded the responses, then identified themes which gave further strength to the results. This study demonstrated the value of hands-on experience to help nurses learn new information.

Chmil et al. (2015) designed a simulation program based on experiential learning model to determine if this approach would improve the development of clinical judgment. Using a quasi-experimental design, the authors designed the research study with a focus on the simulation experience as the concrete experiences of the nurses during the program. The simulation program adhered to Kolb's theory that the best results are obtained when all the phases of the model are included in the experience. The sample size was adequate with the experimental group consisting of 72 active students and the control group consisting of 72 students from the previous year. The study reported adherence to strict guidelines to minimize the effect of variables. This was done by using the same scenario and debriefing methods, the same persons to rate the qualitative responses, as well as using the same faculty and simulation

staff for each session. This study also supports the concept of student or learner engagement aiding the learning process.

The third study included in the literature review on experiential learning was conducted by Knecht-Sabres (2013) using a mixed methods study to look at the effectiveness experiential learning had on the didactic education of occupational therapy students. A pretest/posttest design was used for the quantitative portion of the study. The qualitative portion of the study involved collecting data three ways, including student feedback via survey, observations by the principle investigator documented in a journal, and student journaling. The students, under the direct supervision of a faculty member, evaluated and implemented services for older adults living in the community. The hands-on experiences were based on experiential learning model and provided the basis of a positive experience as reported by the students.

The statistical analysis of the quantitative data was simple, using SPSS to compute a paired t-test. The qualitative data was analyzed using highlighting and memo writing and coded into themes. The authors used methodological triangulation to lend strength to the study as well as peer debriefing throughout the development and analysis phases. The study clearly identified experiential learning helped improve the students understanding and value of the patient-centered approach.

Experiential Learning Summary

Experiential learning was developed by David Kolb (1984) based on the earlier work of Dewey (1938), Lewin (1940), and Knowles (1980). The Experiential Learning Model (ELM), developed by Kolb, has proven useful in many settings, and has been used in a variety of research studies, such as studying the experiences of nursing students in clinical research

(Henoch et al., 2014), designing a study on simulation experiences (Chmil et al., 2015), and even as the basis for interventions for occupational therapy students (Knecht-Sabres, 2013).

Repetition

Repetition has been used for many years in education. The use of repetition can be traced back to ancient Greece when Aristotle commented on the role of repetition to learn and remember information (Saugstad, 2013). More recently, Saville (2011) noted the use of repetition in learning as a tool to evaluate learning. The author noted repetition included simple repetition, music, and mnemonics. Service et al. (2014) used repetition to study generational differences in learning. Putman (2015) used music to enhance recall with jingles proving most effective and Campos (2011) used mnemonics to study the effect of work image vividness. Mnemonics is the study and development of systems for improving memory (Merriam-Webster Dictionary, 2016), often using the first letter of the words to make a name. The use of mnemonics has been criticized as just rote memory but Putman (2015) advocates for their use in the right circumstances. An example of word mnemonics would be the use of HOMES to remember the Great Lakes or PICOT to recall the components of a research question.

Service et al. (2014) conducted a rigorous study addressing age differences when learning a new language using repetition. Some words were repeated once and other words were repeated five times. The authors presented detailed information on the procedure for setting up the study, such as the number of words with five syllables, four syllables, and three syllables. Adults and children demonstrated improvement in language skills when the word was repeated five times but showed little change when words were repeated only once. The study results were significant since the use of text messages represented a form of repetition to retain knowledge.

Campos (2011) used repetition with mnemonics to study the effect of word image vividness. Although the focus of this study was on word image vividness, the use of rote repetition learning method and keyword mnemonics demonstrates the effectiveness of mnemonics as a learning method. Using a sample of 80 adults, Campos (2011) provided detailed information on the method used to conduct the study. The study results demonstrated the recall of abstract words decreased after just one day, even when recall was high immediately after a class. The study confirmed greater retention of information using the keyword mnemonics. The author attributed this to the use of two systems—imagery and language. These findings could provide the basis for future research studies so the use of mnemonics could be included.

Repetition Summary

Repetition has been used for many years to enhance learning and recall of information. Saville (2011) noted the importance of repetition in learning and pointed out repetition has several forms, including simple repetition, mnemonics, and music. Mnemonics also has several forms, specifically name mnemonics, music mnemonics, and word mnemonics (Putman, 2015). Service et al. (2014) used repetition to study generational differences in learning whereas Campos (2011) used mnemonics to study the effect of work image vividness.

Text Messages

Text messages are a form of communication referring to sending short, typed messages between digital devices (Lauricella & Kay, 2013). Short message service, or SMS, is a communication technology that allows brief messages to be sent over the Internet, from one device directly to another. The devices are most often mobile phones but can also be computer to mobile phone. Multimedia Messaging Service (MMS) is another form of communication to send multimedia communication from one device to another. MMS supports sending text

messages but also photos, videos, and audio material as well. The clinical staff targeted for this study commonly own personal mobile phone devices already, so participants would have the tools to receive text messages as a participant.

The literature search revealed health care facilities have used text messages to reminder patients to keep appointments (Norton et al., 2014) or to comply with treatment protocols (Zurovac et al., 2011). Text messages have also been used to enhance communication between teachers and students. Swartzwelder (2014) conducted a study where the instructor sent text messages with probing questions to the students based on the material being studied. The purpose was to determine any change in participant's perception of learning based on the use of texting as a method of instruction. Swartzwelder (2014) noted the importance of using technology to improve student engagement which is associated with higher learning. The literature search did not reveal other studies that used text messages in the same manner as this study.

Lauricella and Kay (2013) conducted a study on the use of instant messaging tools in higher education and clearly demonstrated students were comfortable with the technology. The study also supported the use of text messages in the classroom setting. In the study the instructor sent text messages to the students regarding assignments or deadlines and the students texted the instructor with questions. Although the study did not use technology to reinforce information presented in class, the study did demonstrate how comfortable students were sending and receiving text messages on his or her phone.

Text messages have been used to send remind staff about treatment protocols. Zurovac et al. (2011) conducted a study using text messages to remind Kenyan health care workers to adhere to malaria treatment protocol for children. The text messages were sent twice a day, five

days a week, for six months. The study was conducted in 11 districts in Kenya and involved 119 workers and 2269 children. The study followed strenuous protocols and demonstrated a significant improvement in the adherence to the treatment regimens. This study demonstrated the usefulness of text messages to reinforce previously learned information.

Sandberg et al. (2008) demonstrated the use of text messages in a different manner—with documentation. The study employed the use of custom software to scan anesthesia records for documentation of patient allergies within 15 minutes of starting anesthesia. If the program detected allergy information was not entered for the patient, an alert was sent to the beeper of the person administering anesthesia (nurse anesthetists or anesthesiologist). The study demonstrated a clear improvement in documentation of patient allergies within days of starting the alert system, going from 30% of charts missing allergies, to 8% within five days (Sandberg et al., 2008). This study did not send a set number of text messages but did send an alert whenever allergy documentation was missing. This indicates some anesthesia personnel could have received several alerts while others received none. The authors discussed the possible influence of active avoidance learning indicating the practitioner learned to avoid the alert by documenting the allergy within the 15-minute timeframe.

Text Messages Summary

Text messages are a form of communication technology allowing information to go directly between mobile phones of computers and mobile phones. The literature search revealed text messages have been used in a variety of ways. A study by Swartzwelder (2014) used text messages to improve study engagement in college. Lauricella and Kay (2013) used text messages between instructors and students as discussions about homework. Other studies used text messages to reinforce treatment protocols with Kenyan health care workers (Zurovac et al.,

2011) and used text messages to improve documentation in the clinical setting (Sandberg et al., 2008). Text messages were often used with education but the literature review did not reveal studies that used text messages as a method to reinforce information learned in class as this study did.

Barriers to Research Utilization

While studying the use of research findings among nurses, Funk, et al. (1991) found nurses had a low rate of using research findings. This low usage had been present for over 10 years. So, the researchers developed a questionnaire, The Barriers Scale, to identify the reasons for the low use. The scale and the study were so successful identifying barriers that the scale has since been accepted as the leading instrument to study reasons nurses do not utilize research findings and has been used in numerous studies nationally (Kajermo et al., 2008; Schoonover, 2009; Strickland & O'Leary-Kelly, 2009) and internationally (Omer, 2012).

The studies reveal nurses' perception of barriers to research utilization included characteristics of the adopter (nurses), of the organization, of the research, and of the communication of the research findings (Funk, et al., 1991). Kajermo et al. (2008) surveyed 833 respondents using three questionnaires—the Barriers Scale, the Quality Work Competence questionnaire, and questionnaires about professional issues. The top barriers identified by the respondents included dissatisfaction with support from immediate supervisors, the lack of an academic degree, and unrealistic workplace goals.

McCloskey (2008) surveyed 270 nurses using the Research Utilization Questionnaire to study specific characteristics of nurses and how these characteristics influenced the perception of research. The characteristics included level of education, years of experience, and position held in the hospital. McCloskey (2008) had three content experts review the questionnaire since it

had been designed many years earlier (in 1989) to assure the questions were still appropriate. The statistical analysis demonstrated the researchers maintained rigorous controls and reported a high Cronbach's alpha (ranging from .80 to .91). The study found no significant differences in attitude, use, support, or availability in relation to years of experience. The correlation with education was different. Nurses who held a Master's degree had significantly different attitudes toward research and its use. This finding may be a consideration in this study because many of the clinical staff nurses were attending graduate school during the data collection.

Chan et al. (2011) also noted the link between education and attitude toward research. Surveying 948 emergency room nurses using the Barriers Scale, the Emergency Medical Services for Children survey, and a demographics section, the authors explored the needs and barriers to research for individuals as well as for organizations. The top barriers identified by the nurses were lack of authority to change patient care, lack of awareness of research by the nurse, lack of confidence in ability to analyze research quality, and the amount of information in research was overwhelming. Other barriers identified included lack of support from other staff, including physicians, not enough time, feeling isolated from knowledgeable colleagues, and nurse unwilling to change.

Schoonover (2009) studied the barriers to research utilization at a small community hospital to determine if the results would be similar to Funk et al. (1991) and other researchers using the Barriers Scale. Although the sample population had more educators and nonclinical nurses, the author had similar results. The top barriers were characteristics of the organization, then communication, adopter, and innovation. This study supported the universality of nurses' perceptions of barriers to using research findings.

Wangensteen, Johansson, Bjorkstrom, and Nordstrom (2011), using a quantitative, cross-sectional approach, studied the link between research utilization and critical thinking in new graduates. Surveying 617 new graduate nurses the authors used several independent variables of a) background variables (gender, age, education and health care experience prior to nursing, and the work area), b) critical thinking dispositions, c) Research Utilization Questionnaire (RUQ) availability and support, and d) RUQ attitude toward research. The dependent variables were a) daily use of research in practice, b) view toward research, and c) support to employ research findings. Even though the study had a large sample population, only 25% of the participants were research users. The low number of researchers weakened the findings that critical thinking was a good indicator of a nurse's attitude toward research and therefore a user of research findings.

Omer (2012) studied barriers to research utilization for nurses working in Saudi Arabia. The sample population was interesting because most nurses working in Saudi Arabia were from outside the country. These results were also similar to other studies. The main barriers identified were a) inadequate time, b) lack of authority to change practice, c) lack of cooperation from doctors, and d) lack of knowledge regarding evidence-based practice.

Lundeen (2013) surveyed 10 nurses in a focus study to explore how baccalaureate-prepared registered nurses used research in their work. The themes identified by the qualitative study were better patient care, the process of data collection, prepared/unprepared for research utilization, and research utilization. The group agreed that research was important to improve patient care and outcomes but admitted to using research inconsistently and the same nurses admitted to not reading nursing journals regularly. The participants reported feeling comfortable with research but did not feel supported by the organization and therefore, did not use research.

Barriers to Research Utilization Summary

Several research studies have demonstrated nurses have low use of research findings (Kajermo et al., 2008; Schoonover, 2009; Strickland & O'Leary-Kelley, 2009). The purpose of these studies was to identify the barriers that prevent nurses from utilizing research findings so the barriers could be overcome. The problem was that one group, researchers, identified the problem and barriers but another group, nurse leaders, are needed to make the necessary changes in the workplace. Nurse leaders are essential to developing solutions to overcome these barriers and change the workplace habit to improve the use of research findings in clinical practice.

Conclusion

The literature search demonstrated the value of experiential learning in the process of adult learning. Nursing is a practice-based discipline that requires specialized knowledge but also requires specialized skills that must be practiced for a practitioner to become proficient. The experiential learning model fits the discipline of nursing well because of the practice base. This led to the inclusion of repetition in the literature search. Repetition has been used successfully for many years to enhance learning. The use of repetition led to the use of text messages as a method to deliver repeated messages over several days. While the literature review demonstrated the use of text messages as a communication tool, articles were not available that used text messages to reinforce information learned in class.

The literature search revealed nurses often rely on colleagues for answers instead of research findings to deliver patient care. The implication of this finding is patient care may be based on old, possibly outdated, information (Lundeen, 2013). Researchers identified several barriers that prevented nurses from using research results and made recommendations to improve research utilization. The recommendations, although valid and excellent suggestions, were

deficient because the recommendations were aimed at senior nursing administrations. The researchers made suggestions with the assumption that managers or scholars would implement these changes. The action stopped there without any recommendations regarding actions nurses could take to improve their own use of research findings. The conclusion reached after the literature search was the positive value of using the experiential learning model for the framework of the study and the search provided a strong foundation for using text messages as a method of repetition to enhance learning and overcome many of the barriers preventing nurses from using research findings.

Chapter Summary

The literature search revealed how experience plays an important role in learning, based on the early works of Dewey, Lewin, and Knowles. Kolb developed the Experiential Learning Model (ELM) that stressed the importance of experience and identified four stages of knowledge, including abstract conceptualization, concrete experience, active experimentation, and reflective observation. Experiential learning was used in several studies to demonstrate the positive relation between experience and learning. Nursing is a practice discipline that requires specialized knowledge but also specialized skills that require hands-on experience for expertise in the field.

The use of repetition was included in the literature search as another method of reinforcing information learned in a class or in-service. Repetition and mnemonics have been used with great success for many years to enhance learning, especially in the areas of music and language. The amount of research studies on the use of repetition was limited but included the influence of age on learning (Service et al., 2014), the influence of using mnemonics (Campos, 2011), and the use of music to enhance retention of information (Putman, 2015).

The literature review also covered the use of text messages to enhance learning. The number of research studies in this area was very limited. Studies were conducted using text messages to remind patients of appointments (Norton et al., 2014) or to reminded healthcare workers about treatment protocols (Zurovac et al., 2011). One study used instant messaging as a tool for instructors and students to communicate regarding assignments and deadlines (Lauricella & Kay, 2013). Text messages were used as alerts or reminders but did not involve using text messages to reinforce information from a class.

Funk, et al. (1987) developed the Barriers Scale to identify what prevented nurses from using research findings in their practice. Other researchers used The Barriers Scale and attained results like Funk's group (Kajermo et al., 2008; Schoonover, 2009; Chan et al., 2011). The top reasons listed by many studies (sometimes in a different order) were

- Lacks the authority to change practice.
- Needs time to find and analyze research.
- Absence of awareness of research.
- Inadequate support from other staff including physicians.
- Lack of confidence in determining quality of research and unwillingness to change.

These studies identified the problem that nurses do not always base patient care on the most current findings. The authors made recommendations to overcome the barriers but left it to the senior leadership of health care organizations to make those changes (Kajermo et al., 2008). The recommendations are valid but did not include changes nurses could make at the unit level. Lundeen (2013) engaged nurses in the research process to see if engagement influenced their attitude toward research and therefore increase the usage.

Chapter 3 discusses the research methods for this research study. The chapter starts with an overview of the problem, the purpose of the study, and a review of the research questions and hypotheses. The major portion of Chapter 3 describes the chosen research method, including the appropriateness of the research method to address the problem and alternate methods that were considered. The characteristics of the population, estimated population size, the minimum size required, the inclusion criteria, and the sampling methods are also discussed. Ethical and confidentiality considerations are included in Chapter 3 as well as the instrumentation used. The chapter concludes with detailed information on the data collection and data analysis, including the description of the statistical analysis that used to examine the influence of text messages on the retention of knowledge.

Chapter 3

Methodology

Chapter 1 presented an introduction to the research study on the effect of repetitive text messages on the retention of knowledge among clinical staff, including the background of the problem, the research questions and study hypotheses. Nursing is based on scientific principles and contains elements from other disciplines, such as medicine, psychology, and sociology, yet the discipline also contains science unique to the nursing profession. The information at the core of nursing and the related disciplines changes frequently in response to new findings and developments within the scientific community. Regulatory changes and advancing technology also influence changes in nursing and health care environment. While academic nursing programs provide a great foundation for practice, the standards of care change quite rapidly over the time. Technological advances are made at a brisk pace and the rate is expected to increase. Nurses and clinical partners are challenged to keep up with these changes.

Nurses and clinical partners need help to keep abreast of the volume of changes in the field. One method to learn and remember information quickly is with the use of repetition. This method has been used successfully to learn music, language, and poetry (Saville, 2011; Service et al., 2014). Memorization has fallen out of favor with some educators (Tarman & Baytak, 2012) but still serves a purpose in certain situations, such as music or language. Memorization of medical and nursing terminology is essential to basic nursing practice. A nurse discussing patient symptoms with a physician is required to know assessment terminology. If the physician asks if the patient is obtunded, the nurse would appear to lack basic knowledge if he or she did not know this term meant mentally clouded or dulled. Yet nurses do not always have the time

to search the literature for information pertaining to a certain situation and clinical partners have even less time and education to find, analyze, and implement research findings.

Chapter 1 introduced the problem addressed by this research study. The problem is the challenge health care nurses face to provide patient care based on the best evidence available and research findings that reflect the advances in technology and scientific discoveries (Porter-O'Grady & Malloch, 2011). The purpose of the study is to explore the use of repetitive text messages on the retention of knowledge among clinical staff. The significance of the study and the theoretical framework were also stated. The research questions were presented in chapter 1 and are listed below.

Research question #1

The primary research question for the investigation is as follows:

What is the effect of repetitive electronic text messaging on retention of knowledge among clinical staff?

Hypotheses.

H0: There is no difference in the retention of knowledge for clinical staff who receive electronic text messages for six consecutive days compared to the retention of knowledge for clinical staff that do not receive electronic text messages.

HA: There is a difference in the retention of knowledge for clinical staff who receive text messages for six days compared to the retention of knowledge for clinical staff who do not receive electronic text messages.

The variables associated with this research question are the scores for exam 1 and 2 for both groups of participants (experimental and control). Both variables are continuous with ratio level

measurement. The Wilcoxon Signed Rank Test is the statistical test used for the data analysis (Pallant, 2013).

Research question #2

What is the effect of a staff member's level of education on the retention of knowledge among clinical staff?

Hypotheses.

H0: The level of education has no effect on the retention of knowledge among clinical staff who receive electronic text messages for six consecutive days.

HA: The level of education influences the retention of knowledge among clinical staff who receive electronic text messages for six consecutive days.

The variables associated with this research question are the level of education, a categorical variable with ordinal level measurement, and the scores for exam 2, which are continuous variables with ratio level measurement. Kruskal-Wallis Test is the statistical test used for the analysis with this data (Pallant, 2013).

Research question #3

What is the effect of a staff member's years of experience on the retention of knowledge among clinical staff?

Hypotheses.

H0: The years of experience have no effect on the retention of knowledge among clinical staff who receive electronic text messages for six consecutive days.

HA: The years of experience influences the retention of knowledge among clinical staff who receive electronic text messages for six consecutive days.

The variables associated with the third research question are the years of experience and the scores on exam 2. Both are continuous variables with ratio level measurement. This question concerns the relationship between two continuous variables. Therefore, Pearson's product-moment correlational coefficient (r) is used to examine the strength and direction of the relationship (Salkind, 2013).

Chapter 2 presented a review of the literature that supports the relevance of the study. The process used to conduct the search was identified and the topics included in the search were experiential learning, repetition, text messaging, research utilization, and barriers to using research findings. The review of the literature revealed a lack of information on ways to help bedside nurses retain new information. The identified gap in the literature supports the need for the research study.

Chapter 3 begins with an overview of the problem and purpose of the research study. The chapter continues with a review of the research questions and the hypotheses. Additionally, the chosen research method was described as well as the appropriateness of the research method to address the problem. Alternate methods that were considered are also discussed. Information regarding the study population follows with information on the characteristics of the population, estimated population size, the minimum size required, the inclusion criteria, and the sampling methods. To support the study, the ethical and confidentiality considerations are detailed and include approval by the Institutional Review Board (IRB), informed consent, measures taken to protect the participants' confidentiality and privacy, as well as potential risks and benefits. The instrumentation section discusses the exam for the educational class on preventing patient falls, as well as the validity and reliability of the instrument. Chapter 3 concludes with detailed information on how the data was collected and analyzed, including the description of the

statistical analysis used to determine if text messaging exerts an influence on the retention of knowledge.

Research Design

Research studies fall within one of three broad designs: qualitative, quantitative, or mixed methods. Qualitative research focuses on people and their experiences. Denzin and Lincoln (2008) noted that qualitative research puts the observer at the scene and is interested in how people describe situations or events. This approach examines the quality of an experience from the perspective of the participant using an inductive approach. Quantitative research uses a systematic manner to objectively collect information using standardized measurements. The rigor of these measurements is a defining characteristic of quantitative research that searches to answer the questions of who, what, when, where, why, and how (Boswell & Cannon, 2011).

Qualitative research approach was built on the traditions of positivism, cultural and interpretive studies and includes numerous approaches such as case studies, interviews, focus group interviews, and immersions with cultures. Nieswiadomy (2008) identified six common qualitative methods, including phenomenological, ethnographic, grounded theory, historical, case study, and action research. One of these approaches, action research design, was considered for this research study. Action research centers on activities to enhance practice and to examine the outcomes of those activities (Boswell & Cannon, 2011). The action research approach focuses on a specific problem then uses the results in practice to implement strategies based on the evidence, then to analyze the results (Aaron, 2014). This research method follows the premise that knowledge without action is ineffective. The most notable quality of action research is the conciseness of the process. The method empowers nurses because the data is collected, analyzed, and action taken to implement a solution so the process is relatively quick

even though this may still require months or years to complete. The growth and development of the nurses is enhanced because the process supports and promotes the critical thinking process (Hine & Lavery, 2014). This approach has other benefits, including closing the theory to practice gap and helping nurses develop new knowledge.

Using an action research approach, the investigator searches for solutions to practice problems in a specific setting, usually in a certain facility. The implementation of the solution happens as part of the research project thus eliminating any delay in implementing the solution. Although known better for his work on change theory, Kurt Lewin was influential in this type of research and assisted social workers to improve their practice using action research (Vallenga, Grypdonck, Hoogwerf, & Tan, 2009).

However, action research has limitations that made this approach unsuitable for this research study. Action research requires close collaboration between the participants and the researcher and can require a significant amount of the time (Vallenga et al., 2009). Although careful planning can help minimize the time needed to conduct the study, the type of design would take longer than the amount of time available for this study. The collaboration with the staff would be difficult in two hospitals and the time requirement for conducting the study would eliminate the feasibility of the study at the current time. The determining factor for the best approach for the study was a qualitative approach would not answer the research questions. A quantitative approach was then considered and, after careful consideration, was chosen for the study.

Quantitative Design

Quantitative studies collect information objectively, using tight control of the variables to maintain rigor. This research design uses numbers to measure phenomenon (versus words)

which allows statistical analysis to evaluate the results. A sample of the target population is chosen from which to gather information since surveying or measuring entire populations is not reasonable. Researchers work diligently to choose a sample that will give a true representation of the population so the study results may be applicable a larger population (Grove, Burns, & Gray, 2013).

A quantitative approach was chosen as the best design for this study. Quantitative data will answer the research questions and aligns with the study purpose of exploring the relationship between variables (Polit & Beck, 2014). The quantitative design supports the pursuit of an answer to cause and effect questions. The purpose of this study is to explore the influence of repeated text messages on the retention of information. The cause is the text messages and the effect is the retention of knowledge which aligns with the first research question. The second research question examines the relationship between a staff person's level of education and the retention of information. The third research question examines the relationship between years of experience of a staff nurse or clinical partner and the retention of knowledge. The support from the design determined the quantitative design to be the best design for this study.

Research Method

Experimental

Experimental methods tackle research in a systematic, organized manner and are used to examine cause and effect questions (Grove et al., 2013). Three characteristics essential for the experimental studies are randomization, tight control of the independent variable (cause), and inclusion of a control group (Grove et al., 2013). The results are generally considered the most precise because of these strict controls and the findings are generalizable to larger populations. This study was designed to meet the criteria for a quantitative, experimental approach by

including the randomization of the participants into groups, tight control of the cause, text messaging cue phrases, and included a control group and an experimental group. Measuring the scores of groups' means will provide the opportunity to compare results before and after the intervention.

The disadvantage of the experimental design is one confounding variable may destroy the entire project (Grove et al., 2013). Confounding variables are part of extraneous variables in a study that may be unrecognized until the study is in progress or ones that cannot be controlled. Polit and Beck (2014) placed these confounding variables, or confounders, into two categories, intrinsic and external. External confounders refer to the research environment which can affect the outcome. This variable can be controlled by minimizing the environmental contaminants and making the environmental situation the same for all participants. Randomization is a common and effective method to minimize confounding variables because the control and experimental group are considered equal (Polit & Beck, 2014).

Pretest/posttest

Pretest/posttest is a basic research design that introduces an intervention and measure or observe the outcome (Polit & Beck, 2014). This design requires the outcomes are measured at two different times—before and after the intervention. The pretest or pre-intervention exam provided a baseline score on the knowledge level of the participant on the class contents. The exams for this research study meet the criteria for pretest/posttest design. The first exam was given pre-intervention, or before text messages were sent. The second exam was given after the intervention, the text messages. The study included an experimental and control group.

Population

Study Population

The research study took place in a not-for-profit hospital system located in Miami, Florida. Staff from two of the hospitals within the healthcare system participated in the study. The two hospitals have similar populations and are located within a 10-mile radius. Hospital A is licensed for 281 beds with an average daily census of 84 patients and employs an estimated 285 nurses and 150 clinical partners. The hospital is a designated center of excellence for orthopedic medicine, sports medicine, and neurosurgery. Hospital B is licensed for 452 beds with an average daily census of 179 patients and employs an estimated 639 nurses and an estimated 200 clinical partners. This hospital is a designated stroke center, heart center, and has received Magnet designation. The estimated total of registered nurses is an estimated 924 and an estimated total of 350 clinical partners (1274 total). The number of clinical staff working at the beside is estimated to be approximately 550 registered nurses and approximately 150 clinical partners for an approximate 700 clinical staff eligible for participation in the study.

The recruitment of study participants followed the Institutional Review Board (IRB) regulations as required (Grove et al., 2013). The study posed no harm or threat of harm to the participants. Prior to the educational class, the primary investigator explained the study and the role of the participant in the study. After explaining the study and the participants' role, the investigator allowed time for the recruits to read the consent, then sign or not sign the consent form. The investigator emphasized that subjects may change their mind regarding participation at any time (Grove et al., 2013).

The recruitment process consisted of presentations or announcements at staff meetings, council meetings, flyers posted on the bulletin boards, and through group emails. The flyers had

information regarding the date, time, and location of classes, topic of the class, and purpose of the study. Contact information for the primary investigator was included on the flyers and on any written or electronic materials, as well as the contact information for the IRB representative.

Inclusion and Exclusion Criteria

A convenience sample was used from the population of all registered nurses and clinical partners working in the clinical setting employed by two hospitals in Miami, Florida. The inclusion criteria included employment as a registered nurse or clinical partner within one of the study hospitals, works in the acute care setting, attends the in-service training, and has the ability and the means to receive and read electronic text messages in English at work and at home. Exclusion criteria included registered nurses and clinical partners not currently employed by the organization, do not have the ability and means to receive text messages at work and at home, or do not read or understand English.

Sample Size and Determination

Soper (2014) website for research calculations was used to determine the sample size needed for this study. At least 71 participants were needed to achieve a power of 0.80 with medium effect size and a 0.05 alpha level (α). The total population included approximately 550 registered nurses and approximately 150 clinical partners eligible to participate (total of approximately 700 clinical staff). The goal was to recruit at least 150 nurses and clinical partners from two entities to allow for attrition of study participants. A total of 142 clinical staff enrolled in the research study and 72 completed the final exam as well.

Ethical and Confidentiality Considerations

Informed Consent

Following some research studies that disregarded ethical behavior, such as the Tuskegee Syphilis Study, Institutional Review Boards (IRB) were created to review research proposals to ensure the protection of human rights (Polit & Beck, 2014). Researchers must be familiar with and follow state, federal, and organizational guidelines regarding the protection of the rights of human participants in research. Researchers must obtain approval from the appropriate IRB prior to involving any human subject in a research study (Polit & Beck, 2014). The IRB for the organization has three levels of review for research studies, including exempt, expedited, and a full review. A study that poses no apparent risk and meets certain criteria, such as conducted in an educational setting, involves educational testing, and no disclosure of identifying information, may be exempt from IRB review. Expedited IRB review is the next level of review and may be approved for studies that anticipate minimal risks. This level of review may be done by the chairperson or director of the IRB. The third and highest level of review is a complete IRB review and must ensure risks to participants are minimal (Grove et al., 2013).

Before recruitment of participants for this study, approval for an expedited study was obtained from the Institutional Review Board (IRB) for the organization and the IRB for the University of Phoenix (UOPX). The study followed the IRB process, protecting the rights of the participants as required, including an explanation of the study, obtaining an informed consent, and providing an opportunity to decline participating. Clinical staff were recruited through email, announcement at staff meetings or council meetings, and by flyers posted on the nursing units with the contact information of the primary investigator and the IRB office. Employees interested in participating could call the investigator for any questions or concerns. Prior to

classes being conducted, prospective participants were given a full explanation of the study, any anticipated risks, expectations of their participation, and offered an opportunity to leave and not participate. Recruits were also informed they could withdraw from the study at any time without any consequences (Grove et al., 2013). Those staff members who stayed and signed the informed consent (see Appendix A) were enrolled in the study. The participants listened to a presentation on preventing patient falls in the acute care setting. They were then given a paper exam and a demographic survey. Half the participants were sent text messages over the next six days and all the participants were sent text messages or emails with a link to Survey Monkey to take the final exam. Participants were assigned to Group 1 (experimental) or Group 2 (control) using a randomization table.

Confidentiality

The confidentiality of the study participants was protected by following standard procedures to keep all participant information protected throughout the study. The examinations did not include identifying demographics or identifying characteristics and the report of test statistics included only aggregate information. Participants were asked to develop a personal code to protect their identity by using the first 2 letters of their first name, then last 2 digits of social security number, then last 2 digits of their employee ID number. A master list of participants, matching the personal code with their phone numbers and service providers, was kept to allow text messages to be sent via a secured computer located on the organization's premises. The master list was kept in a secured cabinet in the investigator's office that is locked when the investigator is not present (Grove et al., 2013). The master list, codes, and collected data will be destroyed by shredding after the study is completed. Other required documents will be securely stored for a period of seven years as required by the participating institution.

Potential risks and benefits

The study posed no harm or threat of harm to the participants. The potential benefits to the participants included improved knowledge and skills. If texting messages does influence the retention of knowledge, the procedure may have application in other situations where nurses and clinical partners need the ability to retain information to be able to respond quickly to a situation. Examples of situations might include discussing the patient's status with a physician or other health care professional or answering a patient's questions about the care being received.

Instrumentation

An extensive literature search was performed seeking an instrument to use for this study. An appropriate instrument would need to cover information that could be presented in a 15-minute class on preventing patient falls in the acute care setting. An appropriate exam was not located. Therefore, an examination was developed specifically for this research study based on the information presented in the 15-minute class on why patients fall in hospitals. An extensive literature search was conducted on patient falls within hospitals published within the past ten years. The search included EBSCOhost, ProQuest, Nursing@Ovid, The Joint Commission (2015) and the Agency for Healthcare Research and Quality (AHRQ) (2015) using the search terms patient falls, inpatient falls, and prevention of patient falls. A lot of information on preventing patient falls has been published. Therefore, the search criteria were adjusted to include only articles written within the past five years and focused on falls within hospitals. Information from previous in-services was excluded to reduce the possibility of staff exposure to the information at a previous time. Although the current process for assessing patients for risk of falling is discussed briefly during the class, the focus was to present new information to the staff. Some participants may have previous exposure to the information from other sources but not

through in-services provided through the facilities. After reviewing all the articles, four were chosen for the class, including articles by Oliver (2007), Anderson, Dolansky, Damato, and Jones (2015), Boltz, Podany, Hollenbeak, and Armen (2015), and Spetz, Brown, and Aydin (2015). Three websites were used-- Centers for Medicare & Medicaid Services (2014), Press Ganey (2015), and The Joint Commission (2015). These websites have current and relevant information to help hospitals improve the rate of patient falls throughout the country.

After the literature review, an outline for the class was developed along with a lesson plan. The information was reviewed by the chair and two members of the falls prevention committee for accuracy and appropriateness. The clinical nurse educators, subject matter experts on preventing patient falls, were also asked to review the content for accuracy. Revisions were made based on the recommendation by the members to reduce the number of questions on the examination because of the heavy patient load on the nursing units. The lesson design (see Appendix B for the complete plan) included the objectives and formed the bases of the exam. An expert panel consisting of four nurses with a PhD then reviewed the content of the class and the exam for appropriateness and accuracy. Based on the recommendations of the expert panel, the wording on two questions (# 4 and #6) were revised to clarify the statements, precautions for patients receiving anticoagulation therapy were given greater emphasis, grammar revisions were made to questions 1 and 2, and a description for intrinsic and extrinsic was added for clarification. The resulting exam consisted of six questions. The information includes the most common intrinsic and extrinsic factors associated with inpatient falls, the influence of staff education, actions the staff may take to prevent or reduce patient falls, and the most common side effects of multiple medications. The three functions of the aging process are emphasized because declining metabolism, declining kidney function, and declining liver function contribute

to higher blood levels of medications and may increase the risk for falls. The participant's score was calculated by the number of questions answered correctly. One change to the class format was made based on the recommendations of the panel. Originally, the examination questions were to be presented during the class using Turning Point. This is a program that allows participants to use clickers to answer multiple choice questions and the answers are tallied within a short period. The audience can see the results almost immediately. With the recommendation of the panel, the questions were eliminated from the presentation.

Pilot test

The questions were then tested by presenting the examination to 10 volunteers, eight registered nurses and two clinical partners. The exam results were eight scored 100% (seven nurses and one clinical partner) and two missed one question, scoring 84% (one nurse and one clinical partner). Feedback from the volunteers included a) the answers to the exam questions were presented in the class b) the exam was fair and c) the length of the exam was excellent. No changes to the content or the examination were recommended.

Reliability and Validity

Reliability and validity refer to the consistency and accuracy that an instrument measures what it is intended to measure and are important characteristics of research instruments. These characteristics influence the credibility of the project. Reliability refers to the consistency an instrument demonstrates measuring a variable (Polit & Beck, 2014). Reliability also takes into consideration the accuracy of the instrument. An example might be a scale to weight a set item, such as a bag of sugar. A scale with few variations for the same item has better reliability. The user would doubt the accuracy if the scale showed a wide variation for the same five-pound bag of sugar. The greater the reliability, the less chance for error in the results.

Reliable instruments enhance the power of a study when adjusted for the population being studied (Grove et al., 2013). Dependability, precisions, stability, reproducibility, and comparability contribute to the reliability of an instrument and is expressed in degrees rather than an absolute. Reliability is usually expressed as a form of correlation coefficient, with 1.00 having perfect reliability and 0.00 as no reliability. Instruments with coefficients of 0.80 or higher are considered to have strong reliability. The three most common types of reliability are stability, internal consistency, and equivalence (Polit & Beck, 2014). Stability means the instrument produced consistent results over time and is also referred to as test-retest reliability. This type is commonly used with measures of physical, technical, or paper-and-pencil scales. One requirement for stability reliability is the item being measured must remain the same being measurements.

Equivalence reliability compares two versions of an instrument or compares two observers measuring the same event (inter-rater reliability) (Grove et al., 2013). Establishment of inter-rater reliability is frequently needed for observational measurements for qualitative studies. Internal consistency, commonly used with paper-and-pencil exams, examines the correlation of various items within the instrument to assure the instrument measures one thing. Split-half reliability was used in the past to obtain test-retest reliability without taking the test twice. The items were split evenly and a correlational procedure was done on each half. One problem with this method is the items can be split many ways and each way gives a different result. Researchers would keep splitting the items until a satisfactory high coefficient was obtained. The process has changed to use all the items on the instrument and examines the extent the items measure the concept (Polit & Beck, 2014). Kuder-Richardson formulas can be used to calculate the internal consistency for dichotomous instruments.

Cronbach's alpha coefficient is a commonly used indicator of internal consistency for interval and ration level scales. The coefficient should be above .7 (Pallant, 2013) but the alpha is sensitive to the number of items on the scale. If the scale is short, fewer than 10 items, a low alpha score is quite common. Polit and Beck (2014) noted Cronbach's alpha is the best way to assess source of measurement error in scales, or the sampling but Grove, Burns, and Gray (2013) also noted that scales with fewer than 10-15 items generally score lower. Salkind (2013) explained the issue well. Internal consistency reliability "is used when you want to know whether items on a test are consistent with one another in that they represent one, and only one, dimension, construct, or area of interest." (Salkind, 2013, pg. 149).

The exam for this study consisted of six questions which represent a small number of items that would result in a low Cronbach's alpha. The class topic was preventing patient falls but the exam considered intrinsic and extrinsic factors, medications, staff education, actions to prevent falls, and why older adults react differently to medications. Falls prevention is a multi-faceted approach and the exam reflected this approach. The exam was developed to measure a participant's retention of information gained from listening to a presentation on preventing patient falls. The exam was not a scaled instrument and did not use a Likert scale and did not measure a single concept. The reliability for the exam in this study is demonstrated in the consistency the exam measured the knowledge nurses have about the information presented in class on preventing patient falls. The results of the examination were consistently above 80% with an average of score of 89.

Validity refers to the ability of an instrument to measure the intended data. The validity of an instrument is not established through using the instrument as is the case with reliability. Instead, the validity may be established using a panel of experts or through a search of the

literature on the topic. Validity is crucially important for research studies because the greater the validity, the greater the confidence the instrument will gather data to answer the research question. A broad measurement of validity is referred to as construct validity. This includes various types of validity, including content validity, factor analysis, convergent and divergent validity, contrasting groups, and prediction of future and current events (Grove et al., 2013). Content validity is the method of validation used for the instrument in this study.

Content Validity

Face validity was used extensively in the past (1960s and 1970s) and verified the instrument looked valid and that it had the appearance of measuring the intended item. However, this type is very subjective and did not have established guidelines for determining the validity. Each reviewer relied on their personal experience. Because of the lack of guidelines, face validity is considered a weak method of validation but still useful as a preliminary step to content validity (Grove et al., 2013).

Content validity examines the range of items used to measure the variable, assuring the number and types of items are sufficient to measure the concept (Nieswiadomy, 2008). Three methods can be used to evaluate content validity, including comparing the instrument's content to the literature on the topic, the use of a panel of experts, and representatives of the relative population. This study compared the content of the instrument against the literature and used a panel of four experts to establish the validity of the instrument as recommended by Grove et al. (2013).

The content for the class on preventing patient falls was developed after a literature search for articles on the topic published within the past five years and excluded information provided in earlier in-services by the clinical nurse educators. The exam was developed from the

information provided in class then given to members of the falls prevention committee to review and make recommendations. Recommendations from this group were made then the exam was given to a panel of four experts to review and make recommendations for changes. The final exam incorporated the recommended revisions from the panel and served as the research instrument.

Internal validity

Internal validity deals with the question of whether the independent variable is responsible for the outcome variable (Polit & Beck, 2014). Threats to internal validity are a concern since the research study aims to determine causality. Threats to internal validity include history effect, maturation, testing effect, instrumentation, selection, subject attrition, and diffusions of treatments (Grove et al., 2013). History refers to occurrences during the study that might influence the outcome. Hurricane Matthew was one such event. The town was placed on hurricane watch and protocols were put into place regarding staffing before, during, and after a major storm. This event occurred during the time many participants were sent a link to take the final exam. The group was sent another link a week later but the influence of the situation cannot be measured.

Maturation refers to the participants gaining more experience, getting older, and getting more tired (Grove et al., 2013). Although these changes are a normal part of life, they could influence the study results. Test effect, the effect of being measured, for this discussion refers to the possible influence taking an exam twice might have on a participant. Testing effect was a concern for the study. This threat was minimized by having the exams a week apart. Instrumentation signifies changes in measurements cause by the instrument between exams. Instrumentation could also be a factor if the data collectors improved their skills in collecting

data between exams. This study had only one data collector and the time between exams was one week. The length of time provided little opportunity to improve data collection skills. Selection refers to how participants were chosen. The sample population for this study was a convenience sample from two hospitals and anyone who met the criteria were enrolled in the study. How participants were grouped was determined by using a randomization table to minimize this type of bias.

Subject attrition is a concern for any study but was minimized because of the short interval between exams instead of attending a second session in person to take the second exam. Diffusion or imitation of the intervention refers to the control group gaining information from the experimental group. Although the participants could still discuss the study, a request not to discuss the exam or the answers was presented during the pre-class instructions. The greatest strength of this study was the use of randomization to minimize the influence of other variables for group differences (Polit & Beck, 2014). A randomization table was used to assign nurses and clinical partners to a group to reduce bias.

External validity

This type of validity refers to the generalizability of the study findings (Polit & Beck, 2014). Another way of stating this, the study findings may hold true for other clinical staff, under other conditions, and in different settings. One of the concerns for this area is the sampling plan. If the sample truly represents the population, the generalizability of the study results will be stronger. The sample for this study will draw from many clinical areas of the hospitals and from two acute care facilities. Drawing participants from the different areas will strength the representation of the population of acute care clinical staff.

Another consideration is the replicability of the study. The generalizability of the study is stronger if the study can be replicated and the same results obtained (Polit & Beck, 2014). By including details about the research study, other researchers will be able to duplicate the study. If the research study can be reproduced and attain the same results, then the consistency of the results enhances the validity of the study. This study will contain detailed information so other scientists can duplicate the study.

Data Collection

Recruitment of participants was started by obtaining approval from the Chief Nursing Officer (CNO) of both facilities and from the organization's IRB and the school IRB. Once approval was granted from these sources, directors and managers were informed at leadership meetings and through emails. Presentation of the research study was made at staff meetings and through emails. Flyers regarding the name, purpose of the study, as well as criteria for participation, were distributed on the nursing units as allowed by the patient care managers. Nurses and clinical partners interested in participating in the study were given the primary investigator's contact information, including phone numbers and email address to answer questions.

As per Soper (2014), at least 71 participants were needed to achieve a power of 0.80 with medium effect size and a 0.05 alpha level (α). A one-tailed test hypothesizes is indicated to show a difference in a specific direction while a two-tailed test hypothesizes is indicated to show a difference but does not state in which direction and is often used as the standard for research (Salkind, 2013). The research study hypothesized that electronic text messages would result in higher exam scores for the participants which is a one-tailed hypothesis. The minimum sample was obtained with 142 participants.

Demographic Survey

The demographic survey (see Appendix C for details) included questions regarding age, gender, area of work, years of experience in current job category, years worked at facility in current job category, and how often the participants read his or her text messages. The information will support the use of descriptive statistics including the mean (average), median (midpoint), mode (number that occurs most frequently), frequency, and standard deviation of the groups. The variance of the groups can be computed by using the standard deviation squared (Salkind, 2013). The purpose of the questionnaire was to examine the relationship between text messaging and level of education as well as text messaging and years of nursing experience.

Intervention

The staff who met the criteria and who agreed to participate in the study attended a 15-minute educational program on preventing patient falls. The class included the opportunity to either to leave and not participate in the study without any problem or to stay, sign the informed consent and participate in the study. After signing the consent, participants listened to a presentation on preventing patient falls, then completed an exam, paper version, on the information presented in the class (pre-intervention exam). The participants were then randomly assigned to Group A or Group B using a randomization table to decrease selection bias and strengthen the study results (Grove et al., 2013).

Group A served as the experimental group and received text messages with six phrases containing information presented during the class. The group members received three text messages (due to length of message) each day for six days. The group members were asked only to read the message; no response was required. On the seventh day participants were sent a text message with a link to Survey Monkey to take the final exam. Another link was sent a week

later with a second request to complete the final exam if not done already. The text messages were sent to the participants from a computer within the organization to the participant's mobile phone. (The organization's pre-IRB Leadership group recommended this action due to the high degree of organizational cyber security.) Text messages were sent between 8 and 10 AM or between 8 and 10 PM, as chosen by the participants to accommodate different work shifts. Group B served as the control group and did not receive daily text messages but were sent a link to Survey Monkey to take the final exam either by text message or by email if preferred.

Short Message Services (SMS), known as text messages, have a maximum length of 160 characters. This includes all letters, spaces, and punctuation. SMS did not convey the complete text message during testing so Multimedia Messaging Service (MMS) was used. MMS allows greater content to be sent and trial runs of testing the MMS system allowed the entire text message to be sent at one time. (The texting service automatically splits the message when the maximum length is reached.) Key components of the class content were revised to eliminate non-essential words and focus on the critical words to reduce the number of words to 77 and 467 characters. This revision reduced the number of text messages from five each day to three. The members could access the final exam on a computer or their mobile phone if desired. The study compared the aggregate exam scores between the two groups.

Data analysis

The plan for data analysis is based on several factors, including the research questions, the design of the study, the data collected, and the level of measurement for that data (Grove et al., 2013). Measurement represents an outcome but the level determines what kind of statistical analysis can be used (Salkind, 2013). Four levels are available—nominal, ordinal, interval, and ratio. The test scores, age, and years of experience are a ratio level measurements used in this

study. Level of education is an ordinal level of measurement. The categories were coded numerically to enable use of SPSS in the analysis and was done sequentially on a random basis, such as females = 1 and males =2. Years of experience was a continuous variable and examined as a possible influence on retention of knowledge in association with research question three. Level of education data was also collected and was analyzed with research question two.

Two common categories of statistical analysis are parametric and non-parametric. Parametric statistical analysis requires certain assumptions about the variables, including a normal distribution and at least an interval level of measurement. Normal distribution means the distribution of the scores fall within a symmetrical, bell-shaped curve (Grove et al., 2013). Certain statistical tests can determine if the data meets this requirement. The Kolmogorov-Smirnov statistic assesses the normality of the distribution (Pallant, 2013) and skewness and kurtosis identify other characteristics. Parametric tests are stringent and are the preferred method when possible.

Non-parametric analysis is used for studies that do not meet the two assumptions of parametric—normal distribution and interval measurements. Non-parametric statistical tests used in this study include Mann-Whitney U test, Wilcoxon Signed Rank Test, and Kruskal-Wallis Test (Pallant, 2013). The Mann-Whitney U Test tests differences between two independent, continuous measurements. Wilcoxon Signed Rank Test is used for measurements collected from the same group on two different occasions. This test can be used with matched pairs, such as the pre-intervention scores and the post-intervention scores. Kruskal-Wallis test is used with two or more groups for comparison on a continuous variable (Pallant, 2013).

The data analysis plan also includes correlation analysis which is used when the relationship between two variables is examined. Pearson product-moment correlation

coefficient, also known as r, is used with continuous variables. Pearson's can also be used with a continuous variable and a dichotomous variable (Pallant, 2013). Spearman correlation is available if the data is ranked or ordinal level variables. The following table illustrates the variables and associated measures to be used for the study to explore the effect of repetitive electronic text messaging on the retention of knowledge among clinical staff.

Table 1.

Variables, instrumentation and data analysis for the study.

Variable	Instrument	Data analysis
Retention of Information	Falls Prevention Exam	Ratio level of measurement Wilcoxon Signed Rank Test
Level of Education	Demographic Survey	Ordinal level of measurement Kruskal-Wallis Test
Years of Experience	Demographic Survey	Ratio level of measurement Pearson Correlation

Descriptive Statistics

Two major types of statistics are used in research—descriptive and inferential. Descriptive statistics are used to identify characteristics of the population sample, such as how many females and males are in the study, and can also help describe variables involved in the study (Grove et al., 2013). These statistical tests provide a way to present data in a manner more easily understood, allows data to be compared, and determines relationships among and between variables. The descriptive statistics used included measures of central tendency. Data was entered into a Microsoft Excel spreadsheet then uploaded in the Statistical Package for Social

Services (Version 24) (SPSS) software to calculate the desired statistics. These included the mean, median, and standard deviation.

Summary

This project is a quantitative, experimental study with the purpose to explore the effect of repetitive text messages on the retention of knowledge among clinical staff. The participants were recruited from two hospitals within a large hospital system located in Southeast Florida. Participants were recruited through emails, staff meetings, and flyers. Participants were informed of the purpose of the study, their rights as participants, and signed an informed consent. The subjects then attended a presentation on preventing patient falls and completed a post-class exam. The participants were divided randomly into an experimental or control group. The experimental group received text messages for six days and then both groups were sent a link to Survey Monkey to complete the final exam. Data was collected for four weeks then the results were analyzed and interpreted.

Chapter 3 provided information on the method and design of the research study. The chapter included justification for the chosen method and design, details for the protection of the participant rights, and the process for obtaining Institutional Review Board approval. Also, included in chapter 3 was the process to obtain the informed consent and to maintain the process for maintaining participant privacy. The chapter concluded with information on the recruitment process, data collection procedure, and the plan for analysis of the data.

Chapter 4

Results

The information upon which nursing practice is based changes frequently due to research findings, regulatory changes, and advances in information technology (IT). Updated information is often provided to clinical staff with the expectation the information will be remembered and incorporated into daily practice. However, before the information can become part of practice, more information is pushed onto the staff with the same expectation. Clinical staff need a new process to help keep up with the frequent changes. The purpose of this quantitative, experimental study was to explore the effect of repetitive text messages on the retention of knowledge among clinical staff. The study had three objectives.

- To obtain pre-intervention and post intervention exam scores for a control group and an experimental group.
- To determine if the level of education influenced the retention of information.
- To determine if the years of experience of the participant influenced the retention of information.

A quantitative, experimental research design was used to guide this study and to provide quantitative measurement of retention of knowledge after text messages to boost recall of information. Chapter 4 will review the research questions and hypotheses and discuss the results of the research study. The results include a review of the data screening procedure, survey demographics, data collection, and statistical analysis of the data as related to each research question.

Research Questions and Hypotheses

Research question #1

The primary research question for the investigation is as follows:

What is the effect of repetitive text messaging on retention of knowledge among clinical staff?

Hypotheses.

H0: There is no difference in the retention of knowledge for clinical staff who receive repetitive text messages for six consecutive days as compared to the retention of knowledge for clinical staff who do not receive recurrent text messages.

HA: There is a difference in the retention of knowledge for clinical staff who receive repetitive text messages for six days as compared to the retention of knowledge for clinical staff who do not receive recurrent text messages.

The variables associated with this research question are the scores for exam 1 and 2 for both groups of participants, experimental and control, which are continuous variables with ratio level measurements. The Wilcoxon Signed Rank Test is the statistical test used for the data analysis.

Research question #2

What is the effect of a staff member's level of education on the retention of knowledge among clinical staff?

Hypotheses.

H0: The level of education has no effect on the retention of knowledge among clinical staff who receive repetitive text messages for six consecutive days.

HA: The level of education influences the retention of knowledge among clinical staff who receive repetitive text messages for six consecutive days.

The variables associated with this research question are the level of education, a categorical variable, with ordinal level measurements, and scores for exam 2, which are continuous, ratio level measurements.

Research question #3

What is the effect of a staff member's years of experience in the retention of knowledge among clinical staff?

Hypotheses.

H0: The years of experience has no effect on the retention of knowledge among clinical staff who receive repetitive text messages for six consecutive days.

HA: The years of experience influences the retention of knowledge among clinical staff who receive repetitive text messages for six consecutive days.

The variables associated with the third research question are the years of experience and the scores on exam 2. Both are continuous variables with ratio level measurement. This question concerns the relationship between two continuous variables. Therefore, Pearson's product-moment correlational coefficient (r) is used to examine the strength and direction of the relationship (Salkind, 2013).

Data Screening Procedure

One hundred forty-six participants were recruited from two local hospitals in Miami-Dade County, Florida from a total of 1274 nurses and clinical partners. One hundred, forty-six participants signed consent, listened to the educational presentation on why patients still fall in hospitals, took the pre-intervention exam (exam #1), and completed the demographic questionnaire. Four of these participants did not provide contact information (phone number, carrier, or email) and were eliminated from the study, leaving 142 subjects to start the study.

Seventy-two participants completed the post-intervention exam via Survey Monkey to complete the research study. Demographic questionnaires with more than two missing answers were eliminated from the study. Exam questions missing an answer were marked as incorrect and scored appropriately.

Demographic Statistics

Demographic Survey

The demographic questionnaire (Appendix C) consisted of six questions: age, job category, years of experience as nurse or clinical partner, gender, highest level of education, and area of expertise. The questionnaire also asked for contact information, including how often they checked text messages while at work, preferred time to receive text messages, email address if preferred to receive link to Survey Monkey for final quiz this way, 10-digit mobile phone number, and mobile carrier. This information was needed to send text messages to the mobile phone at the time preferred by the participant. The data were collected to evaluate the consistency and homogeneity between the groups and to describe the population characteristics.

Demographic analysis

SPSS Version 24 was used to help in the demographic analysis, using frequency and codebook functions. One hundred forty-two nurses and clinical partners were recruited to participate in the research study. Registered nurses comprised 103 (72.5%) of the participants and Clinical Partners comprised the other 39 (27.5%). Of the 142 participants, 129 (90.8%) were female and 13 were male (9.2%). The participants' age ranged from 22 to 71 with a mean age of 39.02. Age was not provided by 10 participants (7%). The participants' years of work experience ranged from .4 to 38 years with a mean of 10.6 years with 126 answering the question. The participants' level of education ranged from Graduate Equivalent Degree (GED)

and High School Graduate to PhD/DNP. The participants were grouped according to similar levels of education. Numbers were assigned to each the different levels sequentially for coding purposes to enable use of a statistical analysis program. Twenty-four participants (16.9%) have a GED or graduated from high school, 28 have an Associate Degree, three have a Diploma, 73 have a Bachelor of Science Degree, 12 have a Master of Science Degree, and two have doctoral degrees. The GED and HS graduation were limited to Clinical Partners (since nursing requires higher education) but many also had diplomas and associate degrees in other fields. Most participants work in the medical surgical area (82) and ICU/PCU/CCU (32). Four participants worked in the emergency room area, one in surgical services, and 23 worked in other areas, such as oncology, and mother/baby department.

Figure 3: Distribution of ages

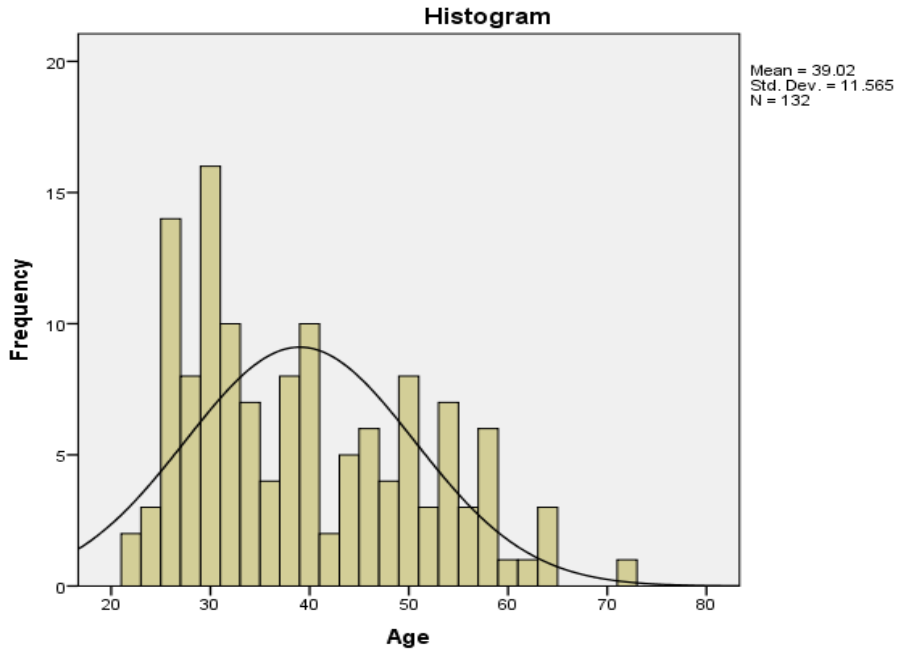


Figure 4: Distribution of years of experience

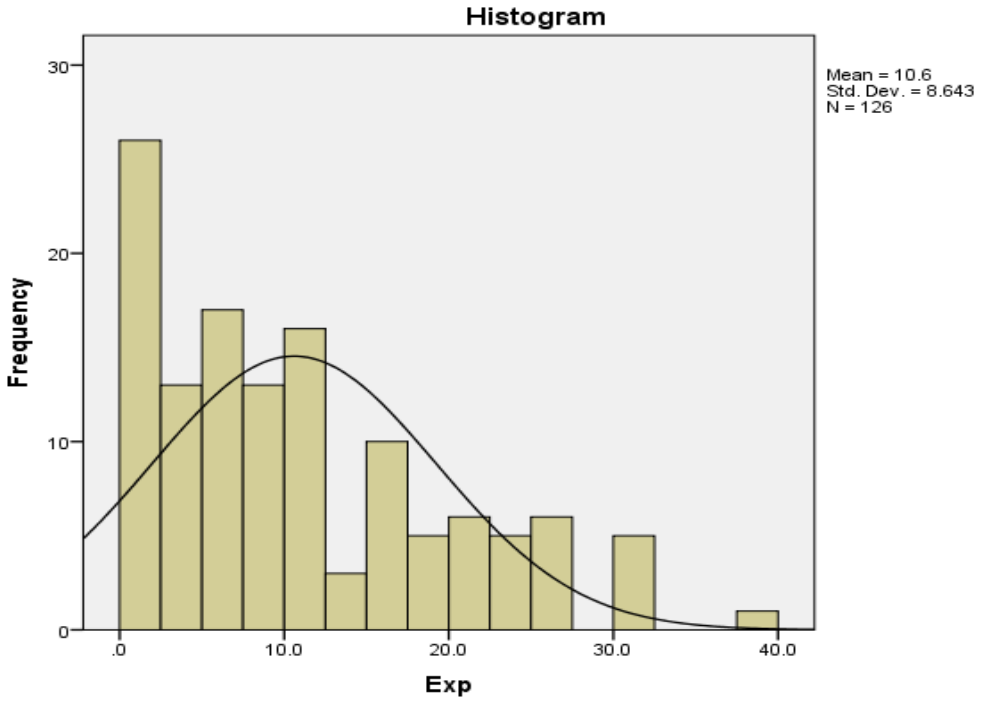


Table 2 Codebook

Variable	Coding instructions	Measurement Scale
Age	None	Ratio
Job	1= Registered Nurse 2= Clinical Partner	Nominal
Years of Experience	None	Ratio
Gender	1= Female 2= Male	Nominal
Level of Education	1= GED/High School 2= Associate Degree 3= Diploma 4= Bachelor of Science 5= Master of Science 6= PhD/DNP	Ordinal
Area of Expertise	1= Medical/ Surgical 2= Intensive Care Unit/Progressive Care Unit /Critical Care Unit 3= Emergency Department/ Urgent Care	Nominal

4= Surgical Services (Operating Room, Recovery, Preplanning)
5= Other (Mother/Baby, Oncology, and Labor & Delivery)

Randomization Table
1= Group 1 (Experimental)
2= Group 2 (Control)

Table 3 Frequency and Percentage of Demographic Data

Demographic	Frequency	Percent
Job Category N= 142		
RN	**103**	**72.5**
Clinical Partner	**39**	**27.5**
Gender N= 142		
Female	**129**	**90.8**
Male	**13**	**9.2**
Age Frequencies N=132		
Age		
22	**2**	**1.5**
24	**3**	**2.1**
25	**8**	**5.6**
26	**6**	**4.2**
27	**4**	**2.8**
28	**4**	**2.8**
29	**5**	**3.5**
30	**11**	**7.7**
31	**4**	**2.8**
32	**6**	**4.2**
33	**2**	**1.4**
34	**5**	**3.5**
35	**1**	**.7**
36	**3**	**2.1**
37	**5**	**3.5**
38	**3**	**2.1**
39	**5**	**3.5**
40	**5**	**3.5**
42	**2**	**1.4**
43	**2**	**1.4**
44	**3**	**2.1**
45	**2**	**1.4**
46	**4**	**2.8**
47	**2**	**1.4**
48	**2**	**1.4**
49	**1**	**.7**
50	**7**	**4.9**

51	**1**	**.7**
52	**2**	**1.4**
53	**1**	**.7**
54	**6**	**4.2**
55	**2**	**1.4**
56	**1**	**.7**
57	**1**	**.7**
58	**5**	**3.5**
59	**1**	**.7**
62	**1**	**.7**
64	**3**	**2.1**
71	**1**	**.7**
Total	**132**	**93.0**
Missing System	**10**	**7.0**
Total 142	**100.0**	

Years of Experience N=126		
.4		
.5	**1**	**.7**
1.0	**5**	**3.5**
1.5	**6**	**4.2**
2.0	**1**	**.7**
3.0	**13**	**9.2**
4.0	**4**	**2.8**
5.0	**9**	**6.3**
6.0	**7**	**4.9**
7.0	**7**	**4.9**
8.0	**3**	**2.1**
9.0	**6**	**4.2**
10.0	**7**	**4.9**
11.0	**9**	**6.3**
12.0	**2**	**1.4**
13.0	**5**	**3.5**
14.0	**2**	**1.4**
15.0	**1**	**.7**
16.0	**4**	**2.8**
17.0	**5**	**3.5**
15.0	**1**	**.7**
20.0	**5**	**3.5**
21.0	**5**	**3.5**
23.0	**1**	**.7**
24.0	**2**	**1.4**
25.0	**3**	**2.1**
26.0	**2**	**1.4**
27.0	**3**	**2.1**
30.0	**1**	**.7**

31.0	**4**	**2.8**
38.0	**1**	**.7**
Total	**1**	**.7**
Missing System	**126**	**88.7**
Total	**16**	**11.3**
	142	**100.0**
Level of Education N= 142		
GED/HS	**24**	**16.9**
Associates/ Diploma	**28**	**19.7**
Diploma	**3**	**2.1**
Bachelors	**73**	**51.4**
Masters	**12**	**8.5**
Doctoral	**2**	**1.4**
Total	**142**	**100.0**
Area of Expertise N= 142		
Medical/Surgical	**82**	**57.7**
ICU/PCU/CCU	**32**	**22.5**
ED/UC	**4**	**2.8**
Surgical Services	**1**	**.7**
Other	**23**	**16.2**
Total	**142**	**100.0**
Frequency Check Messages N= 141		
Several per hour	**14**	**9.9**
Every hour	**10**	**7.0**
4-8 times per shift	**33**	**23.2**
Once per shift	**35**	**24.6**
When receive text	**26**	**18.3**
Not at work	**23**	**16.2**
Total	**141**	**99.3**
Missing System	**1**	**.7**
Total	**142**	**100.0**

Data Collection

Approval was obtained from the organization's pre-IRB Review Committee and from the Chief Nursing Officers (CNOs) of the participating hospitals. Then approval was obtained from the organization's IRB as well as the IRB for the University of Phoenix. The directors, managers, and supervisors of the clinical units were provided information regarding the research study through council meetings and emails. Clinical staff nurses and clinical partners were informed and recruited through emails, flyers (Appendix D), and presentations at staff or council meetings.

The data was collected from participants who signed the informed consent, listened to the educational presentation, completed a six-question quiz (Appendix E) and an 11-question survey on demographics and contact information. Participants were randomly placed into the experimental group (Group A) or the control group (Group B) using a randomization table (Appendix F) with nurses and clinical partners on separate tables. A master list of participants' information (Appendix G) was kept by the primary investigator, kept in a locked drawer in an office that is locked when the primary investigator is not present. The experimental group received text messages (three messages each day) with key phrases (Appendix H) for six days while the control group did not. A computer within the organization was used to deliver the text messages. Using Microsoft Outlook, the text messages were sent using the delayed delivery function which enabled the delivery date to be synchronized with the attendance in the class and the time to be delivered as per participant preference. The experimental group was asked to read the text message but no other action was required by the participants. Seven days after attending the class, members of both groups were sent a link to Survey Monkey and asked to take the final quiz. To verify the group assignments, the final exam had an additional question -- "Did you

receive text messages during the intervening week?" The exams were then graded and the scores noted in the database.

Data analysis

Descriptive statistics are used to organize and describe the data collected (Salkind, 2013). The data collected for this study was taken from a sample of the population and descriptive statistics permitted statistical analysis of the information that enhanced understanding of the material. The study contains three continuous variables, the scores for exam #1, scores for exam #2, and years of experience. The exam scores relate directly to research question #1 and the years of experience relate directly to research question #2. The study contains five categorical variables, listed in the demographic section. One of the categorical variables, level of education, reflects directly on research question #3.

The Statistical Package for the Social Sciences (SPSS) version 24 was used to organize the data and perform statistical tests. As indicated earlier, the exam scores did not meet normality criteria and results were skewed to the right (high scores). Therefore, non-parametric tests were used. The data analysis used the Mann-Whitney U test (compare scores between groups), the Wilcoxon Signed Rank Test (compare differences between two scores for same group), and the Kruskal-Wallis Test (compare scores for three or more groups). Pearson product-moment correlation coefficient (r) was used to examine the relationship between exam 2 scores and years of experience or level of education (two continuous variables).

Data Preparation

Data was screened and checked for missing information. Demographic surveys that were missing more than two answers were eliminated. Exams missing contact information were eliminated since the person could not be sent the text messages or the link to the final exam.

Surveys and exams meeting the criteria were reviewed and entered into an Excel spreadsheet according to the personal codes. All entries were checked twice for accuracy. The post-intervention exam (exam #2) via Survey Monkey asked the participants to use the personal code as the first exam to enable matched pairs for the analysis. The instructions to create their own personal code was included with each exam. The data was then uploaded into SPSS (Version 24) to assist with analysis.

Descriptive analysis

Descriptive statistical tests used to determine the differences between pre-intervention exam and post-intervention exam and between groups were mean, median, and standard deviation. The mean score is the average and the median number is the midpoint. The standard deviation indicates how much scores differ from the mean (Salkind, 2013). The smaller the deviation, the better the mean represents a typical score.

Using SPSS, descriptive statistics was performed on exam #1 (pre-intervention exam). The number of participants was 142 with a mean score of 88.5. The 95% Confidence Interval for Mean revealed a lower boundary of 86.35 and an upper boundary of 90.66. The 5% trimmed mean was 89.6 indicating a close mean to the original mean. The median score was 84 with a standard deviation of 12.97. The skewness was -.965 indicating a cluster to the right with scores falling into the higher range.

Table 4 Examination Results

	Exam 1				**Exam 2**			
	N	Mean	Median	Std Dev	N	Mean	Median	Std Dev
Group 1	72	86.44	84	14.123	37	92.65	100	9.685
Group 2	70	90.63	100	11.393	35	91.78	100	11.880

SPSS tests the normality of the data using the Kolmogorov-Smirnov (K-S) statistics to assess the normality of distribution of scores. A non-significant result (Sig. value more than .05) indicates normality (Pallant, 2013). The Kolmogorov-Smirnov significance value for this study was .000 indicating the data did not meet the normal distribution criteria. Salkind (2013) and Pallant (2013) recommend the use of non-parametric tests when the criteria for normal distribution is not met. The histogram below indicates the distribution pattern is clustered to the right. The normal Q-Q plot shows actual deviation of the score from a straight line. The plot for this study falls between -2 to +1 while normal distribution should plot close to zero line.

Figure 5 Histogram Exam 1 scores

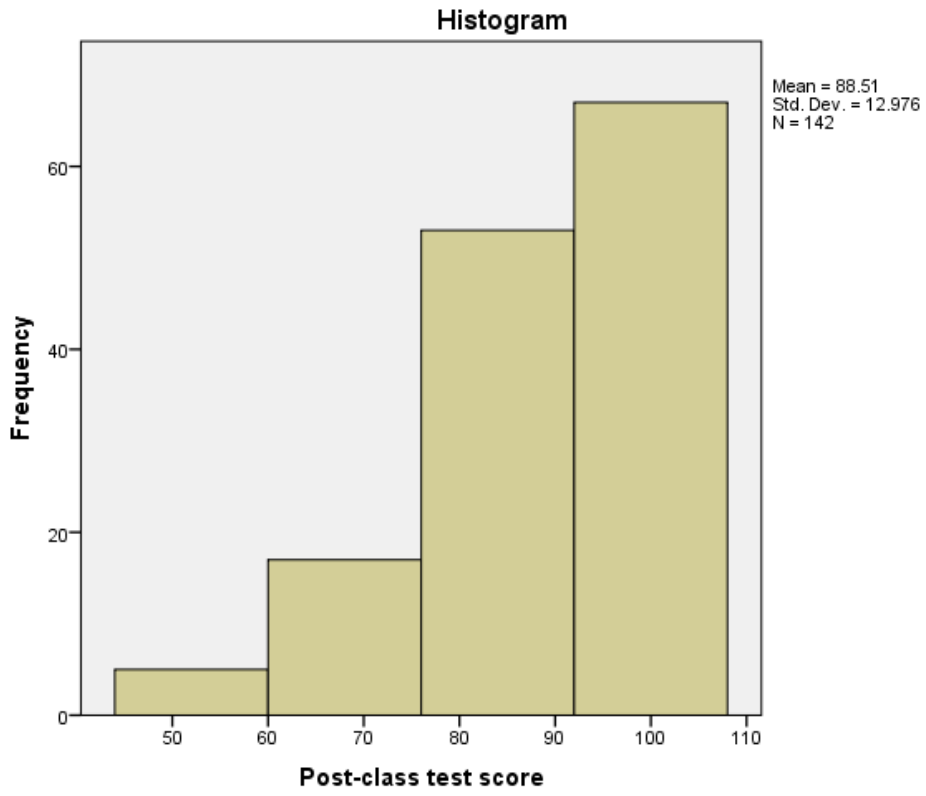
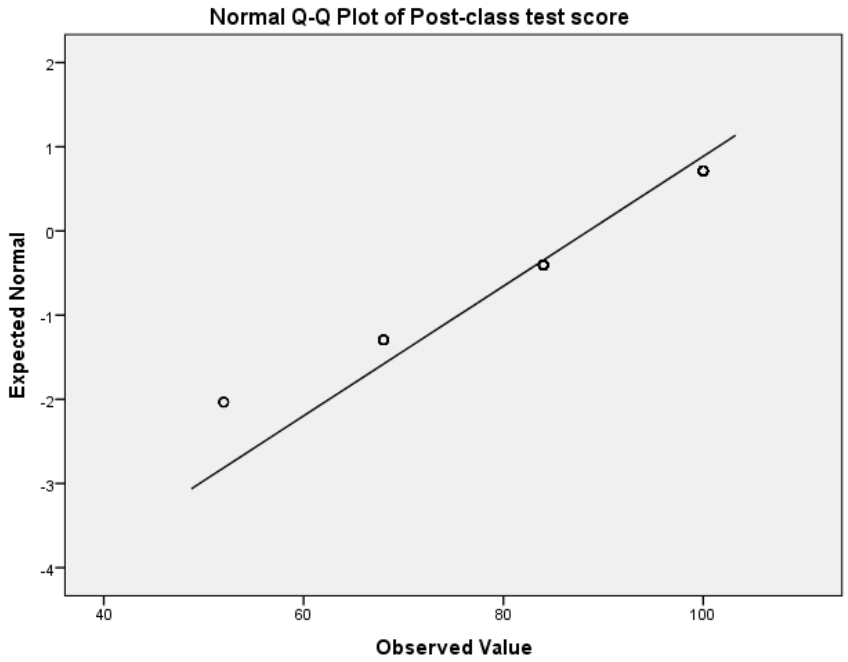


Figure 6 Q-Q Plot Exam 1 scores



Hypothesis analysis.

First hypothesis. The first null hypothesis tested in this study was: There is no difference in the retention of knowledge for clinical staff who received repetitive text messages for six consecutive days as compared to the retention of knowledge for clinical staff who did not. The independent variable (cause or intervention) was text messages (categorical variable) and the dependent variable (effect) was the scores on the exams (continuous variable). A total of 72 participants completed both the pre-intervention exam and post-intervention exam.

The Kolmogorov-Smirnov Text for normality revealed a p=.000 and therefore the data did not meet normal distribution. Because the test scores did not demonstrate normal distribution, the non-parametric statistical analysis was used. Mann-Whitney U test examines the differences between two independent groups on a continuous variable (Pallant, 2013). This statistical technique compares the median of the groups instead of the mean as used by the

parametric equivalent t-test. SPSS converts the score of the continuous variable (final test scores) to ranks across both groups then evaluates if the ranks differ significantly between the groups. The Mann-Whitney U Test was used to compare group 1 and group 2 scores on exam #1 (pre-intervention exam) and exam #2 (post-intervention exam). The U Test for exam #1 revealed the difference in the scores between group 1 (Md= 66.34, N=71) and group 2 (Md=76.66, N=71), U= 2154, Z= -1.63, and p= .103 indicating no significant difference between the groups. Exam #2 revealed the difference between group 1 (Md=36.70, N=37) and group 2 (Md=36.28, N= 35) also was not significant with U= 638.5, Z=-.098, and p= .922. This test demonstrates no statistical difference between the two groups.

Table 5 Groups Scores Comparison – Mann-Whitney U Test

	Exam 1	Exam 2	U	Z	P	r
Group 1			2154	-1.63	.103	No sig. difference
Md=	66.10	36.70				
N=	71	37				
Group 2			638.5	.098	.922	No sig. difference
Md=	77.06	36.28				
N=	71	35				
Total 142	72				> .05	

No significant difference between groups

Wilcoxon Signed Rank Test is a non-parametric test used to examine participants at two different times. For this study, the different times were exam #1 (pre-intervention) and exam #2 (post intervention). The Wilcoxon Signed Rank Test revealed a statistically significant difference in the scores for the two exams results for group 1 (experimental group), Z= -2.214, Asymp Sig=.027. Effect size is not calculated by SPSS but the formula to calculate is r=z/square root of N (N= total observations over two time points). Z= -2.074 and N= 109 yields an r value

of -0.21 which Salkind (2013) considered medium effect (lower range). The average exam scores increased for group 1 increased from 86.44 to 92.65.

A Wilcoxon Signed Rank Test was conducted on group 2 (control group). The Wilcoxon test revealed no statistically significant difference for group 2 between the exam #1 (Md= 100) and exam #2 (Md= 100), Z= -.535, Asympt Sign = .593. Because no significant difference between the scores was found, the effect size was not calculated. The results of exam 1 and exam 2 were compared. Group 2 (control group) demonstrated small change in the average score from 90.63 to 91.77.

Table 6 Groups Pretest/Posttest Scores—Wilcoxon Signed Rank Test

	N	Z	*Asympt Sign 2-tailed*	*r*
Group 1	109	-2.214	.027 < .05 statistically significant	.21
Group 2	105	-.535	.593 >.05 not statistically significant	Not calculated

Second hypothesis. The second hypothesis tested for this study was: The level of education has no effect on the retention of knowledge among clinical staff who received repetitive text messages for six consecutive days. The dependent variable was the test score (continuous) for participants who received text messages and the independent variable is the level of education (categorical). Kruskal-Wallis Test is the non-parametric test used to compare one continuous variable (score on final exam) for more than two groups (level of education). Kruskal-Wallis Test revealed no statistically significant difference between the final test scores for participants who received repetitive text messages across six levels of education (Gp 1,

N=14; Gp 2, N= 8; Gp 3, N=1; Gp 4, N= 42; Gp 5, N= 5; Gp 6, N= 2;) with a total of 72 with significance level of .610, rendering the level of education not statistically significant.

Third hypothesis. The third hypothesis tested for this study was: The years of experience has no effect on the retention of knowledge among clinical staff who received repetitive text messages for six consecutive days. The dependent variable is the final test score (continuous) for participants who received text messages and the independent variable is the years of experience (continuous). SPSS (Version 24) was used to calculate the Pearson Correlation between years of experience and scores on exam 2. Group 1 (experimental group) (N= 126 and sig. = .024) had a r= .278. Pearson's correlation calculations range from -1 to 1 and indicates the strength of the relationship between the final test scores and years of experience. A correlation of 0 indicates there is no relationship and 1 would indicate a perfect positive correlation. Pearson's r of .278 indicates a positive correlation with medium strength between years of experience and retention of information as demonstrated by the scores on the final exam for participants who received repeated text messages (Salkind, 2013).

Summary

Chapter 4 reviewed the demographic characteristics of the 142 participants. The descriptive analysis demonstrated skewed results to the right, indicating a cluster of high scores. Kolmogorov-Smirnov test of normality for distribution demonstrated a significant value of .000 indicated the distribution of scores was not normal and non-parametric statistics should be used for analysis. The chapter presented the demographic characteristics of the study participants and descriptive statistics used included Mann-Whitney U Test, Wilcoxon Signed Rank Test, and Kruskal-Wallis Test. Mann-Whitney test was used to compare the pre-intervention scores of the experimental and control groups to identify any differences between the two groups. The

Wilcoxon Signed Rank Test was used to evaluate differences in scores for members of the same groups at two different time points. The significance for Group 1 was .027 and Group 2 was .593. Kruskal-Wallis Test was used to compare the scores on a continuous variable (scores on exam 2) for more than two groups (level of education). The significance level was .610 (not statistically significant). Pearson's correlation examined the relationship between two continuous variables, years of experience and scores on exam 2 resulting in a significance level of .278 indicating a positive correlation with medium strength (Salkind, 2013).

Chapter 5 presents a discussion on the conclusions based on the data analysis, including a discussion on the influence of the level of education and years of experience. Implications for results and future use including possible methods to improve the performance of bedside staff using text messages is discussed in the chapter. The discussion includes specific implications for clinical nurse educators coaching and educating bedside staff. Recommendations for future research studies are presented as well. The recommendations include changes the author would make to the study and three suggestions for future research studies.

Chapter 5

Conclusions and Recommendations

Nurses learn a lot of information during nursing school which provides a great foundation for the knowledge and skills required to care for patients. But this information quickly becomes outdated and new information must be learned and incorporated into practice. Health care data relevant to patient care is estimated to double every five years and the rate is expected to increase (Barnard et al., 2005). Bedside nurses and clinical partners are challenged to keep up with the changes to provide evidence-based care for their patients. Clinical staff need help to keep up with these changes to provide the best care possible.

One objective of this study was to determine if repeating information would enhance the retention of information with the goal of helping the bedside staff retain information and incorporate the knowledge into practice to improve patient care. The data analyses reported in Chapter 4 were performed to explore the influence repeated text messages would exert on test scores. The analyses also examined the relationship between the level of education and test scores and the relationship between years of experience and test scores. The data were collected from participants who attended a class on preventing patient falls in the hospital, completed a pre-intervention exam, a demographic survey, and a post-intervention exam a week later. Half the participants received text messages daily for six days after the first exam and half did not. All participants were asked to take the final exam (exam #2) a week later and the scores for both groups were compared.

Chapter 5 will focus on the interpretation of the study results. The format will center on the research questions and hypotheses. An overview of the data results and analysis are provided

and conclusions are presented. The implications of the research study are then discussed as well as suggestions for future research studies. The study summary concludes the chapter.

Data Collection and Data Analysis

Approval was obtained from the organization's pre-IRB review committee, the CNOs of the participating hospitals, the IRB for the organization, and the IRB for the University of Phoenix. Participants were recruited without any coercion using emails, flyers, and announcements at meetings from two hospitals in Southeast Florida. Those wishing to participate signed an informed consent, listened to a presentation on preventing patient falls, completed an exam, and a demographic survey. Half the subjects received text messages for the next six days with key concepts from the class. All the subjects were asked to complete another exam seven days later. The study started with 146 clinical nurses and clinical partners. Four did not provide contact information necessary to send text messages and were eliminated from the study. Exam #1 (pre-intervention) had 142 participants and exam #2 (post intervention) had 72 participants.

Demographics

Demographic data. The demographic information collected included age, gender, job category, years of experience, highest level of education, and area of expertise. The information was used to ensure the similarity between the groups. Participants were also asked how often they checked text messages preferred time to receive text messages (morning or evening), their email address if preferred receiving information through this means, mobile phone number and name of carrier. The phone number and name of carrier were needed to send text messages using an organization's computer instead of personal phone.

Demographic analysis. One hundred forty-two participants (142) provided demographic information on his or her age, job category, years of experience, gender, the level of education, and area of expertise. Statistical tests used to help analysis the information included mean, median, and standard deviation. The categories were coded numerically to enable use of SPSS in the analysis and was done sequentially on a random basis, such as females = 1 and males =2. Years of experience was a continuous variable and examined as a possible influence on retention of knowledge in association with research question three. Level of education data was also collected and was analyzed with research question two.

Demographic findings. The analysis of the demographic data indicated the groups were similar. The more groups are similar the better the changes the sample represents the population (Nieswiadomy, 2008). Two demographic questions, years of experience and level of education are presented later in the chapter because this data was used with two of the research questions.

Age. This question had 132 participants provide their age with the average being 39.02. The distribution was skewed to the left indicating a younger group. This is contrary to the national average age of nurses of 47 (National Sample Survey of Registered Nurses, 2008).

Job. The clear majority of participants were registered nurses (72.5%). Clinical partners do not have the level of education nurses are required to have and may influence participation. Nurses may be more inclined to participate in research studies although many still refuse to even participate in studies.

Gender. Most participants were females (90.8%) and males 9.2%. These findings are not unexpected since the nursing profession is predominately female. The United States Census Bureau (2013) reported 9% of practicing nurses as male in the 2011 census.

Summary of results per research questions and hypotheses

Research question #1 and hypotheses. The primary research question for the investigation is as follows: What is the effect of repetitive text messaging on retention of knowledge among clinical staff? The null hypothesis stated there is no difference in the retention of knowledge for clinical staff who receive repetitive text messages for six consecutive days as compared to the retention of knowledge for clinical staff who do not receive recurrent text messages. The alternative hypothesis states there is a difference.

The research question examined the relationship between two examinations for two groups to explore the effect of the intervention, text messages. The scores on each exam are continuous variables with ratio level measurements. The Wilcoxon Signed Rank Test was used to examine participants at two different times, pre-intervention exam and post intervention exam (Pallant, 2013). The test revealed a statistically significant difference between exam #1 score and exam #2 score for the experimental group (group 1), with a medium effect (r= .21). The results for the control group did not reveal a statistically significant.

Research question #2 and hypotheses. What is the effect of a staff member's level of education on the retention of knowledge among clinical staff? The null hypothesis stated the level of education has no effect on the retention of knowledge among clinical staff who receive repetitive text messages for six consecutive days. The alternate hypothesis states the level of education does influence the retention of knowledge.

The research question explored the relationship between education, a categorical variable with ordinal level of measurement and the scores on the final exam which are continuous variables with ratio level measurements. Kruskal-Wallis Test is the non-parametric equivalent to the one-way between-groups analysis of variance (Pallant, 2013). This test allowed comparison

of scores on the final exam with the level of education. Kruskal-Wallis Test was determined to be .601 which is not statistically significant (Pallant, 2013).

Research question #3 and hypotheses. What is the effect of a staff member's years of experience in the retention of knowledge among clinical staff? The null hypothesis states the years of experience have no effect on the retention of knowledge among clinical staff who receive repetitive text messages for six consecutive days. The alternative hypothesis states the years of experience do influence the retention of knowledge.

This research question required the examination of the relationship between two continuous variables, the final test score (dependent variable) for participants who received text messages and the years of experience (independent variable). SPSS (Version 24) was used to calculate the Pearson Correlation between years of experience and scores on exam 2. Group 1 (experimental group) had a r= .278. This score indicates a medium correlation between years of experience and retention of information as demonstrated by the scores on the final exam (Pallant, 2013).

Conclusions

The statistical analysis of the data provided the information necessary to determine the answers to the research questions. Mann-Whitney U Test was used to test for differences between groups on each exam. The significance level for both exams were higher than the standard acceptable level of .05 so the results were not statistically significant. This statistical test established the two groups were similar and allowed valid comparisons regarding the variables.

Hypothesis #1

The purpose of this research study was to explore the effect of repeated text messages on the retention of knowledge among clinical staff. The non-parametric test used, Wilcoxon Signed Rank Test, calculated the changes in scores for Group 1 and was statistically significant (Grove et al., 2013). The average group score improved from 86.44 to 92.65 and the significance level was .027 with a calculated effect size of .21. While Pallant (2013) denotes this score as a small effect, Salkind (2013) noted the ranges for medium effect as .21 to .50. The Wilcoxon test was also conducted on the control group who did not receive text messages. The data analysis indicated no statistical significance in the test scores for this group. Therefore, the null hypothesis for the first research question was rejected—there is a difference in the retention of information among clinical staff.

Hypothesis #2

The Kruskal-Wallis test confirmed that the level of education did not influence the retention of knowledge among clinical staff with a significance level of .610. The null hypothesis was not rejected. The finding supports the concept that the class was successfully designed for registered nurses and clinical partners who have different educational levels.

Hypothesis #3

Pearson product-moment correlation coefficient r is used to identify the strength and direction of a relationship between two variables. The data analysis confirmed a positive relationship between years of experience and the retention of knowledge among clinical staff in this study. Pearson's r identified a medium, positive correlation at .278 with the significance level of .024. The null hypothesis was rejected. Experienced staff have greater experience

working with patients at risk for falling and often relate this experience to questions on the exam and may know the answers from personal experience.

Implications

The purpose of this study was to examine the effect of repetitive text messages on the retention of knowledge among clinical staff. The study also examined the influence that an employee's level of education or years of experience might influence retention of information. These three areas guided the research study with to goal of helping bedside staff keep up with frequent changes within the field and improve patient care.

Research Question #1

The first research question examined the effect of repetitive text messages on the retention of knowledge among clinical staff. As indicated in the results section, the data analysis demonstrated a statistically significant improvement in test scores between exams in the experimental group. The control group demonstrated only a slight increase in the average scores between exams which was not statistically significant. The intervention of text messages for six days is attributed for the improvement in scores. Although the experimental design allows tight controls of the variables, one variable alone may not be responsible for the improvement.

Factors related to the scores include the text messages but may also include other variables, such as consulting co-workers for answers, or even checking references for answers. Asking a co-worker could be risky since the person might not have the correct information. The class content was based on several articles on why patients still fall in hospitals and references were provided so participants did have access to the information. Although staff were instructed not to ask others for help and not seek answers from references, this action cannot be ruled out.

The scenario of participants looking up answers seems unlikely since the staff complains about the lack of time to conduct literature searches.

Familiarity with technology could also play a role in the number of participants who took the final exam. The participants were asked to access the final exam using Survey Monkey and could take the exam on a computer or use a mobile phone. Members of older generations have been known to resist using technology (Palo & Dokadia, 2015). Education level, such lack of knowledge about Survey Monkey, could also play a role because few clinical partners who took the first exam continued to complete the second exam. Financial considerations could be a factor for clinical partners. The pay rate for this group is significantly lower than nurses and clinical partners may not have data plans with adequate coverage. Language may be another factor since many clinical partners within the organization speak primarily Spanish and may not have not acquired English as well as the staff nurses.

How the results relate to the significance. The results of the study support the significance of the project to help nurses and clinical partners keep up with the numerous changes in health care using repeated text messages. Repetitive text messages can serve to act as a memory boost for information learned in class (Kohn, 2014). This study supported the concept that repeating information from a class for six days does help one retain information. Implementation of a program using text messages would require little additional education since a large majority of workers are familiar with the technology. Keeping up with the changes in health care will enable the clinical staff to deliver patient care based on current information from reliable sources and lead to improved patient outcomes.

The facilities involved in the research study provide mobile phones to each bedside nurse and clinical partner. The access to these phones offers another tool CNEs can use to

communicate with bedside staff. Text messages can remind staff of changes in policies, procedures, and new research findings without chasing down each employee (Coates & Fraser, 2014). The timing and content of the text messages can be controlled from a central computer at the nurses' station so the messages are delivered during non-peak workload times. This would also assure the staff receive the messages while at work and not during their off time. The messages should be prioritized so not to overload the staff at any given time. The concern is that excessive use of text messages could lead to a situation like alarm fatigue. Clinical nurse educators serve as facilitators, coaches, and leaders for the bedside staff. Various methods are already used to provide and reinforce information on policies, procedures, and regulations, including lectures, games, case studies, simulations, and group projects. The use of repeated text messages provides another way for the CNEs to assist the bedside staff.

How the results relate to the literature. Few studies in the literature relate the use of text messages with retention of information. The findings of this study are consistent with improved outcomes associated with the use of text messages to improve compliance with treatment protocols (Zurovac et al., 2011). In his study, *Real-time checking of electronic anesthesia records for documentation errors and automatically text messaging clinicians improves quality documentation*, Sandberg et al. (2008) used text message reminders to improve documentation of allergies by anesthesia providers. While these studies did not use repetition as a tool to improve retention of information, the studies did use repetition to improve compliance by reminders. Dolan, Yialamas, and McMahon (2015) conducted a study with medical residents in which the participants attended a one hour class then received a 25-item test via email. The experimental group received one to three questions via email over the next three- to six-month period. Retention of the information as well as clinical outcomes were measures 10 months

later. The experimental group scored higher in both areas compared to the control group who did not receive the repeated emails prior to the final testing.

Research question #2.

The second research question explored the relationship between the level of education and the retention of knowledge. The Kruskal-Wallis Test calculated a significance level of .974 (Pallant, 2013). The null hypothesis was rejected, maintaining that the level of education had no effect on the retention of knowledge. This finding would support the concept that the class was successfully designed to present information to staff with various levels of education. The design of certain classes, such as preventing patient falls, to engage learners of different educational background are sometimes necessary because both groups are active in preventing patient falls. While separate classes are sometimes possible, having the two groups present offers an advantage during discussions. This finding is helpful to the CNEs that must present information to staff members with different levels of education. This finding will be helpful for planning interprofessional activities.

How the results relate to the significance. The lack of relationship between levels of education and retention of information is significant for the topic in this study. Preventing patient falls cannot be the responsibility of nurses alone (Bonuel, Manjos, Lockett, & Gray-Becknell, 2011). All the clinical staff participate in the falls prevention program or the program could not succeed. The findings also confirm the need for classes that provide the required balance to reach audiences with different levels of education. The educators need to provide information simple enough for those with less education to understand and yet sophisticated enough for those with higher education to maintain interest.

How the results relate to the literature. The literature search did reveal articles relating the retention of knowledge to educational levels but did not include research studies. One research study was found on literacy and retention of information that explored teaching strategies and patients' retention of information (Kandula, Malli, Zei, Larsen, & Baker, 2011). The results of this study found all the participants had problems retaining information for two weeks regardless of the literacy level. The authors presented only the most essential material when designing the educational program to minimize the amount of information to be learned yet the patients had difficulty remembering.

Research Question #3

The third research question explored the relationship between the number of years of experience and the retention of knowledge. Pearson's correlation was calculated as .278 with a significance level of .024. Since the significance level is below the standard .05, the result is statistically significant and the null hypothesis was rejected. The implications for this finding is experienced staff members, nurses and clinical partners, can relate past experiences to current problems (Kolb, 1984). This ability allowed the experienced staff to score higher on questions pertaining to preventing patient falls and confirms the value of experienced staff to the health care team in an unforeseen manner.

How the results relate to the significance. The significance of the study was to help nurses retain information to provide the best evidence-based care possible. Experienced staff base patient care on prior experiences. The new graduate nurse or the new clinical partner does not yet have the experience upon which to base patient care (Benner, 1983). Boswell and Cannon (2011) define evidence-based practice as the process of using research findings,

practitioner expertise, and patient input. A disadvantage is experienced staff sometimes have difficulty letting go of old information and retaining the new.

How the results relate to the literature. The results of the analysis for the relationship between years of experience and retention of knowledge relate strongly to the literature reviewed in chapter 2 on experiential learning. Experiential learning served as the theoretical framework used for this study because of the focus on experience and learning. The relationship between years of experience and retention of knowledge corresponds to Kolb's theory that knowledge comes from experience. Pearson's r indicated a positive, medium strength relationship between the two variables, supporting Kolb's theory (1984).

Recommendations

Changes to Study Components

The results of this study have application for clinical nurse educators and nurse leaders striving to help bedside staff learn and retain new information. Other disciplines who also have frequent changes within the workplace may also benefit from the results. Recommendations for using the demographic questions in future studies include changes in survey and some of the wording. Some specific areas should be added, such as adding Mother/Baby, to decrease the number of participants who answer "other". Another recommendation is to change the age question and years of experience question to ranges. These two questions were the questions most often not answered. The question on levels of education should be revised to clarify diploma and associate degree in non-nursing areas and make nursing degrees under one heading, such as Diploma in Nursing and Associate Degree of Nursing. Areas such as the emergency department and surgery had little participation. Gaining participants from these areas is a

challenge because the staffing is different and the workload often does not coincide with other nursing units, making recruitment and participation a greater challenge.

The final exam was accessed through Survey Monkey. This option provided participants the opportunity to complete the second exam at his or her convenience without having to attend another educational event in person. An additional question was added to the final exam "Did you receive text messages during the intervening week?" This question was unnecessary and possibly misleading. The intention was to confirm members of the experimental group did receive text messages over six days between exams. Some participants answered yes to this question but were placed in the control group after the first exam. This information reveals the question was not clear as to the number of text messages that were received over what length of time. Examining the data revealed none of the members placed in the experimental group answered no, however, 11 participants answered yes that were in the control group. Participants identified as part of the control group in the original placement were kept in the control group because repetitive text messages were not sent to those phone numbers.

Future Research

Suggestions for future studies include conducting the study while providing the information in separate classes for registered nurses and clinical partners. The design would decrease the range in levels of education for nurses while enabling the investigator to evaluate clinical partners separately. Including other professional disciplines would also help determine the applicability to other areas. Another suggestion would be to reinforce the information from class over a longer period as done by Dolan, et al. (2015).

For an organization that already has mobile phones available for the staff, such as ASCOM or SpectraLink, a second recommendation would involve using these phones instead of

personal phones owned by the employees. The income level of different staff members varies and may influence participation, especially those with lower salaries. A lower financial level may not allow the staff member to obtain an unlimited data plan and could impede participation in the study due to concerns about cost of receiving text messages for six days. Using mobile phones provided by the organization would eliminate this variable.

A final suggestion for future research is a research study involving the use of text messages to reinforce information then measure changes in nursing practice. The purpose for this type of study would determine if retention of knowledge is translated into a change in practice. Determining these changes in practice would require measurements more involved than giving a test and can be time-consuming and expensive, such as direct observation of patient care. Other methods, such as changes in fall rates or decrease in pressure ulcer development, can also be used to demonstrate the effectiveness of the involved education.

Summary

Chapter 5 presented a discussion on the conclusions and implications based on the data analysis. This included a discussion on the influence of repeated text messages on retaining information, the relationship between the level of education and retention of knowledge, and the relationship between years of experience and retention of knowledge. Staff members who received repeated text messages with cue phrases scored higher on the post intervention exam than those who did not receive repeated text messages. The implications for future use include methods to improve the performance of bedside staff using text messages to send cue phrases from the material covered in a class. The level of education did not influence the scores on the post intervention exam but the years of experience did. Specific implications for clinical nurse educators were discussed and how the nurse educator can use this information to coach and

educate the bedside staff. Recommendations for future research studies were reviewed with changes in replicating the study and three suggestions for future research studies. This study added to the quantitative evidence that use of text messages can help staff learn and retain information.

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Appendix A

INFORMED CONSENT to PARTICIPATE in a RESARCH STUDY

Study Title: The Effect of Text Messaging on the Retention of Knowledge among Clinical Staff
Study Number: [redacted]
Investigator: [redacted]

Study Purpose: As a member of the health care team, you are an important part of patient care at [redacted] You are being asked to participate in a research study to explore the effect of electronic text messaging to improve the retention of knowledge among clinical staff after an educational session on why patients still fall in the acute care setting. The research study will use a quantitative approach with an experimental design.

Procedures: Your participation will consist of attending an approximate 30-minute class, that includes time to explain, and discuss the study, provide informed consent, complete a demographic questionnaire, participate in a 20-minute educational session on preventing patient falls in hospitals, and complete a post class exam. After the class, you will be randomly assigned to one of two groups—an experimental group or a control group. The experimental group will receive three text messages for six consecutive days (the same message at the same time each day); the control group will not receive text messages. You will then be asked to complete the same exam online approximately one week after attending the class. Each exam will take no more than 10 minutes to complete.

The demographic questionnaire consists of 10 questions and will ask for your mobile phone number and carrier service because this information is requested to send out text messages from a [redacted] computer. The paper exam consists of six content questions on material covered during the class. The online exam will be conducted via Survey Monkey and you will receive a link to the survey by email or by text message.

You will receive a reminder email about this online survey about 2 weeks after the initial email or text message whether you completed it or not because I will not be able to determine who has completed and submitted a survey.

Risks: There are no anticipated risks to you for participating in this study but you may experience temporary stress or anxiety while completing the exam. Participation or refusal to participate will not affect your employment at [redacted] in any way.

Benefits: There may be no direct benefit to participation in the study. Potential benefits include improved knowledge and skills. The study may contribute to the development of a new method to help clinical staff retain information.

Alternatives: You have the alternative not to participate in the study.

Costs: Any charges or fees for the text messages will be your responsibility and costs may vary according to your carrier service and service plan.

Compensation: You will not be paid for your participation in this study.

Confidentiality: Your participation in this research study will be kept confidential to the extent permitted by law. You will be given a procedure to create a personal code to place on the forms. The study investigator will keep a master list patching the personal codes and telephone numbers for the purpose of sending text messages only. The paper master list and original paper forms will be kept in a locked cabinet in an office that is locked when the investigator is not present. No attempt will be made to link answers to you. All online data will be password protected on a [redacted] computer that is accessible only by the survey administrator and study investigator. The data will not have individual names or URL addresses connected to it. Individual responses will not be shared and the results will be reported in aggregate form. Only the study investigator and the Institutional Review Board (IRB) for the protection of human subjects at [redacted] will have access to study materials.

Voluntary Participation and Right to Withdraw: Participation in this study is completely voluntary. You may refuse to participate without penalty. You may quit the study at any time without penalty. Your employment status at [redacted] will not be affected in any way should you decide not to participate, refuse to participate or to withdraw from the study.

Right to Ask Questions: Questions regarding your rights as a research participant may be directed to the [redacted]. For any study-related questions, you may contact [redacted]

☐ By checking this box, I acknowledge that I have read and understood the above information. I further understand that by continuing with the study, I am providing informed consent to participate in the research study: *The Effect of Text Messaging on Retention of Knowledge among Clinical Staff.*

Participant Name: _____

Participant Signature: _____Date:_____

Appendix B

Lesson Design

Lesson 1 of Unit 1	
Lesson Topic	Why patients fall in the hospital
Lesson Length	30 minutes
Lesson Objectives	

- **The learner will be able to identify the most common intrinsic factor associated with patients falls in the acute care setting.**
  Competency: The clinical nurse or clinical partner demonstrates knowledge of the five most common reasons patients fall.

  Explain: The clinical nurse and clinical partner work closely with patients and should be familiar with the most common intrinsic reasons for falls to help assess patients' risks for falls adequately.

- **The learner will be able to identify the most common extrinsic factor associated with patients fall in the acute care setting**.
  Competency: The clinical nurse or clinical partner demonstrates knowledge of the five most common reasons patients fall.

  Explain: The clinical nurse and clinical partner work closely with patients and should be familiar with the most common extrinsic reasons for falls to help assess patients' risks for falls adequately.

- **The learner will be able to identify and critically assess patients at high risk of falling**.
  Competency: The clinical nurse and clinical partner can identify a patient at high risk of falling through two case scenarios.

  Explain: The clinical nurse and clinical partner work at the patient's bedside and are often the first to assess a patient's ability to ambulate or to follow directions or to pick up subtle clues that might indicate a patient is at high risk for falling.

- **The learner will be able to discuss three ways to improve communication of a patient's risk of falling by including the assessment in the handoff report, during walking rounds, and by placing the information on the white board in the patient's room.**
  Competency: The clinical nurse or clinical partner can demonstrate knowledge of three forms of communication that can help reduce patient falls.

  Explain: The clinical nurse and clinical partner work have the responsibility to keep patients safe and to communicate relevant findings to other health care team members.

- **The learner will be able to identify the two most common side effects of polypharmacy as confusion/ disorientation and dizziness**.
  Competency: The clinical nurse and clinical partner can assess a patient's cognitive functions, disorientation and note any signs or reports of dizziness. The staff can also identify any change in the patient status or assessment.

  Explain: Confusion and disorientation are symptoms of several disease process, such as stroke, inadequate cardiac function but multiple medications can also cause these same symptoms.

- **The learner can identify three reasons older adults may accumulate drugs in their body faster than young adults. These reasons are decreased metabolism, decreased kidney function, and decreased liver function.**
  Competency: The clinical nurse and clinical partner can state three reasons older adults accumulate drugs in their system.

  Explain: Metabolism, kidney function, and liver function are necessary to break down medications and eliminate from the body. These systems slow with advanced age and therefore, drug levels climb at a faster rate than younger adults.

Instructional Strategies and Activities

Identify teaching and learning activities you plan to use in this lesson. For each activity, identify your rationale of using it.

- Lecture and discussions with case scenarios.
  Rationale: Lecture remains a valid method of delivering new information to learners but used minimally (Chilwant, 2012).

  Rationale: Discussions are a good method to engage learners (Smart, Witt, & Scott, 2012).

  Rationale: Case scenarios offer the opportunity for learners to critique a situation before the discussion and encourages analytical skills (Bastable, 2014).

  (Bradshaw & Lowenstein, 2014).

Media Analysis

Media resources for this class will be minimal with projector and monitor to show PowerPoint presentation and using Turning Point technology for polling audience members during the class.

Assessment Plan

The participants will take an exam at the completion of the 30-minute class and again a week later.

Appendix C

Demographic Survey

Personal Code: _____

Fill in the blank or circle the number with the appropriate answer.

1. Age: _____
2. Job Category
    a. Registered Nurse
    b. Clinical Partner
3. Years of experience as nurse or clinical partner: _____
4. Gender
    a. Female
    b. Male
5. Highest level of education
    a. General Equivalency Diploma (GED)
    b. High School
    c. Associate's Degree
    d. Diploma
    e. Bachelor of Science in Nursing
    f. Bachelor other than Nursing
    g. Masters of Science in Nursing
    h. Master's other than Nursing
    i. PhD or DNP

6. Area of Expertise
    a. Medical Surgical unit
    b. Intensive Care Unit/ Progressive Care Unit/ Cardiac Care Unit
    c. Emergency Department/ Urgent Care
    d. Surgical Services—Pre-op, OR, PACU
    e. Other: _____
7. How often do you check text messages while at work?
    a. Several times an hour
    b. Every hour
    c. 4-8 times per shift
    d. Once a shift
    e. Whenever I receive a text message
    f. Do not check text messages while at work
8. Preferred time to receive text messages for this study?
    a. 8-10 AM
    b. 8-10 PM
9. Preferred email address to receive link to final exam in 7 days:

    _____

10. Your 10-digit mobile phone number: _____
11. Your mobile carrier (AT&T, Sprint, Verizon, etc.) _____

Location for classes:

Night Shift:

Sept. 6, 2016	*4:30 AM—5:00 AM*	*Coco Plum*
Sept. 8, 2016	*4:30 AM—5:00 AM*	*Coco Plum*
Sept. 10, 2016	*5:00 AM—5:30 AM*	*Coco Plum*
Sept. 13 2016	*4:30 AM—5:00 AM*	*Coco Plum*
Sept. 16, 2016	*2:00 AM—2:30 AM*	*Coco Plum*
Sept. 17, 2016	*5:00 AM—5:30 AM*	*Coco Plum*
Sept. 19, 2016	*4:30 AM—5:00 AM*	*Coco Plum*

Day Shift:

Sept. 6, 2016	*1:30 PM—2:00 PM*	*Valencia*
Sept. 8, 2016	*2:30 PM—3:00 PM*	*Riviera*
Sept. 10, 2016	*1:30 PM—2:00 PM*	*Coco Plum*
Sept. 13, 2016	*3:00 PM—3:30 PM*	*Valencia*
Sept. 16, 2016	*9:00 am—9:30 am*	*Valencia*
Sept. 17, 2016	*1:30 PM—2:00 PM*	*Coco Plum*
Sept. 19, 2016	*2:30 PM—3:00 PM*	*Valencia*

[redacted]

If you have any questions or concerns about your rights as a research participant, please contact:

[redacted]

Appendix D

Class Flyer (Sample)

Now Recruiting Participants

[redacted] nurses and clinical partners are invited to participate in a research study:

The Effect of Repetitive Text Messaging on the Retention of Knowledge among Clinical Staff

Join us for a short class on why patients still fall in the hospital and enjoy some refreshments while you learn the latest information!

All clinical RNs and CPs are invited to participate in a research study who meet the following criteria:

- work in the clinical setting
- have a mobile phone capable of receiving text messages

The study will involve attending a 20-minute class, complete a short exam, and take the same exam one week later. Half the participants (chosen at random) will receive three text messages daily for six days after the class. The exam will take no longer than 10 minutes to complete.

For further information please contact:
Primary Investigator

[redacted]

Appendix E

Exam with Answer Key

Personal Code: _____

Please create your personal code number and place it on this demographic survey. **DO NOT** write your name anywhere on the survey! Create your personal code by using the first 2 letters of your **first** name, then your last 2 digits of your social security number, then the last 2 digits of your employee number.

Example: Susie Nurse Social Security # 999-55-0000 Employee # 55555

So, the code will be -- Su0055.

Circle the letter for the single best answer.

1. What are the most common intrinsic factor associated with inpatient falls?
   - **A. Cognitive impairment/ confusion**
   - B. Poor eyesight
   - C. Use of vitamins
   - D. Medical equipment
2. Where is the most common extrinsic factor associated with inpatient falls?
   - **A. Unfamiliar environment**
   - B. Proper use of devices, such as walker, crutches, and cane
   - C. Dry floor
   - D. B & C only
3. How can staff education help reduce patient falls?
   - A. Staff education does not impact patient falls
   - **B. Improve critical assessment of a patient's risk for falling and improve identification of patients at high risk or very high risk of falling**
   - C. Patient falls are simple problems that staff education can easily fix
   - D. All the above

4. What actions can impact patient falls?
    A. Include patient's risk for falling in handoff report
    B. Walking rounds can help reduce patient falls
    C. Use white board to communicate patient's risk of falling
    D. All the above
5. What are the most common side effects of multiple medications?
    A. Difficulty breathing
    B. Confusion/disorientation
    C. Dizziness
    D. B & C only
6. Older adults accumulate drugs in their body faster than young adults due to
    A. Decreased rate of metabolism
    B. Decreased kidney function
    C. Decreased liver function
    D. All the above

Appendix F

Randomization Table

Subject	Date	RN	Code	Mobile #	Carrier	Time	Email
1		A					
2		B					
3		B					
4		A					
5		A					
6		B					
7		A					
8		A					
9		B					
10		B					
11		B					
12		A					
13		A					
14		B					
15		B					
16		A					
17		A					
18		B					
19		A					
20		B					
21		B					
22		B					
23		B					
24		B					
25		A					
26		A					
27		A					
28		B					
29		B					
30		A					
31		B					
32		B					
33		A					
34		A					
35		A					

Randomization Table

Time 2	CP	Code 2	CP Mobile Phone	Carrier2	Time	Email 2
	A					
	B					
	B					
	B					
	A					
	B					
	B					
	A					
	A					
	A					
	A					
	A					
	B					
	A					
	A					
	A					
	B					
	B					
	B					
	A					
	B					
	A					
	B					
	A					
	A					
	B					
	A					
	B					
	A					
	A					
	B					
	A					
	B					
	A					

Appendix G

Master List of Participants Information

Personal code	10-digit Phone number	Cell phone service provider	Preferred time to Receive text

Carrier	Email to SMS gateway	
Alltel	[insert 10-digit number] @message.alltel.com	@mms.alltelwireless.com
AT&T	[insert 10-digit number] @txt.att.net	@mms.att.net
Boost Mobile	[insert 10-digit number] @myboostmobile.com	@myboostmobile.com
Sprint	[insert 10-digit number] @messaging.sprintpcs.com	@pm.sprint.com
T-Mobile	[insert 10-digit number] @tmomail.net	@tmomail.net
US Cellular	[insert 10-digit number] @email.uscc.net	@mms.uscc.net
Verizon	[insert 10-digit number] @vtext.com	@vzwpix.com
Virgin Mobile	[insert 10-digit number] @vmobl.com	@vmpix.com

Appendix H

Text messages

The text message phrases are introduced to the participants during the educational class and are the basis of the post-class exam.

1. Common intrinsic factor is cognitive impairment/ mental status
2. Common extrinsic factor is unfamiliar environment
3. Increased staff knowledge increases critical evaluation and identification of high risk patients
4. Three ways to improve communication --include risk for fall in handoff report, during walking rounds, and put on the white board
5. Two most common side effects of polypharmacy are confusion/disorientation and dizziness.
6. Older adults accrue drugs in their body faster due to decreases in metabolism, kidney function, and liver function

These messages constitute 77 words and 467 characters. The maximum length for one text message is 160 characters. The above message will split into three messages by the service providers. The need for three text messages will be included in the study explanation.