12-1-2016

The Impact of Nursing Crew Resource Management Training on the Patient Safety Self-Efficacy of Nursing Students

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THE IMPACT OF NURSING CREW RESOURCE MANAGEMENT TRAINING ON THE PATIENT SAFETY SELF-EFFICACY OF NURSING STUDENTS

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Bachelor of Science in Nursing
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2004

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2009

A dissertation submitted in partial fulfillment of the requirements for the

Doctor of Philosophy - Nursing

School of Nursing
Division of Health Sciences
Graduate College

University of Nevada, Las Vegas
December 2016

UNLV | GRADUATE COLLEGE

Dissertation Approval

The Graduate College
The University of Nevada, Las Vegas

October 24, 2016

This dissertation prepared by

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entitled

The Impact of Nursing Crew Resource Management Training on the Patient Safety Self-Efficacy of Nursing Students

is approved in partial fulfillment of the requirements for the degree of

Doctor of Philosophy - Nursing
School of Nursing

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ABSTRACT

Quality health care and optimal health outcomes begin by assuring patient safety. This is a shared responsibility of all health care providers. However, nurses have a fundamental obligation to assure patient safety, given their constant presence with patients requiring care. Patients who are cared for by nurses with insufficient or outdated patient safety education and knowledge can and often experience costly and catastrophic outcomes (Institute of Medicine (IOM), 2011). Medical errors now rank as the third leading cause of death in the United States and cost over 17.1 billion dollars/year (Makary & Daniel, 2016; Andel, Davidow, Hollander & Moreno, 2012). A shocking report issued in 2010 by the Society of Actuaries indicated that when years of lost productivity were calculated with the direct costs, the total costs were near one-trillion dollars per year (Shreve et al., 2010).

National health organizations have been calling for improvements in patient safety practices and in patient safety education for years (IOM, 2011; QSEN, 2014; The Joint Commission, 2014). To date, no solid consensus on how to effectively accomplish this has been determined. This has prompted many in health care to look at what other industries are doing to assure employee and consumer safety.

Years ago, the airline industry adopted the use of the Crew Resource Management (CRM) training program and noted improvements in several key safety categories (Sculli & Sine, 2011). More recently, CRM has been adapted as Nursing Crew Management (NCRM) training and it has shown promise with improving patient safety in some health care settings. However, its' use with nursing students, who will soon be entering practice is lacking in the literature (Aebersold, Tschannen, & Sculli, 2013).

The purpose of this quasi-experimental, two group, pre and post-test pilot study was to determine if NCRM training could make a significant improvement in patient safety self-efficacy

in nursing students. The self-efficacy aspect of Bandura's Social Learning Theory was used to inform the study.

The sample consisted of 46, final semester baccalaureate nursing students. A four-hour, NCRM training was provided to the experimental group. The Health Professional Education in Patient Safety Survey (H-PEPSS) was used as a pre and posttest to gauge the self-efficacy related to patient safety of both groups. The H-PEPSS includes 7 categories related to safety including understanding humans and environments, communication, working in teams, clinical safety, managing safety risks, disclosing adverse events and maintaining a culture of safety. Data was analyzed using 2 x 2 factorial analysis of variances for each of the seven categories on the H-PEPSS. Significant differences were found between the control and experimental groups posttest scores on all of the H-PEPSS categories except clinical safety.

Results of the study indicated that NCRM training can positively impact patient safety self-efficacy in nursing students. Recommendations include repetition of the study with larger groups using different educational delivery mechanisms. Nurse academic administrators and faculty are encouraged to consider if inclusion of the NCRM training would be helpful as part of a larger effort to develop student knowledge and skills related to working with health care teams to provide safe patient care.

ACKNOWLEDGEMENTS

The completion of this doctoral dissertation was made possible because of the support of so many of my incredibly amazing family, friends, colleagues, and of course the awesome staff and professors at UNLV's School of Nursing. The gratitude I feel for each and every one of you is really unmeasurable and it is deeply engrained in my heart and soul.

First, I want to thank my husband Cedrick Donaway for his never-ending love and support throughout, not only this educational endeavor, but throughout me obtaining my AS, BS, MSN and now my PhD. I cannot express in words how important he was to my success on this journey. He is my partner in everything, he is my inspiration, the love of my life, my happiness, my heart, and my world and I am so blessed to share my life with him. We did it babe!

I want to thank my children Justine, Cedrick, Spencer and Mason for all of your encouragement and for all the times you kept the house quiet so I could study. When you would tell me how you were "bragging" to your friends and classmates about how your mom was about to earn her doctorate you inspired me more than you will ever know. Knowing that you thought what I was doing was cool made the whole experience fun and exciting. Thank you for being loving, caring, intelligent, brave, honest, funny, amazingly beautiful people both inside and out, and for always having my back!

To my parents, David and Roberta Merxbauer, where can I even begin? Thank you so much for everything, literally everything! Thank you for raising me to be the kind of person who could persevere throughout this journey. This process was really tough at times and whenever I wanted to quit I would realize that if I did I would be giving up a chance to make you proud and that was the only thought I needed to put me back on the right path. Throughout my life you have shown me how to work hard and strive for the things that are important to me. There is no

doubt in my mind that those lessons guided me to be able to accomplish this degree. Thank you for being such remarkable parents throughout my entire life and never giving up on me!

Several friends, classmates, and fellow nurses have helped me out along the way. However, Ashley Nicole Kingdon-Reese deserves a special shout out for the countless hours she spent listening to me talk about my study and for reminding me over and over that I could do this. As usual, she was right! Thank you Ashley for your support on this endeavor and for being my life long ride or die! Now it is your turn!

My friend and colleague Dr. Michelle Geirach was instrumental in me being able to complete my study. She opened up her classroom to me and allowed her students the opportunity to participate in my study. Without her support I may not have been able to conduct my study. She not only allowed me the opportunity to conduct my study but then graciously helped guide and mentor me through many phases of the process. Her assistance and support meant the world to me. Thank you Michelle!

I also want to thank Gary Sculli RN, MSN, ATP. As one of the nation's top authorities on Nursing Crew Resource Management (NCRM), Mr. Sculli willingly and without hesitation offered to training me in the delivery of NCRM. Receiving this training was a critical component of my study. I will always be grateful for his expert guidance and his dedication to the improvement of patient safety.

Finally, I want to acknowledge with my deepest respect, the dedicated members of my dissertation committee, Dr. Lori Candela, Dr. Jessica Doolen, Dr. Diane Thomason, and Dr. Richard Tandy. As the chairperson of my committee Dr. Candela was my rock! She was so patient and supportive and always there when I needed her. She guided me through this process in a way that had taught me to appreciate and love the process of research. She helped me

overcome every obstacle and truly had my back when I needed her the most. Her expert feedback and guidance throughout the writing process was critical to y success. I am so proud to be able to say that Dr. Candela was my chair person because I learned so much from her and I know that I learned from the best! Thank you to Dr. Doolen and Dr. Thomason for your support and kind words throughout the process, and thank you to Dr. Tandy in particular for your assistance and support with the statistical evaluation of this dissertation. I will forever be thankful to you all.

DEDICATION

I would like to dedicate this work to my mother-in-law, Lillian Victoria Donaway who passed away in 1996. In the short time that I was blessed to be a part of her life she made such an enormous impact on my soul. She deeply valued education and spent her life educating those who needed her most. In my eyes, Vicki Donaway was one of the most loving, caring, accepting people that ever walked the face of the earth and I am so honored and humbled to be able to dedicate this work in memory of her.

TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION

The following chapter will introduce the background and significance of the research problem, aim, research hypothesis, definitions of variables, importance to the nursing profession and the conceptual framework that guided this study.

Background and Significance

When it comes to healthcare, patient safety is an issue that is a top priority for everyone involved, including patients, providers, nurses, family members and every single member of the health care team. In the year 2000, the Institute of Medicine (IOM) notified health care workers and consumers that preventable medical errors in the United States caused as many as 98,000 deaths per year (Kohn, Corrigan, & Donaldson, 2000). Currently deaths cause by preventable medical errors are said to be the third leading cause of death in America (Makary & Daniel, 2016)

Accompanying the grave societal impacts related to the loss of life and function resulting from these preventable errors is a tremendous financial burden. Andel, Davidow, Hollander, and Moreno (2012) calculated that based on current estimates the cost of preventable medical errors in the United States is as high as $980 billion dollars per year. Using data from medical claims Shreve et al. (2010) looked at the costs associated with medical errors of all types and found that after including the costs of quality adjusted life years the costs may be upwards of one-trillion dollars. Shreve et al. based their calculation off of the estimates from Clausen et al. (2011) that found that current methods of measuring medical errors are extremely poor and that they miss as many as 90% of all errors indicating that the true numbers may be as much as ten times higher than previously reported.

Despite numerous efforts by the healthcare community, the following decade has not shown an improvement in these statistics. New estimates released in a 2013 edition of the

Journal of Patient Safety stated that in the United States the number of deaths directly related to medical errors ranges anywhere from 210,000 to more than 400,000 deaths per year (James, 2013). If accurate, these numbers place preventable medical error deaths as the third leading cause of all deaths in the United States of America, according to the Center for Disease Control (CDC) (CDC, 2014). It should be noted that those estimates do not include the number of patients who are harmed but survive medical errors each year.

James (2013) estimated the number of patients injured by medical harm to be as much as 10 to 20 times more common than the number of patients that die. These preventable injuries add to the personal and financial expense of health care and leave some with physically and or mentally debilitating residual injuries. Expanded patient safety research efforts in practice and academia must be implemented now to improve the safety of health care of patients in the United States. Without immediate and ongoing efforts, the number of deaths and injury will continue at this alarming rate.

Ten years after the IOM released their landmark report identifying the extremely large numbers of deaths caused by medical errors, they released a report in 2010 titled; *The Future of Nursing Leading Change, Advancing Health* (IOM, 2010). In this report the IOM called for nurses to take an active leadership role in guiding change to improve the quality and safety of health care delivery. The report called for evidence-based changes and indicated the importance of the role of nurses in the change process. It also provided recommendations for nurses to follow in planning and implementing change initiatives related to patient safety. The report placed the focus on improving the nursing education system and called for nurses to achieve higher levels of nursing education (IOM, 2010).

An improved education system that focuses more on safety is critical to the improvement of quality and safety in health care. All health care professionals begin their careers with an

educational program. It is during this time when these future health care workers develop critical knowledge, skills and attitudes related to patient's safety, as well as other crucial aspects of health care (Vaismoradi, Salsali & Marck, 2011). Vaismoradi et al. (2011) reported that designers of nursing curriculum should focus on devising strategies aimed at increasing students' abilities regarding the use of safety knowledge and competencies.

An important aspect of developing abilities is that of self-efficacy. The concept of self-efficacy represents a person's level of confidence of "how well one can execute courses of action required to deal with prospective situations" (Bandura, 1982, p. 122). When a person has a high level of self-efficacy in their ability to perform a task, they perform differently (better) that those who have low levels of self-efficacy. People with high levels of self-efficacy tend to perceive difficult tasks as challenges that they can master and do not back away from them (Bandura, 1989). If Bandura is correct, and the literature supports that he is, then increasing student nurses' levels of self-efficacy related to providing safe patient care and will improve their ability to provide safe care.

Nursing Crew Resource Management (NCRM) is a training program designed to improve nurses' knowledge, skills, and attitudes about patient safety in health care. NCRM training focuses on human factors. Madhavanpraphakaran (2012) reports that the inclusion of Human Factors Theory (HFT) into nursing curricula "could act as a foundation towards quality education, to produce competent safe practitioners" (p. 92).

When discussing health care, the HFT describes human interactions with systems such as the environment, teams, technology, systems, and equipment and the effects of those interactions on safety and patient care outcomes. The HFT rejects the idea that in most cases humans are to blame when an error occurs as a result of human factors. Joseph Cafazzo, an associate professor

at the University of Toronto stated that in most cases where humans make an error it is typically the result of a design flaw (as cited in Eggertson, 2014).

NCRM is being utilized and evaluated in health care and initial findings show promising improvements in several areas of patient safety (Dunn et al., 2007; Neily, Mills, Lee et al., 2010; Neily, Mills, Young-Xu et al., 2010; Paull et al., 2013. To date, no studies are available in the literature that have reported the impacts of NCRM training on self-efficacy related to patient safety in any health care profession or setting. Evaluating the impact of NCRM training on nursing students' self-efficacy can provide scientific groundwork for the potential integration or exclusion of NCRM training into nursing curriculums and open a door for more research on the impacts of NCRM patient safety.

Research Purpose and Aim

The purpose of this study was to add to the science of nursing, nursing education, and patient safety by researching the impact of NCRM on the self-efficacy of nursing students. The findings of this study are intended to help nursing program administrators and faculty determine if the use of NCRM in their programs will help them to meet the IOM recommendations related to patient safety regarding the use of educational strategies that are evidence-based (IOM, 2010). This was an important step in the overall goal of improving the safety patient. The aim of this study was to evaluate the impact of NCRM training on nursing student's self-efficacy related to patient safety competence using the Health Professional Education in Patient Safety Survey (H-PEPSS).

Hypothesis

Nursing Crew Resource Management will have a significant positive effect on final semester baccalaureate nursing student's self-efficacy related to providing safe patient care as represented by their Health Professional Education in Patient Safety Survey scores.

Definition of Variables

NCRM.

NCRM is a version of Crew Resource Management (CRM) which is an error reduction/safety improvement program originally developed by the National Aeronautics and Space Administration (NASA) that focuses on human resources and human factors (Sculli & Sine, 2011).

Self-efficacy.

Self-efficacy as defined by Wood and Bandura (1989) is "beliefs in one's capabilities to mobilize the motivation, cognitive resources, and courses of action needed to meet a given situational demands" (p. 408).

Participant.

Final semester baccalaureate nursing student who has participated in this study.

Intervention.

The delivery NCRM to final semester baccalaureate nursing students in this study.

Importance to Nursing

This study is important because the literature is lacking in evidence-based findings that can help nursing faculty determine the best ways to educate their students about patient safety (Vaismoradi, Salsali, & Marck, 2011). There have been a few frameworks and sets of competencies developed that are recommended for use when developing a patient safety program or curriculum (Quality and Safety Education for Nurses [QSEN], 2014; Joint Commission, 2014). For example, the Quality and Safety Education for Nurses (QSEN) Institute was started in the year 2005 and has since published a list of competencies they believe nurses and student nurses need to possess in order to enhance the quality of patient safety that is provided. To date there are journal articles that discuss the integration of QSEN competencies into nursing

curriculum, but very few that offer specific techniques to use, or programs to follow, and even less that have published validated proof that their strategy of teaching the competencies worked to benefit patient safety. This lack of research may be partially related to the lack of validated measurement instruments (McKeekin, n.d.).

The QSEN competencies and the assumptions of NCRM are both directed at the primary goal of improving patient safety and decreasing medical errors. The pre-licensure QSEN competencies focus on identifying specific competencies that a student nurse needs to possess in order to practice safely. NCRM focuses on training the practitioner to be aware of the potential dangers associated with providing patient care and attempts to teach students and providers to recognize, intervene and respond to potentially adverse actions and events. The primary difference is that QSEN lists skills or competencies that nursing students should possess in order to be prepared to practice safely while NCRM is a training program that teaches the learner awareness of how to practice safely and gives specifics on how to respond when adverse situations arise (Quality and Safety Education for Nurses (QSEN), 2014; Sculli & Sine, 2011).

The student's self-efficacy was measured with the H-PEPSS before and after the implementation of the intervention (NCRM training). The findings of this study add to the science of nursing education and patient safety by introducing knowledge about the effect of NCRM on the student's self-efficacy related to patient safety competence. These study findings are important to nursing education and to patient safety educators' understanding of what types of training strategies increase self-efficacy.

NCRM is a modified version of Crew Resource Management (CRM) (Aebersold, Tschannen, and Sculli, 2013). CRM is a safety improvement program developed for the aviation industry. CRM was designed to improve safety by decreasing the likelihood of human error

from pilots and crew/team members (Sculli & Sine, 2011). Aebersold et al. (2013) developed NCRM with a focus on nursing activities, issues, and knowledge.

NCRM helps nursing team members develop skills that promote uninterrupted focus and teaches knowledge, skills, and attitudes (KSAs) that can guide them in the event of an unexpected outcome. NCRM focuses on concepts such as managing fatigue and workload, stress management, creating and managing teams, recognizing and responding to adverse situations, cross-checking and communicating, assertiveness, situational awareness, and giving and receiving performance feedback (McConaughey, 2008).

CRM and NCRM have been tested in education and health care settings and have proven the ability to positively impact knowledge, skills, attitudes, and outcomes when appropriately implemented and utilized (Sculli & Sine, 2011). In health care CRM has been studied most frequently in operating rooms and in labor and delivery settings where processes and workflow tend to be standardized (Gore et al., 2010; McConaughey, 2008;).

CRM has been studied in other areas of health care as well, such as medical/surgical units, medicine, and nursing academia; although the available literature stemming from these areas is limited, it is gaining popularity with researchers (Aebersold, Tschannen & Sculli, 2013; Sculli & Sine, 2011). A search of CRM in Education Resources Information Center (ERIC), PsychINFO, and the Cumulative Index to Nursing and Allied Health Literature (CINAHL) online databases produced 229 results ranging from the years 1991-2016, with 27% of the total number of resources having been published in the last four years.

Conceptual Framework

The self-efficacy theory portion of Bandura's Social Cognitive Theory (SCT) acted as the conceptual framework for this study. According to Bandura, (1977) improving self-efficacy increases one's confidence to perform; therefore, it along with the incentive to act, helps to

determine peoples' choice of action, how much effort they will put into action, and how long they will persist with the action in the face of adversity. This study obtained and compared the self-efficacy levels related to patient safety of final semester baccalaureate nursing students by measuring their self-efficacy related to patient safety with the Health Professional Education in Patient Safety Survey (H-PEPSS) tool (Ginsburg, Tregunno, & Norton, 2013).

Summary

In summary, this study sought out information about the impact NCRM has on the self-efficacy of final semester nursing students as it related to patient safety. The SCT theory supported the belief that improvement in self-efficacy is an effective strategy for improving performance. By measuring the self-efficacy of student nurses as it related to patient safety both before and after NCRM training, the findings can be added to the science and provide nurse educators with additional vital information that can help them make decisions about the best way to teach patient safety to student nurses.

CHAPTER 2: REVIEW OF THE LITERATURE

The following review of the literature will include several topics; self-efficacy, CRM, and NCRM and their impacts on patient safety, safety attitudes of health care workers, staff knowledge, confidence, communication and teamwork skills, perceptions of health care worker's feelings related to teamwork, communication and staff morale, and finally the primary modality used to deliver the intervention used in this study (lecture) will be reviewed. The information used in this literature review was obtained from several different online databases including, CINAHL, PubMed/MedLine, ERIC, Nursing Consult, and the Cochrane Library.

Self-Efficacy

A search of self-efficacy in CINAHL and MEDLINE yielded 32,176 journal articles with the oldest dating back to 1966. A search for recent literature about self-efficacy yields a large range of studies from several arenas such as pharmacy, medicine, nursing, education, addiction, psychology, and sports (Chiu, 2014; Crowley et al., 2014; Saville et al., 2014; Taliaferro & Harris, 2014; Yorra, 2014).

Merriam Webster's Dictionary defines efficacy as "the power to produce an effect" (Self-efficacy, 2014, para. 1). Wood and Bandura (1989) refer to self-efficacy as "beliefs in one's capabilities to mobilize the motivation, cognitive resources, and courses of action needed to meet a given situational demands" (p. 408). Bandura (1977) defined self-efficacy as an individual's evaluation of his or her ability to achieve a given task. Katz-Navon, Naveh, and Stern, (2006) took the definition one step further and defined safety self-efficacy as a "focus on one's judgment of one's ability to assure patient safety" (p. 574).

A person's self-efficacy levels are not fixed or stagnant, they fluctuate based upon experiences. Both failures and success will impact one's self-efficacy. Success will enhance

one's self-efficacy while failure will lower or even devastate one's self-efficacy when failure happens despite heavy efforts (Bandura, 1986).

A descriptive-correlational designed study was conducted by Lee and Ko (2010) that examined the influence of three different variables, self-efficacy, affectivity, and collective efficacy on the nursing performance of hospital based nurses. Several factors were identified as elements that influence a nurses' performance including, level of education, years of experience, level of self-efficacy, perceptions of justice, and their age.

In 2006 Lee and Ko (2010) mailed surveys to 2268 hospital nurses from 28 different hospitals in six different Korean cities. The nurses were mailed the following four surveys; Personal Efficacy Beliefs Scale, Positive Affectivity Scale Collective Efficacy Beliefs Scale, and a Nursing Performance Scale. The response rate was 1966 out of 2268 yielding a 92.2% return rate. Data was analyzed with descriptive statistics, Cronbach's Alpha coefficients, Pearson correlation coefficients, and multileveled analysis. Self-efficacy proved to have a statistically significant correlation to all of the other variables and showed the strongest correlation to nursing performance ($r = 0.57$, $P < 0.0001$). Based on these results Lee and Ko (2010) determined that self-efficacy was deemed important in enhancing overall nursing performance.

The limitations of this study included the limited collection of data at just one point in time when ideally to measure performance improvement longitudinal research should have been conducted. In addition, the study collected and analyzed self-reported data as opposed to objective measures of nursing performance (Lee & Ko, 2010).

See, Chan, Huggan, Tay, and Liaw (2014) conducted a study in which they measured the impact of a patient education intervention called, Alert Worsening Conditions and Report Early (AWARE) on the self-efficacy of hospitalized patients to recognize and report the worsening of

their own symptoms. The goal was to identify whether or not the use of AWARE could enhance the patient's self-efficacy to recognize and report symptoms of acute deteriorating conditions.

A cluster randomized controlled study with pretest–posttest design was conducted. The study took place over a three-month period of time during 2012. Two general medical-surgical units at an acute tertiary hospital in Singapore, Japan were used in the study. Each unit was randomly designated as either the control or experimental group using a coin toss to assign the groups (See et al., 2014).

Eligible patient participants had to meet the following criteria: at least 21 years of age, ability to obey simple commands and instructions, must speak English, and must be hospitalized with at least one or more acute medical condition. Upon admission to the hospital and after giving consent to participate in the study, the researchers conducted face-to-face interviews with all participants to administer a demographic questionnaire and the Self-Efficacy Response Scale (SERS) that was developed by the researchers for this study. The SERS had a content validity index of 0.81 and a Cronbach's alpha score of 0.94. Content validity was confirmed by a panel of eight content experts (See et al., 2014).

The study included 33 patients in the control group and 34 patients in the experimental group (See et al., 2014). All of the participants in the experimental group received a 30-minute one on one educational session that addressed three key concepts. First, the patients were educated to "be alert" to their feelings and symptoms, encouraging the patient to be alert to recognizing and reporting the early signs of deteriorating conditions. Second, patients were taught a method to help identify worsening conditions using the mnemonic ABCDE (Airway blocked, Breathlessness, Cold hands and feet, Dizziness, Extreme pain, and Expel and Excrete blood). Third, patients were encouraged and instructed to report changes early by using the

phrase “I am worried about my condition. I feel……” and then a description of their symptoms (See et al., 2014, p. 123).

Results of the study revealed that at baseline assessment there was no significant different in self-efficacy between the experimental and control groups. At the conclusion of the study the patient's self-efficacy levels increased significantly for both the control and the experimental groups, although the experimental group had much higher post-test scores $P<0.0001$ as compared to the control group $P<0.05$ (See et al., 2014).

According to the researchers, although the study did provide them with confirmation that the AWARE intervention did improve self-efficacy it did not determine if that increase in self-efficacy resulted in improved behaviors in patients such as recognizing and reporting complications (See et al., 2014). The researchers reported that another study is currently underway to examine the effects of the intervention on patient outcomes (See et al., 2014).

The generalizability of the AWARE intervention should be questioned due to the fact that only one nurse implemented all of the interventions. Future attainment of positive results with the intervention in multiple settings could be altered by inconsistent implementation of the AWARE intervention by multiple nurses. The researchers suggest that a future feasibility study should be conducted to determine nurses’ abilities to implement the AWARE intervention (See et al., 2014).

CRM and NCRM

CRM was first introduced to members of the aviation industry during a safety improvement workshop titled Resource Management on the Flight Deck (Sculli & Sine, 2011). CRM was presented to the aviators by the National Aeronautics and Space Administration. The workshop inspired attending members to become committed to the implementation and utilization of the techniques in their field (Sculli & Sine, 2011).

Originally CRM was called Cockpit Resource Management and was designed specifically and only for pilots and crew members within the cockpit. Soon after CRMs introduction to the aviation industry it was realized that CRM was applicable to more than just the cockpit members of the flight crew. CRM training soon became required for the entire flight crew and so it was renamed to be Crew Resource Management (Sculli & Sine, 2011). With the entire flight crew learning team building skills, participating in team briefings, practicing situation awareness enhancement techniques, and developing stress management and decision making strategies the crews were able to greater enhance safety and efficiency (McConaughey, 2008).

McConaughey (2008) revealed that during the span of ten years from 1967 to 1976 passengers on U.S. domestic jet flights had a one in two million chance of dying due to an in-flight accident. After the implementation of CRM and by the 1990s that same risk had fallen to one in eight million demonstrating an impressive decline in risk.

CRM was first adopted into health care in 1994 at a Switzerland hospital operating room. Since that time CRM has been utilized and tested in several health care settings (Aebersold, Tschannen, & Sculli, 2013; McConaughey, 2008; Clay-Williams, Greenfield, Stone & Braithwaite, 2014; Gore et. al., 2010; Levy et al., 2014; Paull et al., 2013; Young-Xu et al., 2013). Gary Sculli RN was the first person to directly use the concepts of CRM to attempt to improve patient safety as it related to nursing care (Sculli et al., 2013).

Faculty from the University of Michigan's College of Nursing conducted a study to evaluate the effective use the handoff communication tool Situation Background Assessment Recommendation (SBAR) during simulations with their students. The researchers found that just 16% of their students were using their SBAR during handoff report. Having learned about CRM the faculty partnered with Sculli and the National Center for Patient Safety (NCPS) to

develop a program they titled Nursing Crew Resource Management (NCRM). Very similar to CRM, NCRM consists of a six-hour didactic session and a two-hour simulation (Aebersold et al., 2013).

CRM and NCRM Research Findings

The developers of NCRM sought to determine if NCRM training was able to improve the student's self-perceived ability to effectively communicate. Final semester nursing students (n = 28), faculty (n = 6), and others (n = 3) attended a six hour didactic NCRM training. The students were allowed time to practice the newly learned techniques, and then participated in a two-hour simulation. Finally, all participants who attended the didactic session completed a seven question survey. The survey sought to evaluate their satisfaction and perceived learning experience (Aebersold et al., 2013).

The participant's responses were based on a five point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The study participants strongly agreed that CRM concepts could be applied to nursing care to reduce harm to patients (M = 4.7, SD = 0.46). Participants also agreed that they developed new skills from the CRM training (M = 4.4, SD = 0.60) and that they would use those skills in practice (M = 4.4, SD = 0.55). Participants gave high ratings for the overall program (M = 4.5, SD = 0.56) and the effectiveness of the teaching strategies (M = 4.6, SD = 0.55). Ninety-seven percent of the participants agreed that this training was beneficial and that it should be offered to other clinicians (M = 4.6, SD = 0.54), and 81% agreed they would be interested in receiving additional training on CRM concepts (M = 4.3, SD = 0.77) (Aebersold et al., 2013, p. 129).

Aebersold et al. (2013) findings strongly suggest that CRM is effective in improving self-perceived communication skills in student nurses. In addition, 50% of the students effectively used the communication strategies taught in NCRM training when they participated

in the simulation at the end of the semester. The NCRM program has since been implemented into the Leadership and Management course that all senior nursing students must take at the university. A primary limitation of this study was that it used a small, non-randomized group of participants with no control group (Aebersold et al., 2013). This limitation likely reduces the generalizability of the study findings.

The impacts of CRM training on the safety attitudes of operating room staff members has been researched by Gore et al. (2010). Gore et al. (2010) wanted to know if a specific component of CRM, which involves pre-procedural briefings, could improve the safety attitudes of operating room staff. A pre and post-survey measuring the staff's attitudes toward patient safety was conducted prior to the implementation of the briefings and six months after their initial implementation. The authors hired aviation pilots to guide the study subjects in the use of pre-procedure briefings. The study originally solicited 600 study participants and secured 156 participants whom completed both the pre and post-surveys (Gore et al., 2010).

The tool used in the study by Gore et al. (2010) was developed by the Agency for Healthcare Research and Quality and it was composed of 45 questions aimed at assessing patient safety issues within the hospital setting. Twenty-eight of the 45 questions in the survey tool focused on CRM tactics including teamwork, error reporting, and the overall patient safety climate. The remaining questions in the survey were specific to the transferring of patients between units within the hospital and those questions were not included as part of this study by Gore et al. (2010).

Using a Mann-Whitney test to analyze the data the researchers considered $P < 0.05$ as significant. Gore et al. (2010) showed that after the training, nurses demonstrated statistically significant improvements in seven out of 28 survey questions. When looking at the subset of

responses by nurses, nurses showed statistically significant improvements in three of four question related to teamwork and in three of 11 questions concerning patient safety environment.

Resident physicians only showed significant improvements in one of the 28 questions and physicians did not show significant improvement in any of the questions. The findings suggest that CRM does lead to improved attitudes regarding patient safety for nurses. These finding suggest that more research needs to be completed to understand why and how the training has a more significant impact on nurses as compared to physicians and resident physicians. Because of the significant findings in this study more research should be performed to examine the impacts that CRM has on nursing and the potential CRM has to improve patient safety (Gore et al., 2010).

Limiting the strength of this study was a poor response rate of follow-up surveys from the resident physicians which complicated the results for that group. Also, only operating room staff were evaluated in this study thus limiting the generalizability of the findings to other units or departments within the hospital. In addition, a private company, Life-Wings Partners LLC, was contracted to implement the intervention making it difficult for other researchers to duplicate the training (Gore et al., 2010).

Sculli et al. (2013) conducted a large study on NCRM within the Veterans Health Administration (VA). Sculli et al. choose 11 out of 41 interested VA hospitals to be included in the study. Nurses at the 11 hospitals were provided NCRM training. The NCRM training included six-hours of didactic curriculum, two hours of high-fidelity simulation and on-going consultation support including a refresher one-year post intervention. Based on the concepts of NCRM training each unit developed and implemented a unit based quality improvement project.

The study by Sculli et al. (2013) utilized a modified version of Sexton's safety attitudes questionnaire, that they renamed the Nursing Questionnaire (NQ). The NQ was administered at

baseline, at 6-months, and at the 12-month reinforcement learning sessions. The impacts of the simulation module were assessed separately by comparing pre and post-program self-efficacy for teamwork effectiveness and patient safety scores and observed teamwork and communication skills were measured at baseline and after completion using the clinical teamwork scale. Five teamwork and communication skills were observed and measured (Sculli et al., 2013).

Staff perceptions were analyzed by Sculli et al. (2013) using Chi Square analysis with Bonferroni corrections for multiple comparisons and showed that teamwork increased significantly with a $P < 0.01$. The effectiveness of simulation training was evaluated using a two-tailed unpaired t-test and showed a significant improvement in self-efficacy for teamwork effectiveness ($P < 0.001$ pre vs post). The clinical teamwork scale revealed significant improvements in teamwork, communication, decision-making, and situational awareness when analyzed with an unpaired t-test ($P < 0.05$) (Sculli et al., 2013).

The researchers reported that all teamwork domain questions on the NQ showed significant improvements after NCRM training. Individual facilities found significant gains in their outcomes based upon their quality improvement projects in the areas of medication errors, glucose control, failure-to-rescue events, and care processes. Interestingly, as the impact of NCRM on staff and patients continued to be assessed for 12-months after the training, the positive impact of NCRM on staff and patients continued to rise (Sculli et al., 2013).

Participation in the study by Sculli et al. (2013) and in the NCRM training was voluntary thus making it highly likely that those units who volunteered to participate already had a desire to improve patient safety. If the staff already had a desire to improve patient safety they may have been more likely to make significant improvements than other units might. This limitation makes the results less generalizable to other areas. The findings in this study came from self-reports which can be influenced by any number of factors such as leadership attitudes, support

for the project from leadership, staff morale, and workload. In addition, this study was conducted only within the VA making it less generalizable to non-VA health care systems.

Levy et al. (2014) conducted a hospital quality improvement initiative that included examining the effects of CRM training on the provision of care for acute coronary syndrome (ACS) patients who sought treatment in the emergency department. Using performance measures from the American College of Cardiology and the American Heart Association (ACC/AHA) Joint Task Force guidelines on ACS management the researchers evaluated the care that patients received before and after the educational intervention (Levy et al., 2014).

The researchers reviewed the patient charts gathering data on five guideline based measures including: the use of standardized risk assessment; the timing of ACS evaluation and assessments; timing of ACS interventions such as reperfusion in less than 90 minutes; differential use and timing of medication administration; and the time it took to transfer patients from the emergency department to inpatient units (Levy et al., 2014).

The study took place in three different hospitals: Moses Cone Hospital (MCH) in Greensboro, NC; Detroit Receiving Hospital (DRH) in Detroit, MI; and Harper University Hospital (HUH) in Detroit. The researchers reviewed the charts of 120 patients at each facility totaling 360 chart reviews. Retrospective chart reviews were conducted on charts in which the patients were at least 18 years of age or older with symptoms indicating potential ACS during their initial emergency department evaluation. Charts at MCH were reviewed pre-intervention between March and December 2010 and post-intervention between April and November 2011. Charts at HUH and DRH were reviewed pre-intervention from January and June 2011 and post-intervention at DRH between September 2011 and May 2012, and at HUH between October 2011 and March 2012 (Levy et al., 2014).

The researchers also gathered pre and post-participation surveys from the staff involved in the training. The surveys that were developed by the researchers collected data about the participant's confidence, knowledge, and competency of caring for patients with ACS. Surveys were obtained immediately pre-intervention, immediately post-intervention, and 30-days post-intervention (Levy et al., 2014).

Data from the confidence, knowledge, and competency surveys found that CRM training did improve participant's knowledge and confidence in regards to providing care to patients with acute coronary events. For example, participants' confidence in their own ability to identify process related factors that could lead to medical errors increased from 64% of the participants feeling at least moderately confident or better in their abilities at the time of the pretest, to 90% feeling at least moderately confident at the time of the posttest. The results also showed that participants were able to retain these improvements up to 30-days post intervention. Despite the improvements in knowledge and confidence, only minor improvements in a few of the ACC/AHA guidelines showed any significant improvements. Guideline-compliant anticoagulation use increased significantly (29% vs. 63%; $P < 0.001$) at HUH only (Levy et al., 2014).

In fact, in the case of door-to-ECG times and in thienopyridine use there was a significant decrease in performance at all of the hospitals, and MCH in particular showed a significant decrease in the rate of anticoagulation use. The researchers were unclear as to why these decreases happened. No provider-level clinical data was obtained during the study leaving the researchers unable to make any scientific conclusion about the causes for the decreases in performance (Levy et al., 2014).

This study reported a number of limitations including, lack of interest in participation by participants and stake holders, unanticipated staffing changes, poor completion rate by

participants and accidental non-inclusion of pertinent cases of acute coronary events. These limitations were significant and weakened the reliability of the information (Levy et al., 2014).

Paull et al. (2013) investigated the impact of CRM training techniques on the teamwork and communication skills of postoperative heath care personnel. The conceptual framework guiding the study was the High-Reliability Organization by Carroll and Rudolph. The researchers wanted to answer two questions. First, they wanted to know if there were significant differences in the participant's confidence in using CRM techniques while working in interprofessional teams before and after receiving CRM training in a simulation based curriculum. Secondly, they wanted to know if CRM training would produce significant differences in observable teamwork and communication techniques among post-operative care interprofessional teams.

Paull et al. (2013) used the Self-Efficacy of Teamwork Competencies Scale to measure the team's confidence. The researchers did not provide detailed insight into the validity of the tool; "the validity of the instrument was supported by its measurement of confidence in the CRM behaviors taught in the MTT Program" (Paull et al., 2013, p. 4). An exhaustive search of the literature failed to yield any additional information on the reliability or validity of the Self-Efficacy of Teamwork Competencies Scale.

To measure observations of teamwork and communication Paull et al. (2013) used the Clinical Teamwork Scale (CTS). The CTS measures teamwork and communication using a 10 point Likert scale. Inter-rater reliability of the scale using the Ebel's algorithm was 0.71 which was comparable to that from the original study which was 0.78 (Paull et al., 2013).

Paull et al. (2013) included 334 staff members from 12 different health care facilities. The staff were exposed to simulation based CRM training and then completed pre and post self-reported surveys that indicated their perceptions of teamwork and communication levels. After

CRM training teamwork scores improved by an average of 18% ($p < .05$) in all eight assessed categories. Communication rating scores were also significantly improved by as much as 16% ($p < .05$). The study findings showed that simulation-based CRM team training for staff caring for perioperative patients was associated with measurable improvements in teamwork and communication (Paull et al., 2013).

The study may have been limited by social desirability biases despite that fact that the surveys were given anonymously. Mitchell and Jolley (2012) reported that making a survey anonymous decreases the risk of social desirability bias. A non-randomized sample was used which threatens the internal validity of the sample (Burns & Grove, 2005).

Young-Xu et al. (2013) used CRM training to see if it could increase patient safety by increasing the number of times nurses could recognize subtle changes in a patient's condition. The researchers were specifically interested in changes that may be signaling a life-threatening event. In addition, the researchers wanted to know if an increase in recognition would lead to an increase in the utilization of rapid response teams and reduce the number of failure-to-rescue events. The study involved providing CRM training to step-down unit staff members and then directing them to develop a read-and-do checklist to evaluate changes in patient's conditions based on the CRM concepts they had learned.

Young-Xu et al. (2013) collected data before the study participants received the CRM training and again after the training was complete and the participants had developed and implemented the read-do-checklist. Using $\chi 2$ analysis, the researchers analyzed the percentage of accurate STAT team calls and the percentage of failure-to-rescue events that occurred before and after CRM training.

Results showed that there was a statistically significant increase in correct STAT team calls, from 4% (6 of 163) in the 12 months before training to 22% (13 of 60) in the 12 months

after training ($P < 0.001$). In addition, there was a "statistically significant decrease in failure-to-rescue events, from 25% (41 of 163) the 12 months before the training to 12% (7 of 60) in the 12 months after the training" ($P = 0.03$) (Young-Xu et al., 2013, p. 54). These statistics indicated that CRM training and use of read-do-checklists did improve patient safety on this inpatient nursing unit. Limitations of this study included a small sample size from just one hospital and no control group. These limitations affect study generalizability.

Shea-Lewis (2009) conducted a study on an obstetrical hospital unit to determine if CRM training could improve communication between and among people in different health care disciplines. The researcher believed CRM could potentially encourage situation monitoring throughout the continuum of care, and hoped it could foster mutual support and respect among caregivers. Lastly, Shea-Lewis (2009) believed that CRM had the potential to and cultivate effective team leadership.

Looking at patient care data from 8,807 patients' medical records (4,323 prior to training and 4,484 post training) the researchers collected data about 10 of the most common adverse events that occurred in their labor and delivery unit. They found statistically significant improvements in patient outcomes after the CRM training with the average percentage of adverse events dropping from 7% before CRM training to 4% after training. The employees expressed a 14.7% increase in perceived teamwork and a 17.6% increase in perceived safety (Shea-Lewis, 2009).

The study by Shae-Lewis (2009) was only conducted in one hospital making it problematic to generalize the results to employees at other hospitals. The author acknowledged that interdisciplinary cooperation and mentoring were very important to the success of the training and to the overall improvements in patient outcomes. Without such cooperation and commitment to mentoring the study may not have produced such a significant result.

According to West et al. (2012), a nursing unit within the VA medical system chose to experiment with the NCRM safety improvement technique called the sterile cockpit rule. The sterile cockpit rule is a set of rules that attempts to remove as many distractions as possible while people are performing important or high-risk tasks.

The study participants included 26 RNs, 12 licensed vocational nurses (LVNs), and 9 CNAs totaling 47 total staff. All 47 participants worked on the same inpatient unit at a VA hospital in Texas. The unit provided several different services such as cardiology, neurology, oncology, and medical surgical care.

West et al. (2012) discussed how the sterile cockpit rule was used in an attempt to improve efficacy and safety for certified nursing assistants (CNAs) in the performance of patient care duties. The rule created protected time for CNAs while they collected vital signs and blood glucose checks on patients at the beginning of each shift. While the CNAs were collecting vital signs and blood glucose readings the staff nurses would answer call lights and attempt to mediate any distractions that attempted to interfere with the CNAs' tasks.

The researchers collected staff perceptions of teamwork, communication, and morale before the CRM training session and again 6 and 11 months after the session. During the first year after NCRM training, participants tracked the following measures of efficiency; time required to complete nursing patient assessments at the time of shift change; time required for Licensed Practical Nurses to complete medication passes; and time required for CNAs to collect vital signs and blood glucose levels (West et al., 2012).

Perceptions were collected using the Nursing Questionnaire (NQ). The NQ survey is an abbreviated version of the Safety Attitudes Questionnaire (SAQ). The NQ is composed of 16 questions from the SAQ. The researchers identified that the SAQ was a well validated survey tool developed by CRM project staff and used to measure safety culture, including the

participant's perceptions of teamwork, communication, and patient safety; however, they do not provide specific data on how and to what extent the tool has been shown to be valid (West et al., 2012).

The sterile cockpit rule in this case had the nurses protecting CNAs from distractions, which was a change from the normal practice. Using X^2 analysis with Bonferroni corrections for multiple comparisons results showed that the unit experienced improvements in perceptions of efficiency and communication among nursing personnel, with the added benefit of increased staff morale. Improvements in efficiency were observed and are presented below in Table 1.

Table 1
Improvements in Efficiency

Measure	Average time to complete pre NCRM	Average time to complete Post NCRM
CNA obtains morning vital signs and blood glucose	2.5 hours	0.5 hours
RNs to complete nursing assessment	3 hours	1 hour
LVNs complete medication passes	2.5 hours	1.5 hours

A limitation of this study was that it did not have a control group, so it was not possible to know that it was the CRM training that influenced the improvements to happen. In addition, the study was conducted in a VA hospital so the results may not be generalized to other hospital settings and cultures (West et al., 2012). In addition, the sample size was quite small for the number of questions asked in the survey raising concerns over the generalizability and validity of the findings. Also, it was unclear as to if the researchers did any analysis on the improvements in efficiency to determine if in fact they were significant increases or not.

Teaching Strategies Used

In this study the ultimate goal in providing NCRM training was to enhance the student nurses' self-efficacy in their ability to provide safer patient care and in turn hopefully decrease

patient harm related to preventable human errors. This meant that the goal was to change their attitudes about their own abilities. In order to have better chances of change their attitudes more than one teaching strategies was used. To this goal, interactive lecturing including the use of case-based learning with real life case reviews, and small group discussions was utilized during the delivery NCRM training.

Webster's Dictionary (2011) defines lecture as "a discourse given before an audience or class especially for instruction" (p. 83). Lecture has dominated nursing education as the primary teaching strategies used in classroom education for decades (Benner, Sutphen, Leonard & Day, 2012). In *Educating Nurses a Call for Radical Transformation*, Benner (2010) recommended changes in the delivery of nursing education and proclaimed that traditional lecture when used alone is contradictory to the way most adults learn. In recent years, scientists have studied the most effective ways to teach adults and some have even studied the best way to educate health care professionals (Fahlberg, Rice, Muehrer, & Brey, 2014; Herreid, 2006; Roberts, 2012).

Baeten, Dochy and Struyven (2013) studied "whether mixed instructional methods combining case-based learning and lectures have the power to enhance students' approaches to learning, compared to instructional methods using either case-based learning or lectures" (p. 315). The researchers used a quasi-experimental, pre/post-test design to conduct the research. The study participants included 1,098 first-year student teachers taking a course on child development. The participants were divided into one of four different groups. The groups were defined by the types of educational intervention they received; all lecture; all case-based (CB), lecture and CB used in an alternate fashion (first lecture then CB then lecture then CB); and finally lecture with a gradual progression into CB (Baeten et al., 2013).

Baeten et al. (2013) used the Approaches to Learning and Studying Inventory (ALSI) to measure the approaches to learning and how changes in the teaching-learning strategies affected

students' approaches to learning. The researchers used ALSI, which is a five-point Likert scale in which the following options were available for the participant to choose from;

> "deep approach (e.g. 'I usually set out to understand for myself the meaning of what we have to learn.'), surface approach (e.g. 'Often I have to learn over and over things that don't really make much sense to me.'), monitoring studying (e.g. 'When I've finished a piece of work, I check to see it really meets the requirements.'), organised studying (e.g. 'I'm quite good at preparing for classes in advance.') and effort management (e.g. 'I generally keep working hard even when things aren't going all that well.')" (Baeten et al., 2013, p. 16).

Confirmatory factor analysis on both pre and post-test data indicated the five scales were separate constructs, the standardized root mean square residual indicated an adequate fit of the model and Cronbach's alpha for both the pre and posttest data were acceptable at ".76/.75 for deep approach, .79/.78 for surface approach, .69/.67 for monitoring studying, .76/.80 for ~~organised~~organized studying and .72/.73 for effort management" (Baeten at al., 2013, p. 16).

Statistical analysis was conducted by means of multilevel analysis using a linear mixed model procedure in SPSS. The results showed that participants in the group that moved from lecture to CB gradually, scored significantly higher in organized studying and effort management compared to students in a completely case-based setting. These finding support the use of lecture when combined with CB learning techniques in nursing education as an effective teaching method (Baeten et al., 2013).

According to Shin and Kim (2013) "Problem-based learning (PBL) is an educational design that emphasizes active participation, problem-solving, and critical-thinking skills" (p. 1107). In PBL students are divided into small groups and provided with a case scenario that is based on either a real life situation or a realistic scenario that pertains to the topic being

presented. In small groups the learners, supported by a faulty person, will hold a discussion that includes identifying what they already know based on their previous knowledge or experience, what they do not know, and finally what they would need to know in order solve the problem or move the next step in the problem solving process (Williams, 2001).

Williams (2001) indicated that learners must engage in self-directed learning in which they seek out the information that they have and the information that they need. After gathering the information needed the groups would then apply that information to the situation/scenario through discussion within the group and revisit previous assumptions to rule out or include those assumptions in their final steps. The final step of the PBL process learners would summarize their findings and assumptions and reflect though discussion how the knowledge they gained could be applied in future nursing situations (Williams, 2001).

Shim and Kim (2013) conducted a meta-analysis to investigate the effects of PBL as it relates to nursing education. The inclusion criteria for studies to be included in the meta-analysis included; only studies that used quantitative outcomes focused on student learning or reasoning; only experimental, quasi-experimental and descriptive and comparative designs that examined the effectiveness of PBL. In participants that the studies used had to be English speaking nurses or nursing students. When these criteria were applied to the population a sample of 22 different studies remained and were included in the meta-analysis (Shin & Kim, 2013).

The analysis by Shin and Kim (2013) was extensive and provided a total of 130 different effect sizes, from the 22 studies. The overall Cohens effect size was 0.70 revealing that PBL has a medium to large effect size on nursing education. This finding indicated that PBL can and does offer greater educational benefits to nursing education when it is compared to other types of learning strategies used in nursing education.

Social Cognitive Theory

The Social Cognitive Theory (SCT) also referred to as Social Learning Theory served as the learning framework for this study. The SCT is a learning theory that is largely based upon the works of Albert Bandera (1977; 1986; 1989). Bandura (1989) describes SCT theory as a model of causation that focuses on three primary influences that affect a person's actions and decisions, behaviors, cognition including personal factors, and the environment. These influences are all interdependent and impact each other continually.

The SCT was chosen to be the framework for this study due to the similarities in SCT and NCRM that can be linked to enhancing patient safety knowledge. These similarities include self-efficacy, behavior, cognition, personal and environmental factors, and modelling (Bandura, 1986; Sculli & Sine, 2011). The SCT is an extensive theory that consists of multiple concepts. For the purposes of this study the SCT concept of self-efficacy will guide the design.

The underpinnings of this study were based on the principal assumption by Bandura (1977) that increased self-efficacy positively influences a persons' behaviors, actions, commitment to success, and degree of efforts put forth into performance and problem solving. Bandura (1977) explained how self-efficacy influences peoples' actions, that individuals can be highly confident that a particular behavior or action will lead to a certain outcome, however, if they do not have the self-efficacy or belief in their own ability to accomplish such a behavior or action, the original notion will not likely influence their behavior to act.

According to Bandura (1997), because self-efficacy reflects upon a person's beliefs or perceptions about whether they can achieve a given level of success at a particular task, perceived self-efficacy is a contributing factor to cognitive functioning and development. Bandura (1993) also said, a "student's beliefs in their ability to regulate their own learning and to master academic activities determine their aspirations, level of motivation and academic

accomplishments" (p. 117). Self-efficacy beliefs influence how people feel, think, behave, and motivate themselves which in turn influences the goals they set for themselves and their level of academic achievements (Bandura, 1992).

Bandura (1991) expressed that people have stronger commitment to their goals when they have a strong perceived ability (self-efficacy) to accomplish those goals. Bandura (1992) also said that it is believed that self-efficacy beliefs influence a person's performance associated with self-set goals directly and indirectly. He went on to report that this hypothesized relationship has been studied, proven and reported on in organizational research studies.

NCRM training places a strong focus on a four-step assertive communication tool that teaches the learner how to; get attention, state the problem, offer a plan, and pose a question to get resolution. This four-step assertive communication tool teaches the learners' how to react when they feel they are not being heard and was designed to enhance the learner's self-efficacy (Sculli & Sine, 2011).

Summary

The findings in the literature review presented above clearly support continued research of NCRM to fully examine its impacts on patient safety self-efficacy. Currently a complete gap in the literature exists as to how NCRM impacts patient safety self-efficacy for nursing students or other health care professionals. This study has added to the science by examining the effect NCRM training has on improving student nurse's self-efficacy regarding patient safety.

CHAPTER 3: METHODOLOGY

This chapter presents the study methodology. Specifically, the research design, population and sample, procedures and data collection, and analyses procedures are described. A full description of the intervention Nursing Crew Resource Management (NCRM) training is included. Study limitations and ethical considerations are also described in detail.

Pre-Study Student Investigator Training

It was important for the Student Investigator (SI) to first become trained in the delivery of the NCRM training program. NRCM training is a patient safety training program specifically aimed at nurses. Gary Sculli RN, MSN, ATP, NCRM and David Sine MA, CSP, ARM, CPHRM wrote the book *Soaring to Success Taking Crew Resource Management from the Cockpit to the Nursing Unit* in which they reveal ways that Crew Resource Management (CRM) training can be modified and molded to fit the health care industry and specifically the nursing departments and staff (Sculli & Sine, 2011).

CRM is a set of training procedures most often used in high-risk industries such as aviation, astronautics, and nuclear power production and management. CRM is most appropriately used in industries where human error can have a devastating, dangerous or lethal effect on people and safety outcomes. Originally developed by NASA in 1979 and later adopted by the aviation industry, CRM focuses on teamwork and human factors such as interpersonal communication, fatigue, situational awareness, leadership abilities, and decision-making skills (Sculli & Sines, 2011).

Sculli is a registered nurse who became a commercial airline pilot and received extensively training in CRM. After several years in the airline industry Sculli returned to health care and focused his attention on patient safety. Sculli currently holds the position of Director of

Clinical Team Training for the Department of Veteran Affairs at the National Center for Patient Safety (NCPS) (Sculli & Sine, 2011).

During the summer of 2015 the SI for this study traveled to Ann Arbor Michigan to the National Headquarters for the office of NCPS and spent two days receiving training from Sculli on how to deliver NCRM training. Sculli granted the SI permission to use his training materials in the delivery of NCRM training to this studies participants.

Research Design

A pilot study using a quasi-experimental, two group, pre and posttest design was used in this study. Pilot studies are often used to refine or develop the steps, design, intervention or data collections methods of a study (Burns & Grove, 2005). According to Van Teijlingen and Hundley (2002) pilot studies are underused and underreported. Pilot studies are useful in identifying such issues as inadequate recording or poor response rates. Other concerns such as intervention problems or design flaws can also be identified and precautionary measures can be developed prior to conducting a larger scale study (Van Teijlingen & Hundley, 2002). A quasi-experimental design is appropriate in studies where complete control is impossible and when the original population sample is considered nonrandom (Burns & Grove, 2005). The sample used in this study was a convenience sample of baccalaureate nursing students from one university. The sample participants were randomly assigned to either the control or experimental group.

According to Burns and Grove (2005), when a study involves the use of an intervention that is tightly controlled by the researcher and has randomly assigned control and experimental groups that originate from a non-randomly assigned population, the design is termed quasi-experimental. This definition fits the design of this study with a tightly controlled intervention (NCRM) and randomly assigned groups (control vs. experimental) from a non-random population (nursing students at just one university).

Sample and Setting

The university where this study took take place was a private liberal arts university located in the upper Midwestern United States. The university was founded in 1860 and offers more than 50 different majors and pre-professional programs. The college of nursing at this school is more than 60 years old and offers a baccalaureate nursing degree in both a traditional and accelerated path. The nursing program is accredited by the Commission on Collegiate Nursing Education and is approved by the state Board of Nursing.

The target population for this study was 46 final semester baccalaureate nursing students at the above mentioned university who were all enrolled in a maternal and child care course. All nursing students entering into this maternal and child course were in their final semester and they all had successfully completed all program prerequisites and previous semester nursing courses prior to the start of this final semester. These similarities that existed amongst the sample helped strengthen the internal validity of the sample (Burns & Grove, 2005).

Procedures

Institutional review board approval was obtained from the University of Nevada Las Vegas and from the university where the study was conducted. Following the receipt of IRB approval, the study commenced in the spring of 2016.

NCRM training includes training on such concepts as the culture of patient safety, situational awareness, countermeasures, leadership, and followership. In this study the SI delivered NCRM training to the students over a four-hour period of time with a one-hour break positioned half way through the training. The NCRM training consisted of lecture with accompanying PowerPoint slides, and classroom group activities. The NCRM training also included the examination and discussion of several real life examples of times when human error caused catastrophic outcomes in both health care settings and in aviation.

The NCRM training was delivered in a university classroom setting. Prior to the start of the course students were assigned to either the control or experimental groups by randomly drawing pieces of paper with their names out of a container. Random assignment of study participants to groups was especially important because when using a convenience sample, random group assignment is assumed to eliminate systemic bias between the groups and strengthens internal validity (Dimitrov & Rumrill, 2003).

The students were placed into either the control or experimental group by assigning every other name, beginning with the first name drawn, to the experimental group and the remaining names into the control group. The students were then scheduled to attend the training on different dates based upon their group assignment. A time line for the study and intervention delivery is provided in Table 2.

Table 2
Timeline for Study

Introduce Study / Gain Consent	Pretest Both Groups	Intervention to Experimental Group	Posttest to Both Groups	Intervention to Control Group
Day 1	Day 1	Day 18	Day 21	Day 25

During day one of the intervention the SI met with both groups at the same time to explain the study to the students and to gather their consents. Student were told that they were not required to participate in the pre or posttests although their participation in the training was a requirement of their course.

An informed consent contract was designed to ensure that students could sign the consent to acknowledge that they had been notified that; there were no known risks to subjects who agreed to participate in the intervention or study; potential benefits were enhanced patient safety knowledge, confidence and perceptions; their answers were and would remain anonymous; scores for each section would be reported as a group average only; and there would be no compensation for their participation in the survey. It was made very clear to students by the SI

that although participation in the NCRM training was required because it was included as part of their grade for their course, participation in the study was completely voluntary and that even after signing the consent form that if they decided that they did not want to participate that they had the right to end their participation at any point during the study. Participants were asked to sign the informed consent form if they agreed to participate in the study.

On day 18 the SI delivered the NCRM training to the experimental group only. On day 21 the SI met with both the control and experimental groups simultaneously and delivered the posttest to both groups. Finally, on day 25 the SI delivered the NCRM training to the control group. Delivering the NCRM training to the control group after the necessary data was collected for the study ensured that the members of the control group had the opportunity to receive the same potential benefits of the training as the experimental group. Keeping the length of time between the intervention and the posttest to a minimum was purposeful in order to lessen the threat to internal validity from potential maturation and history biases (Dimitrov & Rumrill, 2003).

The SI created an online version of the H-PEPSS survey in Qualtrics. After creating the survey, Qualtrics generated a link that allowed the participants to go directly to the survey by simply clicking the link. The SI composed an email to each of the study participants that included the link to the survey. On the day of the pretest the SI met with both the control and experimental groups and electronically delivered the survey link to their email address. The SI stayed with the participants until they all had completed the surveys to endure there were not any technical difficulties.

Survey Tool

The Health Professional Education in Patient Safety Survey (H-PEPSS) developed by Ginsburg, Castel, Tregunno, and Norton (2012) from the University of York in Ontario Canada

was used as the data collection instrument in this study. Ginsburg et al. (2012) developed the H-PEPSS after the Canadian Patient Safety Institute (CPSI) released their six domains of patient safety competence in which they deemed the six competencies as necessary for all health care professionals to possess in order to deliver safe patient care.

The original H-PEPSS is a 38-question data collection tool designed to "measure health professionals' self-reported patient safety competence around the time of entry to practice" (Ginsburg et al., 2012, p. 666). The H-PEPSS 2010 Version has three sections. The first section collects perceptions about their confidence in what they have learned from their training in six different patient safety content areas; culture of safety, teamwork, communication, managing safety risks, human and environmental factors, and managing and responding to adverse events and close calls. The second section evaluates perceptions about the ways in which broader patient safety issues are addressed in health care education, and the third and final section possess questions specifically aimed at licensed health care professionals (Ginsburg et al., 2012).

Self-efficacy embodies a reciprocal relationship between individual's behaviors, internal personal factors, and environmental events (Bandura, 1977). The tool used in this study, H-PEPSS, does not measure self-efficacy directly, instead it measures confidence. Confidence has been identified as a component of self-efficacy, especially as an attribute of an individual's internal personal factor and has been used as a measure of self-efficacy in several studies (Bandura, 1989; Bandura, 1993; Betz & Hackett, 1983; Schunk, 1981; Shell et al. 1989; Shell et. al., 1995; Pajares, 1996; Pajares & Miller, 1994). Bandura (2006) discussed the standard methodology for measuring self-efficacy and provided an example, which asked the respondents to rate their confidence of their ability to perform a task. According to Pajares (1996) "researchers assess self-efficacy beliefs by asking individuals to report the level, generality, and strength of their confidence to accomplish a task or succeed in a certain situation" (p. 546).

The original H-PEPSS evaluated each category in both the classroom and clinical setting. Because this study involved only student nurses who were not yet practicing in the clinical setting and because the NCRM training was only presented in a classroom learning environment, the SI modified the tool by removing the column for evaluating the clinical setting as well as section three which was specific to practicing nurses, leaving the tool with 27 questions divided into seven sections.

Permission was received to use the H-PEPSS in this study from the primary investigator and developer of the H-PEPSS, Associate Professor Liane Ginsburg (Appendix C). Ginsburg works at the School of Health policy and Management at York University in Ontario Canada. It is there at York University where Ginsburg and her peers developed and validated the H-PEPSS (Ginsburg et al., 2012).

Ginsburg et al. (2012) report that the H-PEPSS is best suited for those health professionals who are nearing the end of their education or who have just recently entered into their professional roles. Ginsburg and her research team used a confirmatory factor analytic (CFA) methodology to test the H-PEPSS. CFA was used because of its ability to show associations amongst latent variables.

After conducting a small pilot study with a group of 20 students the research team conducted the full study that included 1247 out of 4316 eligible new graduates, which represented a 28.9% response rate. After removing participants with incomplete survey responses the final sample size was 1016 and included a mixture of medicine, nursing, and pharmacy students (Ginsburg et al., 2012).

Cronbach's alpha was used to examine the internal consistency reliability of the six dimensions of patient safety competence. The results showed that the tool produced an internal consistency reliability that exceeded 0.80 for each of the six factors of patient safety. Ginsburg

et al. (2012) reported that the researchers used multiple group CFA techniques to test the construct validity of the tool and that it was found to be a valid tool "X^2 = 117.65, df = 89, p = 0.023, CFI = 0.972, RMSEA = 0.050, relative X^2 = 1.32" (p. 680).

Doyle, VanDenKerkhof, Edge, Ginsburg, and Goldstein (2015) used the H-PEPSS to measure self-reported patient safety competence of medical students (255) and other postgraduate trainees (141) from other health care specialties at one Canadian university. Doyle et al. (2015) modified the H-PEPSS questions slightly to make the questions read in present tense as opposed to past tense. Due to this modification of the questions Doyle et al. (2015) decided to revalidate the tool structure using CFA and "commonly accepted indices of fit (Confirmatory Factor Index >0.95, Root Mean Square Error of Approximation <0.06)" (p.137). Based on the indices of fit the H-PEPSS was found to be a good fit for both the medical students and the trainees (Doyle et al., 2015).

Stevanin, Bressan, Bulfone, Zanini, Dante, and Palese (2015) translated the H-PEPSS into Italian and used it to measure the perceptions of nursing students concerning their own knowledge and competence associated with patient safety. To determine the validity of the Italian H-PEPSS Stevanin et al. (2015) used an Explorative Factor Analysis to confirm its validity. The Italian H-PEPSS actually produced a stronger representation of internal consistency than the original H-PEPSS (α 0.81 to 0.85) with an α of 0.939 in the classroom setting and an α = 0.936 in the clinical training setting (Ginsburg et al., 2012).

The H-PEPSS data collection method utilizes a five-point Likert scale. The five points were represented on the survey as strongly disagree, disagree, neutral, agree, strongly agree, and it also included a "don't know" option. For this study the H-PEPSS was delivered with an electronic survey utilizing the online survey tool Qualtrics.

Data Collection

Data collection was conducted with the web-based survey software tool Qualtrics. Participants took the H-PEPSS on their personal computers by opening a link from an email that took them directly to the first question on the H-PEPSS. Qualtrics protects survey data with a high-end firewall system that routinely conducts self-scans to ensure that any vulnerabilities are identified and corrected. Qualtrics uses Transport Layer Security encryption for all transmitted data to ensure a crucial level of safety and it runs a complete backup of all its data every 24 hours (Qualtrics, 2015). Data from the H-PEPSS pre and posttests was populated and saved in Qualtrics online database as the participants completed their surveys. Upon completion of the pre and posttests the data was then exported to SPSS Version 23 for analysis.

Data Analysis

To confirm that there was no incomplete, incorrect, or missing data and to ensure that the transfer of data from Qualtrics to SPSS was successful, the SI conducted a manual review of the data. The review consisted of a cross-check to assure that the data transferred correctly to SPSS. No discrepancies were found. There was no missing data. Once the data was transferred to SPSS it was saved and stored on a flash drive storage device that is being kept secure by the SI.

A 2 x 2 factorial analysis of variance (ANOVA) was conducted on each of the seven domains of the H-PEPSS. A 2 x 2 ANOVA is used when a study has one between-subjects' independent variable and one within-subjects' independent variable. The mixed ANOVA is often used to determine whether there are differences between independent groups over time (Burns & Grove, 2005).

In order to find the results of a mixed ANOVA valid there are several assumptions that must be tested and confirmed to be true. The assumptions are that there are no outliers, the data is normally distributed and that there is homogeneity of variances, homogeneity of covariance

and when appropriate sphericity. To identify outliers a boxplot was used and a Shapiro-Wilk test was used to test for normally distributed data. A Levene's test was sued to test the assumption of homogeneity of variances and a Box's test of equality of covariance was used to measure the homogeneity of covariance. Because there were just two points of measure, sphericity was not considered (Field, 2013).

Assumptions

For this study the following assumptions were made

1. There is positive correlation between a students' self-efficacy related to patient safety competence and their ability to provide safe patient care.
2. The participants would answer the survey questions with honest and accurate responses.
3. The participants would participate in the full NCRM training.

Ethical Considerations

There were no known or anticipated negative effects associated with participating in this study. Participants received a very thorough description of the study and its objectives and plans. Participants were informed of their right to stop participating the study at any point in time and had the right to request that their data not be included in the study findings.

Summary

To summarize, a quasi-experimental, two group, pre and posttest design was used to determine the impact of NCRM training on final semester nursing students. A sample population consisting of 46 senior level baccalaureate nursing students at one university served as the participants and were a convenience sample for this small pilot study. The H-PEPSS was used to measure the participant's self-reported self-efficacy related to patient safety competence before and after NCRM training and it was delivered electronically through the Qualtrics web-

based survey platform. The data was analyzed with SPSS Version 23 and 2 x 2 factorial ANOVAs were used to identify changes in self-efficacy.

The purpose of this study was to determine if NCRM training could produce a significant increase in posttest H-PEPSS scores of final semester nursing students after they received NCRM training. Based upon Bandura's Social Cognitive Theory (1977), increases in self-efficacy lead to improvements in commitment, behavior, performance and ones' ability to act when faced with adversity or challenging situations. Such improvements in self-efficacy result in improved outcomes (Bandura, 1977).

Study findings will help nursing educators determine the importance of NCRM training in nursing curriculums. The findings will provide nursing educators more information about how to best deliver patient safety education and help move nursing one step closer to an improved education system and improved patient safety as deemed necessary by the IOM (IOM, 2010). The results of this pilot study will provide direction for future research on NCRM training and its impact on student nurse's self-efficacy competence as it relates to patient safety and ultimately NCRMs impact on patient safety outcomes in the clinical setting.

CHAPTER 4: STUDY FINDINGS

This chapter presents the findings of this quasi-experimental, two group, pre and posttest pilot study in which the purpose of the study was to discern if Nursing Crew Resource Management (NCRM) training could make a significant improvement in patient safety self-efficacy for final semester baccalaureate nursing students. The Health Professional Education in Patient Safety Survey (H-PEPSS) assessment tool was used to gather data on the student nurses' levels of self-efficacy. Information about the sample and results of the statistical analyses performed on each of the seven categories of the H-PEPSS assessment tool will be presented.

Hypothesis Statement

The hypothesis for this study stated that Nursing Crew Resource Management will have a significant positive effect on final semester baccalaureate nursing students' self-efficacy related to providing safe patient care as represented by their Health Professional Education in Patient Safety Survey scores.

Description of the Sample

The sample for this study consisted of 46 final semester baccalaureate nursing students who were all enrolled in a maternal child care course at a private university in the Midwestern United States. The 46 out of 47 possible students who participated in this study represented a 97.9% participation rate. One student was unable to participate in the study due to a pre-planned absence. Participants were randomly assigned to either the control or experimental groups by random draw and alternating assignment within the groups. Both the control group and treatment group consisted of 23 students. No further demographic data was collected.

To test the impacts of NCRM training, after taking the H-PEPSS pretest the treatment group received four hours of face-to-face NCRM training that was presented by the Student Investigator (SI) while the control group received no additional training. The post-test was

conducted four days after the treatment group received the NCRM training. One week following the posttest survey, the control group also received four hours of NCRM training that was presented by the same SI.

Prior to the first NCRM training Institutional Review Board approval was obtained and all participants provided consent to participate in the study. There was no attrition during the course of this study which lasted a total of two weeks in duration from pretest to post-test.

Data Analysis

The H-PEPSS survey tool was used to collect data on the student nurse's levels of self-efficacy related to patient safety. The survey consisted of 27 Likert answer style items which were divided into seven categories. Each item was preluded by the statement; I feel confident in what I know about…. The participants could choose from one of six options; strongly disagree, disagree, neutral, agree, strongly agree, or don't know.

The survey was delivered to the participants through an online survey tool called Qualtrics. For both the pretest and the post-test Qualtrics allowed the SI to email each student a link that redirected them directly to the online H-PEPSS survey. The survey results were anonymous preventing the SI from being able to link students to their survey results. On the day of the pretest the students were instructed to open the email and complete the surveys during their scheduled class time. The pretest was conducted on day one of the study, the intervention day five, and the post-test on day 10. On day 14 the SI conducted a second four hour NCRM training with the control group to ensure they received the same beneficial information as the treatment group. The data was transferred to SPSS Version 23 for analysis. Prior to analysis the Likert scale responses were numerically coded.

Due to this study having both a within-group factor and a between-groups factor, one dependent variable (H-PEPSS scores), and two independent variables that are both split into two

categories, a Two-Way Mixed Model ANOVA was used for analysis. The independent variables in this study were Group (control and treatment) and Time (pre and post). The Two-Way ANOVA allowed for the comparison of group mean differences between the control group and treatment group (between groups factor), and for the evaluation of the pre-and post-test scores for the treatment group (within group factor).

Descriptive Statistics

The first step in analyzing the data was to review the descriptive statistics. Table 3 below shows the descriptive statistics associated with both the control and treatment group's pretest and post-test mean group scores. The seven categories are represented by the following acronyms; Clinical Safety (CS), Working in Teams with Other Health Professionals (WT), Communicating Effectively (CE), Managing Safety Risks (MSR), Understanding Humans and Environmental Factors (HE), Recognize, Respond and Disclose Adverse Events and Close Calls (RRD), and Culture of Safety (COS).

The descriptive statistics show that in every category except CS there was an increase in the group means scores on the H-PEPSS between pre and post-test scores. Pretest scores between the treatment and control groups was similar for all categories except the CE (control = 3.96 and treatment 4.41) (see Table 3).

Table 3.
Descriptive Statistics (Pretest/Post-Test)

H-PEPSS Category	Group	N	Mean	St. Deviation
CS - Pretest	Control	23	4.61	.37
	Treatment	23	4.57	.44
CS - Post-test	Control	23	4.67	.39
	Treatment	23	4.46	1.14
WT - Pretest	Control	23	3.83	.58
	Treatment	23	3.83	.48
WT - Post-test	Control	23	3.85	.68
	Treatment	23	4.49	.44
CE - Pretest	Control	23	3.96	.71
	Treatment	23	4.41	.57
CE - Post-test	Control	23	4.16	.68
	Treatment	23	4.59	.44
MSR - Pretest	Control	23	3.74	.64
	Treatment	23	3.80	.73
MSR - Post-test	Control	23	3.90	.47
	Treatment	23	4.32	.62
HE - Pretest	Control	23	3.90	.69
	Treatment	23	4.01	.66
HE - Post-test	Control	23	4.01	.70
	Treatment	23	4.41	.47
RRD - Pretest	Control	23	3.52	.58
	Treatment	23	3.74	.55
RRD – Post-test	Control	23	3.59	.63
	Treatment	23	4.27	.53
COS - Pretest	Control	23	4.23	.59
	Treatment	23	4.05	.48
COS – Post-test	Control	23	4.13	.67
	Treatment	23	4.53	.44

Note. Clinical Safety (CS), Working in Teams with Other Health Professionals (WT), Communicating Effectively (CE), Managing Safety Risks (MSR), Understanding Humans and Environmental Factors (HE), Recognize, Respond and Disclose Adverse Events and Close Calls (RRD), Culture of Safety (COS).

Two-Way ANOVA Assumptions

The Two-Way ANOVA is associated with the assumptions of homogeneity of variance and normal distribution (Field, 2013). To test for normal distribution of the data the Shapiro-Wilk test was performed and its results showed that 14 of 27 of the participant's responses did not fall within a normal distribution. This may be partially due to the small sample size, but is likely due to that fact that the scores created a ceiling effect. Powers (2014) defines the ceiling

effect as "the phenomenon that occurs whenever a cognitive test is too easy for the subjects being tested and when judges or evaluators rate almost everyone at or near the top of the scale" (p. 18). However, despite this violated assumption Fields (2013) reported that the ANOVA is a robust test even when the assumption of normal distribution is violated as long as the group sizes are equal, and have at least 20 degree of freedom (which is true of this study). Based on the information from Fields the SI decided not to correct for the non-normal distribution. The Levine's test was used to test the assumption of homogeneity of variance and it showed that there was in fact homogeneity of variances ($p > .05$) and covariances ($p > .05$) in each category.

Next, the results of the analysis of each category will be presented. After a review of the descriptive statistics of each category of the H-PEPSS, Two-Way mixed ANOVA (alpha = .10) was conducted on each of the seven H-PEPSS Categories.

Clinical Safety

After a review of the descriptive statistics, in the category of CS the control group scored higher on the pretest ($M = 4.61$) than the treatment group did ($M = 4.57$) and the control group performed even better on the post-test ($M = 4.67$) than the treatment group ($M = 4.46$). These unexpected findings, although not initially expecting these results, the results were not surprising after further consideration since the CS category focuses on clinical safety actions such as hand hygiene and infection control which were not topics directly covered in this NCRM training. Based on these initial findings no further analysis was completed on this category and it is assumed that NCRM training has no effect the on concepts of clinical safety as measured by the H-PEPSS.

Working in Teams with Other Health Professionals

Concerning working in teams with other health care professionals, there was a significant interaction between Group and Time ($F(1,44) = 7.557$, $p = .009$, $\eta^2 = .147$). A review

of the simple main effects indicated that the treatment group improved significantly ($t_{22} = -5.11$, $p < .001$) and that the treatment group scored significantly higher than the control group on the posttest ($t_{44} = -3.814$, $p < .001$). These results led to the rejection of the null hypothesis and acknowledgment of the positive effect of NCRM training on this category.

Communicating Effectively

There was not a significant interaction found between Group and Time ($F(1,44) = 0.001$, $p = .975$, $\eta^2 = .000$). There was a positive main effect identified for the treatment group when compared to the control group ($F(1,44) = 10.145$, $p = .003$, $\eta^2 = .187$). There was no significant effect of pre verses post-test scores ($F(1,44) = 2.776$, $p = .103$, $\eta^2 = .000$) despite overall stronger scores on the post-test than the pretest. These results conclude that it is unlikely that the NCRM training had any significant impact the students' confidence in their abilities to communicate effectively and therefore the null hypothesis was retained.

Managing Safety Risks

There was not a significant interaction between Group and Time ($F(1,44) = 1.970$, $p = 0.167$, $\eta^2 = .043$) although the treatment group showed a marked increase in their scores. The main effect of Group showed that there was a statistically significant difference in mean H-PEPSS scores for the treatment group as compared to the control group ($F(1,44) = 3.437$, $p = .07$, $\eta^2 = .072$) with overall stronger perceptions from the treatment group than the control group.

The main effect of Time showed a statistically significant difference in mean pretest scores as compared to the mean post-test scores ($F(1,44) = 6.964$, $p = .011$, $\eta^2 = .137$) with overall stronger scores on the post-test than the pretest. While this is descriptive for participants in both the treatment and control groups, the effect was stronger on the treatment group. Despite a non-significant interaction, the null hypothesis for this category was rejected because of the

significant main effects and it is determined that NCRM did in fact positively affect the student's self-efficacy.

Understanding Human and Environmental Factors

There was not a significant interaction between Group and Time ($F(1,44) = 1.165$, $p = .286$, $\eta^2 = .026$). The main effect of Group showed that there was a statistically significant difference in mean H-PEPSS scores for the treatment group as compared to the control group ($F(1,44) = 3.398$, $p = .072$, $\eta^2 = .072$) with an overall stronger understanding for the treatment group than the control group.

The main effect of Time showed a statistically significant difference in mean pretest scores as compared to the mean post-test scores ($F(1,44) = 3.952$, $p = .053$, $\eta^2 = .082$) with overall stronger scores on the post-test than the pretest. While this is descriptive for participants in both the treatment and the control groups, the effect was stronger on the treatment group and so the null hypothesis was rejected and it was determined that NCRM did have a positive effect on the student's understanding of human and environmental factors.

Recognize, Respond and Disclose Adverse Events and Close Calls

There was a significant positive interaction between Group and Time ($F(1,44) = 3.755$, $p = .059$, $\eta^2 = .079$). There was significant improvement in the treatment group ($t_{22} = -3.854$, $p = .001$) and the treatment group scored significantly higher than the control group on the posttest ($t_{44} = -3.969$, $p < .001$).

The main effect of Time showed a statistically significant difference in mean pretest scores as compared to the mean post-test scores ($F(1,44) = 6.143$, $p = .017$, $\eta^2 = .123$) with overall stronger scores on the post-test than the pretest. While this is descriptive for participants in both the treatment and control groups, the effect was stronger on the treatment group and

therefore the null hypothesis was rejected indicating that NCRM did have a positive effect on the student's self-efficacy.

Culture of Safety

There was a positive interaction between Group and Time ($F(1,44) = 4.964$, $p = .031$, $\eta^2 = .101$). A review of simple main effects showed that there was significant improvement in the treatment group ($t_{22} = -3.362$, $p = .003$) and the treatment group scored significantly higher than the control group on the posttest ($t_{44} = -2.427$, $p = .019$) causing the null hypothesis to be rejected.

Summary

This chapter has presented the statistical findings of this study. The chapter has covered findings for each of the 7 H-PESS categories by way of analysis with a 2-Way mixed model ANOVA. Only two of the seven categories (WT, COS) showed a significant interaction between the treatment and control groups pre and post-test scores, while five of the categories (WT, CE, MSR, HE, RRD) showed no interaction. All categories except CS revealed a main effect that identifies statistically significant differences in mean H-PEPSS post-test scores for the treatment group as compared to the control group, while all except the CS and CE categories showed statistically significant differences in pre verses post-test scores for the treatment group. These findings suggest that NCRM training does positively impact student nurses' self-efficacy related to patient safety concepts on the majority of the chosen measures on the H-PEPSS. The next and final chapter of this dissertation will further explore the study's findings and their implications for the patient safety, the nursing profession, and nursing education in particular. In addition, the final chapter will discuss recommendations for further research into the effectiveness and usefulness of NCRM training for improving overall patient safety.

CHAPTER 5: DISCUSSION

The final chapter provides a discussion of the study results. The study methodology is summarized as well an interpretation of the findings. Conclusions are drawn and implications are discussed for nursing education and nursing practice. Study limitations are discussed. Recommendations for future research are provided followed by a chapter summary.

Study Summary

The study focused on the use of Nursing Crew Resource Management (NCRM) training with a convenience sample of final semester, baccalaureate nursing students. NCRM is a nursing focused version of Crew Resource Management (CRM) which has been found to decrease errors and improve safety practices in multiple industries (Sculli & Sine, 2011). NCRM includes several important patient safety components such as effective communication, decision-making, managing fatigue and workload, working in teams and recognizing and responding to adverse events (McConaughey, 2008). There is a growing body of literature on both CRM and NCRM. However, little focus has been placed on the use of NCRM training with nursing students who are expected to maintain patient safety the moment they enter practice despite their lack of experience.

This novel pilot study examined the effect of NCRM training on students' self-efficacy related the provision of safe patient care. To assess the impact of NCRM training, a quasi-experimental pre posttest design was used. NCRM training was predicted to improve the student's self-efficacy. The Health Professional Education in Patient Safety Survey (H-PEPSS) was used to measure the students' levels of self-efficacy related to patient safety.

The data from each of the seven different H-PEPSS categories were computed into group mean scores. Factorial 2 x 2 Analysis of Variances (ANOVAs) were used to identify significance in each of the categories. A significance level of .10 was used for each analysis.

Factorial ANOVAs were utilized because the test enabled the SI to search for significant differences in experimental group pre and posttest scores, control and experimental group's posttest scores, and interactions between the independent variables of Group and Time all with one analysis per category (Fields, 2013).

Prior to the start of the study, the student investigator (SI) received NCRM trainer training. Following IRB approval, students were recruited and randomly assigned to the control group or an experimental group that received the NCRM training. Both groups completed the H-PEPSS as the pretest and posttest and it was delivered online.

Demographic Descriptions of the Sample

A convenience sample consisting of 46 final semester nursing students from one private university in the Midwestern United States constituted the study sample. The sample was opportune due to its location and because of the expressed interest of the universities nursing faculty member. The gender split of the group was 44 females and 2 males. This mimics but is somewhat less than the current underrepresentation of males in the nursing profession, which as of 2014 was at 11% (American Nurses Association [ANA], 2014). The 46 students were randomly assigned to either the control or experimental group by random draw and they formed evenly distributed control and experimental groups of 23 participants in each group.

A large majority of the study participants were actively engaged in all 4 hours of the NCRM training and put forth obvious efforts to learn and participate in the activities and discussions. NCRM training discusses the prevention of errors at length and it is a concept that is incorporated throughout all of the training modules. NCRM teaches participants that it is their right and their duty to speak up and to be advocates the safety of those assigned to their care, and that they must speak up when they see, hear or fear that a potential error may be imminent or possible (Sculli & Sine, 2011). This important component of the training is based on evidence

that shows that nurses and other health care personnel are often afraid to speak up (Attree, 2007). Attree (2007) reported that nurses perceived raising concerns as a high-risk, low-benefit action and that perceived safety and perceived efficacy of speaking up can affect their behavior in regards to speaking up. This failure to speak up can result in errors that happen right in front of people who had the opportunity to stop the error from happening but did not. NCRM training advocates for all team members, despite their role on the team, to have this confidence and it offers suggestions on ways for the trainees to structure their concerns in a professional, direct, and concise manner (Sculli & Sine, 2011).

The one area of the training in which the SI felt that the students had a difficult time accepting was the portion of the training that focused on assertive communication. NCRM training takes the participants though it's Effective Followership Algorithm, which is provided as a guide for them to follow when communicating with team members (Sculli & Sine, 2011). The steps are presented as an algorithm helping to guide communication. When the SI taught the assertive communication techniques, especially those that encouraged the student participants to speak up boldly yet professionally if necessary to prevent errors, the students expressed concerns over the realistic nature of being able to do this. A participant in the experimental group stated that it was "unrealistic" to think that a student nurse would ever speak up in such a way to a doctor or other licensed experienced professional even in the event that they knew or feared the doctor may be about to cause an error. Other students voiced the same concern and this led to a group discussion about why they were not alone in feeling that way and how the current culture perpetuates these feelings despite the fact that it leads to dangerous practice. We then discussed how this was a great example of why we need to work to change the current culture in health care so that these fears of speaking up are a thing of the past. Tsao (2015) wrote that learning through discussion "promotes the development of critical thinking skills that lead to greater

understanding of instructional material" (p. 334). This impromptu discussion brought to light valuable insights regarding the students' fears related to speaking up. The discussion educated the group as to how these fears are part of the problem and how their fears could lead to catastrophic outcomes for their patients.

Interpretation of the Findings

Clinical safety (CS). The experimental group (pretest M = 4.57, post-test M = 4.46) did not improve and in fact scored worse on their posttest scores while the control group (pretest M = 4.61, posttest M = 4.67) scored better on the posttest. The questions in the CS category asked the participants how they felt about what they had learned in four specific clinical safety areas; hand hygiene, infection control, safe medication practices and safe clinical practices in general. The SI did not place direct focus on these four specific concepts while presenting the NCRM training. After further reflection and review of the training materials, these four concepts were not emphasized in the NCRM trainer training that the SI received. This finding should be considered when conducting additional research of NCRM. This represents an error in indirect measure as described by Burns and Grove (2005) as occurring when the measure contains elements that are not part of the concept.

Communicating effectively (CE). No significant improvement was found between the experimental groups pre and posttest scores. This was an unexpected finding based on the review of several studies that have identified positive links between CRM training and improvements in communication skills (Chan et al., 2016; Halbesleben, Cox and Hall, 2011; Hefner et al., 2016; Lemson et al., 2015; Sculli et al. 2011; Tschannen et al., 2015; West et al., 2012). The NCRM training that was presented had a strong focus on dealing with difficult conversations. As mention earlier in this chapter the SI received some push back from study participants who did not think that it was realistic to ask them (students) to speak up to a

physician or other experienced members of the health care team. Okuyama, Wagner and Bijnen (2014) listed several factors that prevent people from speaking up including; not wanting to deliver bad news, fear of expressing undesirable ideas, and overall fear of social pressures that exist amongst groups. The study participants expressed that they would be fearful to speak up because of their level of inexperience. Despite reassurance from the SI that speaking up when they have concerns is a professional nursing responsibility, always the right thing to do and that it is more important to protect the patients than to worry about what someone will think or say, the impression from a large number of participants was that they still felt it was very unlikely that they would possess the confidence to be able to speak up in the face of that much trepidation and uncertainty. Nurses must adhere to the American Nurses Association's Code of Ethics that hold nurses accountable for having authority, accountability and responsibility for their decisions and actions, and holds nurses responsible for "protecting patient health and safety by action on questionable practice" (Lachman, Swanson & Winland-Brown, 2015, p. 363).

The participant's refusal to buy into the idea that they have not only the right but the responsibility to speak up despite their fears is an interesting phenomenon and one that deserves more research. According to Bandura (1982) "those of low efficacy will give up readily, should their efforts fail to produce results" (p. 141). Garon (2012) places the responsibility for changing this culture of fear with nursing leaders and found that nurse managers play a critical role in creating a culture in which nurses feel safe to speak up and empowered to ensure their voices are heard. Similarly, when Crawford, Omery and Seago (2012) conducted a review of the literature they found that organizations hold the primary responsibility for establishing nonhierarchical communication environments that emphasize "respect, openness, active listening and a free flow of patient-centered information" (p. 549) in order to enhance interprofessional communications. The SI questions if this fear could be alleviated in a multidisciplinary CRM based training

situation in which the nursing students could learn the importance of speaking up and practice the algorithm alongside of other members of the health care team where they were all hearing and learning the same message.

Working in teams with other health professionals (WT). This category asked how confident participants felt about different aspects of working in teams. Some of the aspects included specifically asking the participants how confident they were in what they had learned about encouraging team members to speak up, question and advocate for safety issues. The H-PEPSS scores showed significant improvements in pre and posttest scores for the experimental group and significant differences in scores between the control and experimental groups. This indicates that the participants did feel more confident in what they learned about working in teams with other professionals after NCRM training hence their self-efficacy was improved. These findings offer additional support to the study conducted by West et al. (2012) that found an increase in perceived teamwork abilities in nurses after receiving CRM training. Berry et. al. (2016) reported significant decreases in serious safety events, hospital mortality and hospital harm along with improved teamwork after the implementation of a hospital wide patient safety program. The concern still remains as to if the participants will use what they learned effectively in practice based their verbalized fear of speaking up.

Managing safety risks (MSR). Both the pre and post-test scores of the experimental group and between the experimental and control group's posttest scores. These positive findings indicate that the NCRM training did positively influence the self-efficacy of student nurses regarding managing safety risks. Managing safety risks, such as patient falls, medication administration, and communication failures is imperative for nurses in order to improve patient safety. Nurses' frequently work in erratic environments where they must make decisions quickly and where their clinical judgments and decisions directly impact the health and safety of the

patients they care for (Johnstone & Kanitsaki, 2007). Despite a thorough review of the literature no publications were able to be identified that specifically addressed the impact of CRM or NCRM on health care professionals' ability to manage safety risks. Johnstone and Kanitsaki (2007) conducted a search of the literature to identify publications regarding risk management education for nurses and found a gap in the evidence on how to engage nurses in risk management education. This lack of published information on the importance and correct application of risk management education coincides with the lack of overall lack of research on the topic of nurses and risk management.

Understanding human and environmental factors (HE). NCRM training produced significant improvements in the participants' understanding of human and environmental factors in the pre and posttest scores of the experimental group and between the experimental and control group's posttest scores. A review of the literature produced no comparable studies in which any CRM based training program has ever been evaluated for its ability to impact understanding of human or environmental factor for nurses or any other health care professionals at any level. Faculty at the Severn Postgraduate Deanery School of Surgery identified human factors training as critical to the improvement of patient safety and developed a one-day training course in human factors for junior level surgical students. The researchers evaluated the students' confidence in four different human factors skills (situational awareness, decision making, communication, and teamwork/leadership skills) before and after providing the human factors training. The researchers found that there were statistically significant differences ($p<0.001$) in the students' confidence in all four categories (Jones et. al., 2014). Jones et. al. (2014) concluded that more research is necessary to confirm that improvements to the understanding of human factors has a direct correlation to the improvement of patient safety outcomes.

The specific topics addressed in the HE category of the H-PEPSS were factors such as fatigue, the safe use of health technology, workflow, ergonomics, and resources. Roth, Brewer, and Wieck (2016) conducted a study in order to rank the top ten human factors associated with patient safety errors. The top three human factors on the researchers list were all factors that were included in NCRM training (fatigue, large workloads and communication problems) confirming the importance of this category in NCRM training.

Recognize, respond to and disclose adverse events and close calls (RRD). A significant result was found between the control and experimental group's posttest scores and between the experimental group's pre and posttest scores. These finding indicates the NCRM training did have a positive effect on the participants' self-efficacy related to their ability to recognize, respond to and disclose adverse events and close calls. A thorough review of the literature produced no other published studies that looked at this particular indicator.

Levett-Jones et. al. (2010) reported differences between how a novice nurse and an experienced nurse process clinical reasoning and recognize and respond to adverse events and indicated that novice nurses need additional training to overcome this disparity. Lukewich et al. (2015) released the results of a study on baccalaureate nursing students in which they evaluated the student's confidence about learning patient safety and although they were not evaluating a CRM based training program like in this study they did use the H-PEPSS to gather their data. Their study included students from all four years of the nursing program and found that student scores in the RRD as well as score in the WT and MSR categories declined in their final year of the program. This finding supports the need for new and additional training techniques such as NCRM for senior students to ensure that new graduates are confident in their abilities to recognize and respond appropriately to adverse events.

Culture of safety (COS). NCRM training did improve the participants' self-efficacy related to COS. Significant results were found between the control and experimental group's posttest scores and between the treatments group's pre and posttest scores. This coincides with much of the available literature that exists regarding CRM based trainings and its effect on COS.

COS is defined by the Agency for Healthcare Research and Quality (AHRQ) as a concept that requires a full commitment to safety from all members of an organization including practitioners and leaders ("Safety Culture", 2016). AHRQ identified four elements that are key to a strong COS; "acknowledgment of the high-risk nature of an organization's activities and the determination to achieve consistently safe operations, a blame-free environment where individuals are able to report errors or near misses without fear of reprimand or punishment, encouragement of collaboration across ranks and disciplines to seek solutions to patient safety problems, and organizational commitment of resources to address safety concerns" ("Safety Culture", 2016, para. 1).

After discovering low scores on a patient safety culture survey the VAs NCPS reacted by rolling out CRM based team training. They conducted a study to evaluate its effectiveness in improving the perceived culture of safety. In this study Sculli et al. (2013) found a statistically significant 14% increase in one nursing unit's staff's teamwork perceptions after they received and then utilized NCRM training techniques. In somewhat of a contrast Verbeek-van Noord et al. (2014) conducted a systematic literature review to determine the effectiveness of classroom-based CRM trainings on patient safety culture. Their review included the evaluation of 22 publications and produced mixed results. Their ultimate conclusion was that more studies are needed and that the validity of the new studies need to be enhanced as compared to previous studies.

It is important to understand the relationship between COS and patient safety. When examining the relationship between COS and patient outcomes the literature revealed conflicting data. While Mardon, Khanna, Sorra, Dyer, and Famolaro, (2010) found that hospitals with a strong COS had lower rates of adverse events, Groves (2014) found no that relationship existed between COS and patient outcomes. Further research is needed to determine the full significance of safety culture on patient safety.

Implications for Nursing

The findings of this study were meant to assist academic nursing administrators' and their faculty in determining the benefits of utilizing NCRM and or CRM based training in their schools. It is clear from the results of this study that there are positive impacts on nursing students' patient safety self-efficacy after receiving NCRM training. Although the literature is still limited, the extent of literature available on the impacts of NCRM or CRM based trainings in the clinical setting is rising. According to Gallagher (2016) the number of published articles about CRM training in healthcare has increased five times over in the 13 years from 2000-2013. The literature regarding the impacts of CRM based trainings on nursing students is much more limited. Only one study was found in the literature that looked at the impacts of NCRM on student nurses (Aebersold et al., 2013).

According to Parker, Giles, Lantry, and McMillan (2014), a nurses' experiences in their first year of practice has significant implications on their career outlook. Wilson, Squires, Widger, Cranley, and Tourangeau (2008) reported that typically the nurses first year of practice is burdened with stress which leads to dissatisfaction and a high turnover rate. Freeling and Parker (2015) conducted a literature review to determine what experienced nurses expected from newly graduated nurses and found that the new graduates lacked several important skills that the experienced nurses expected of them; decision making, time management, delegation, patient

assessment, and communication. Considering the rapid inclusion of CRM based trainings in practice settings it is critical that educators begin evaluating the effects of such trainings on students. Equipping students with this knowledge early will make them more prepared to step into the practice setting with the skills they need and will better prepare them to provide safe patient care.

The Quality and Safety Education for Nurses (QSEN) Institute's mission is to build upon "nursing's capacity to continuously improve the quality and safety of health care" (QSEN, 2014, para. 1). QSEN has taken a lead role in promoting the integration of patient safety education into nursing education programs throughout the country. QSEN has developed competencies, teaching strategies and faculty development tools to support their mission (QSEN, 2014). There is no lack of evidence telling us that as health care providers we are not where we need to be with patient safety, and that teaching about patient safety needs to start early and be reviewed often (Chan et al., 2016; Halbesleben, Cox and Hall, 2011; Hefner et al., 2016; Lemson et al., 2015; Sculli et al. 2013; Sculli & Sine, 2011; Tschannen et al., 2015; West et al., 2012).

Although the rates of deaths caused by medical errors vary by report, a recent report by researchers at John Hopkins University found that that more than 250,000 Americans die each year as a result of medical errors (Makary & Daniel, 2016). The nursing profession is the largest health care group with nearly four million members strong (ANA, 2014). Nurses must take advantage of this opportunity to lead the change. Further, the IOM (2010) recommended that nurses should lead the way in transforming health care and health care education to improve patient safety and that it must be treated as an immediate priority.

Social Cognitive Theory (SCT) is a well-known and widely accepted theory of learning (Lin, 2016). Within the SCT is the concept of self-efficacy and more specifically perceived self-efficacy. Self-efficacy is "concerned with judgments of how well one can execute courses of

action required to deal with prospective situations (Bandura, 1982, p. 122). Bandura (1988) declared that improvements in self-efficacy result in improvements in performance and lead to increased efforts toward success. This study measured self-efficacy by asking participants to rate their level of confidence in what they knew about patient safety before receiving NCRM training and again after receiving the training. A control group was used to compare posttest findings. As revealed by Parjes (1996) and Bandura in Parjes and Urdan (2006), measures of confidence are commonly used to assess levels of self-efficacy. Based on Bandura's assertions the results of this study confirmed that NCRM training improved self-efficacy regarding patient safety knowledge. Self-efficacy was improved significantly in six of seven categories related to patient safety and the findings do support the implementation of NCRM training into nursing programs.

Limitations

One of the main limitations associated with this study was the small sample size. Small sample sizes can lead to results that may not have enough power to adequately identify differences and can put the results at risk of a false negative result that can lead to a type II error (Nayak, 2010). A small sample size was deemed acceptable for this study because this was a pilot study in which the results were meant to help direct the feasibility and planning of a larger study on the phenomena (Burns & Grove, 2005). The Encyclopedia of Nursing Research defined pilot studies as "a smaller version of a proposed or planned study that is conducted to refine the methodology for a larger study" (Musil, 2011, para. 1). Burns and Grove (2005) identified several characteristics of pilot studies; desire to refine the research treatment, identify issue with the study design if any, refine the data collection methods and analysis plan as needed, and provide the researchers with experience working with the subjects, methodology and analysis techniques. Each of these characteristics will be taken into consideration during the

planning of future studies that follow this pilot study and will be discussed in the recommendations.

Another limitation was the use of a convenience sample. A convenience sample was necessary for this study due to time and location restrictions at the nursing school where the study took place. Convenience samples are generally less desirable due to a decreased ability to control for biases (Burns & Grove, 2005). Although it further limited the possible sample, the inclusion of only final semester nursing students was intentional because the SI wanted to investigate the levels of patient safety self-efficacy in students who were near graduation and "ready" to enter into practice and assume the responsibility of unsupervised direct patient care. Furthermore, Aubeeluck, Stacey and Strupple (2016) found that as many as 70% of newly graduated nurses experience imposter phenomenon early in their careers. Imposter Phenomenon or Imposter Syndrome is when a person appears to be successful and competent to others but internally they feel very incompetent (Aubeeluck at al., 2016). This feeling of incompetence would in turn result in low self-efficacy (Bandura, 1982). Support from peer groups can impede the effects of the impostor phenomenon through "consistent validation, respectful challenge, acceptance in spite of mistakes, connection even in conflict, recognition and affirmation of being human, celebration of self and of success" (Clance, Dingman, Reviere, and Stober 1995, p. 94). Clinical debriefing sessions may be an ideal place to encourage such support amongst students. As we know from Bandura (1988) a student's level of self-efficacy is a predictor of their behavior and performance therefore this supports the importance of alleviating imposter syndrome and fostering student nurse's self-efficacy levels.

In all of the seven H-PEPSS categories when an effect was present it was small. According to Burns and Grove (2005) "effect size is the extent of the presence of a phenomenon" (p. 355). The small effect sizes could be in part due to the small sample size

(Burns & Grove, 2005). The presence of these small effect sizes reinforces the need for a larger sample size in any future research using this tool with NCRM training. Adequate sample size can be determined through a power analysis (Burns & Grove, 2005).

It is important to acknowledge that although the data analysis identified statistically significant improvements in six of the H-PEPSS categories, statistical significance does not equate to clinical significance. Clinical significance is the "magnitude of the actual treatment effect" which determines if the results of the study are likely to impact current practice (Ranganathan, Pramesh & Buyse, 2016, p. 169). Ranganathan et al. go on to report that there is no concrete way to determine clinical significance and that it is often determined by the opinions of the clinicians and patients or study participants. It will be very important to conduct additional studies that evaluate patient safety outcomes for patients cared for by NCRM trained nurses in order to determine true clinical significance of the training. Specific measures should include, number of errors, reported near misses, patient average length of stay, readmission rates, patient falls, nosocomial infections, willingness to speak up despite fear of repercussion, and the financial impacts of training verses no training.

The H-PEPSS was modified for this study. Two sections of the tool were removed, one section~~s~~ that was aimed at assessing the patient safety confidence acquired in the clinical setting, and the other section that was intended for licensed nurses. These modifications to the H-PEPSS impacted and altered the original validity and reliability of the tool. New validity and reliability studies will need to be done to determine accurate validity and reliability results on this modified version of the H-PEPSS if it is to be used in future studies.

Some of the survey question responses were limited by the ceiling effect. A ceiling effect is a level of measure that has reached its full potential and it cannot improve any further (Frost et al. 2005). When looking at the percentage of participants in this study whom either agreed or

strongly agreed, on their pretest survey questions, 4 questions in the survey revealed a score of 100%. For those 4 question no improvement could be achieved. In addition, another 12 questions produced scores of 86.9% or higher on the pretest leaving little room for improvement. This limitation made it difficult to impossible to recognize any improvement in these 16 survey questions.

Another important limitation to acknowledge was the limitation of the SI's expertise associated with the delivery of NCRM training. Although the SI had the opportunity to learn how to deliver the training from an expert in the field and despite the fact that the SI is an experienced faculty member with several years of teaching experience, this was the first opportunity the SI had to deliver the NCRM training. It is unknown how the level of expertise in the delivery of NCRM impacted the results of the training. The SI must gain more experience in the delivery of NCRM training in order to diminish the impact of this limitation. In future training sessions the SI will use course and facilitator evaluations to gain feedback from participants on ways to improve the training experience and the methods of delivery for the NCRM training.

Recommendations

It is strongly recommended that schools of nursing implement NCRM or another CRM based training program throughout their curriculum and that they study outcomes of this training with pre and posttest analysis of the student's self-efficacy, knowledge and performance. Performance based outcomes can be evaluated in the simulation or lab settings (Aebersold et al., 2013). Nursing programs must support NCRM trainer training for their faculty so that all faculty members can include NCRM concepts in their courses and they can continuously reinforce the concepts of NCRM throughout the students' nursing education.

It is recommended that an online version of CRM and/or NCRM training be developed and evaluated for effectiveness. According to Sculli and Sine (2011) it took a full decade for CRM to become fully integrated into the aviation industry and the health care industry is a much larger more complex industry with more variability than aviation. This means that health care will face new and different challenges in the attempt to decrease errors and increase safety but the stakes have never been hirer. We must at all costs strive to end preventable medical errors and eliminate preventable deaths due to errors in health care. Online education will allow NCRM training to be more accessible to more people and can be much more cost effective than face to face training (Billings & Halstead, 2016). Billings and Halstead (2016) reported that 75% of all higher education organizations now offer online education and they questioned if the time has come in which online instruction is the best way to go when compared to classroom teaching because of its accessibility and cost effectiveness.

A future study is currently planned to further examine the phenomenon of NCRM training and its effects on student nurses' patient safety self-efficacy. In the future study a larger sample that includes students from multiple schools of nursing and from all grade levels will be used. The concepts of NCRM will be integrated into the curriculum during the nursing students' freshman year and will be emphasized, expounded upon and revisited in courses throughout the remainder of the curriculum. In addition, simulation will be used to assess the impact of the training on the students' clinical skills and performance in the clinical setting.

The SI will need to refine the NCRM training to address some of the limitations such as clinical safety and communication. Additional content will be incorporated into the NCRM training that places an emphasis on communicating during difficult conversations. The participants fear or perceived inability to confront or speak up to physicians or those with more experience is a major concern. More time will have to be dedicated to addressing these fears and

additional content will need to be added that is aimed at empowering student nurses to speak up. This will be a longitudinal study with the intent of collecting data from trainees before and after they enter into practice to determine if the NCRM training in their academic settings made a difference in their long-term self-efficacy related to patient safety. This pilot study has revealed the need to expand the sample size, refine the intervention and revisit the data analysis plan to include a power analysis to determine an appropriate sample size.

Summary

This pilot study was conducted with the intent of answering the question as to if NCRM had a significant effect on final semester baccalaureate nursing students' self-efficacy related to patient safety, to inform the nursing education community, and to help improve the quality of future research on this subject. The findings indicated that, NCRM training was effective at making a positive change in nursing student self-efficacy in six of seven patient safety categories on the H-PEPSS survey. Although the improvements were significant, their effect sizes were small and future research must include a power analysis to help determine appropriate sample sizes need to produce a stronger effect that can strengthen the meaning of the findings (Burns & Grove, 2005). While more research is needed on the effects of NCRM on nursing students, additional research is also needed on the clinical significance of the impact. Longitudinal studies should be conducted that examine the long term impacts of NCRM training on patient outcomes and the delivery of safe patient care.

Nursing education programs should incorporate NCRM training concepts into their curriculum in an attempt to enhance safety practices with their students. A variety of teaching methods should be considered and experimented with in the delivery of NCRM training. Online education has been widely adopted in nursing education and is accepted as a highly effective teaching method that should be used or at least strongly considered (Billings & Halstead, 2016).

Other effective teaching techniques as presented by Crookes, Crookes, and Walsh (2013) that should be considered are; simulation, reflection, gaming, problem based learning, and art (such as music and storytelling).

Time is of the essence and nurses must take action now to make immediate and substantial contributions to the efforts of improving patient safety through leadership, investigation and analysis of the problem, and by taking action. The loss of even one life due to a preventable medical error is one life too many. If we calculate a daily rate based on James' (2013) estimates, 1096 people will die today in the U.S. from the result of a preventable medical error. We must take ownership of this devastating problem and do everything we can to solve it and improving education for nurses and other health care professionals is a critical component of the solution.

APPENDIX A: INSTITUTIONAL REVIEW BOARD APPROVALS

UNLV Biomedical IRB - Exempt Review
Exempt Notice

DATE:	January 14, 2016
TO:	Lori Candela, EdD
FROM:	Office of Research Integrity - Human Subjects
PROTOCOL TITLE:	[851144-1] The Impact of Nursing Crew Resource Management Training on the Patient Safety Self-Efficacy of Nursing Students
ACTION:	DETERMINATION OF EXEMPT STATUS
EXEMPT DATE:	January 14, 2016
REVIEW CATEGORY:	Exemption category #1

Thank you for your submission of New Project materials for this protocol. This memorandum is notification that the protocol referenced above has been reviewed as indicated in Federal regulatory statutes 45CFR46.101(b) and deemed exempt.

We will retain a copy of this correspondence with our records.

PLEASE NOTE:
Upon final determination of exempt status, the research team is responsible for conducting the research as stated in the exempt application reviewed by the ORI - HS and/or the IRB which shall include using the most recently submitted Informed Consent/Assent Forms (Information Sheet) and recruitment materials. The official versions of these forms are indicated by footer which contains the date exempted.

Any changes to the application may cause this protocol to require a different level of IRB review. Should any changes need to be made, please submit a **Modification Form**. When the above-referenced protocol has been completed, please submit a **Continuing Review/Progress Completion report** to notify ORI - HS of its closure.

If you have questions, please contact the Office of Research Integrity - Human Subjects at IRB@unlv.edu or call 702-895-2794. Please include your protocol title and IRBNet ID in all correspondence.

Office of Research Integrity - Human Subjects
4505 Maryland Parkway . Box 451047 . Las Vegas, Nevada 89154-1047
(702) 895-2794 . FAX: (702) 895-0805 . IRB@unlv.edu

AUGUSTANA UNIVERSITY

2001 S. Summit Avenue
Sioux Falls, SD 57197

Augustana IRB 01

Date:	January 28, 2016
PI:	Lori Candela, University of Nevada-Las Vegas
Co-PI:	Deanne Donaway, University of Nevada-Las Vegas
Project:	SP16.01 The Impact of Nursing Crew Resource Management Training and Patient Safety Self-Efficacy of Nursing Students
Review Level:	Expedited
Risk Level:	No more than minimal risk *(unless otherwise determined)*
Project Approval Period:	January 22, 2016 – January 22, 2017

Approved Items associated with your project:
Consent Letter
Survey Instrument
Interview Script

Note: All Informed Consent documents including cover letters must include the project title and effective date of IRB approval.

The study submission and informed consent for your proposal referenced above has been reviewed and approved via the procedures of Augustana's Institutional Review Board 01.

Please refer to the Augustana University IRB policy regarding investigator responsibilities pertaining to:

- Prior approval of any changes in the protocol or consent form
- Prompt reporting of any research-related injuries, adverse effects, or other unexpected problems occurring during the conduct of this study
- Project completion report
- If applicable, annual progress report and request for continuation

If you have questions, please contact irb@augie.edu or 605-274-5440.

Sincerely,

Olivia K. Lima, Ph.D.
Chair, Institutional Review Board

APPENDIX B: INFORMED CONSENT

UNLV

INFORMED CONSENT

Department of Nursing

TITLE OF STUDY: The Impact of Nursing Crew Resource Management Training on the Patient Safety Self-Efficacy of Nursing Students

INVESTIGATOR(S): Principal Investigator: Lori Candela EdD, RN: Student Investigator: Deanne Donaway RN, MS

For questions or concerns about the study, you may contact **Lori Candela at 702-895-2443** or **Deanne Donaway at 605-214-5762.**

For questions regarding the rights of research subjects, any complaints or comments regarding the manner in which the study is being conducted, contact **the UNLV Office of Research Integrity – Human Subjects at 702-895-2794, toll free at 877-895-2794 or via email at IRB@unlv.edu.**

Purpose of the Study

The purpose of this study is to examine how Nursing Crew Resource Management (NCRM) training affects nursing student self-efficacy regarding patient safety. To determine this, your faculty has decided to incorporate NCRM training into your course curriculum and collect your views on self-efficacy related to patient safety before and after the training.

Participants

You are being asked to participate in this study because you meet the following criteria: you are enrolled in the final semester Maternal Child course in the baccalaureate nursing program at the university where this study is taking place.

Procedures

You will receive the NCRM training as part of your Maternal Child course. If you agree to provide consent to participate in the study, you will complete a pre and a post 34-item Likert scale online survey regarding patient safety self-efficacy. For study purposes, all students enrolled in the Maternal Child course have been randomly divided into 2 groups. Participants in both groups will complete the pre-survey to determine and document self-efficacy levels related to patient safety prior to the intervention. One group will receive NCRM training while the other group receives no instruction. One week later both group's participants will take the post NCRM survey. Finally the second group will receive NCRM training while the first group receives no instruction. The Likert scale surveys and the NCRM training will be given to you during your regularly scheduled class times. Group survey scores will be calculated and reported to your nursing program for their review and consideration as to whether or not to continue the use of NCRM training in the course.

Benefits of Participation

There may be no direct benefits to you as a participant in this study. However we hope to learn how the Nursing Crew Resource Management (NCRM) training affects student nurse's self-efficacy related to patient safety.

Protocol #851144-1, Exempted: 01-14-16

Risks of Participation

There are risks involved in all research studies. This study includes the possibility of minimal risks. The risk involved in this study is that it is possible that you may feel uncomfortable answering one or more of the survey questions. However, you may skip any question you do not wish to answer.

Cost /Compensation

There is no financial cost to you to participate in this study. The consenting process, administration of Likert scale surveys and the NCRM training will all occur during regularly scheduled class time in the maternal Child course. You will not be compensated for your participation.

Confidentiality

All information gathered in this study will be kept as confidential as possible. No reference will be made in written or oral materials that could link you to this study. All records will be stored in a locked cabinet in the locked offices of the principal and student investigators for 3 years after completion of the study. After the storage time the information gathered will be destroyed. Survey results will be reported as group scores only and no participant names will be linked to the study or its findings.

Voluntary Participation

Your faculty has included Nursing Crew Resource Management (NCRM) training as part of your course curriculum; because of this your participation in the NCRM training is not optional. However, you do have the right to decide if you want to participate in the surveys and allow your survey results to be reported in group form only in publications or presentations.

If you choose to provide consent please know that only group scores from the survey will ever be used and reported on. As noted above, your name will not be linked in any way to the reported results. You may also choose to participate in the study but skip any survey question that makes you feel uncomfortable. If you provide consent and agree to allow your results to be included in the study, you may change your mind and revoke your consent at any time prior to the completion of the study without prejudice to your relations with UNLV.

Your school and faculty will not, at any time, know which students chose to participate in the study and which students refused to participate. You are encouraged to ask questions about this study at the beginning or any time during the research study.

Participant Consent:

I have read the above information and agree to participate in this study. I have been able to ask questions about the research study. I am at least 18 years of age. A copy of this form has been given to me.

_____ _____

Signature of Participant Date

_____

Participant Name (Please Print)

Protocol #851144-1, Exempted: 01-14-16

APPENDIX C: HEALTH PROFESSIONAL EDUCATION IN PATIENT SAFETY SURVEY

H-PEPSS

Health Professional Education in Patient Safety Survey

Instructions:

- The H-PEPSS questionnaire asks about:
  - **clinical safety issues** such as hand hygiene, transferring patients, medication safety)
  - **system issues that effect safety** such as aspects of the organization, management, or the work environment including policies, resources, communication and other processes
- The survey is seeking your **perceptions** and **opinions** only. There are no right or wrong answers. Indicate the extent to which you agree or disagree with each question statement. If you are unsure whether you agree or disagree, mark "neutral".

What do we mean by:

- **Patient Safety:** The pursuit of reduction and mitigation of unsafe acts within the health care system, as well as the use of best practices shown to lead to optimal patient care outcomes

Research funded by the Canadian Patient Safety Institute (CPSI) and York University

For information about or permission to use the H-PEPSS, please contact Professor Liane Ginsburg in the School of Health Policy & Management at York University at lgins@yorku.ca

SECTION 1: Learning about specific patient safety content areas

Here we ask about 7 areas that have to do with keeping patients safe. We would like to know about the extent to which you feel confident about what you know in each of these areas.

	strongly disagree	disagree	neutral	agree	strongly agree	don't know
Clinical safety: *"I feel confident in what I know about…*						
1. hand hygiene	O	O	O	O	O	O
2. infection control	O	O	O	O	O	O
3. safe medication practices	O	O	O	O	O	O
4. safe clinical practice in general	O	O	O	O	O	O
Working In Teams with Other Health Professionals: *"I feel confident in what I know about…*						
5. team dynamics and authority/power differences	O	O	O	O	O	O
6. managing inter-professional conflict	O	O	O	O	O	O
7. debriefing and supporting team members after an adverse event or close call	O	O	O	O	O	O
8. engaging patients as a central participant in the health care team	O	O	O	O	O	O
9. sharing authority, leadership, and decision-making	O	O	O	O	O	O
10. encouraging team members to speak up, question, challenge, advocate and be accountable as appropriate to address safety issues	O	O	O	O	O	O
Communicating Effectively: *"I feel confident in what I know about…*						
11. enhancing patient safety through clear and consistent communication with patients	O	O	O	O	O	O
12. enhancing patient safety through effective communication with other health care providers	O	O	O	O	O	O
13. effective verbal and nonverbal communication abilities to prevent adverse events	O	O	O	O	O	O
Managing Safety Risks: *"I feel confident in what I know about…*						
14. recognizing routine situations in which safety problems may arise	O	O	O	O	O	O
15. identifying and implementing safety solutions	O	O	O	O	O	O
16. anticipating and managing high risk situations	O	O	O	O	O	O
Understanding Human and Environmental Factors: *"I feel confident in what I know about…*						
17. the role of human factors, such as fatigue, that effect patient safety	O	O	O	O	O	O
18. safe application of health technology	O	O	O	O	O	O
19. the role of environmental factors such as work flow, ergonomics, resources, that effect patient safety	O	O	O	O	O	O
Recognize, Respond to and Disclose Adverse Events and Close Calls: *"I feel confident in what I know about…*						
20. recognizing an adverse event or close call	O	O	O	O	O	O
21. reducing harm by addressing immediate risks for patients and others involved	O	O	O	O	O	O
22. disclosing an adverse event to the patient	O	O	O	O	O	O
23. participating in timely event analysis, reflective practice and planning in order to prevent recurrence	O	O	O	O	O	O

H-PEPSS version 2010

	strongly disagree	disagree	neutral	agree	strongly agree	don't know
Culture of safety: *"I feel confident in what I know about…*						
24. the ways in which health care is complex and has many vulnerabilities (e.g. workplace design, staffing, technology, human limitations)	O	O	O	O	O	O
25. the importance of having a questioning attitude and speaking up when you see things that may be unsafe	O	O	O	O	O	O
26. the importance of a supportive environment that encourages patients and providers to speak up when they have safety concerns	O	O	O	O	O	O
27. the nature of systems (e.g. aspects of the organization, management, or the work environment including policies, resources, communication and other processes) and system failures and their role in adverse events	O	O	O	O	O	O

APPENDIX D: APPROVAL TO USE H-PEPSS

Deanne Donaway <donawayd@unlv.nevada.edu>

Requesting permission to use H-PEPSS

Liane Ginsburg <lgins@yorku.ca> Fri, Oct 2, 2015 at 3:06 AM
To: Deanne Donaway <donawayd@unlv.nevada.edu>

Hi Deanne
thanks for resending your note - i completely missed your initial email!
You are most welcome to use the H-PEPSS in your work. It has been used with new graduates as well as with those nearing the end of training - slightly different question stem with these 2 groups.
the trainee paper can be found at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4316835/

best of luck in your work.
someone at UNLV asked about the isntrument a few years back - not sure if was the same group yu are wokring with.
Lianne

Faculty of Health

Liane Ginsburg | Associate Professor | School of Health Policy & Management | **Tel.** 416 736 2100 ext 33925 | **Fax.** 416 736 5227 | **Email.** lgins@yorku.ca | http://www.yorku.ca/patientsafety// York University | HNES Building, Suite 413 | 4700 Keele Street Toronto, Ontario, Canada M3J 1P3

-----Deanne Donaway <donawayd@unlv.nevada.edu> wrote: -----
To: lgins@yorku.ca
From: Deanne Donaway <donawayd@unlv.nevada.edu>
Date: 10/02/2015 02:37AM
Subject: Requesting permission to use H-PEPSS
[Quoted text hidden]

REFERENCES

Aebersold, M., Tschannen, D., & Sculli, G. (2013). Improving nursing students' communication skills using crew resource management strategies. *Journal of Nursing Education*, *52*(3), 125-130. doi:10.3928/01484834-20130205-01

American Nurses Association (ANA). (2014). *FAST FACTS The Nursing Workforce 2014: Growth, Salaries, Education, Demographics & Trends*. Retrieved from http://www.nursingworld.org/MainMenuCategories/ThePracticeofProfessionalNursing/workforce/Fast-Facts-2014-Nursing-Workforce.pdf

Andel, C., Davidow, S. L., Hollander, M., & Moreno, D. A. (2012). The economics of health care quality and medical errors. *Journal Of Health Care Finance*, *39*(1), 39-50.

Attree, M. (2007). Factors influencing nurses' decisions to raise concerns about care quality. *Journal of Nursing Management, 15*(4), 392-402. doi:10.1111/j.1365-2834.2007.00679.x

Aubeeluck, A., Stacey, G., & Stupple, E. J. N. (2016). Do graduate entry nursing student's experience 'imposter phenomenon'?: An issue for debate. *Nurse Education in Practice, 19*, 104-106. doi:10.1016/j.nepr.2016.06.003

Bandura, A. (1977). *Social learning theory.* Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist, 37*, 122-147.

Bandura, A. (1986). *Social foundations of thought and action: A social-cognitive theory.* Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (1989). Perceived self-efficacy in the exercise of personal agency. *The Psychologist: Bulletin of the British Psychological Society, 2*, 411-424.

Bandura, A. (1991). Self-efficacy conception of anxiety. In R. Schwarzer & R. A. Wicklund (Eds.), *Anxiety and self-focused attention* (pp. 89-110). New York: Harwood Academic Publishers.

Bandura, A. (1992). Self-efficacy mechanism in psychobiologic functioning. In R. Schwarzer (Ed.), *Self-efficacy: Thought control of action* (pp. 355-394). Washington, D.C.: Hemisphere.

Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational Psychologist, 28*, 117-148.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: W. H. Freeman.

Bandura, A. (2006). Toward a psychology of human agency. *Perspectives on Psychological Science, 1*(2), 164-180. doi:10.1111/j.1745-6916.2006.00011.x

Burns, N., & Grove, S. (2011). *Understanding nursing research building an evidence-based practice* (5th). Maryland Heights, MO: Elsevier Saunders.

Baeten, M., Dochy, F., & Struyven, K. (2013). Enhancing students' approaches to learning: The added value of gradually implementing case-based learning. *European Journal Of Psychology Of Education*, *28*(2), 315-336.

Benner, P. E., & ebrary, I. (2010). *Educating nurses: A call for radical transformation* (1st ed.) Jossey-Bass.

Berry, J. C., Davis, J. T., Bartman, T., Hafer, C. C., Lieb, L. M., Khan, N., & Brilli, R. J. (2016). Improved safety culture and teamwork climate are associated with decreases in patient harm and hospital mortality across a hospital system. *Journal of Patient Safety, 1*. doi:10.1097/PTS.0000000000000251

Betz, N. E., & Hackett, G. (1983). The relationship of mathematics self-efficacy expectations to the selection of science-based college majors. *Journal of Vocational Behavior, 23*, 329-345

Billings, D. M., & Halstead, J. A. (2016). *Teaching in nursing: A guide for faculty* (Fifth ed.) Elsevier.

Center for Disease Control (CDC). (2014). *Leading Cause of Death*. Retrieved from http://www.cdc.gov/nchs/fastats/leading-causes-of-death.htm

Chan, C. K. W., So, H., Ng, W., Chan, P., Ma, W., Chan, K., . . . Ho, L. (2016). Does classroom-based crew resource management training have an effect on attitudes between doctors and nurses*? International Journal of Medical Education, 7*, 109. doi:10.5116/ijme.56f5.6804

Chiu, S. (2014). The relationship between life stress and smartphone addiction on Taiwanese university student: A mediation model of learning self-efficacy and social self-efficacy. *Computers in Human Behavior*, *34,* 49-57. doi:10.1016/j.chb.2014.01.024

Clance, P. R., Dingman, D., Reviere, S. L., & Stober, D. R. (1995). Impostor phenomenon in an interpersonal/social context: Origins and treatment. *Women & Therapy, 16*, 79–96.

Classen, D. C., Resar, R., Griffin, F., Federico, F., Frankel, T., Kimmel, N., James, B. C. (2011). 'global trigger tool' shows that adverse events in hospitals may be ten times greater than previously measured. *Health Affairs (Project Hope), 30*(4), 581-589. doi:10.1377/hlthaff.2011.0190

Clay-Williams, R., Greenfield, D., Stone, J., & Braithwaite, J. (2014). On a wing and a prayer: An assessment of modularized crew resource management training for health care professionals. *Journal of Continuing Education in the Health Professions, 34*(1), 56-67. doi:10.1002/chp.21218

Crawford, C., Omery, A., & Seago, J. (2012). The challenges of nurse-physician communication: A review of the evidence. *JONA: The Journal of Nursing Administration, 42*(12), 548-550. doi:10.1097/NNA.0b013e318274b4c0

Crookes, K., Crookes, P. A., & Walsh, K. (2013). Meaningful and engaging teaching techniques for student nurses: A literature review. *Nurse Education in Practice, 13*(4), 239-243. doi:10.1016/j.nepr.2013.04.008

Crowley, J., Ball, L., Leveritt, M. D., Arroll, B., Dug Yeo, H., & Wall, C. (2014). Impact of an undergraduate course on medical students' self-perceived nutrition intake and self-efficacy to improve their health behaviors and counselling practices. *Journal of Primary Health Care*, *6*(2), 101-107.

Dimitrov D. M., Rumrill P. D. (2003), Pretest-posttest designs and measurement of change. *Work: A Journal of Prevention, Assessment and Rehabilitation. 20*(2):159–165.

Doyle, P., VanDenKerkhof, E. G., Edge, D. S., Ginsburg, L., & Goldstein, D. H. (2015). Self-reported patient safety competence among Canadian medical students and postgraduate trainees: A cross-sectional survey. *BMJ Quality & Safety*, *24*(2), 135–141. http://doi.org/10.1136/bmjqs-2014-003142

Dunn, E., Mills, P., Neily, J., Crittenden, M., Carmack, A., & Bagian, J. (2007). Medical team training: Applying crew resource management in the Veterans Health Administration. *Joint Commission Journal on Quality & Patient Safety*, *33*(6), 317-325.

Eggertson, L. (2014). How studying human factors improves patient safety. *Canadian Nurse*, *110*(2), 25-29.

Fahlberg, B., Rice, E., Muehrer, R., & Brey, D. (2014). Active learning environments in nursing education: The experience of the University of Wisconsin-Madison School of Nursing. *New Directions For Teaching & Learning, 2014*(137), 85-94. doi:10.1002/tl.20089

Field, A. (2013). *Discovering statistics using IBM SPSS statistics using SPSS* (4th ed.). London: Sage.

Freeling, M., & Parker, S. (2015). Exploring experienced nurses' attitudes, views and expectations of new graduate nurses: A critical review. *Nurse Education Today, 35*(2), e42-e49. doi:10.1016/j.nedt.2014.11.011

Frost, A. E., Langleben, D., Oudiz, R., Hill, N., Horn, E., McLaughlin, V., . . . STRIDE-1 Stdy Grp. (2005). The 6-min walk test (6MW) as an efficacy endpoint in pulmonary arterial hypertension clinical trials: Demonstration of a ceiling effect. Vascular Pharmacology, 43(1), 36-39. doi:10.1016/j.vph.2005.03.003

Gallagher, D. (2016). Crew resource management. following up. *Nursing Management, 47*(7), 50.

Garon, M. (2012). Speaking up, being heard: Registered nurses' perceptions of workplace communication. *Journal of Nursing Management, 20*(3), 361-371. doi:10.1111/j.1365-2834.2011.01296.x

Ginsburg, L., Castel, E., Tregunno, D., & Norton, P. G. (2012). The H-PEPSS: An instrument to measure health professionals' perceptions of patient safety competence at entry into practice. *Quality and Safety in Health Care,* doi:10.1136/bmjqs-2011-000601

Ginsburg, L., Tregunno, D., & Norton, P. (2013). Self-reported patient safety competence among new graduates in medicine, nursing and pharmacy. *BMJ Quality & Safety*, *22*(2), 147-154. doi:10.1136/bmjqs-2012-001308

Gore, D., Powell, J., Baer, J., Sexton, K., Richardson, C., Marshall, D., & Townsend, C. (2010). Crew resource management improved perception of patient safety in the operating room. *American Journal of Medical Quality*, *25*(1), 60-63. doi:10.1177/1062860609351236

Groves, P. S. (2014). The relationship between safety culture and patient outcomes: Results from pilot meta-analyses. *Western Journal of Nursing Research, 36*(1), 66-83. doi:10.1177/0193945913490080

Halbesleben, J.R.B., Cox, K.R. and Hall, L. (2011) 'Transfer of crew resource management training', *Leadership in Health Services, 24*(1), pp. 19–28. doi: 10.1108/17511871111102508.

Hefner, J. L., Hilligoss, B., Knupp, A., Bournique, J., Sullivan, J., Adkins, E., & Moffatt-Bruce, S. D. (2016). Cultural transformation after implementation of crew resource management: Is it really possible? *American Journal of Medical Quality*, doi:10.1177/1062860616655424

Herreid, C. F. (2006). The case study method in the STEM classroom. *Metropolitan Universities*, *17*(4), 30-40.

Institute of Medicine. (2010). *The future of nursing: Leading change, advancing health*. Washington, DC: The National Academies Press.

James, J. T. (2013). A new, evidence-based estimate of patient harms associated with hospital care. *Journal of Patient Safety*, *9*(3), 122-128. doi:10.1097/PTS.0b013e3182948a69

Johnstone, M., & Kanitsaki, O. (2007). Clinical risk management and patient safety education for nurses: A critique. *Nurse Education Today, 27*(3), 185-191. doi:10.1016/j.nedt.2006.04.011

Jones, M., Howells, N., Mitchell, S., Burnand, H., Mutimer, J., & Longman, R. (2014). Human-factors training for surgical trainees. *The Clinical Teacher, 11*(3), 165-169. doi:10.1111/tct.12147

Katz-Navon, T., Naveh, E., & Stern, Z. (2006). Safety self-efficacy and safety performance: Potential antecedents and the modernization effects of standardization. *International Journal of Healthcare Quality Assurance, 20*(7), 572–584.

Kohn, L. T., Corrigan, J., & Donaldson, M. S. (2000). *To err is human: Building a safer health system*. Washington, D.C: National Academy Press.

Lachman, V. D., Swanson, E. O., & Winland-Brown, J. (2015). The new 'code of ethics for nurses with interpretative statements'. *MedSurg Nursing, 24*(5), 363.

Lecture. (2011). In *Merriam-Webster.com*. Retrieved from http://www.merriam-webster.com/dictionary/lecture

Lee, T.W., & Ko, Y.K. (2010) Effects of self-efficacy, affectivity and collective efficacy on nursing performance of hospital nurses. *Journal of Advanced Nursing 66*(4), 839–848.

Lemson, J., Kox, M., Houterman, S., Pickkers, P., Haerkens, M. H., & Hoeven, J. G. v. d. (2015). Crew resource management in the intensive care unit: A prospective 3-year cohort study. *Acta Anaesthesiologica Scandinavica, 59*(10), 1319-1329. doi:10.1111/aas.12573

Levett-Jones, T., Hoffman, K., Dempsey, J., Jeong, S. Y., Noble, D., Norton, C. A., . . . Hickey, N. (2010). The 'five rights' of clinical reasoning: An educational model to enhance nursing students' ability to identify and manage clinically 'at risk' patients. *Nurse Education Today, 30*(6), 515-520. doi:10.1016/j.nedt.2009.10.020

Levy, P. D., Dancy, J. N., Stowell, S. A., Hoekstra, J. W., Arthur, C. L., Wilson, C. H., ... Hiestand, B. (2014). Lessons in flying: Crew resource management as a quality improvement method for acute coronary syndromes care. *Critical Pathways in Cardiology*, *13*(1), 36-42. doi:10.1097/HPC.0000000000000002

Lin, H. (2016). Impact of nurses' cross-cultural competence on nursing intellectual capital from a social cognitive theory perspective. *Journal of Advanced Nursing, 72*(5), 1144-1154. doi:10.1111/jan.12901

Lukewich, J., Edge, D. S., Tranmer, J., Raymond, J., Miron, J., Ginsburg, L., & VanDenKerkhof, E. (2015). Undergraduate baccalaureate nursing students' self-reported confidence in learning about patient safety in the classroom and clinical settings: An annual cross-sectional study (2010-2013). *International Journal of Nursing Studies, 52*(5), 930. doi:10.1016/j.ijnurstu.2015.01.010

Madhavanpraphakaran, G. K. (2012). Patient safety and nursing education. *International Journal of Nursing Education*, *4*(2), 92-96.

Makary, M. A., & Daniel, M. (2016). Medical error-the third leading cause of death in the US. *BMJ (Clinical Research Ed.), 353*, i2139. doi:10.1136/bmj.i2139

Mardon, R. E., Khanna, K., Sorra, J., Dyer, N., & Famolaro, T. (2010). Exploring relationships between hospital patient safety culture and adverse events. *Journal of Patient Safety, 6*(4), 226-232. doi:10.1097/PTS.0b013e3181fd1a00

McConaughey, E. (2008). Crew resource management in healthcare the evolution of teamwork training and medteams. *Journal of Perinatal and Neonatal Nursing, 22*(2), 96-104.

McKeekin, D. (n.d.). QSEN safety instrument search. Retrieved from https://docs.google.com/a/unlv.nevada.edu/file/d/0B5YGF5c2vqn5TXpyenNTSk4xU1E/edit

Mitchell & Jolley, (2012). *Research design explained* (8th ed.). Belmont, CA: Cengage Learning.

Musil, C. (2011). Pilot study. In J. Fitzpatrick, *Encyclopedia of nursing research*. New York, NY: Springer Publishing Company. Retrieved from http://search.credoreference.com/content/entry/spennurres/pilot_study/0

Nayak, B. K. (2010). Understanding the relevance of sample size calculation. *Indian Journal of Ophthalmology, 58*(6), 469-470. doi:10.4103/0301-4738.71673

Neily, J., Mills, P., Lee, P., Carney, B., West, P., Percarpio, K., … Bagian, J. (2010). Medical team training and coaching in the Veterans Health Administration; Assessment and impact on the first 32 facilities in the programme. *Quality & Safety in Health Care*, *19*(4), 360-364. doi:10.1136/qshc.2008.031005

Neily, J., Mills, P., Young-Xu, Y., Carney, B., West, P., Berger, D., … Bagian, J. (2010). Association between implementation of a medical team training program and surgical mortality. *JAMA: Journal of the American Medical Association*, *304*(15), 1693-1700. doi:10.1001/jama.2010.1506

Okuyama, A., Wagner, C., & Bijnen, B. (2014). Speaking up for patient safety by hospital-based health care professionals: A literature review. *Bmc Health Services Research, 14*(1), 61-61. doi:10.1186/1472-6963-14-61

Pajares, F. (1996). Self-efficacy beliefs in academic settings. *Review of Educational Research, 66*(4), 543-578. doi:10.2307/1170653

Pajares, F., & Miller, M. (1994). The role of self-efficacy and self-conceptsbeleifs in mathmatical problem-solving. *Contemporary Educational Psychology, 86*, 193-203.

Pajares, F., & Urdan, T. C., (2006). *Self-efficacy beliefs of adolescents* IAP - Information Age Pub., Inc.

Parker, V., Giles, M., Lantry, G., & McMillan, M. (2014). New graduate nurses' experiences in their first year of practice. *Nurse Education Today, 34*(1), 150-156. doi:10.1016/j.nedt.2012.07.003

Paull, D. E., DeLeeuw, L. D., Wolk, S., Paige, J. T., Neily, J., & Mills, P. D. (2013). The effect of simulation-based crew resource management training on measurable teamwork and

communication among interprofessional teams caring for postoperative patients. *Journal of Continuing Education in Nursing*, *44*(11), 516-524. doi:10.3928/00220124-20130903-38

Powers, B. (2014). *Dictionary of nursing theory and research: Fourth edition* (4th ed.) Springer Publishing Company.

Ranganathan, P., Pramesh, C. S., & Buyse, M. (2015). Common pitfalls in statistical analysis: Clinical versus statistical significance. *Perspectives in Clinical Research,6*(3), 169-170. doi:10.4103/2229-3485.159943

Roberts, A. (2012). Beyond the lecture: Interactive strategies in the health profession education curriculum. *Journal of Career and Technical Education*, *27*(1), 48-55.

Roth, C., Brewer, M., & Wieck, K. L. (2016). Using a delphi method to identify human factors contributing to nursing errors: Human factors. *Nursing Forum,* doi:10.1111/nuf.12178

Safety culture, (2016, July). Retrieved from https://psnet.ahrq.gov/primers/primer/5/safety-culture

Saville, P. D., Bray, S. R., Martin Ginis, K. A., Cairney, J., Marinoff-Shupe, D., & Pettit, A. (2014). Sources of self-efficacy and coach/instructor behaviors underlying relation-inferred self-efficacy (RISE) in recreational youth sport. *Journal of Sport & Exercise Psychology*, *36*(2), 146-156. doi:10.1123/jsep.2013-0144

Sculli, G. L., Fore, A. M., West, P., Neily, J., Mills, P. D., & Paull, D. E. (2013). Nursing crew resource management. *Journal of Nursing Administration, 43*(3), 122-126. doi:10.1097/NNA.0b013e318283dafa

Sculli, G. L., Fore, A. M., Neily, J., Mills, P. D., & Sine, D. M. (2011). The case for training Veterans Administration frontline nurses in crew resource management. *Journal of Nursing Administration, 41*(12), 524-530. doi:10.1097/NNA.0b013e3182378b93

Sculli, G.L., & Sine, D.M. (2011). *Soaring to success: Taking crew resource management from the cockpit to the nursing unit.* Danvers, MA: HCPro.

See, M. A., Chan, W. S., Huggan, P. J., Tay, Y. K., & Liaw, S. Y. (2014). Effectiveness of a patient education intervention in enhancing the self-efficacy of hospitalized patients to recognize and report acute deteriorating conditions. *Patient Education and Counseling*, *97*(1), 122-127. doi:10.1016/j.pec.2014.07.003

Self-Efficacy. (2014, January 1). Retrieved from http://www.merriam-webster.com/

Shea-Lewis, A. (2009). Teamwork: Crew resource management in a community hospital. *Journal for Healthcare Quality: Promoting Excellence In Healthcare*, *31*(5), 14-18.

Shin, I., & Kim, J. (2013). The effect of problem-based learning in nursing education: A meta-analysis. *Advances In Health Sciences Education*, *18*(5), 1103-1120.

Shreve, j., Van Den Bos, J., Gray, T., Halford, M., Rustagi, K., & Ziemkiewicz, E. (2010) *The economic measurement of medical errors.* (Milliman Report). Retrieved from https://www.soa.org/Research/Research-Projects/Health/research-econ-measurement.aspx

Stevanin, S., Bressan, V., Bulfone, G., Zanini, A., Dante, A., & Palese, A. (2015). Knowledge and competence with patient safety as perceived by nursing students: The findings of a cross-sectional study. *Nurse Education Today*, *35*(8), 926-934. doi:10.1016/j.nedt.2015.04.002

Taliaferro, A., & Harris, N. P. (2014). The effects of a one-day workshop on physical educators' self-efficacy toward inclusion of students with autism. *Palaestra*, *28*(3), 38-43.

The Joint Commission. (2014, January 1). Retrieved from http://www.jointcommission.org/

Tsao, C. I. P. (2015;2014;). Using learning through discussion in medical education settings. *Academic Psychiatry, 39*(3), 332-334. doi:10.1007/s40596-014-0156-1

Quality and Safety Education for Nurses (QSEN). (2014). *Competencies.* Retrieved from http://qsen.org/competencies/

Vaismoradi, M., Salsali, M., & Marck, P. (2011). Patient safety: Nursing students' perspectives and the role of nursing education to provide safe care. *International Nursing Review*, *58*(4), 434-442. doi:10.1111/j.1466-7657.2011.00882.x

Verbeek-van Noord, I., de Bruijne, M. C., Zwijnenberg, N. C., Jansma, E. P., van Dyck, C., & Wagner, C. (2014). Does classroom-based crew resource management training improve patient safety culture? A systematic review. *SAGE Open Medicine, 2*, 2050312114529561.

Van Teijlingen, E., & Hundley, V. (2002). The importance of pilot studies. Nursing Standard (Royal College of Nursing (Great Britain) : 1987), 16(40), 33-36.

West, P., Sculli, G., Fore, A., Okam, N., Dunlap, C., Neily, J., & Mills, P. (2012). Improving patient safety and optimizing nursing teamwork using crew resource management techniques. *Journal of Nursing Administration*, *42*(1), 15-20. doi:10.1097/NNA.0b013e31823c17c7

Williams, B. (2001). Developing critical reflection for professional practice through problem-based learning. *Journal Of Advanced Nursing*, *34*(1), 27-34. doi:10.1046/j.1365-2648.2001.3411737.x

Wilson, B., Squires, M., Widger, K., Cranley, L., & Tourangeau, A. (2008). Job satisfaction among a multigenerational nursing workforce. *Journal of Nursing Management, 16*(6), 716-723. doi:10.1111/j.1365-2834.2008.00874.x

Wood, R. E., & Bandura, A. (1989). Social cognitive theory of organizational management. *Academy of Management Review, 14*, 361-384

Yorra, M. L. (2014). Self-efficacy and self-esteem in third-year pharmacy students. *American Journal of Pharmaceutical Education*, *78*(7), 1-5.

Young-Xu, Y., Fore, A. M., Metcalf, A., Payne, K., Neily, J., & Sculli, G. L. (2013). Using crew resource management and a 'read-and-do checklist' to reduce failure-to-rescue events on a step-down unit. *American Journal of Nursing*, *113*(9), 51-57.

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