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Examining the Relationship Between the Use of Simulation in Nursing Education andSafety with Medication Adminstration in the Clinical Setting

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Medication errors represent a significant threat to patient safety. Administration of medications is a primary role of nursing practice and a critical component of nursing education curricula. Safe medication is a challenging process to teach nursing students. Simulation may provide students with a realistic opportunity to practice the process of safe medication administration. The purpose of this pilot study was to examine the relationship between the use of simulation as a teaching strategy for medication administration and the incidence of medication errors in the clinical setting.

The pilot study consisted of a sample of 26 second semester junior nursing students enrolled in an Adult Health III medical-surgical clinical course using a quasi-experimental, pre-test/post-test design. The teaching intervention included simulation scenarios containing embedded medication errors and distractions which were constructed using Jefferies (2012) nursing education simulation framework. The goal of the simulation scenarios were to increase the students' ability to administer medications safely. Competency during the simulation sessions was measured using the Creighton Competency Evaluation Instrument. Medication safety

knowledge and competency was measured using the Medication Safety Knowledge Assessment tool and the Healthcare Professionals Patient Safety Assessment Curriculum Survey tool. Medication errors and near miss errors were measured by documenting in the clinical setting using the Clinical Medication Administration Assessment Tool. Analysis was done using descriptive statistics, including the means and standard deviations, Chi-square, Pearson's correlation coefficient, and independent t-tests. The findings of this study will add to the knowledge in the use of simulation as an educational method to enhance nursing students' competency with medication administration.

Keywords: *Simulation, nursing education, medication administration, medication errors*

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CHAPTER 1

INTRODUCTION

Safety in healthcare has been a priority since the Institute of Medicine (1999) published the report *To Err is Human: Building a Safer Health System*. The Institute of Medicine found that healthcare in the United States is not as safe as it should be, as an estimated 98,000 people died in hospitals each year due to human error and up to 7,000 of those deaths were due to preventable medication errors (Institute of Medicine, 1999). The Agency for Healthcare Research and Quality (AHRQ) (2016) defined medication errors as "an error (of commission or omission) at any step along the pathway that begins when a clinician prescribes a medication and ends when the patient actually receives the medication" (para. 2). According to James (2013) there is an estimated 400,000 premature deaths per year due to medical errors or preventable adverse events. Although side-effects and adverse reactions to medicines are an accepted risk of treatment, those caused by non-adherence to protocol, mistakes, or complacency are not acceptable and can be avoided (Harris, Pittiglio, Newton, & Moore, 2014). The most common medical errors are medication errors due to inappropriate prescribing, dispensing or administration of medicine.

A medication is administered to a patient in four stages: prescribing or writing the medication order, transcribing the order, dispensing the medication and finally administering the medication (Duruk, Zencir & Eser, 2016). While potential medication errors are more commonly detected in the early stages of the medication process, such as prescribing or dispensing stages, approximately one third of total medication errors are during the administration phase and nurses administer most of the medications (Cloete, 2015). This number is expected to be higher than reported because medication errors in the administration phase often go undetected.

Potential medication errors or near misses occur more frequently than actual medication errors. In the clinical setting, nursing students administer medications under the supervision of clinical instructors. Therefore, the majority of nursing student medication errors are considered potential or near misses as the clinical instructor intercedes prior to an actual error occurring (Dolansky, Druschel, Helba & Courtney, 2013). It is essential that nursing students be educated in correct procedures of medication administration to ensure patient safety. Nursing students require instruction and the opportunity to apply knowledge regarding medication administration procedures to keep patients safe and deliver quality nursing care (Konieczny, 2016). Preparing nurses to deliver safe, quality care during medication administration requires education that addresses the complexity of the clinical setting. The use of simulation in nursing education provides a realistic environment in which students can apply best practices and concepts to medication administration.

Scope of the Problem

The use of prescription medications has increased in the United States with nearly one-third of adults taking five or more medications (Agency for Healthcare Research and Quality, 2016). While older adults make up approximately 14.5% of the population in the United States, they purchase 33% of all prescription drugs due to a high prevalence of medical comorbidities (Kim & Parish, 2017). The increased number of prescribed medications also known as polypharmacy has led to an increase in the number of adverse drug events and medication errors. According to Agency for Healthcare Research and Quality (2016), an adverse drug event occurs when a patient experiences harm as a result of exposure to a medication and a non-preventable medication error is one in which a patient experiences an adverse drug event even when the medications are prescribed and administered appropriately. Preventable adverse drug events

result when there is harm to the patient due to a medication error that has occurred at any step along the pathway from prescription of the medication to when the patient actually receives the medication. One in thirty older adult hospital admissions are due to adverse drug events; the average hospitalized patient experiences at least one medication error each day (de Silva & Krishnamurthy, 2016).

Medication errors are a leading cause of patient mortality in acute care settings (Harris et al., 2014). According to the United States Food and Drug Administration (2016), 1.3 million people are injured every year in the United States while at least one death occurs every day due to medication errors. Upon discharge from the hospital, 30% of patients have at least one discrepancy in their medications with 24% - 33% of the reported adverse drug events considered preventable (de Silva & Krishnamurthy, 2016). Medication errors are detrimental to the relationship between the patient and provider and have adverse effects on the economy.

Medication errors are not only the most common cause of unintended harm to patients, they also result in a large financial burden for healthcare systems (Cloete, 2015). Approximately one in five doses of medications are given in error, resulting in a cost of $17 billion per year (Agency for Healthcare Research and Quality, 2015). In addition to financial costs, adverse drug events prolong the length of hospital stays by 1.7-4.6 days (de Silva &Krishnamurthy, 2016), cause more than one million visits to the emergency department and 280,000 hospitalizations each year (Centers for Disease Control and Prevention, 2016). Medication administration that prioritizes quality and safety is more efficient and less expensive care and results in fewer patients being harmed or injured. Nurses have very important responsibilities in the prevention of medication errors as they play a key role in the medication administration process.

Administration of Medications

Medications play a central role in treating illness and consequences can occur if administration is done incorrectly. Administration of medications is a vital aspect of nursing practice and a critical component of nursing education curricula (Wolf, Hicks, & Serembus, 2006). The calculation, preparation, and administration of medications are significant aspects of the role of registered nurses (Ford, Seybert, Smithburg, Kobulinsky, Samosky, & Kane-Gill, 2010). The responsibilities of the nurse in the medication process are to give the appropriate medicine to the appropriate patient in the appropriate dose at the appropriate time through the appropriate method, to evaluate and support the desired effect and to take corrective measures in the case of undesired effects (Unver, Tastan, & Akbayrak, 2012). Medication errors directly related to nursing practice usually involve non-adherence of one or more of the "five rights" of medication administration: (a) the right patient, (b) right drug, (c) right dose, (d) right route, and (e) right time (Mariani, Ross, Paparella, & Allen, 2017; Schneidereith, 2014). In addition to the traditional five rights, many scholars have added other dimensions of safe medication administrations. These may include the right documentation, right action, right form, right response, right education, right to refuse, right assessment, and right evaluation of the patient after the medication is administered (Miller, Haddad & Phillips, 2016). Increasing the number of rights has not had an impact on the number of medication errors made by nurses (Miller et al., 2016). For the purpose of this pilot study, the traditional five rights of medication administration will be used with one additional right of right documentation. According to the integrative review of literature conducted by Hewitt (2010), common themes identified for causes of medication errors included distractions, failure to follow the five rights, failure to follow protocol, and miscalculations.

Choi et al. (2016) conducted a retrospective case control study using voluntary error reports on the incidence, type and cause of medication errors of 57,554 patients. Each medication error was classified by stage of the process; ordering, transcription, dispensing and administration. Errors at the ordering stage included duplicate orders, illegible handwriting, and inappropriate dose or medication. Errors at the transcription and dispensing stages included deviation from the prescription and uncoordinated deliveries of prescribed medications. The administration stage had errors related to wrong medication, patient, route or time. Choi et al. (2016) found that 0.8% of the patients experienced medication errors during hospitalization. The majority of the errors occurred during the administration stage (189 errors), followed by transcription (121 errors), dispensing (87 errors) and ordering (73 errors). The most frequent types of errors were wrong time (19.8%), wrong medication (18.1%), wrong dose (17%), and omission errors (10.9%). The most frequently reported types of medication errors reported in this study are similar to those reported by other studies, although a limitation for this study does exist with the use of voluntary error reports as there is a tendency to underreport the true rate of errors due to fear of punishment (Choi et al., 2016).

Nurses play a crucial role in protecting patients during medication administration and monitoring for adverse reactions. It is essential that nursing education train nursing students to correctly administer medications. Nurses require knowledge and skills of safe medication administration processes that allow identification of errors before they occur (Xu, Li, Ye, & Lu, 2014). Henneman et al. (2010), found that less experienced nurses and nursing students are more likely to make mistakes. This may be due to ineffective training on medication administration. Nursing students need the opportunity to build on their theoretical knowledge by practicing the

medication administration concepts (Reid-Searl & Happell, 2012). Simulation is one method to apply safe medication administration is through the use of simulation (Ford et al., 2010).

Simulation in Nursing Education

Simulation is an effective teaching strategy in nursing education (Henneman et al., 2010; Mariani et al., 2017). This approach is a method of teaching used to simulate an actual patient care encounter, in which nearly all of the essential aspects of the clinical condition are replicated so that the situation may be understood and managed when it occurs in the clinical setting (Schiavenato, 2009). Simulation can provide students with realistic opportunities to practice and apply knowledge learned in theory (Brewer, 2011). In healthcare, simulated clinical experiences are used to replicate the essential aspects of a clinical situation so that students can understand it and develop an adequate response when it happens in the clinical setting (Lavoie & Clark, 2017). Simulation use in nursing programs has increased in recent years due to shortages of clinical space for students, an interest in alternative assessment criteria from multiple choice exams to clinical competency and a movement toward interprofessional health education (Kardong-Edgen, Willhaus, Bennett & Hayden, 2012).

The use of simulation allows for an immersive, experiential learning activity. The students are active participants, not merely recipients of didactic content in a lecture class (Schlairet, 2011). All simulation–based learning experiences are followed by debriefing sessions that are learner focused with the instructor guiding the discussion and reflection process (Nickerson & Pollard, 2010). Debriefing should be tied to the expected outcomes developed for the simulation scenario (Lavoie & Clarke, 2017). The facilitator must create a trusting environment in which students are comfortable in exploring their thinking processes and actions taken or not taken during the scenario and to identify gaps in their knowledge and skills (Sittner

et al., 2015). It is essential that students be allowed to assess their actions, mistakes, communication and abilities following the scenario in order to make improvements and enhance learning (Jefferies, 2012).

The emphasis of simulation is often on the application and integration of knowledge, skills, and critical thinking (Howard, Englert, Kameg, & Perozzi, 2011). Benefits of using simulation are manikins may be programmed by instructors to perform in a desired manner for specific learning experiences and the students do not have the pressure to perform quickly without mistakes as there is no fear of harming a living patient (Brewer, 2011). Additionally, this method allows an opportunity for students to repeat skills as many times as needed. Schlairet (2011) found students (n=150) reported improvement in critical thinking, knowledge, skill performance, and self-confidence, while faculty (n=26) noted improved student learning outcomes when simulation was utilized.

Simulation allows students to enhance their knowledge while assessing and strengthening the skills and competencies needed to deliver safe patient care (Schiavenato, 2009). The International Nursing Association for Clinical Simulation and Learning (INACSL) published the Standards of Best Practice: Simulation in 2011. The standards were developed to share best educational practices in the design, conduct, and evaluation of simulation activities thereby ensuring high quality and effective learning activities for learners (Sittner et al., 2015). In the fall of 2014, the results of the National Council of State Boards of Nursing (NCSBN) Simulation Study of pre-licensure nursing programs were released providing evidence that high fidelity simulation using best practice standards supports the development of clinical competence, critical thinking, and preparedness to practice skills in nursing students (Hayden, Smiley, Alexander, Kardong-Edgren, & Jefferies, 2014). It also determined that up to 50% of traditional

clinical hours in the major courses could be safely substituted with simulation and still have positive student learning outcomes (Rutherford-Hemming, Lioce, Kardong-Edgren, Jefferies & Sittner, 2016).

Significance of the Study

Patient safety has become a priority concern, particularly in the task of medication administration (Harris et al., 2014; Mariani et al., 2017). Medication errors committed by nurses or nursing students' impact patient safety and outcomes. The Joint Commission (2017) established the National Patient Safety Goals Program in 2002. The purpose of the National Patient Safety Goals are to improve patient safety with the belief that a patient should not experience any adverse effects as long as there are means to prevent them. They are a method in which the Joint Commission promotes and enforces major changes in patient safety. The Joint Commission's safety initiatives require that all nurses be competent ensuring patient safety when administering medication by confirming that all patients are correctly identified prior to any interaction with healthcare workers, that standards are set to decrease errors involving look-alike and sound-alike drugs, and ensuring accuracy in medication administration be maintained (Sparacino & Della Vecchia, 2013).

It is important for nursing faculty to utilize educational strategies to teach safe medication administration practices and promote patient safety. While research has been done to show that simulation is an effective teaching strategy to enhance knowledge and comfort with performing nursing tasks such as medication administration, there is a lack of research available to see if knowledge gained from simulation transfers to the clinical setting. The purpose of this pilot study was to examine the relationship between the use of simulation as a teaching strategy for medication administration and the incidence of medication errors in the clinical setting. A pilot

study was utilized to develop and refine the simulation scenarios used in this research study (Burns & Grove, 2011). The pilot study addressed the following research question:

> What is the effect of the addition of medication administration simulation for baccalaureate nursing students in the level III Adult Health medical/surgical clinical course on the number of medication errors and/or near misses in the clinical setting?

The primary hypothesis for this pilot study was that nursing students participating in the simulation sessions would have fewer errors in the clinical setting than nursing students not participating in the simulation sessions. The secondary hypotheses would be that participating in simulation scenarios with embedded medication errors would lead to an increase in medication knowledge and comfort with identifying and reporting medication errors.

CHAPTER 2

LITERATURE REVIEW

Prior to entering the clinical setting, students are required to provide evidence of competency in specific nursing skills such as proper technique for administering medications (Ferguson, Delaney, & Hardy, 2014). Even though other healthcare professionals such as physicians and pharmacists take part in the medication preparation and administration process, nurses are the key participants because they are usually the last line of defense for medication administration. In general, approximately 40% of nurses work time is spent on the medication administration process (Huynh et al., 2016). This process includes: 1) assessing the patient to obtain pertinent data, 2) gathering medications, 3) confirming the six rights, 4) administering the medication, 5) documenting the administration, and 6) observing for adverse reaction of the medication (Huynh et al., 2016). The role of the nurse in medication administration requires possession of knowledge, skills, and behaviors to ensure patient safety with medications. This involves adequate preparation in nursing education concerning the administration of medications so that graduates are delivering safe patient care.

Best practices for medication administration include teaching medication calculations, proper techniques in administering medications following protocols and guidelines, and decreasing interruptions and distractions during the medication administration process (Blignaut, Coetzee, Klopper, & Ellis, 2017; Bowling, 2015; Brown, 2006; Dolansky et al., 2013; Duruk, etal., 2016; Ferguson et al., 2014; Goodstone & Goodstone, 2013; Henneman et al., 2010; Jarvill, Jenkind, Akman, Astroth, Pihl, & Jacobs, 2018; Kim & Bates, 2012; Koharchik, Hardy, King & Garibo, 2014; Schneidereith, 2014; Walsh, 2008; Westbrook, Woods, Rob, Dunsmuir & Day, 2010; Wolf et al., 2006). Many researchers have studied whether using the controlled

environment of simulation helps to develop communication skills and adherence to safety guidelines for medication administration by nursing students (Ford et al., 2010; Harris et al., 2014; Henneman et al., 2010; Howard et al., 2011; Mariani et al., 2017; Pauly-O'Neill & Prion, 2013; Schneidereith, 2014; Sears, Goldsworthy & Goodman, 2010). Other authors have found that students' comfort level and self-confidence with medication administration may increase through the use of simulation (Horan, 2009; Kardong-Edgren, Starkweather & Ward, 2008; Krautscheid, Orton, Chorpenning, & Ryerson, 2011; Mariani, Cantrell, Meakim & Jenkinson, 2015; Pauly-O'Neill & Prion, 2013). There is an abundance of literature available identifying factors contributing to registered nurses making medication administration errors but there is limited amount of evidence with students making medication errors in the clinical setting.

Medication Administration Practices

The plan for administering a medication begins with the five rights (Ferguson et al., 2014). A deviation from medication administration protocols involving the five rights can be a critical factor for medication errors to occur (Athanasakis, 2012). Schneidereith (2014) found medication errors committed by students failing to adhere to the guidelines may be categorized as: 1) failing to identify the patient prior to administering a medication; 2) selecting the wrong medication; 3) dispensing an incorrect concentration of the medication; 4) calculating an incorrect dose of the medication; and 5) using incorrect technique when administering medications. The author suggests that there is a need for increased verification of the rights of medication administration in nursing education.

An observational study was conducted by Kim & Bates (2012) to evaluate for the use of the five rights and medication recording rules. A total of 293 cases of medication activities were observed using a checklist of basic medication administration guidelines consisting of the five

rights. The researchers found that regarding the five rights, there were a high percentage of rights followed with the right medication given (98.6%), right dose (98.6%), and right route (98%). The medication was administered at the right time 41% of the time and although the right patient was identified by reading the medication label 98% of the time, the wristband was checked only 6.5% of the time and the nurse only asked the patient their name 3-4% of the time. Although the medications were documented as given 100 % of the time, the actual time of administration was done correctly only 52.8% of the time. The authors suggested that medication administration guidelines including the five rights are not consistently followed by nurses and there is a need to emphasize the protocols and guidelines in nursing education (Kim & Bates, 2012).

Blignaut et al., (2017) also used direct observation of medication administration for 315 patients (1847 medications) to determine the number of medication administration errors, deviations from safe practice and factors associated with errors. They found 296 medication errors occurred with most being the wrong time (43%) or omission (41%) and wrong dose (12%). A total of 1824 deviations from safe practice were observed, with no patient identification done (70%), or lack of asepsis or handwashing (90%). Factors including interruptions and patient acuity were associated with deviations from safe practice for medication administration. Safe practice protocols and regulations are necessary to uphold patient safety during medication administration and deviation may lead to medication errors (Blignaut et al., 2017).

Goodstone and Goodstone (2013) developed a performance-based evaluation tool to measure competency of medication administration. The Medication Administration Safety Assessment Tool (MASAT) is an 8 item checklist to demonstration adherence to the 6 rights of medication administration. Inter-rater reliability was calculated using the rater agreement index

and found to be 0.90 for three samples and Cronbach's alpha was 0.90 (Goodstone & Goodstone, 2013). Jarvill et al. (2018) used the MASAT to evaluate the effect of an individual simulation experience on nursing students' competency with medication administration. The individual simulation experience was a one on one ratio of student to facilitator in the simulation exercise. The authors found the students who participated in the individual simulation (n=42) scored significantly higher (p=.00) on the MASAT in the simulation setting than students (n=43) in the traditional practice session group. The authors suggest that there is evidence that the use of simulation has an impact on medication administration competency but it did not address the transfer of competence to the clinical setting (Jarvill et al., 2018). Bowling (2015) also suggests a need for simulation experiences that require the student to demonstrate the ability to provide safe patient care. The author used simulation in a study to determine the student's performance of safety skills and found that over half of the students (55.7%) did not assess the patient identification and over half did not administer meds following the five rights (53.4%) or state the purpose of the medication or how to administer it (75.3%). The ordered medication should have been administered over 30 minutes but more than one third of the students administered the medication over one to two minutes. It is imperative that nursing students develop an accurate understanding of how to safely administer medications to their patients.

Beyond the five rights, consideration must be given to factors such as the dilution of the some medications and the safe rate at which they can be delivered (Brown, 2006; Koharchik et al., 2014). Administering the wrong amount of medication related to incorrect calculations can lead to medication errors causing harm to patients (Wolf et al., 2006). Some scholars have found that nursing students struggle with calculations involving fractions, decimals, percentages and conversions between measuring units (Brown, 2006; Koharchik et al., 2014; Wolf et al., 2006).

Likewise, Schneidereith (2014) found that as the students progressed through the nursing program there was a decrease in mathematics proficiency. Meanwhile, Walsh (2008) found that students' anxiety with mathematics decreased, self-confidence increased, and mathematics performance improved when practice of dosage calculation was done in simulation sessions. Schneidereith (2014) and Koharchik et al. (2014) identified areas of weakness that occur with students when administering medication such as incorrect conversions and misreading or not understanding doctor's orders to calculated the correct dose. The recommendation from the authors was that simulation training sessions be used to teach best practices for medication administration.

Another factor that may contribute to medication errors includes the occurrence of environmental distractions or interruptions during medication preparation (Athanasakis, 2010; Dolankey et al., 2013). During the process of medication administration, nurses are multitasking in both action and thought. Distractions or interruptions in the medication administration process may lead to medication errors. Most interruptions come from non-stop calling from patients, answering telephone calls, and conversations with other nurses (Thomas, McIntosh & Allen, 2014). Duruk et al. (2016) conducted a study in which 122 observations were made of medication administration by nurses. The authors found there were interruptions in the preparation of medications in 95.9% of the observations. The individuals causing the interruption were mainly other nurses working on the same unit. Westbrook, Woods, Rob, Dunsmuir and Day (2010) also found an increase in medication errors with interruptions during medication administration. The authors observed nurses preparing and administering 4,271 medications to 720 patients. Each interruption was associated with a 12.1% increase in procedural failures and a

12.7% increase in errors. It was noted that the more interruptions a nurse received, the great the number of errors (Westbrook et al., 2010).

There are many distractions nurses encounter during medication administration that may lead to errors. Pitkanen, Tauho, Uusitalo and Kaunonen (2016) suggest that working conditions should allow the nurse to concentrate on medication administration alone and avoid multitasking during the process. Interventions such as a clothing item being worn to indicated medications are being administered, a "no interruption zone" be implemented and a separate medication room be provided to decrease distractions and improve medication safety (Pitkanen et al., 2016). Nurses cannot avoid all sounds and people during the medication process but they may be able to reduce the impact it may have on medication errors. Thomas et al., (2014) suggested that exposing nursing students to simulation scenarios containing medication distractions will help the students to become aware of the many distractions they may encounter and also learn how these distractions may lead to medication errors.

Technology may also be used in healthcare to reinforce students' knowledge regarding safe medication administration. Ferguson et al. (2014), conducted a study to determine if using an automated medication dispensing system in a simulated setting would increase students' comfort level and knowledge base with medication administration. The authors found the five rights were reinforced when automated medication dispensing technology was used in the simulation and 85% of the students reported feeling somewhat or very comfortable with administering medications. The authors speculated that the reinforcement of the five rights may have been due to the reminders embedded in the technology. Like Ferguson et al. (2014), other researchers recommend that simulation training session be used to teach best practices (Ford et al., 2010; Henneman et al., 2010; Schneidereith, 2014).

Clinical decision making for the administration of medications may be assisted by other technology such as computerized alerting systems and electronic physician order entry. However, some errors have been generated by information technology such as not detecting unsafe orders; also poor design of devices may contribute to patient deaths and serious injuries. Barcode Point of Care (BPOC) software is technology that automates the five rights of medication administration and provides clinical advisories and cross-sensitivities. BPOC has been shown to reduce medication errors but may also contribute to errors by nurses overriding discrepancies, and dropping or delaying activities in order to ensure timely medication administration (Wolfe, 2007). Poon et al. (2010) assessed the rates of medication errors on units before and after the implementation of the BPOC. The authors observed 776 medication errors (11.5% error rate) on units that did not use BPOC and 495 (6.8%) on units that did use it, resulting in a 41.1% relative reduction in errors ($p<0.001$). The authors suggest that BPOC is an important intervention to improve medication safety (Poon et al., 2010).

Simulation as a Teaching Strategy

Numerous researchers have examined the use of simulation to improve nursing students' medication calculation and administration abilities (Harris et al., 2014; Pauly-O'Neill & Prion, 2013). Harris et al. (2014), found that scores on medication administration examination were significantly higher ($p=.004$) for the intervention group ($n=79$) which used traditional didactic instruction and simulation review sessions than for the control group ($n=79$) which used traditional instruction only. An evaluative study conducted by Pauly-O'Neill and Prion (2013) used a convenience sample ($n=32$) who attended lectures and completed 50 hours of clinical practice and 40 hours of simulation sessions. All students were administered a pretest and posttest as well as a self-confidence survey before and after the interventions. The authors found

the mixed method of lecture, clinical exposure and simulation practice enhanced knowledge and self-confidence with pediatric medication administration. The patient scenarios used in the simulation practice included, correct calculations, following the "five rights" of medication administration, and medication preparation. Findings from both studies support that simulation review facilitated the abilities of the students to demonstrate a mastery of medication administration on the exams (Harris et al., 2014; Pauly-O'Neill & Prion, 2013).

Researchers have studied the use of simulation to assess competency in medication administration as measured by the use of the five rights (Ford et al., 2010; Henneman et al., 2010; Schneidereith, 2014). Henneman et al. (2010) and Schneidereith (2014) both found that students who participated in the simulation exercises committed at least one error. Most of the errors occurred with failure to verify the correct patient, correct dose, or the patient's allergies (Ford et al., 2010; Henneman et al., 2010; Schneidereith, 2014). Henneman et al., (2010) conducted a study to describe the types and frequency of errors committed or recovered in a simulated environment by nursing students. The embedded errors needed to be identified, interrupted and corrected by the student. The authors found all students committed at least one error and had a low rate (14%) for identifying the embedded medication error. The authors suggested future research is needed to provide insight into sources of errors, error prevention and recovery strategies.

Mariani et al. (2017) also used medication safety enhanced simulation scenarios to determine if there was a difference in knowledge, competency and perceptions of medication safety between those students (n=43) who participated in the simulation and those (n=43) who did not. The authors found that there was statistically significant improvements in knowledge ($p=.02$) and competence ($p=.028$) for students who participated in the simulations (Mariani et al.,

2017). The findings support the use of simulation as an effective method to contribute to student learning and performance about medication administration practices. The authors suggest that studies in the clinical setting could provide valuable information about medication safety in health care and academic environments.

Although some research shows a reduction in the number of medication errors made by students who have participated in simulations, very little has been done that use simulation to demonstrate changes in competency of safe medication administration while in the clinical setting (Sears et al., 2010). Ford et al. (2010) and Sears et al. (2010) conducted studies to assess if simulation contributed to decreasing the risk of medication errors when in the clinical setting. Ford et al., (2010) conducted a longitudinal quasi-experimental study to compare nursing medication administration error rates before and after the use of educational sessions using either lecture or simulation based training. Data consisting of all portions of the medication administration process including the right drug, dose, route, time and technique was collected on nurses (n=12) from the medical intensive care unit (MICU) and nurses (n=12) from the coronary critical care unit (CCU). Data collection sessions included: baseline observations, initial post-intervention observations at 1-4 weeks and final post-intervention observation at 8-12 weeks. The nurses in MICU, had educational sessions presented in traditional lecture while the information for the CCU nurses was presented in a simulation based session. Authors found a statistically significant decrease in medication error rates in the CCU (30.8% to 4%; $p<0.001$) in the initial post intervention observation and in the final observation (30.8% to 6.2%; $p<0.001$). The error rate for the MICU was not statically significant from the baseline in the initial post intervention observation (20.8% to 22.7%; $p=0.672$) and increased in the final observation (20.8% to 36.7%; $p=0.002$). The authors suggest that the use of simulation-based learning with

nursing staff provides a significant advantage to patient care through the reduction of medication administration errors compared to lecture style learning.

Sears, Goldsworthy and Goodman (2010) used an experimental post-test only design to assess if simulation contributed to overcoming the risk of medication errors. In the study, volunteer nursing students (n=54) from a baccalaureate nursing (BSN) program were randomly assigned to a treatment group (n=24) and a control group (n=30). The intervention for the control group consisted of replacing some early clinical hours with simulated case scenarios. Data on medication errors was collected on both groups in the clinical setting. The control group was found to have statistically significant ($p<0.001$) higher medication error rates than the treatment group. The authors suggested that simulation had an effect on the reduction of medication administration errors.

The authors of both studies found the control group to have significantly higher medication error rates than the treatment group. Although the researchers concluded that simulation had an effect on the reduction of medication administration errors in the clinical setting, they suggested more research is needed to determine whether or not the knowledge gained from simulation transfers to clinical practice (Ford et al., 2010; Sears et al., 2010).

Student Perception

While some authors noted an improvement in competency of medication administration by nursing students, not all investigated the students' perception or comfort level regarding nursing concepts (Ford et al., 2010; Harris, et al., 2014; Howard et al., 2011; Sears et al., 2010). Kardong-Edgren et al. (2008) and Mariani et al. (2015) found that using simulation contributed to increasing undergraduate nursing students' comfort with reporting or investigating errors. Additionally, Howard et al. (2011) and Pauly-O'Neill and Prion (2013) found that the students'

perspective on the use of simulation was positive and that it enhanced their self-confidence with nursing skills. Likewise, Horan (2009) surveyed 57 nursing students about their experience after they were exposed to mini-scenarios in simulation along with lecture. The results were 93% thought it helped them understand the didactic concepts, 88% thought it helped them feel more capable in caring for patients, 89% thought it helped them make clinical decisions, 89% thought it enhanced their confidence, 89% thought it provided a nonthreatening environment and 91% thought it helped them develop critical thinking.

Like Sears et al. (2010), Krutscheid et al. (2011) was interested in the effect the use of simulation had on the students' experiences in the clinical setting. The authors used a phenomenological research design in the qualitative study to explore the students' perspectives with transferring medication administration knowledge from the simulation environment to the clinical setting. They found the students (n=13) reported that both lecture and laboratory taught them how to find information in drug guides, perform six rights of medication administration, determine what assessments to do prior to medication administration, question orders and how to give injections. The faculty felt the students were confident with the skills of medication administration but needed "to learn how to manage distractions and interruptions in the laboratory prior to entering acute care practice" (Krutscheid et al., 2011, p. 12). They suggested the faculty focus on educating students on how to manage distractions and interruptions so they may focus on principles of safe medication administration (Krutscheid et al., 2011).

While Sears, et al. (2010) and Harris, et al. (2014) suggested an improvement in competency of medication administration by nursing students, neither investigated the student's perception or comfort level regarding safety principles. Mariani, et al. (2015) conducted a pre-experimental, pre-test, post-test study to determine whether nursing students' perceptions and

comfort level regarding safety principles and practices increased after participating in a safety-focused simulation based experience (SBE). The participants (n=175) were senior-level undergraduate students enrolled at a mid-sized private religious affiliated BSN school in the mid-Atlantic US. The authors suggested SBE is a teaching strategy that may contribute to increasing undergraduate nursing students' comfort with reporting or investigating errors. This seems to support Pauly-O'Neill and Prion's (2013) findings with the increase in students' self-confidence with the use of simulation.

Limitations in the Literature

Limitations of some studies may include a threat to external validity. External validity is the ability to generalize the findings of a study to other situations and people (McMillian & Schumacher, 2010). Regarding the sampling for the studies presented in this literature review, there was a limitation on the ability to generalize the findings beyond the institution in the study due to small sample sizes and the use of convenience samples (Ferguson et al., 2014; Henneman et al., 2010; Huyngh et al., 2016; Jarvill et al., 2018; Kim & Bates, 2012; Mariani et al., 2015; Pauly-O'Neill & Prion, 2013; Schneidereith, 2014; Sears et al., 2010). Many of the studies were conducted by faculty of the university being studied resulting in nonrandomized samples being drawn from a single school of nursing or used only one hospital setting for the study and used only the day shift for data collection (Durukk et al., 2016; Ferguson et al., 2014; Goodstone & Godstone, 2013; Harris et al., 2014; Howard et al., 2011; Huynh et al., 2016; Jarvill et al., 2018; Kardong-Edgren et al., 2008; Kim & Bates, 2012; Krautscheid et al., 2011; Mariani et al., 2015; Mariani et al., 2017; Pauly-O'Neill & Prion, 2013; Pitkanen et al., 2016; Schneidereith, 2014; Sears et al., 2010; Walsh, 2008; Westbrook et al., 2010).

Five of the studies used a pre-test/post-test design, which compromised internal validity as it is difficult to determine if the difference is from the treatment or history (Ferguson et al., 2014; Ford et al., 2010; Harris et al., 2014; Mariani et al., 2015; Pauly-O'Neill & Prion, 2013). Instrumentation used may be a threat to internal validity and a limitation to a study (McMillian & Schumacher, 2010). Although the Healthcare Professionals Patient Survey Assessment Tool, had been utilized in previous studies, Mariani et al. (2015) found a low reliability for Part 1 of the tool. Harris et al. (2014) and Pauly-O'Neill and Prion (2013) both selected the MAE as the outcome measure for their studies, the results of the studies were limited due to the use of only one outcome to evaluate the effects of simulation on enhancing medication safety.

The Hawthorne effect is an alteration in behavior by subjects of a study due to awareness of being observed (McMillian & Schumaker, 2010). This may cause a subject to perform medication administration in a different manner if they are being observed for medication errors. Some studies used direct observation in order to collect data (Blignaut et al., 2017; Kime & Bates, 2012; Westbrook et al., 2010). Potential observer bias may have been a limitation in some of the studies (Kardong -Edgren et al., 2008; Schneidereith, 2014; Sears et al., 2010). Sears et al. (2010) used different clinical instructors and Kardon-Edgren et al. (2008) used faculty members as the observers which could potentially bias the reporting of the errors. The observer in the study by Schneidereith (2014) was the primary investigator in the control room behind the one-way mirror completing a checklist on the actions of the student administering the medication. There is potential for experimenter bias as the researcher may have had a stake in the outcome of the study; however the use of the one-way mirror did allow the observer to be unobtrusive. The observer for the study conducted by Kim & Bates (2012) had a limitation as well as an ethical issue concerning what the observer did when an error was observed. The observer did not

interrupt or give feedback when a medication error was observed. Pitkanen et al. (2016), had the limitation of self-reporting. The reporting rates may not be accurate due to fear of reporting or retribution which may affect the willingness to report.

Implications of the Literature

From the review of literature, it is clear that many studies have been conducted on factors contributing to medication errors and recommendations for prevention of medication errors. Patient safety with medications remains a problem in healthcare and additional education for nursing students is needed to ensure competency during the medication administration process. Most authors of the studies included in this review suggested that simulation sessions may help to develop skills and adherence to safety guidelines (Ferguson et al., 2014; Ford et al., 2010; Harris et al., 2014; Henneman et al., 2010; Koharchik et al., 2014; Mariani et al,. 2017; Pauly-ONeill & Prion, 2013; Schneidereith, 2014; Sears et al., 2010). In many of the studies reviewed there was a significant increase in knowledge and/or skills associated with safe medication administration after the use of simulation (Ford et al., 2010; Harris et al., 2014; Mariani et al., 2015; Pauly-O'Neill & Prion, 2013; Schneidereith, 2014; Sears et al., 2010). Future evidence-based research is needed to understand the impact of simulation training in medication administration as an educational preparation on the prevention of medication errors in the clinical setting by nursing students. With comprehensive education in this area, students should be able to identify potential factors leading to medication administration errors and therefore be able to prevent errors from occurring. There is a need to determine if the knowledge and skills gained through application-based training in simulation are transferred to the clinical setting (Ford et al., 2010; Sears et al., 2010). This pilot study has the potential to address the gap by

exploring the medication administration practices of nursing students in the clinical setting following the use of simulation exercises with embedded medication errors.

Theoretical Framework

The theoretical framework used for this study is Kolb's Theory of Experiential Learning while the framework for the design of the simulation exercises is based on Jefferies (2012) Nursing Education Simulation Framework (see Figure 2, Appendix A). The process of learning according to Kolb is through experience where the learner makes the experience meaningful by reflecting on it (Waldner & Olsen, 2007). The learning cycle consists of four phases where the learner participates in the experience, then reflects on the experience, next the learner identifies the significance of the learning experience and considers what may have been done differently to enhance the outcome, and the final phase involves using what was learned toward direct future practice (Poore, Cullen & Schaar, 2014). Each phase of the cycle must be experienced in order to achieve optimal learning. Experiential learning aids the student in developing their knowledge, skills and attitudes while each cycle of learning leads to a higher more complex level (Poore et al., 2014).

For this study the first three phases of Kolb's theory provided the framework for the simulation process and the fourth phase involved the act of medication administration in clinical practice. The first phase includes the concrete experience, where there is participation in the medication administration based simulation experience, phase two is reflective observation on what they have done, which occurs during debriefing session after the simulation experience, phase three is abstract conceptualization where the learner thinks critically and conceptualizes the medication administration process by relating what was learned in the simulation to clinical

practice, and the fourth phase is active experimentation where the learner applies the learned behaviors of medication administration to clinical practice (Brown & Bostic, 2016).

According to Kolb's model, learning takes place not only during the simulation activity but also during reflection in the debriefing session. The simulation experience allows students the opportunity to interact with the environment and one another while examining their beliefs and ideas. Group debriefing following the simulation allows the student to review and discuss their performance (Waldner & Olsen, 2007). Appling Kolb's model, debriefing encourages the student to reflect on their performance and to consider the relevance of the experience. It stimulates new ideas, and offers the learner an opportunity to consider if anything should have been done differently during the simulation (Poore et al., 2014). The reflection provides the learner the ability to learn and understand by applying the current and past experiences and reasoning so as to reduce the odds that the student repeats the same mistake and can be used when a difficult situation is encountered in the future. Experiential learning is fundamental to preparing nursing students for clinical practice. According to this theory, the use of the medication administration simulation experience should effectively improve the knowledge and performance of the nursing students, resulting in safe medication administration to their patients.

The nursing education simulation framework (NESF) devised by Jefferies (2012) helped to guide the design of the simulation experiences in order to enhance learning that may be transferred to the clinical setting. The NESF is a general nursing education framework that incorporates currently known best practices in education (Jefferies, 2012). The NESF includes five major components: (a) teacher characteristics, (b) student characteristics, (c) educational practices, (d) the simulation design characteristics (the educational intervention), and (e) the outcomes (Jefferies, 2012).

According to Jefferies (2012), the teacher in the simulation setting takes on the role of both facilitator and evaluator. As a facilitator, the teacher may provide support and encouragement to the learner and act as an observer in the role of evaluator. Students are expected to be responsible for their own learning and need to complete preparation for the role they will be playing in the simulation. The educational practices address the features of active learning, diverse learning styles, collaboration and high expectations in order to improve student performance and learning. Students must be actively engaged with the simulation as it uses diverse learning styles such as tactile, auditory, and visual. Collaboration is required between the teacher and student to achieve learning and the concept of high expectations refers to the learner doing well in the scenarios. The design characteristics should include objectives to guide learning, fidelity to demonstrate reality in the scenario, problem solving related to the complexity of the simulation, student support that may include cueing and debriefing to allow reflective thinking. Finally, clearly defined outcomes such as knowledge gained, skills performed, learner satisfaction, critical thinking, and self-confidence must be established before the simulation and attainment of the objectives measured with valid tools. Evaluating outcomes is essential to determine what learning took place and to determine if the objectives were met (Jefferies, 2012).

The NESF was used to provide guidance for the simulation design in this pilot study. The relationship to be tested involved the use of simulation with embedded medication errors as a teaching strategy in nursing education and its influence on students' ability to administer medications competently, thereby increasing patient safety. This relationship is of interest to nursing programs as medication administration errors continue to be a problem in the healthcare setting (Ferguson et al. 2014).

For this pilot study, the teachers were two faculty members who were not currently involved in classes with the students participating in the study. The teachers acted as facilitators and evaluators in the simulation setting. The students were second semester junior level nursing students enrolled in a medical/surgical Adult Health III clinical course in a baccalaureate nursing program. The educational practices included a simulation experience with embedded medication errors and distractions, which allowed the students to be actively engaged with a situation involving the medication administration process. The high expectations of safe medication administration were identified using the Creighton Competency Evaluation Instrument to measure competency during the simulation and collaboration between faculty and student was achieved through constructive feedback during debriefing. The simulation design had characteristics that included: (a) planned objectives that reflected the outcomes of safety and competency with medication administration, (b) as much fidelity as needed to lend realism to the scenario, and (c) an element of problem solving involving medication administration process by detecting embedded medication errors and correcting the problem. The students had the opportunity to identify any medication errors, interrupt and correct the process as needed, select the appropriate drugs ordered, determine and calculate the safe dosages, properly identify the patient, administer medications by a variety of routes, deal with typical interruptions that may occur in a clinical setting, observe for side effects, and evaluate the effectiveness of the medications. The simulation had planned objectives that reflect the measured outcomes of competency and patient safety.

CHAPTER 3

METHODOLOGY

The proposed pilot study utilized a quasi-experimental design to address the following research questions.

> What is the effect of the addition of clinical simulation with involving medication administration scenarios with embedded errors for baccalaureate nursing students in the level III Adult Health medical/surgical clinical course on the number of medication errors and/or near misses in the clinical setting?

The primary hypothesis for this pilot study is: nursing students participating in the simulation sessions will have fewer errors in the clinical setting than nursing students not participating in the simulation setting. The secondary hypothesis is participating in simulation scenarios with embedded medication errors will lead to an increase in medication knowledge and comfort with identifying and reporting medication errors.

Design

The purpose of a quasi-experimental design is to determine cause and effect of an intervention controlled by the researcher (McMillian & Schumacher, 2010). This design is appropriate for this pilot study because the purpose is to determine the effect of using simulation as a teaching method to reduce the number of medication errors committed by nursing students in the clinical setting. The intervention controlled by the researcher is the use of simulation sessions.

In this pilot study the participants completed a pre-test medication knowledge exam and survey during the first week of classes. One half of the students were randomly selected to participate in a scheduled hour-long simulation session the following week. The simulation

session contained embedded medication errors and distractions during medication administration. All participants were then administered a post-test knowledge exam and survey the following week. For the entire semester, all medications administered in the clinical setting were recorded by the clinical instructor to determine if the six rights of medication administration were followed (see Table 1).

Table 1: Timing of Data Collection and Intervention

Time in Semester	Control Group	Intervention Group
Week 1 (Monday)	MSKA and HPPSACS pretest	MSKA and HPPSACS pretest
Week 1 (Wednesday)		Intervention group randomly selected and provided information sheet with patient information and simulation objectives.
Week 2 (Wednesday)		Two patient simulation sessions with embedded medication errors evaluated with CCEI
Week 3 (Monday)	MSKA and HPPSACS posttest	MSKA and HPPSACS posttest
Weeks 4 and 5	Prescheduled Standard Clinical Simulations	Prescheduled Standard Clinical Simulation
End of Semester	Data for CMAAT reported each week	Data for CMAAT reported each week

The instructors were unaware of which students had participated in the simulation exercises and all data were recorded using numerical codes for identification of the student.

Research Sample

This pilot study occurred within a Bachelor of Science in Nursing (BSN) program at a public university in Maine. The sample for this pilot study was a convenience sample. The participants included the fall 2017 cohort of second semester junior-level nursing students enrolled in the level III Adult Health medical/surgical clinical. The use of a convenience sample is appropriate for this study as the purpose is not necessarily to generalize the findings but to better understand the relationship that may exist between simulation and competency of

medication administration in the clinical setting. There were 25 students enrolled in the class during the first week of classes but one student took a semester long leave of absence during the third week of classes due to medical reasons. This individual was included in the pre-test results and completed 3 medication passes in the clinical setting before leaving the clinical, the student was not included as a participant in the post-test portion of the study.

All participants had completed a one credit course on dosage calculations during their sophomore year. In the previous semester, the students completed a pharmacology didactic course, passed a dosage calculation exam with a score of 100%, and demonstrated competency in the administration of one oral and one intravenous medication in a laboratory skills testing scenario. This was the first semester the students were allowed to administer intravenous medications in the clinical setting. During this semester, the students had didactic medical/surgical information, clinical on a medical/surgical unit and a scheduled day in the simulation lab which included patient care and the administration of intravenous medications to take place after the medication administration simulation and post-test survey has been completed.

Protection of Human Subjects

To address ethical issues for this study, approval from the institutional review board from the University of Maine (see Appendix B) and also from Eastern Maine Medical Center (see Appendix C) were obtained. Both institutes deemed the study exempt from further review. The participants were provided with an explanation of the study and data collection (see Appendix D) including any risks involved and an opportunity to withdraw from the study without any penalties, consent was implied by filling out the demographic questionnaire survey (see Appendix E). Data collection posed minimal risk to the participants. The participants were also

assured that their identities would remain confidential as each questionnaire was coded numerically. All information will be kept in a locked cabinet for up to 3 years.

Intervention

The setting for the simulations was the simulation lab located in the School of Nursing at the University of Maine. Approximately one half of the students (n=12) were randomly chosen to participate in the simulation exercises. One week prior to the scheduled simulation sessions, the students were notified that they were chosen and sent a Student Simulation Information sheet (see Appendix F). The students were instructed not to discuss the simulation information with any other students. There were three simulation sessions conducted with four students at each session. After the students entered the simulation lab, a script (see Appendix G) was read which included the use of the monitor for the vital signs, and that assessments would be discussed and values given to save time for the administration of the medications. In each simulation session, the students participated as either an active participant or an observer in two separate patient scenarios. During the first scenario, two students worked together to administer the ordered medications, the students were instructed that it was necessary for each to administer a medication. The other two students observed the scenario and took notes on what went well and what could have gone better. After the completion of the first scenario, the students reversed roles and a new patient scenario took place. Following the second patient scenario, debriefing with all four students and the two facilitators took place concerning both scenarios. The debriefing consisted of prepared questions that matched the objectives of the scenario and would prompt responses from the participants.

The scenarios for the simulation sessions consisted of two separate patients with medications ordered that needed to be administered. Each scenario had embedded medication

errors for the student to identify and correct. Each scenario also contained a distraction or interruption that may be typical in the clinical setting. New nurses face many challenges, and safe medication administration may be one of the most important. Interruptions and poor communication practices can lead to errors in medication administration. The creation of distraction simulation scenarios can be helpful in understanding the role distractions can play in potential medication errors (Thomas et al., 2014). There are many distractions nurses encounter every day that may lead to medication errors, exposing them to medication simulations is a valuable experience.

During the first scenario, the patient named Tones (see Appendix H) was diagnosed with diabetes mellitus and atrial fibrillation and had an allergy to penicillin. The embedded medication errors were that the heparin infusion was running at the wrong rate and that an antibiotic was ordered that is contraindicated in patients who are allergic to penicillin. The distraction for this scenario was that a nurse (played by one of the facilitators) approached the students while they were preparing the medications and asked for help in another room due to concern over another patient. The second scenario involved a patient named Johnson (see Appendix I) diagnosed with malignant lung cancer. In this scenario, the patient was wearing a wristband where the date of birth and medical record number did not match the computerized chart and the medication lorazapam was ordered to be administered by mouth but the dosage in the patient's medication drawer was for intravenous administration. The interruption for this scenario was that a family member called during the administration of the medications and asked to talk to the nurse. Each student was evaluated during the simulation using the Creighton Competency Evaluation Instrument (CCEI) and a debriefing session followed after completion of the second scenario.

Setting

The clinical settings were on the cardiac and rehabilitation medical/surgical units at Eastern Maine Medical Center (EMMC). Clinical sites are selected by the School of Nursing and EMMC each semester. Specialty units such as intensive care, emergency department, pediatrics, and maternity were not used. When students register for their classes, they are placed into one of the available sites. All clinical sites were at EMMC, thereby ensuring that the same medication administration system were used by all students. The clinical groups consisted of approximately six to seven students with one instructor present. The students were chosen randomly to participate in the simulation sessions regardless of which clinical group they were assigned. The clinical instructors were not aware of which students attended the simulation sessions. Three of the groups were on the cardiac unit and had the same instructor and worked a day shift. The fourth group had a different instructor and was on the rehabilitation unit also working on a day shift. The cardiac unit is a 46 bed unit that has a patient population comprised of cardiac issues, such as coronary bypass surgeries, myocardial infarctions, and cardiovascular disease. The rehabilitation unit is a 26 bed unit that has a diverse patient population from all areas of the hospital as well as the state. The needs of the patients vary with such diagnoses as stroke, multi-traumas or palliative care and requires demonstration of many nursing skills. On this unit therapies play an integral part of patient care therefore collaboration, time management and prioritization are important aspects of the care.

Description of Instruments

The instruments used to collect data in this pilot study include the Medication Safety Knowledge Assessment (MSKA) (see Appendix J). Approval was obtained from the principal investigators (see Appendix K) for use of the MSKA (Mariani et al., 2017). The MSKA is a 25-

multiple choice question criterion-referenced test. It focuses on the most critical areas of safe medication administration and measures students' knowledge about safety issues with medications, concerns for patient safety, and possible morbidity and mortality (Mariani et al., 2017). Mariani et al. (2017) used the Angoff method to determine a pass/fail cut score rate with the passing score of 21 and above and a failing score of below 21, this study will use the same pass/fail rate. The MSKA was found to be both valid (content validity index = 0.94) and reliable (pretest r =.83; posttest r =.96) when developed (Mariani et al., 2017). This instrument was administered as a pre-test/post-test to the participants of the study.

Another instrument used in the pilot study is the Healthcare Professionals Patient Safety Assessment Curriculum Survey (HPPSACS) (see Appendix L). Approval was obtained from the principal investigators (see Appendix M) for use of the HPPSACS (Chenot & Daniel, 2010). The HPPSACS is a 29-item instrument with three parts. In Part 1 the participants are asked 18 knowledge questions about their level of agreement using a scale of 1 (strongly disagree) to 5 (strongly agree) concerning errors and safety in healthcare. Part 2 is five questions about the participants' comfort level with reporting and disclosing errors using a Likert-type scale of 1 (very uncomfortable) to 5 (very comfortable). Part 3 includes 6 yes or no questions about their experience with medical errors, on whether they have seen, disclosed or reported a medical error and whether they thought their nursing education program provided information on the topic of patient safety. (Chenot & Daniels, 2010). The Cronbach alpha reliability coefficient for the entire scale was below the recommended 0.70 but the alpha estimates for the subscales were near or above the recommended range with coefficient alphas of 0.82 for comfort, 0.70 for error reporting, 0.65 for denial, and 0.64 for culture (Chenot & Daniels, 2010). This tool was also administered as a pre-test/post-test survey.

Competency in the simulation sessions was measured using the Creighton Competency Evaluation Instrument (CCEI) (see Appendix N). The CCEI focuses on 22 general nursing behaviors divided into the following four categories; assessment, communication, clinical judgment and patient safety. Each item is rated on a scale from 0–1 or N/A (not applicable), with 0 scoring for does not demonstrate competency and 1 scoring for demonstrates competency (Hayden, Keegan, Kardong-Edgren, & Smiley, 2014). The CCEI has been determined to be valid (content validity index raged from 3.78 to 3.89) and reliable (Cronbach's alpha was > 90) (Hayden et al., 2014).

For this pilot study, the CCEI was altered to contain 12 behaviors that were consistent with medication administration. A training tool was developed which provided a detailed explanation for each assessment item on the CCEI including examples of the embedded medication errors (See Appendix O). A training session was held with the evaluators where the tool was presented and student expectations discussed. The tool was altered by removing one item as it was repeating another item and therefore already being assessed and the embedded distraction was also added in to the tool as a separate item. A practice session involving a faculty member playing the part of the student was then conducted while the evaluators completed the CCEI. Initially there was a difference of 3 points between the raters but after discussion there was agreement. This allowed for changes in the criteria for selected items to be made to make it clearer for the raters. It was determined that documenting the last dose of a pain medication given needed to be added to the medication administration record for the students to access. The following week another practice session using two faculty members as the nursing students was conducted where both raters completed the CCEI and the total scores were found to be 100% consistent with each other.

Competency and patient safety in the clinical setting was measured using the Clinical Medication Administration Assessment tool (see Appendix P) developed to document medication errors and near misses. The tool required the clinical instructor to document the student identification by code, time of medication administration, number of medications classified by the route in which they were ordered, any rights not followed and comments if an error or near miss occurred. The tool was designed to be easy to use and still provide the needed information. The content validity of the tool was determined by several faculty members and experienced clinical nurses.

Data Collection

All participants in the study completed a demographics questionnaire and each completed a pre-test and post-test of the MSKA and the HPPSACA. Pre-test for both instruments was done during the first week of school (August, 28, 2017). The post-test with both instruments was conducted two weeks later (September 11, 2017), this was five days after the medication administration simulation scenarios were concluded and before the scheduled clinical simulations took place.

Approximately one half of the students were randomly selected to participate in simulation exercises involving patient medication administration scenarios. The students were notified that they were selected and received patient information along with the learning objectives for the simulation one week prior to the scheduled simulation. The students were instructed not to talk about being selected for the simulation nor to talk about the simulation information. The sessions for the simulation exercises were scheduled over three consecutive hours in one afternoon at a time the students did not have class or clinical. The simulations contained built in medication errors and interruptions that are typical in the clinical setting. The

content validity of the simulations was checked by two faculty members who were clinically active and three medical/surgical nurses with many years of clinical experience. It was determined that the simulation scenarios were realistic with the embedded medication errors. Creating simulation scenarios that have embedded errors for medication administrations helps to address both the systems errors and human errors that occur with medication administration (Latimer, Hewitt, Stanbrough, & McAndrew, 2017). This strategy will have a greater impact on reducing medication errors as it focuses on instilling patient safety (Miller et al., 2016). Improving knowledge about the factors that are associated with medication errors increases students' awareness and understanding for potential errors. The scenarios were evaluated using the CCEI by two faculty members who were not involved in grading any of the courses the students were currently taking.

Competency and patient safety in the clinical setting was measured using the Clinical Medication Administration Assessment tool to document medication errors and near misses. Clinical data was collected over a period of 12 weeks during the clinical rotation starting the week following the pre-test and ending two weeks prior to the end of the semester. It was completed by observation of each case of medication administration for medication errors and near misses documented by the clinical instructors. For the purpose of this study, a medication error was defined as: an error that reached the patient or would have reached the patient had the instructor not intervened (Sears et al., 2010), it may or may not have resulted in harm to the patient. An example of a medication error is: (a) 25 mg of Lopressor was ordered, (b) the medication comes in a 50 mg pill, (c) the student forgets to cut the pill in half, and (d) administers a whole pill or the instructor stops the student just before they administer it. A near miss was defined as: an event, situation, or error that took place but was captured by the student

before reaching the patient (Sears et al., 2010). For example, penicillin was ordered for a patient who is allergic to that drug; however, the pharmacist was alerted to the allergy by the student, the prescriber was called, and the penicillin was not dispensed or administered to the patient. For the purposes of this pilot study, in addition to the traditional five rights of medication administration, a sixth right was added for "right documentation." Each medication error or near miss was classified by which of the six rights was not followed.

Clinical instructors participated in a training session to understand the purpose of the pilot study, the definitions of terms used, and how to complete the documentation properly. The clinical instructors met with the researcher to go over the tool and the directions on how to use it. In addition, there were practice sessions in the simulation lab conducted using simulations of medication administration and with the clinical instructors documenting the occurrence. The researcher played the part of the student administering medications to the manikin while the instructors used the Clinical Medication Administration Assessment Tool. Debriefing took place after the simulation to discuss the documentation to make sure both clinical instructors were using the tool correctly. In order to control bias, it is necessary to carefully train the instructors and compare their observations using similar and different situations (McMillan & Schumacher, 2010). After the training was completed, the clinical instructors stated they felt competent to document the medications administered in the clinical setting noting any occurrence of medication errors or near misses and the reason for the occurrence. After each clinical day, the researcher met with the clinical instructor to collect the Clinical Medication Administration Assessment Tool and discuss each violation of the rights of medication administration.

Data Analysis

The MSKA was analyzed based on the pass/fail cut score of the exam, with any grade of 21 or higher considered a passing grade and any grade <21 considered a failing grade. Analysis

was done by having a chi-square analysis computed for the pre-MSKA and the post-MSKA. Chi-square is a procedure that is used with nominal data to answer questions about association or relationship based on frequency of observations (McMillan & Schumacher, 2010). The HPPSACS was analyzed using a t-test of the differences in the means of the pre-test and post-test. The purpose of using a t-test is to determine if there is a statistically significant difference in the dependent variable between two different groups, by comparing two means (McMillan & Schumacher, 2010). The CCEI was analyzed using Pearson's correlation coefficient and independent t-test. The correlation coefficient represents the directions and strength of the relationship between two or more variables (McMillan & Schumacher, 2010). The documentation of medication errors and near misses by the clinical instructors was analyzed by comparing percentages between the control group and experimental group and performing an independent t-test.

Data were analyzed to identify, describe, and explore the effect of simulation scenarios with medication errors embedded on knowledge, comfort and performance of nursing students administering medications in the clinical setting. Prior to data entry, variables were pre-coded. Students answered directly on the test and survey questionnaires, and the researcher was present during all the testing to ensure that all questions were answered and demographic profiles were filled out before the participants submitted them. This action was to ensure that there was no missing values when entering the data. The analysis of data was done using statistical package of social science SPSS (Version 25). Descriptive statistics (mean, standard deviation and frequencies) were used. In understanding the effect the simulation scenarios on nursing students, it was necessary to compare scores between the intervention and control group. For this reason chi square and independent t-Tests were used to analyze the data.

CHAPTER 4

RESULTS

Each participant was given a demographic questionnaire to fill out before completing the pre-test MSKA and HPPSACS. The participants (n=25) consisted of 96% (n=24) females and 4% (n=1) males. Of this cohort, 100% identified their ethnicity as Caucasian. The ages of the participants ranged from 20 to 40 years of age with a mean age of 22.5 years. All participants reported spending some time preparing for clinical rotations, 52% (n=13) reported spending 1 to 4 hours (M= 2.8 hours) of time for preparation for clinical while 48% (n=12) reported spending more than 4 hours.

MSKA

The MSKA was analyzed based on a knowledge pass/fail cut score (<21 = fail and $\geq$ 21 = pass). A total of 25 students completed the pre-test MSKA and 24 students completed the post-test MSKA. The combined scores for both the intervention and control group for the pre-MSKA ranged from 14-24, (M = 18.96, SD = 2.49) (See Table 2).

Table 2: Descriptive Statistics of Overall MSKA Scores

	N	Minimum	Maximum	Mean	%	SD
Total Score Pre-Test: Intervention Group	12	17	22	20.00	80.0	1.907
Total Score Post-Test: Intervention Group	12	15	22	19.42	77.6	1.975
Total Score Pre-Test: Control Group	13	14	24	18.38	73.5	3.042
Total Score Post-Test: Control Group	12	14	22	19.00	76.0	2.296

Crosstabs and chi-square analyses were computed for the pre-MSKA and post-MSKA. For the pre-MSKA, there was no statistically significant difference between the intervention (42% passed, n=5) and the control (31% passed, n=4) groups (X^2 = .322, df = 1, p = .571) in the

number of participants who passed with a cut score of $\geq$ 21. The post-MSKA had a range of 14-22 (M = 19.21, SD = 2.11). For the post-MSKA there was no statistically significant difference (X^2 = .202, *df* = 1, *p* = .653) between the intervention (33% passed, n=4) and the control (25% passed, n=3) groups. There were no statistically significant differences between the pre and post-test for either the control (X^2 = .103, *df* = 1, *p* = .748) or the intervention (X^2 = .178, *df*=1, *p* = .673) groups (See Table 3). This does not support the hypothesis that there would be in increase in medication knowledge as a result of participating in the simulation scenarios with embedded medication errors.

Table 3: Chi-Square Test for MSKA

Groups	*X2*	p Value
PreMSKA intervention group and control group	.322	.571
PostMSKA intervention group and control group	.202	.653
PreMSKA and PostMSKA control group	.103	.748
PreMSKA and PostMSKA intervention group	.178	.673

HPPSACS

The pre and post-test scores on the HPPSACS were analyzed using descriptive statistics (see Table 4) and an independent t-test.

Table 4: Descriptive Statistics of HPPSACS Part 1 and Part 2 Scores

	N	Mean	SD
Part 1 Score Pre-Test: Intervention Group	12	53.08	2.275
Part 1 Score Post-Test: Intervention Group	12	53.33	4.519
Part 2 Score Pre-Test: Intervention Group	12	16.25	3.415
Part 2 Score Post-Test: Intervention Group	12	17.17	3.271
Part 1 Score Pre-Test: Control Group	13	53.92	3.252
Part 1 Score Post-Test: Control Group	12	53.42	3.895
Part 2 Score Pre-Test: Control Group	13	17.08	3.353
Part 2 Score Post-Test: Control Group	12	16.17	3.271

For both the intervention and control groups, there were no statistically significant differences

between groups in the pre-test scores for Part 1 ($t(23) = .742$, $p = .466$) and Part 2 ($t(23) = .611$, $p = .547$) or on the post-test scores for Part 1 ($t(22) = .048$, $p = .962$) and for Part 2 ($t(22) = -.537$, $p = .596$). Although there were a decrease in the mean between the pre and post-test Part 2 scores for the control group (Pre-test Part 2: M= 17.08, SD = 3.35 and Post-test Part 2: M= 16.17, SD = 5.55) and an increase in the mean for the intervention group between the pre-test and post-test (Pre-test Part 2: M= 16.25, SD = 3.41 and Post-test Part 2: M = 17.17, SD = 3.27), there was no statistically significant differences between the pre and post-test scores for Part 2 with either the control group (t (23) =.501, p=.621) or the intervention group ($t(22) = -.672$, p=.509). There was also no statistically significant difference between the Part 1 pre-test scores and post-test scores for either the intervention group ($t(22) = -.171$, $p = .866$) or control group 1 ($t(23) = .354$, $p = .727$) (see Table 5). This did not support the hypothesis that there is an increase in comfort level of identifying and reporting medication errors with participation in simulation scenarios with embedded medication errors.

Table 5: T-Test for HPPSACS Parts 1 and 2

HPPSACS Parts 1 & 2 Groups	*p* Value
Pre-test intervention group and control group Part 1	.466
Pre-test intervention group and control group Part 2	.547
Post-test intervention group and control group Part 1	.962
Psot-test intervention group and control group Part 2	.596
Pre-test and Post-test control group Part 1	.727
Pre-test and Post-test intervention group Part 1	.866
Pre-test and Post-test control group Part 2	.621
Pre-test and Post-test intervention group Part 2	.509

Part 3 of the HPPSACS includes six yes or no questions on the students experience with observing, disclosing or reporting medical errors and whether or not the nursing program provides sufficient coverage on the topic of patient safety (see Table 6). On the pre-survey 4% (n=1) of students indicated they had observed a medical error during clinical experience and no

one in the sample (n=25) reported disclosing or reporting a medical error. All students (n=25) indicated that the nursing program provides sufficient coverage of patient safety on both the pre and post-survey. On the post-survey an additional two students (12.5%) reported that they had observed a medical error and one of whom reported they had disclosed (4%) a medical error but no participants reported an error using an incident report.

Table 6: Percentages for HPPSACS Part 3

Question	Pre-test Survey		Post-test Survey	
	Yes	No	Yes	No
24. Have you observed a medical error in your clinical experience?	4%	96%	12.5%	92%
25. Have you disclosed a medical error in your clinical experience?	0%	100%	4%	96%
26. Have you disclosed a medical error to a staff member?	0%	100%	4%	96%
27. Have you disclosed a medical error to a fellow student?	0%	100%	0%	100%
28. Have you reported an error using an incident report?	0%	100%	0%	100%
29. Did your nursing program of study provide sufficient coverage on the topic of patient safety?	100%	0%	100%	0%

CCEI

The CCEI was used to evaluate the simulation scenarios. The inter-rater reliability for the total scores on the CCEI was statistically significant (r =1.000, n= 24, p =.000) with 100 % agreement on the total scores although there was a difference in the scoring on three of the items between the raters. The items were analyzed using the Pearson Correlation Coefficient. The total score and a majority of the items had a perfect positive (r = 1.000) relationship. The three items with the difference in scoring: item seven (performs evidence based practice) had a strong relationship (r = .557), item eight (uses patient identifiers) had a moderate relationship (r = .368) and item nine (utilizes standardized practices and precautions including hand washing) had a

strong (r = .698) relationship. The scores on the CCEI (M= 9.67, SD = 1.308) ranged from 8-12. There was no statistically significant difference ($t(22) = -1.615$, p=.121) in the scores between the patient named Johnson (M= 9.25, SD = 1.138) and the patient named Tones (M=10.08, SD= 1.379). Three items on the CCEI were scored as 1 (demonstrates competency) for all participants. The three items were item 2 (assesses the environment in an orderly manner); item 3 (communicates effectively with the patient); and item 6 (prioritizes appropriately). Item 1 (obtains pertinent data) was scored as a 0 (does not demonstrate competency) for all participants taking care of patient Johnson and as a 1 for all participants taking care of patient Tones.

The students participating in the scenario with patient Johnson has some difficulty with question 8 (uses patient identifiers) with 33.3% (n=2) of the participants not checking the wristband of the patient. Also 66.6% (n=4) of students participating in the scenario for patient Tones did not wash their hands prior to administering medications. Identifying the embedded medication error (Item 5) was demonstrated competently 66.6% (n=4) of the time for both patient scenarios. These errors were discussed in the debriefing sessions. The distraction was ignored by all students participating in the simulation with patient Johnson and 66.6% (n=4) of students participating in the simulation with patient Tones. Two students (33.3%) did stop in the medication administration process to respond to the person interrupting the process.

Clinical Medication Administration Assessment Tool

The number of medications administered, route of the medications, near misses and medication errors were documented in the clinical setting using the Clinical Medication Administration Assessment Tool. The data collected on the Clinical Medication Administration Assessment Tool was collected over 12 weeks from September 2017 through November 2017. The students were assigned to the intervention group randomly regardless of what clinical group

they were assign. There were four clinical groups, three of the group had 6 students assigned to them and the one had seven students assigned. After the third week, one student dropped from the class and there were 6 students in each group. It turned out that there were two students from the intervention group in two of the clinical groups and 4 from the control group and the other two clinical groups had four from the intervention group and two from the control group (see Table 7). The clinical instructors were not told which students were in the intervention group and the control group.

Table 7: Distribution of Students in the Clinical Setting

Clinical Group	Control Group	Intervention Group	Reported Errors
Cardiac Tuesday	4	2	13
Rehab Tuesday	2	4	4
Cardiac Thursday	5*	2	13
Cardiac Friday	2	4	7
Total	n=13	n=12	37

(*) one student dropped from the clinical before posttest.

The intervention group (n=12) had 153 medication passes documented. A medication pass is an instance when the student takes one or more medications to the bedside to administer to the patient. A total of 579 medications were administered by the intervention group by various routes (see Table 8). The control group (n=13) had 157 medication passes with a total of 664 medications administered.

Table 8: Routes of Medications Administered

Route of Medication	Control Group (n=13)	Intervention Group (n=12)
Oral medication	462 (70%)	406 (70%)
Subcutaneous Injection	57 (9%)	45 (8%)
Intramuscular Injection	5 (0.7%)	3 (0.5%)
Intravenous Push Medication	24 (3.6%)	32 (5.5%)
Intravenous Piggyback Medication	24 (3.6%)	18 (3.1%)
Topical Medication	84 (12.6%)	63 (10.8%)
Maintenance Intravenous Infusion	7 (1%)	12 (2%)
Total Medications	664	579

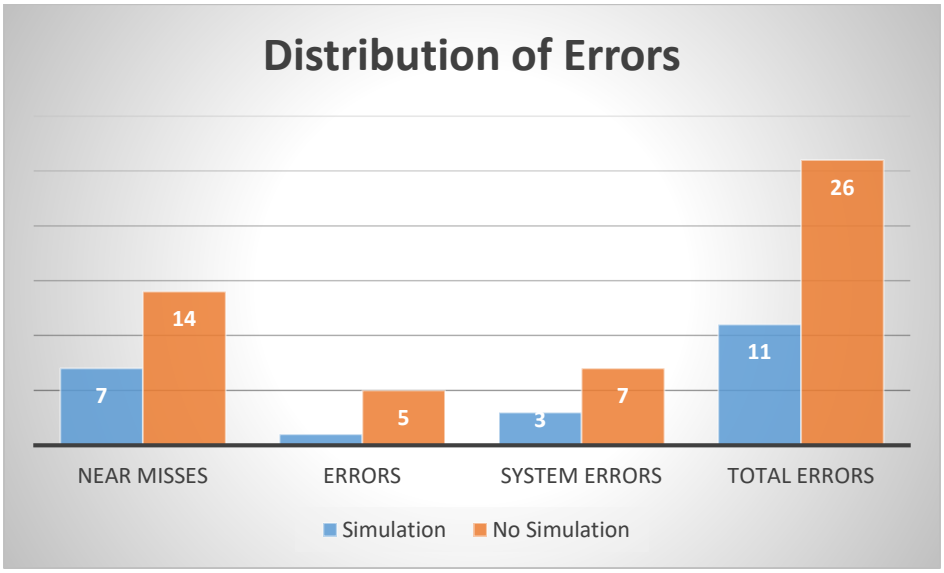
An independent t-test was used to analyze the medication passes, medications administered, and the number of rights of medications violated for the control group and intervention group. There was no significant difference between the control group and the intervention group in the number of medication passes ($t(23) = -.535$, $p = .598$) and the number of medications administered ($t(23) = .453$, $p = .655$).

Each clinical instructor documented each medication administered and any cases of when one or more of the six rights were violated. The documentation was coded for each of the rights violated while administering the medications. Five students in the intervention group (n=12) did not violate any of the rights of medication administration while only one student in the control group (n=13) had no violations of the medication administration rights. The intervention group had a total of 11 medication passes where one of the six rights were not followed while the control group had a total of 23 medication passes that violated one of the six rights and two medication passes that violated two of the six rights. There was a statistically significant ($t(23) = 2.372$, $p = .026$) difference noted between the intervention group and the control group with documentation for not following the six rights of medication administration. This supports the primary hypothesis that students who participated in the simulation scenarios with embedded medication errors would make fewer medication errors in the clinical setting. These violations were reported as near misses or errors. Near misses were instances when the error did not reach the patient as the students caught the violation and corrected it. Errors were instances where either the error did reach the patient or did not reach the patient because the clinical instructor intervened. During data analysis, reported errors were reclassified as errors or system errors as there were cases where the medication could not be administered on time for reasons beyond the control of the student or the clinical instructor (See Figure 1). For instance, an intravenous

medication could not be administered when the site was leaking and the student had to wait for a registered nurse to restart the intravenous site or the medications were not prepared by pharmacy or had not been delivered to the unit when the medications were due.

During medication administration, the intervention group had errors in the areas of the right patient and right time while the control group had errors in the areas of right patient, right drug, right dose, right time and right documentation.

Figure 1: Distribution of Errors



Neither group had a reported error with the right route of medication administration (see Table 9).

Table 9: Rights of Medication Administration

Medication Administration Right	Intervention Group (n=12)	Control Group (n=13)
Right Patient	7	3
Right Drug	0	6
Right Dose	0	4
Right Time	4	11
Right Route	0	0
Right Documentation	0	1

There was not a significant difference between the intervention and control groups with not following the rights related to patient ($t(23) = -1.391$, $p = .178$), time ($t(23) = 1.621$, $p = .119$) and documentation ($t(23) = .959$, $p = .347$) but there was a statistically significant difference related to the right drug ($t(23) = 2.418$, $p = .024$) and right dose ($t(23) = 2.215$, $p = .037$) between the intervention and control groups. There were no statistically significant differences between the instructors for the number of medications administered ($t(23) = 1.923$, $p = .067$), number of medication passes ($t(23) = -.967$, $p = .344$) or total number of medication errors ($t(23) = -1.989$, $p = .059$)

CHAPTER 5

DISCUSSION

The study of safe medication administration in the clinical setting is an important issue. Many studies have been done with the use of simulation as a teaching intervention among undergraduate nursing students and medication administration in the laboratory setting but there have not been many done to determine if the knowledge or competency is transferred to the clinical setting. The main goal for this pilot study was to determine the effect of the use of simulation scenarios with embedded medication errors on the number of medication errors and near misses that occur in the clinical setting when administering medications. The MSKA and HPPSACS were administered to determine if there was a change in the knowledge or comfort level of medication administration and errors when simulation was used as a teaching strategy.

Initially a total of 25 students participated in the study to show the effect of simulation on medication errors in the clinical setting. Three weeks into the semester one student dropped from the clinical course due to medical reasons. The student did complete the pre-test MSKA and HPPSACS along with the demographics sheet and did administer medications in the clinical setting for one week. Due to the small sample size, there was not a great deal of diversity in gender, age or ethnicity reported on the demographic questionnaire for this pilot study. Findings from each of the instruments used in the study will be discussed.

MSKA

Much literature agrees that insufficient knowledge and competency of medication administration are the main reasons for medication errors (Krautscheid et al., 2011; Whitehair, Provost, & Hurley, 2013). The MSKA was administered to the students prior to the simulation experience and again following the simulation experience. The findings do not support those of

Mariani et al. (2017), as there were less students who passed the post-test with a score ≥ 21 than the pre-test for the intervention group and no change in the number from the pre-test to the post-test of students who passes with a score ≥ 21 in the control group. There was also a noted decrease in the mean score from the pre-test to the post-test for the intervention group. There was one question on the assessment tool that the students performed very poorly on, 80% (n=20) of the students on the pre-test answered incorrectly and 95.8% (n=23) answered incorrectly on the post-test. The question was asking what not to do when taking a telephone order. All of the students who answered the question incorrectly selected the option of "write/enter the order on the chart and read back the order" instead of the correct answer "repeat back the telephone order." Some possible reasons for this answer may be due to lack of experience since nursing students are not allowed to take telephone orders in the clinical setting or that the only clinical experiences that students have had up to the this point have the Computerized Physician Electronic Order Entry (CPOE) system. This system allows all orders to be entered from the physician/provider from remote sites so there is no need to take telephone orders. The use of CPOE may reduce the risk for medication errors due to incorrect telephone orders in patient care settings (Ammenwerth, Schnell-Inderst, Machan and Siebert, 2008; Kaushal, Kern, Barron, Quaresimo, & Abramson, 2010).

The MSKA also had multiple questions that were concerned with the correct abbreviations used in medication orders. The students were taught the content on acceptable abbreviations for medication orders one year earlier when they are not yet administering medications, this may have an effect on whether or not the student views the information as significant. Factors that influence retention of information include significance and repetition (Dirksen, 2016). The use of the CPOE also has the correct abbreviations embedded in the

program and does not require the student to document using these abbreviations. Not practicing the use of the abbreviations may have affected the scores on the MSKA. According to Dirksen (2016) the two main components to developing a skill are practice and feedback. Learners need practice with skills and information before they can develop proficiency. While the simulation scenarios contained embedded mediation errors, they were focused on the six rights of medication administration and not on the information presented on the MSKA.

HPPSACS

The HPPSACS is a validated and reliable tool that measures the attitudes about patient safety in the areas of (a) comfort in revealing errors, (b) error reporting, (c) denial tendencies, and (d) culture of safety improvement (Chenot & Daniel, 2010). The HPPSACS contains three parts, Part 1 asks for the level of agreement on 18 statements, Part 2 asks for the level of comfort on five items and Part 3 is six yes or no questions about prior experience the participant has had with medical errors. Descriptive statistics of the nursing student's responses on the HPPSACS provided information that the mean for the intervention group did increase from the pre-test to the post-test for both Part 1 and Part 2 while the mean for the control group decreased from the pre-test to the post-test in both Part 1 and Part 2. Data were analyzed with the independent t-test did not show any statistically significant difference between the pretest and posttest for either group nor between the groups. This may be due to the small sample size used in the study. While there was no statistically significant difference found, there were differences in the means of the intervention group related to comfort levels with medical errors. The intervention group's scores for comfort in "advising a peer how to respond to an error", "disclosing an error to a faculty member" and "disclosing an error to another healthcare provider" indicated an increased comfort level in the post-test scores. During debriefing of the simulation sessions, these topics were

discussed. This increase in comfort level is consistent with findings of Mariani et al. (2015) of an increase in nursing students' comfort with reporting errors and Pauly-O'Neill and Prion's (2013) findings of an increase in students' self-confidence with the use of simulation.

There was no increase in scores for comfort level for either the intervention group or the control group in "accurately completing an incident report." During the simulation session it was not required to complete an incident report for the embedded medication errors due to time constraints for the sessions. Future research should include the use of incidence reports for medication errors in order to provide a more realistic setting. In order to understand clinical situations such as medication errors, it is essential to have simulation experiences that replicate the clinical situation so that students can understand it and develop an adequate response when it happens in the clinical setting (Brewer, 2011; Lavoie & Clark, 2017). In the clinical setting an incident report would be completed for any medication error that occurs.

It was clear from the data in Part 3 of HPPSACS that students had very little experience observing, disclosing or reporting medical errors. Only one student in the pre-test and two students in the post-test reported observing a medical error and only one students reported it while none reported completing an incident report. Sullivan, Hirst, and Cronenwett (2009), conducted a study to assess student perspectives of quality and safety content in their nursing programs including self-reported levels of preparedness of competencies. They found that clinical lab and simulation were underused for safety education with limited instruction on incident reports and error reporting. There is a need to maximize the teaching of safe medication administration to nursing students. This may be accomplished by improving their knowledge of medication safety thereby improving their self-confidence in clinical situations. All students in this pilot study reported that their nursing program of study provided sufficient coverage on the

topic of patient safety.

CCEI

The CCEI is a valid and reliable tool (Hayden et al., 2014) that has been used in several studies for evaluation of simulation experiences (Tabor & Vaughn, 2017). The simulation sessions provided an opportunity for the nursing students to practice medication administration, identify and correct medication errors without risk of harm to the patient. The simulation sessions consisted of two patient scenarios with embedded medication errors for the students to detect and correct during the simulation experience. A debriefing session took place after each session. The principles of Kolb's Experiential Learning Theory support the transformation of practical application of problem solving, decision making, and active reflection gained through participation in the simulation scenarios with embedded medication errors into improved safe medication administration skills demonstrated by nursing students (Poore et al., 2014; Waldner & Olsen, 2007). Both raters gave the same scores for each of the students on the CCEI but there was one students in which one rater scored the problem under "Performs Evidence Based Interventions" and the other scored under "Administer Medication Safely" although both had the same comment for the scoring. This would indicated that the CCEI training tool may need to clarify between the two items.

There were three simulation sessions that lasted one hour each. Both scenarios were performed followed by a debriefing session in that one hour time frame. A total of six students completed care for each patient with two students working together for each patient during the session. The embedded medication errors for the patient named Johnson included the wrong wristband on the patient (wrong patient) and the lorazapam was order by mouth but available as intravenous (wrong route) and the errors for the patient named Tones was the Heparin infusing at

the wrong rate (wrong dose) and the patient having an allergy to the antibiotic ordered (wrong drug). It was impossible to create an embedded error for the wrong time due to the limited amount of time available for the simulation sessions and the documentation was assessed on every medication administered in the simulation lab. The majority of the students (66.6%) were able to identify the embedded medication error and correct it. This result is higher than those found by Henneman et al. (2010) where only 14% of embedded medication errors were identified. Two students (33.3%) caring for patient Johnson did not identify the wrong date of birth or medical record number on the wristband for the patient prior to giving medications and two (33.3%) students taking care of patient Tones did not identify the wrong rate infusing on the Heparin. One student caring for patient Tones gave the wrong dose to the patient on a medication that did not have an error attached. The student gave only one pill when two pills were ordered. The findings on the CCEI are similar to those of Bowling (2015) where nearly half of the students did not correctly identify the patient (55.7%) or follow the five rights (53.4%) of medication administration when providing patient care in the simulation setting.

Other deviations from safe practice with medication administration that were noted on the CCEI were that none (100%) of the students caring for patient Johnson asked the patient about allergies while all (100%) of the students caring for patient Tones asked about allergies. Other studies have found that failure to check the patient's allergies is an error that may occur when administering medications (Ford et al., 2010; Henneman et al., 2010; Schneidereith, 2014). It is unknown why none of the students checked allergies for patient Johnson while all of the students checked for patient Tones. One explanation may be that the patient chart for Tones had penicillin listed as an allergy while no allergies were listed for Johnson. The fact that the allergies were listed may have been a trigger for the student. There can be an association between a visual

trigger and an action where the trigger may encourage memory and behavior (Dirksen, 2016). Also it was noted that 33.3% of students caring for Johnson and 66.6% of students caring for Tones did not wash their hands before administering medications. This is similar to findings in a study conducted by Blignaut et al. (2017) where deviations were noted when medication administration was directly observed to find there was a lack of asepsis or hand washing 90% of the time.

Along with embedded medication errors, the patient scenarios contained distractions to interrupt the medication administration process. The distractions for the simulation experience with patient Johnson consisted of a phone call from a family member requesting information about the patient while the student was administering the medications. The distraction for patient Tones was a nurse approaching the student while they were preparing the medications to ask for help with another patient that was not doing well. These are typical distractions that occur in the clinical setting (Thomas et al., 2014). Findings on the CCEI were that two students (33.3%) caring for patient Tones allowed themselves to be distracted by the nurse while preparing the medications. All other students did not engage in the distraction and asked the nurse or family member to please wait in a professional manner. During debriefing it was found that earlier in the morning in nursing class, the students had seen a video on distractions in nursing and how they were to be handled. It was unknown to the researcher that this video was being shown in class on the day of the simulation scenarios. Because this information was presented to the students a few hours before the simulation experience, it was stored as short term memory which allows the learner to hold onto ideas or thoughts long enough to take action (Dirksen, 2016). Krutscheid et al. (2011) suggests that nursing students need to be educated on how to manage distractions and interruptions so they can focus on the administering medications safely.

Participation in the simulation scenarios provided the opportunity for students to administer medication safely including committing actual and potential medication errors without risk to patient safety. During the debriefing session, students were able to recognize actual and potential medication errors incorporated within the scenario, determine nursing interventions to minimize error risk and review appropriate responses to interruptions and distractions. The students were able to expand their knowledge and learn from their mistakes without causing patient harm with the simulated learning experience (Campbell, 2013).

Clinical Medication Administration Assessment Tool

Although there are many studies regarding factors associated with medication administration errors with nurses, there is limited research on the reasons for medication errors committed by nursing students (Dolansky et al., 2013; Reid-Searl & Happell, 2012). The Clinical Medication Administration Assessment Tool was used to collect data for each medication pass that took place in the clinical setting for the students enrolled in the level III Adult Health Medical-Surgical clinical course. For each medication pass, the date, time, number of medications per route and the use of the six rights of medication administration were documented. According to Hewitt's (2010) integrative review of literature on nurses' perceptions of the causes of medication errors, failure to follow the rights of medication administration is the second most frequently seen reason for medication errors by nurses. It is very important for the clinical instructor to supervise the nursing student while administering medications. Performing medication administration on real patients in the clinical setting puts nursing students in an error-prone environment (Reid-Searl, Moxham, & Happell, 2010).

There were three clinical groups on the cardiac unit who all had the same clinical instructor and there was one group on a rehabilitation unit who had another clinical instructor.

There were no statistically significant differences between the groups, clinical instructors nor units assigned. Each student had been randomly assigned to the intervention or control group regardless of which clinical group they were attending. This resulted in two clinical groups having two students from the intervention group and four students from the control group and the other two clinical groups having four students from the intervention group and two students from the control group. It is noted that for the first three weeks one clinical group did have five students from the control group and two from the intervention group. The clinical instructors were not notified which of the students had completed the simulation sessions.

There were 153 medication passes with a total of 579 medications administered by the intervention group (n=12) while the control group (n=13) had 157 medication passes with a total of 664 medications administered. There was no statistically significant difference in the number of medication passes nor in the number of medications administered between the two groups. However, there was a statistically significant difference between the groups in the number of times the six rights of medication administration were violated. The intervention group had five students without any violations of the rights and the control group had only one student without any violations of the rights. This is consistent with the findings of Sears et al. (2010) where students in the clinical placement that had a prior exposure to a related, simulation experience generated fewer medication errors.

It was noted that the intervention group had violations only in two categories, the right patient and the right time. While the control group had violations in five of the six rights. The violations for the right patient for both groups were all for not checking the wristband prior to administering the medication. This is consistent with findings in many studies on the use of simulation and the rights of medication administration (Bowling, 2015; Ford et al., 2010;

Henneman et al., 2010; Mariani et al., 2017; Schneidereith, 2014; Sears et al., 2010). This is also consistent with number of students not checking the wristband in the simulation setting. Sears et al. (2010), found 24 errors were made in the control group and only 7 in the simulated group. These findings suggest that practice with medication administration in a simulated setting can reduce medication errors in clinical practice by nursing students.

The assigned clinical groups took place in a hospital that uses the Barcode Point of Care (BPOC) system for the medication administration process. Barcode Point of Care (BPOC) software is technology that automates the five rights of medication administration including right patient when it is used properly (Wolfe, 2007). Many nurses feel that scanning the wristband with BPOC is sufficient in identifying the patient but this strategy is not effective if the wristband is wrong of if the wrong patient chart is on the screen for medication administration. It is imperative that patient identification is done by using a minimum of two different patient identifiers such as the full name, date of birth, or medical registration number (Young et al., 2015). All three of the identifiers are located on the patient's wristband that is required to be on the patient at all time. The identifiers on the wristband must be matched to those on the medication administration record before any medications are administered.

The right time was another right that was violated by students in both the intervention and control group. The majority of the time (73%) this was classified as a system error because the medication was not administered to the patient at the right time due to a problem beyond the control of the student or the clinical instructor. For instance, on two occasions the medication was an intravenous medication and the intravenous site was leaking or clotted which required a new site be inserted. Nursing students are not allowed to insert intravenous sites and need to wait until a registered nurse is available to restart the site so the medication may be administered.

Also a medication may not be available to be given as it may not be on the unit or pharmacy has not yet prepared the medication this occurred on six occasions. During this study there was a patient with a latex allergy that needed the medications to be mixed in a special syringe which was not available on the units, therefore the student had to wait until the medication was available from the pharmacy. Finally, medications were administered late due to the fact that two patients had left the unit for tests and one had refused to take the medication until later in the day. In all instances, the medications were administered later than the time ordered by the doctor. There were four occasions of the medication being at the wrong time that were attributed to the students, in these cases, the medication was late because the student failed to complete the vital signs on the patient, have the technician obtain the blood sugar reading, forgot to bring in a medication that was due earlier in the day and brought in a medication that was not due until later in the day. Administration time errors are generally defined as medication administration occurring one hour before or after the prescribed time. This definition is the policy for the hospital used in the study. A study conducted by Teunissen, Bos, Pot, Pluim and Kramers (2013) found time errors to be the most common medication errors.

The control group also had errors in the category of right drug (6 errors), right dose (4 errors) and right documentation (1 error). In the cases of the right drug, on one occasion the student brought a drug that had been discontinued to the bedside to be administered and on five occasions, one of the ordered medications was not brought to the bedside to be administered. For the right dose, all instances were that the student brought only one tablet to the bedside when the dosage required two tablets and the one case for documentation was that the student attempted to sign off that the medications were given before they were actually administered. These findings of violations in the use of the five right during medication administration are consistent with the

findings of several other studies (Blignaut et al., 2017, Bowling, 2015; Ford et al., 2010; Henneman et al., 2010; Kim & Bates, 2012; Schneidereity, 2014; Westbrook et al., 2010).

The intervention group had fewer medication errors and near misses than the control group and had violations in only two areas where the control group had violations in five areas. Even in the areas that there was not a statistically significant difference between the group in errors, there was a clinically significant difference noted as any decrease in medication errors is clinically significant to patient safety. Simulation allows repetition of clinical skills needed for safe medication administration. Repetition of critical skills allows the student nurse to perfect psychomotor skills. Evidence shows that repetition of safe medication administration skills through the use of simulation experiences can help to reinforce safe practices of medication administration in the clinical setting by nursing students (Schneidereith, 2014). Skills and knowledge gained within the safe learning environment of the simulation lab can be applied to successful performance in the clinical setting leading to improved patient safety. Medication administration errors that are due to the system are difficult to resolve, as the solution is often at the administrative level and beyond the control of the nursing student or nurse. Causes of medication errors contributed by the system include receiving medications from the pharmacy with issues such as late deliveries, lost orders, and limiting the availability of the drugs. The use of simulation in nursing education can contribute to reduction in medication administration errors (Sears et al., 2010). Future research may include the sustainability of safe medication administration in the clinical setting with the use of the intervention of medication administration simulation scenarios with embedded medication errors. Continuing the use of realistic medication administration simulation sessions may reinforce the use of proper protocols such as the use of the six rights of medication administration.

Limitations

Limitations for the pilot study include those related to external validity and the ability to generalize the findings. Generalizability is limited if the subjects are not selected randomly from an identified population and the setting in which the study is conducted (McMillan & Schumacher, 2010). In this pilot study, external validity may be compromised as there is a single site of the study, small sample size, and the use of a convenience sample. The results of the study may not be generalized to other programs but will have value for the institute in which the study took place. The use of a pre-test/post-test design may have compromised the internal validity as it is impossible to determine if the differences are due to the intervention or history. All students in the intervention group were told not to talk about the simulation experience but it is impossible to determine if any of the information was shared with the control group or the clinical instructor. The use of the MSKA as a measurement for this pilot study may have been a mismatch for the aim of the intervention. The simulation scenarios were not consistent with medication knowledge measured in the tool. The MSKA was not aligned with the curriculum for the nursing program identified in the pilot study at the level from which the sample was drawn. This tool may be better utilized at a lower level when the content is being taught.

Because of time factors and limited space in the simulation lab, the students worked in pairs for each patient scenario which may have affected the performance in detecting and correcting medication errors. Although all students were in the same hospital and therefore had the same medication system, there were two different instructors and two different units used for the clinical groups. There could be potential bias in reporting the errors as the clinical instructors may have been more vigilant in documenting the violation of the six rights due to having to fill out the assessment sheet and having the researcher meet with them after each clinical rotation. The

limitation of observation is with the person who record what is seen and heard (McMillan & Schumacher, 2010). The fact that training was done for both clinical instructors may help with this limitation.

Implications for Nursing Profession and Nursing Education

It was previously stated that promoting safe medication administration is very important in nursing to maintain patient safety. Nursing students must be taught the importance of safe medication administration and this competency needs to begin early in the nursing curriculum. The simulations scenarios for this pilot study were developed with the standards recommended in the National Council of State Boards of Nursing National Survey (Kardong-Edgen et al., 2012). The findings of the study are supported in the results of this pilot study as it was demonstrated that the use of simulation as a teaching strategy for safe medication administration may be used to reduce medication errors in the clinical setting. Suggested curricular changes for the nursing program include incorporating simulation sessions that are realistic with embedded medication errors and distractions at an earlier level of education. Recommendations include providing more time for the simulation scenario to include filling out an incident report for the errors and for extended debriefing time to reflect on the actions taken during the simulation scenario. However, further research is needed to enhance the generalizability of these findings and to address the gap in the literature exploring the ability to transfer knowledge and skills learned in simulation sessions to the clinical setting. The sample size of 64 or larger should be used to attain a power of 0.80 and a medium effect size of 0.5 (Cohen, 1988)

Nursing education needs to focus on nursing students' skill performance and assessing safe medication administration practices in the clinical setting. Having seen from the study that the rights of medication administration are violated when administering medications in the

clinical setting there is a need for nursing education to reinforce the importance and use of protocols such as the six rights when administering medications to ensure patient safety. Recommendations from the pilot study are that compliance is needed with the rights of medication administration, students have been identified to have the knowledge and skills to safely administer medications but still occasionally do not follow the rights. Future research is required to identify the barriers that prevent students from administering medications safely. Multi-site studies are needed to identify the educational strategies needed to ensure nursing students are providing safe medication administration in the clinical setting.

Conclusion

Reducing medication errors in the clinical setting is a priority but achieving medication administration competence is a challenge to nursing students. As the concern for medication safety increases, nurse educators are compelled to implement teaching and learning strategies that allow students to gain knowledge, as well as analyze and synthesize information related to safe medication administration (Kardong-Edgren et al., 2008). Nursing students and clinical instructors should be vigilant and careful when administering medication to patients by observing the six rights of medication administration. Nursing students need solid and comprehensive education in the area of medication administration so they are able to identify possible actions leading to medication errors and therefore be able to prevent errors from occurring.

Incorporating medication administration into patient simulation scenarios offers numerous learning opportunities and multiple benefits to students (Harris et al., 2014). The students have an opportunity to identify the appropriate drugs, determine and calculate safe dosages, properly identify the patient, administer medications by a variety of routes, observe for

side effects, and evaluate the effectiveness of medications (Ford et al., 2010; Henneman et al., 2012; Scheneidereith, 2014). There is a lack of research to demonstrate that knowledge and skills are transferred from the simulation experience to clinical practice (Ford et al., 2010; Sear et al., 2010). This pilot study adds to the knowledge in the use of simulation as an educational method to enhance nursing students' competency with medication administration. The findings suggest that simulation education may contribute to a reduction in medication errors in the clinical setting.

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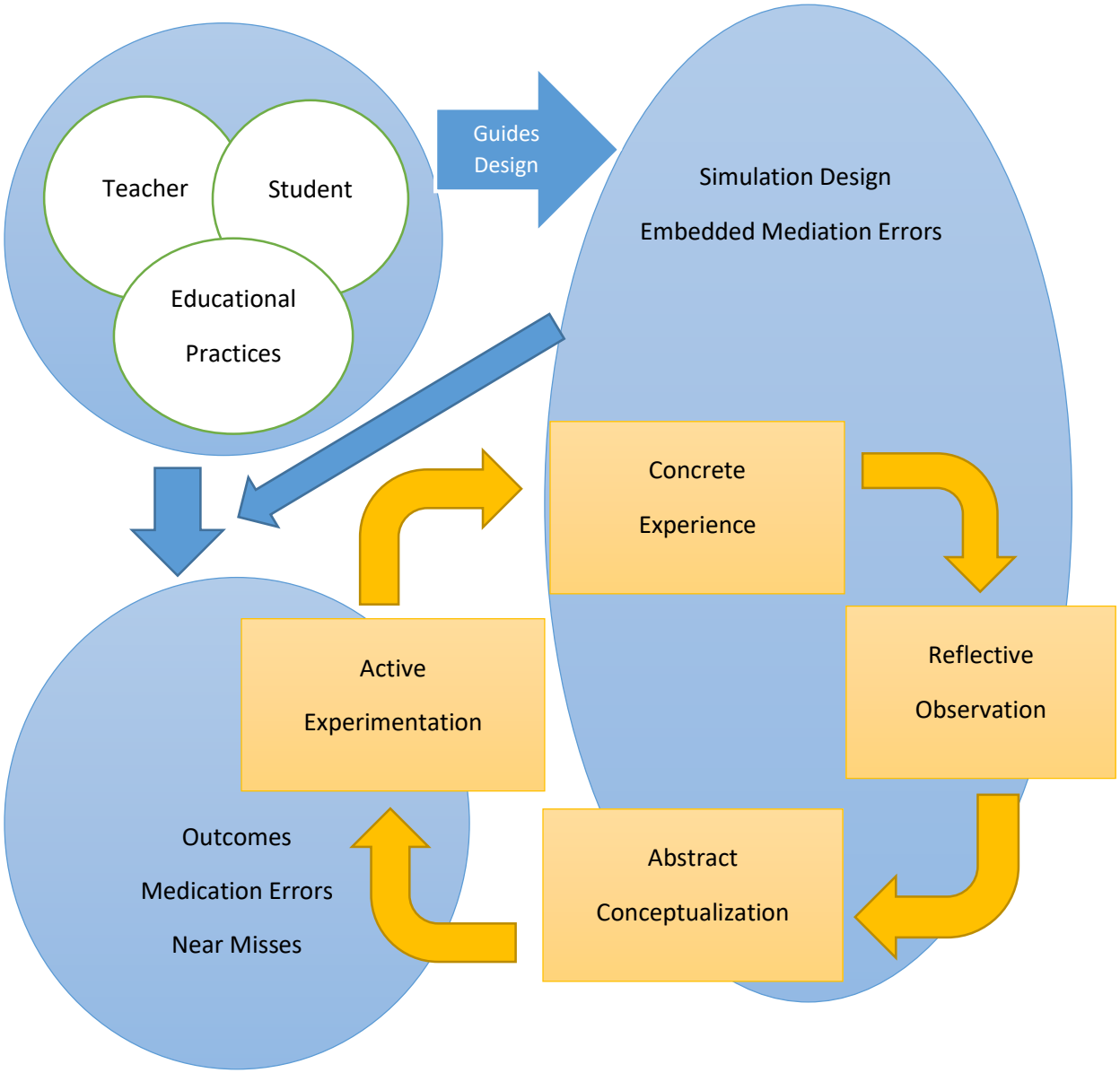
Appendix A

Figure 2: Adaptation of Kolb's Theory of Experiential Learning and Jefferies Nursing Education Simulation Framework



Appendix B

University of Maine IRB Approval

APPLICATION COVER PAGE

- *KEEP THIS PAGE AS ONE PAGE – DO NOT CHANGE MARGINS/FONTS!!!!!!!!!*
- *PLEASE SUBMIT THIS PAGE AS WORD DOCUMENT*

APPLICATION FOR APPROVAL OF RESEARCH WITH HUMAN SUBJECTS
Protection of Human Subjects Review Board, 400 Corbett Hall

(Type inside gray areas)
PRINCIPAL INVESTIGATOR: Deborah Eremita EMAIL: Deborah.eremita@maine.edu
CO-INVESTIGATOR: EMAIL:
CO-INVESTIGATOR: EMAIL:
FACULTY SPONSOR: Patricia Poirier EMAIL: Patricia.Poirier@maine.edu
(Required if PI is a student):
TITLE OF PROJECT: Examining the Relationship between the Use of Simulation in Nursing Education and Safety with Medication Administration in the clinical setting.
START DATE: 08/28/2017 PI DEPARTMENT: School of Nursing
FUNDING AGENCY (if any):

STATUS OF PI: FACULTY/STAFF/GRADUATE/UNDERGRADUATE (F,S,G,U)

1. If PI is a student, is this research to be performed:

☐	for an honors thesis/senior thesis/capstone?	☐	for a master's thesis?
X☐	for a doctoral dissertation?	☐	for a course project?
☐	other (specify)		

2. Does this application modify a previously approved project? NO (Y/N). If yes, please give assigned number (if known) of previously approved project:

3. Is an expedited review requested? Yes (Y/N).

Submitting the application indicates the principal investigator's agreement to abide by the responsibilities outlined in Section I.E. of the Policies and Procedures for the Protection of Human Subjects.

Faculty Sponsors are responsible for oversight of research conducted by their students. The Faculty Sponsor ensures that he/she has read the application and that the conduct of such research will be in accordance with the University of Maine's Policies and Procedures for the Protection of Human Subjects of Research. REMINDER: if the principal investigator is an undergraduate student, the Faculty Sponsor MUST submit the application to the IRB.

Email this cover page and complete application to UMRIC@maine.edu

****

FOR IRB USE ONLY Application # 2017-07-01 Review (F/E): E Expedited Category:
ACTION TAKEN:

X☐ Judged Exempt; category 1 & 2 Modifications required? Yes Accepted (date) 8/3/2017
☐ Approved as submitted. Date of next review: by Degree of Risk:
☐ Approved pending modifications. Date of next review: by Degree of Risk:
Modifications accepted (date):
☐ Not approved (see attached statement)
☐ Judged not research with human subjects

FINAL APPROVAL TO BEGIN 8/3/2017
Date

01/2017

Appendix C

Eastern Maine Medical Center IRB Approval

EASTERN MAINE MEDICAL CENTER
EMHS MEMBER

489 State Street
PO Box 404
Bangor, Maine 04402-0404
207.973.7000
www.emmc.org

September 8, 2017

Deborah Eremita, RN, MS
University of Maine, School of Nursing
226 Dunn Hall
Orono, ME 04469

Dear Ms. Eremita,,

Your research proposal, Examining the Relationship Between the Use of Simulation in Nursing Education and Safety with Medical Administration in the Clinical Setting (17-1-M-359) has been reviewed by myself, and Janet Berkel, EMMC Chief Compliance Officer, and was approved as expedited as of this date.

The research involves no more than minimal risk to the patients and you have indicated patient confidentiality will be maintained. Any injury to the subject, unanticipated problems in the research activity must be reported to the Institutional Review Board. Any proposed changes in the research activity must be approved prior to implementation.

Approval as expedited research is based on the following CFR 46 Expedited Categories:

Clinical studies of drugs and medical devices only when condition (a) or (b) is met. A) Research on drugs for which an investigational new drug application (21 CFR Part 312) is not required. (Note: Research on marketed drugs that significantly increases the risks or decreases the acceptability of the risks associated with the use of the product is not eligible for expedited review.) b) Research on medical devices for which (i) an investigational device exemption application (21 CFR Part 812) is not required; or (ii) the medical device is cleared/approved for marketing and the medical device is being used in accordance with its cleared/approved labeling.

Collection of blood samples by finger stick, heel stick, ear prick, venipuncture as follows: a) from healthy, non-pregnant adults who weigh at least 110 pounds. For these subjects, the amounts drawn may not exceed 550 ml in an 8 week period and collection may not occur more frequently than 2 times per week; or b) from other adults and children[2], considering the age, weight, and health of the subjects, the collection procedure, the amount of blood to be collected, and the frequency with which it will be collected. For these subjects, the amount drawn may not exceed the lesser of 50 ml or 3 ml per kg in an 8 week period and collection may not occur more frequently than 2 times per week.

Please use the File No 17-1-M-359 on documents and correspondence related to this study.

This approval will be announced to the members of the Institutional Review Board at its next regular meeting. I wish you every success in attaining the goals of this study.

Sincerely,

Glenn S. Rampe, M.D.
Chair, Institutional Review Board

/cw

Appendix D

Student Explanation of the Study and Data Collection

A requirement in the NUR 335 Adult Health III Clinical course for fall 2017 is the administration of medications to patients in the clinical setting. In preparation for this nursing skill, you have completed a dosage calculation course, a medication calculation exam on which you needed to get a grade of 100, a pharmacology course and skills testing on medication administration in the lab setting. I am conducting a study to determine if the use of simulation sessions on medication administration will decrease the incidence of medication errors in the clinical setting. I will be asking all of you to fill out questionnaires on medication administration today and again in three weeks (Sept. 18th). I will randomly select approximately half of you to participate in the medication simulations in groups of four, this will take approximately one hour. The simulations will take place on Wed. Sept. 6th in the simulation lab, room 126 Dunn Hall. To measure your performance in the simulation two raters (faculty not associated with any of the courses you are currently taking) will use the Creighton Competency Evaluation Instrument (C-CEI©). The C-CEI© is a tool specifically designed to provide quantitative evaluation of simulated clinical experiences of nursing students. Neither this rating nor the questionnaire will have any impact on your grade for the course. Please know that you may refuse to participate in the simulation at any time during the study without any penalty.

Please be aware that I (Deborah Eremita) will be collecting data on the questionnaires and simulation evaluating instrument, C-CEI© being used in this study to address the following questions:

1. What is the relationship between the use of traditional didactic lecture versus lecture with the addition of clinical simulation involving medication administration patient scenarios for nursing students in the level III Adult Health medical/surgical course and the student's ability to administer medications safely in the clinical setting?

2. What is the effect on the competency level of the student administering medications when simulation is added to the traditional didactic lecture as measured by the Adult Health Creighton Competency Evaluation Instrument (CCEI), the Medication Safety Knowledge Assessment (MSKA), and the Healthcare Professionals Patient Safety Assessment Curriculum Survey (HPPSACS) tools?

Each student will select an individual tracking identification number for all questionnaires and assessments thereby ensuring confidentiality. Please pick a four digit number and one letter that you will remember, for instance the last 4 digits of your phone number and your middle initial. Data collection information will be secured and stored electronically on a secure server at the University of Maine. Data will be entered only by your individual tracking numbers to maintain your confidentiality. The data will be destroyed in 2020. At the end of the semester, all students names enrolled in NUR 335 will be put into a raffle for 10 Dunkin Donuts gift cards valued at $10 each.
If you have questions, please let me know. Does anyone have any questions at this time?

Appendix E

Demographics Questionnaire

Please select an ID Code that is 4 numbers and 1 letter _____
(make sure you can remember your code)

What is your gender? _____ Male _____ Female

What is your age? _____

Please enter your ethnicity: _____ Caucasian

_____ Asian

_____ Hispanic

_____ African American

_____ American Indian

_____ Other

Status: _____ Single

_____ Divorced

_____ Married

_____ Married with children

Number of hours spent preparing for clinical: _____ 0 hours

_____ 1 hour

_____ 2 hours

_____ 3 hours

_____ 4 hours

_____ more than 4 hours

Appendix F

Student Simulation Information Sheet

Pt. #1: Carol Tones Age: 62
Height: 165.1 cm/ 5'5" Weight: 92 kg
Allergies: PCN
Physician: Dr. Michael Smertka Dx: Afib

HPI: Patient at home when she felt her chest flutter, patient states "it happened before when I had Afib" Pt called doctor's office and they instructed her to call 911. Pacer insertion done yesterday.
Social Hx: Drinks socially, Tobacco 2 ppd X 36 years, Retired 4th grade teacher**,** support: sister
IVs: NS 1 L @ TKO and Heparin 1200 Units/hr mixed as 25,000 Units/250 mL D5W
Labs: Ptt 15.2 INR 1.2 Glucose 135

Learning Objectives:

1. Perform physical shift assessment (e.g., VS, pain, etc) include line reconciliation.
2. Prepare medications to be administered (correct drug, dose, route and time)
3. Demonstrate proper technique in medication administration using the 6 rights of medication administration (Warfarin, Metformin and Cefazolin).
4. Demonstrate documentation of medications administered on the Medication Administration Record (MAR).

Pt. #2: Karen Johnson Age: 46
Height: 162.6 cm/ 5'4" Weight: 62 kg
Allergies: NKA
Physician: Dr. John Mack Dx: Metastatic cancer of the R lung

HPI: Patient reports severe pain in R chest. Two months ago, patient reported soreness in her chest, Chest X-ray and CT reveal a 4.6 X 3.4 cm nodule in the right chest. ? metastasis from squamous cell carcinoma of the anus 7 years ago.
Social Hx: Married for 25 years, drinks socially, denies Tobacco use, works part time as a secretary at Acadia Hospital. Support: husband.
IVs: D5W/0.45 NS & 20 mEq KCL @ 100 mL/hr
Labs: WBC 10.1 Hgb 8.6 Hct 26.1 RBC 2.8
Learning Objectives:

1. Perform physical shift assessment (e.g., VS, pain, etc) include line reconciliation.
2. Prepare medications to be administered (correct drug, dose, route and time)
3. Demonstrate proper technique in medication administration using the 6 rights of medication administration (Morphine, Lorazapam, Narcan).
4. Demonstrate documentation of medications administered on the Medication Administration Record (MAR).

Appendix G

Simulation Report Script

Carol Tones (simulation 1)

Time: 7 PM

Ms. Tones is a 62 year old African American female who was admitted with a diagnosis of Afib status post pacer/ICD yesterday.

She is in normal sinus rhythm, HR 64, BP 127/60, RR 18, SpO2 98 on R/A, Temp 38 C

Lung sounds slightly diminished in the bases.

She needs encouragement to use IS, up 1000 cc X10 q2hours while awake. She is on bedrest with BRP while on Heparin. She has been up to the bedside commode.

Bowel sounds present in all 4 quadrants; last BM yesterday before surgery; She had been NPO but has now advanced to a diabetic diet and is tolerating it well.

Labs are ptt 15.2, INR 1.2 and glucose 135

Left chest incision is clean, dry, and intact with sutures. Heparin was ordered at 1200 units/hour and with the ptt lab, I gave a bolus of 2300 units. NS is also infusing at TKO (30 mL) in R FA so there are 2 IV sites.

I have not been able to get to the Warfarin, metformin and cefazolin that has been ordered and is due now.

Karen Johnson (simulation 2)

Time: Noon

Thanks for covering for me, I am so hungry. Ms. Johnson is a 46 year old female who was admitted with pain due to a tumor in her R lung.

She is stable with a HR 78, BP

142/74, RR 22, SpO2 96 on 2 L via NC, Temp 37.5 C

Lung sounds are diminished on the right.

Labs are WBC 10.1, Hgb 8.6, Hct 26.1 and RBC 2.8

She has been having a lot of pain and anxiety due to her dx. I last medicated her with MS 2 mg IVP, a little over 2 hours ago and she has been resting. Bowel sounds are present in all 4 quadrants; last BM yesterday. I am headed to the cafeteria for lunch and will be back in 30 minutes or so.

Appendix H
Simulation for Patient Tones

Date: 5/14/17 **File Name: Med Administration 1**

Discipline: Med-Surg **Student Level: BSN Jr. Level 2nd semester**
Location: Simulation Lab **Location for Reflection: Debriefing Room**
Expected Simulation Run Time: 15 min
Guided Reflection Time: 30 min after completion of Simulation 2

Admission Date: (Yesterday) **Today's Date:** **Brief Description of Client** **Name: Carol Tones Gender: F Age: 62** **Race: Afr. Amer. DOB: 4/15/1955** **Weight: 92 kg Height: 165.1 cm / 5'5"** **Religion: Baptist Major Support: sister** **Phone: 555-5555** **Allergies: PCN** **Immunizations: up to date** **Attending Physician/Team: Dr. Michael Smertka** **Medical History:** **DM, A-fib, pacer** **History of Present illness:** **Patient at home when she felt her chest flutter, patient states "it happened before when I had Afib" Pt called doctor's office and they instructed her to call 911.** **Social History:** **Drinks socially** **Tobacco 2 ppd X 36 years** **Retired 4th grade teacher** **Primary Medical Diagnosis: Afib** **Surgeries/Procedures & Dates: pacer insertion (yesterday)** **Appendectomy age 9** **Cholecystectomy 5 years ago**	**Psychomotor Skills Required Prior to Simulation** **Head to toe assessment** **Medication Administration: PO, SC, IM, & IVPB routes** **Dosage Calculations for medications and Pump rates** **Cognitive Activities Required prior to Simulation:** **Review Henke book: Ch. 6 (pg 212-215, CH. 7 (pg 240-248, 260-264), and Ch 9 & 10.** **Taylor book: Ch 28 (pg. 836-840).**

Simulation Learning Objectives –Medication Administration 1

8. Perform physical shift assessment (e.g., head-to-toe or focused) including line reconciliation.

9. Prepare medications to be administered (correct drug, dose, route and time)

10. Demonstrate proper technique in medication administration using the 6 rights of medication administration (Warfarin, Metformin and Cefazolin).

11. Demonstrate documentation of medications administered on the Medication Administration Record (MAR).

Fidelity (choose all that apply to this simulation)

o **Setting/Environment** ○ ER • **Med-Surg** ○ Peds ○ ICU ○ OR / PACU ○ Women's Center ○ Behavioral Health ○ Home Health ○ Pre-Hospital ○ Other _____ **Simulator Manikin/s Needed: Susie** **Equipment attached to manikin:** ○ **Saline Lock 2 sites in R FA (1 with Heparin one with NS)** ○ **Secondary IV line NS running at TKO (30) cc/hr** ○ **IV pump X 2 Alaris** ○ Foley catheter _____cc output ○ PCA pump running	**Medications and Fluids** ○ **IV Fluids: NS 1 L bag at TKO** **NS 50 mL bags labeled Cefazolin** **Bag labeled Heparin 25000 Units/ 250 D5W** **• Oral Meds:** **Warfarin (Coumadin) 10 mg tabs** **Metformin(Glucophage) 500 mg tabs** ○ **IVPB:** **Cefazolin in premixed bag 50 ML NS** • IV Push: IM or SC:

○ **IVPB with Heparin running at 20 cc/hr** ○ 02 NC – set up not on mannikin ○ **ID band** / Allergy Band ○ Other: ○ ○ Equipment available in room ○ Bed pan ○ Foley kit ○ Straight Catheter Kit • **Incentive Spirometer** ○ **Fluids** ○ IV start kit ○ **IV tubing** ○ **IVPB Tubing X 2** ○ **IV Pump**	**Diagnostics** **Available** • **Labs** ○ X-rays (Images) ○ 12-Lead EKG ○ Other_____ **Documentation Forms in Sim EHR** • **Physician Orders** • **Admit Orders** • **Flow sheet** • **Medication Administration Record** ○ **Kardex** ○ **Graphic Record** ○ **Shift Assessment** ○ Triage Forms ○ Code Record ○ Anesthesia / PACU Record ○ **Standing (Protocol) Orders for Heparin** ○ Transfer Orders ○ Other_____ _____ **Recommended Mode for Simulation (i.e. manual, programmed, etc.)** **Manual simulation**

Roles / Guidelines for Roles

- **Primary Nurse**
- **Secondary Nurse** ○ Clinical Instructor • Family Member #1 ○ Family Member #2 ○ **Observer/s X 2**
- Recorder X2
- Physician / Advanced Practice Nurse ○ Respiratory Therapy ○ Anesthesia ○ Pharmacy ○ Lab
- ○ Imaging
- ○ Social Services ○ Clergy
- ○ Unlicensed Assistive Personnel
- ○ Code Team

Important Information Related to Roles

Scripted end of shift report outside patient room from RN leaving night shift to the primary and secondary nurse (on orientation).
Primary and secondary nurse begin morning assessment and medication administration.

Susie remote voice to answer questions posted by nurse. Patient to answer questions asked by the nurse (id. Identification information) and patient to ask questions about the medication being administered (ie, what is it, why getting it). Students should demonstrate the 6 rights of medication administration.

Recorders complete the observation checklist and are responsible for beginning the debriefing session

Wrong rate should be noted on the Heparin drip and allergy to PCN means use cefazolin with caution. Need to check on the reaction (rash).

Student Information Needed Prior to Scenario:

- **Has been oriented to simulator**
- **Understands guidelines /expectations for scenario**
- **Has accomplished all pre-simulation requirements**
- **All participants understand their assigned roles**
- **Has been given time frame expectations**
- **Other Show primary and secondary nurse the patient chart**

Report Students Will Receive Before Simulation

Time: 7 PM
Ms. Tones is a 62 year old African American female who was admitted with a diagnosis of Afib status post pacer/ICD yesterday.
She is in normal sinus rhythm, HR 64, BP 127/60, RR 18, SpO2 98 on R/A, Temp 38 C
Lung sounds slightly diminished in the bases. She needs encouragement to use IS, up 1000 cc X10 q2hours while awake. She is on bedrest with BRP while on Heparin.
Bowel sounds in all 4 quadrants; last BM yesterday; She had been NPO but has now advanced to a diabetic diet and is tolerating it well.
Labs are in the chart all WNL
Left chest incision is clean, dry, and intact with sutures. Heparin is infusing at 1200 units/hour and NS is infusing at TKO (30 mL) in R FA
I have not been able to get to the Warfarin, metformin and cefazolin that has been ordered and is due now.

Significant Lab Values (7 am) Ptt 15.2 INR 1.2 Glucose 135 **Physician Orders** Heparin 1200 Units/hr mixed as 25000 Units/250 mL D5W NS 1 L @ TKO Heparin protocol Telemetry Cefazolin (Ancef) 1 Gm in 50 mL NS IVPB infurse over 30 minutes q12 hours Warfarin (Coumadin) 10 mg PO daily Metfomin (Glucophage) 1000 mg PO BID Morphine sulfate 2 mg IV push q 2 hours prn pain BMP (Chem 7) qAM Titrate oxygen to keep $SpO_2 \geq 93$ Incentive spirometer q1-2 hours while awake Weight daily Bedrest w/bedside commode while on Heparin NPO adv as tol to Diabetes Diet **Call Orders** SBP less than 90 mm Hg or greater than 180 mm Hg HR less than 60 bpm or greater than 140 bpm Urine output less than 30 ml / hour in any 2 consecutive hours	

References, Evidence-Based Practice Guidelines, Protocols, or Algorithms Used For This Scenario: IV Heparin protocol

2007 NCLEX-RN Test Plan Categories and Subcategories

Choose all areas included in the simulation

Safe and Effective Care Environment

Management of Care

- Advance Directives
- Advocacy
- Case Management
- Client Rights
- Collaboration with Interdisciplinary Team
- Concepts of Management
- Confidentiality / Information Security
- Consultation
- Continuity of Care
- Delegation
- **Establishing Priorities**
- Ethical Practice
- Informed Consent
- Information Technology
- Legal Rights and Responsibilities
- Performance Improvement (QI)
- Referrals
- Resource Management
- Staff Education
- Supervision

Safety and Infection Control

- Accident Prevention
- Disaster Planning
- Emergency Response Plan
- Ergonomic Response Plan
- Error Prevention
- Handling Hazardous and Infectious Materials
- Home Safety
- Injury Prevention
- Medical and Surgical Asepsis
- **Reporting of Incident/Event**/ Irregular Occurrence/Variance
- Security Plan
- Standard /Transmission-Based / Other Precautions
- Use of Restraints/Safety Devices
- **Safe Use of Equipment**

Health Promotion and Maintenance

- Aging Process
- Ante/Intra/Postpartum and Newborn Care
- Developmental Stages and Transitions
- Disease Prevention
- Expected Body Image Changes
- Family Planning
- Family Systems
- Growth and Development
- Health and Wellness
- Health Promotion Programs
- Health Screening
- High Risk Behaviors
- Human Sexuality
- Immunizations
- Lifestyle Choices
- Principles of Teaching/Learning
- Self-Care
- **Techniques of Physical Assessment**

Psychosocial Integrity

- Abuse/Neglect
- Behavioral Interventions
- Psychopathology
- Religious and Spiritual Influences

Chemical and Other Dependencies
Coping Mechanisms
Crisis Intervention
Cultural Diversity
End of Life Care
Family Dynamics
Grief and Loss
Mental Health Concepts
on Health
Sensory/Perceptual Alterations
Situational Role Changes
Stress Management
Support Systems
Therapeutic Communications
Therapeutic Environment
Unexpected Body Image Changes

Physiologic Integrity

Basic Care and Comfort

Assistive Devices
Complementary and Alternative Therapies
Elimination
Mobility/Immobility
Non-Pharmacological Comfort Interventions
Nutrition and Oral Hydration
Palliative/Comfort Care
Personal Hygiene
Rest and Sleep

Pharmacological and Parenteral Therapies

Adverse Effects/Contraindications
Blood and Blood Products
Central Venous Access Devices
Dosage Calculation
Expected Effects/Outcomes
Medication Administration
Parenteral/Intravenous Therapies
Pharmacological Agents/Actions
Pharmacological Interactions
Pharmacological Pain Management
Total Parenteral Nutrition

Reduction of Risk Potential

Diagnostic Tests
Lab Values
Monitoring Conscious Sedation
Potential for Alterations in Body Systems
Potential for Complications of Diagnostic Tests/Treatments/Procedures
Potential for Complications from Surgical Procedures and Health Alterations
System Specific Assessments
Therapeutic Procedures
Vital Signs

Physiologic Adaptation

Alterations in Body Systems
Fluid and Electrolyte Imbalances
Hemodynamics
Illness Management
Infectious Diseases
Medical Emergencies
Pathophysiology
Radiation Therapy
Unexpected Response to Therapies

Scenario Progression Outline

Timing (approximate)	**Manikin Actions**	**Expected Interventions**	**May Use the Following Cues**
5 minutes	Temp 38º C NSR 64 bpm Resp 18/min BP 127/62 SpO2 98% Lung sounds normal diminished in bases volume 3	Head to toe assessment VS Complete line reconciliation: detect wrong rate of heparin infusing. Ask about diet and how feeling? Question about allergies	Patient cue: I suppose you need to check me out since you just started Is it time for my medications? If questioned on med allergies: rash with PCN
14 minutes	VS remain WNL	Prepare mediations: Metformin 2 tab Warafarin 1 tab 1 Gm cefazolin (1 mL) mixed in NS Administer the PO medications after checking wrist band If had cefazolin before okay to give. (follow 6 rights)	**Role member providing cue:** **Pt. Cue:** **What are you giving me?** **Why am I getting (name of medication)?** **If asked ok for cefazolin.**
15 Minutes		Document medication on MAR in EHR.	

Debriefing / Guided Reflection Questions for This Simulation

Questions to ask the participants the following question.

a. How did you feel throughout the simulation experience?

b. What went well?

c. Were there any challenges?

d. Describe the patient shift assessment including line reconciliation. Was there anything you would change or add? Ask observers if there was anything they observed.

e. Describe your technique on preparing and administering the medications? Was there anything you would change or add? Ask observers if there was anything they observed.

f. Review 6 rights of medication administration. Tell me about your documentation of the medications. Ask observers if there was anything they observed.

g. Is there anything you would like to add?

Observation Checklist

Carol Tones – A fib/pacer insertion – Medication Administration

Learning Objective	Behavior	Met:
Demonstrate appropriate shift assessment of newly assigned patient including line reconciliation	Performs VS and a complete head-to-toe assessment. Notes Heparin infusing at incorrect rate. Asks patient about allergies	
2.Prepare medications to be administered (correct drug, dose, route and time)	Checks medication orders Checks metformin, and warfarin for correct med, dose, route and time. Mixes Ancef 1 Gm in 50 mL D5w. Preforms correct calculations for Ancef.	
Demonstrate proper technique in medication administration (Warfarin, Metformin and Ancef)	Checks wrist band to identify patient, scans wristband and medication bar code. Administers PO medications with fluid. Hangs Ancef on NS IV. And sets pump to infuse 50 mL/hr. Monitors patient for allergic rxn.	
3.Demonstrate documentation of medications administered on the MAR	Documents medication given on the MAR in the EHR.	

Appendix I
Simulation for Patient Johnson

Date: 5/16/17 **File Name: Med Administration 2**

Discipline: Med-Surg **Student Level: BSN Jr. Level 2nd semester**
Location: Simulation Lab **Location for Reflection: Debriefing Room**
Expected Simulation Run Time: 15 min
Guided Reflection Time: 30 min after completion of Simulation 2

Admission Date: (Yesterday) **Today's Date:** **Brief Description of Client** **Name: Karen Johnson Gender: F Age: 46** **Race: Cauc.** **Weight: 62 kg Height: 162.6 cm / 5'4"** **DOB: 7/22/71** **Religion: Catholic Major Support: husband** **Phone: 555-5555** **Allergies: NKA** **Attending Physician/Team:** **Dr. John Mack** **Medical History:** **R lung malignancy** **History of Present illness:** Patient reports severe pain in R chest. Two months ago, patient reported soreness in her chest, Chest X-ray and CT reveal a 4.6 X 3.4 cm nodule in the right chest. ? metastasis from squamous cell carcinoma of the anus 7 years ago. **Social History:** Married for 25 years Drinks socially Denies Tobacco use Works part time as a secretary at Acadia Hospital **Primary Medical Diagnosis:** Metastatic Cancer of the R lung **Surgeries/Procedures & Dates:** Colectomy 2010 Hysterectomy 2008 Laproscopic oophorectomy 2009	**Psychomotor Skills Required Prior to Simulation** **Head to toe assessment** **Medication Administration: PO, SC, IM, & IVP routes** **Dosage Calculations medication administration** **Cognitive Activities Required prior to Simulation:** **Review Henke book: Ch. 5 (pg 131-147, and Ch 9 & 10.** **Taylor book: Ch 28 (pg. 812-823, 832-835, 841-845).**

Simulation Learning Objectives –Medication Administration 2

1. Perform pain assessment.

2. Prepare medications to be administered (correct drug, dose, route and time)

3. Demonstrate proper technique in medication administration using the 6 rights of medication administration (Morphine, Lorazapam, Narcan).

4. Demonstrate documentation of medications administered on the Medication Administration Record (MAR).

Fidelity (choose all that apply to this simulation)

o **Setting/Environment** o ER
• **Med-Surg** o Peds o ICU o OR / PACU o Women's Center o Behavioral Health o Home Health o Pre-Hospital
o Other _____

Simulator Manikin/s Needed: Susie

Equipment attached to manikin:
o **Saline Lock in R FA with D5 0.45 NS & 20 mEq KCL @ 100 mL/hr infusing**
o Secondary IV line
o **IV pump with above IV infusing**
o Foley catheter _____cc output
o PCA pump running
o IVPB
o **02 NC – set up not on manikin at 2LPM**
o **ID band with wrong DOB and MRN** / Allergy Band
o Other:
o
o Equipment available in room
o Bed pan o Foley kit
o **Straight Catheter Kit** • **Incentive Spirometer** o **Fluids**
o IV start kit

o **IV tubing** o IVPB Tubing o **IV Pump**

Medications and Fluids o
IV Fluids: D5 ½ NS & 20 mEq KCL infusing at 100 mL/hr
NS 50 mL bags
• **Oral Meds:**
Percocet 5/325 tabs
o IVPB:
• **IV Push:**
Morphine 2mg/mL vials (cartridges)
Lorazapam 2mg/mL vial
Narcan 0.1 mg vial
IM or SC:

Diagnostics Available • Labs
o X-rays (Images)
o 12-Lead EKG
o Other_____

Documentation Forms in Sim EHR
• **Physician Orders**
• **Admit Orders**
• **Flow sheet**
• **Medication Administration Record** o **Kardex with DOB listed as 4/15/76 and MRN different from wristband**
o **Graphic Record**
o **Shift Assessment** o Triage Forms o Code Record
o Anesthesia / PACU Record o Standing (Protocol) Orders for Heparin o Transfer Orders
o Other_____

Roles / Guidelines for Roles

- **Primary Nurse**
- **Secondary Nurse** ○ Clinical Instructor • Family Member #1 ○ Family Member #2 ○ **Observer/s X 2**
- Recorder X2
- Physician / Advanced Practice Nurse ○ Respiratory Therapy ○ Anesthesia ○ Pharmacy ○ Lab
- ○ Imaging
- ○ Social Services ○ Clergy
- ○ Unlicensed Assistive Personnel
- ○ Code Team

Important Information Related to Roles

Scripted report outside patient room from RN to nurses covering for lunch break. Patient calls out for pain medications and primary and secondary nurse begin pain assessment and medication administration.

Susie remote voice to answer questions posted by nurse. Patient to answer questions asked by the nurse (id. Identification information, DOB (7/22/71) and MR number (TBD) do not match the wristband) and patient to ask questions about the medication being administered (ie, what is it, why getting it).
Students should demonstrate the 6 rights of medication administration.
Lorazapam is ordered PO but will be IV in pyxis.

Recorders complete the observation checklist and are responsible for beginning the debriefing session

Student needs to check that MS is compatible with KCL.

Student Information Needed Prior to Scenario:

Has been oriented to simulator
Understands guidelines /expectations for scenario

Has accomplished all pre-simulation requirements

All participants understand their assigned roles

Has been given time frame expectations
Other Show primary and secondary nurse the patient chart

Report Students Will Receive Before Simulation

Time: Noon
Thanks for covering for me, I am so hungry. Ms. Johnson is a 46 year old female who was admitted with pain due to a tumor in her R lung.
She is stable with a HR 78, BP 142/74, RR 22, SpO2 96 on 2 L via NC, Temp 37.5 C
Lung sounds are diminished on the right. She has been having a lot of pain and anxiety due to her dx. I last medicated her with MS 2 mg IVP, 2 hours ago and she has been resting. Bowel sounds are present in all 4 quadrants; last BM yesterday. I am headed to the cafeteria for lunch and will be back in 30 minutes or so.

Significant Lab Values **WBC 10.1** **Hgb 8.6 (L)** **Hct 26.1 (L)** **RBC 2.8 (L)** **Physician Orders** D5W/0.45NS & 20 mEq KCL @ 100 mL/hr Morphine Sulfate 2 mg IVP q 5 min for breakthrough pain Morphine Sulfates 6 mg q 1 hr IVP prn severe pain Narcan 0.1 mg IVP q 5 min prn sedation Lorazapam 0.5 mg 1 tab q 6 hr prn anxiety O2 via NC to keep $SpO_2 \geq 90\%$ Straight cath prn urine retention DAT Amb ad lib **Call Orders** SBP less than 90 mm Hg or greater than 180 mm Hg HR less than 60 bpm or greater than 140 bpm Urine output less than 30 ml / hour in any 2 consecutive hours	

References, Evidence-Based Practice Guidelines, Protocols, or Algorithms Used For
This Scenario: IV medication protocol

2007 NCLEX-RN Test Plan Categories and Subcategories

Choose all areas included in the simulation

Safe and Effective Care Environment

Management of Care

- Advance Directives
- Advocacy
- Case Management
- Client Rights
- Collaboration with Interdisciplinary Team
- Concepts of Management
- Confidentiality / Information Security
- Consultation
- Continuity of Care
- Delegation
- **Establishing Priorities**
- Ethical Practice
- Informed Consent
- Information Technology
- Legal Rights and Responsibilities
- Performance Improvement (QI)
- Referrals
- Resource Management
- Staff Education
- Supervision

Safety and Infection Control

- Accident Prevention
- Disaster Planning
- Emergency Response Plan
- Ergonomic Response Plan
- Error Prevention
- Handling Hazardous and Infectious Materials
- Home Safety
- Injury Prevention
- Medical and Surgical Asepsis
- **Reporting of Incident/Event**/ Irregular Occurrence/Variance
- Security Plan
- Standard /Transmission-Based / Other Precautions
- Use of Restraints/Safety Devices
- **Safe Use of Equipment**

Health Promotion and Maintenance

- Aging Process
- Ante/Intra/Postpartum and Newborn Care
- Developmental Stages and Transitions
- Disease Prevention
- Expected Body Image Changes
- Family Planning
- Family Systems
- Growth and Development
- Health and Wellness
- Health Promotion Programs
- Health Screening
- High Risk Behaviors
- Human Sexuality
- Immunizations
- Lifestyle Choices
- Principles of Teaching/Learning
- Self-Care
- **Techniques of Physical Assessment**

Psychosocial Integrity

- Abuse/Neglect
- Behavioral Interventions
- Chemical and Other Dependencies
- **Coping Mechanisms**
- Crisis Intervention
- Cultural Diversity
- End of Life Care
- Family Dynamics
- Grief and Loss
- Mental Health Concepts
- Psychopathology
- Religious and Spiritual Influences on Health
- Sensory/Perceptual Alterations
- Situational Role Changes
- Stress Management
- Support Systems
- **Therapeutic Communications**
- Therapeutic Environment
- Unexpected Body Image Changes

Physiologic Integrity

Basic Care and Comfort

- Assistive Devices
- Complementary and Alternative Therapies
- Elimination
- Mobility/Immobility
- Nutrition and Oral Hydration
- Palliative/Comfort Care
- Personal Hygiene
- Rest and Sleep
- **Non-Pharmacological Comfort Interventions**

Pharmacological and Parenteral Therapies

- **Adverse Effects/Contraindications**
- Blood and Blood Products
- Central Venous Access Devices
- **Dosage Calculation**
- **Expected Effects/Outcomes**
- **Medication Administration**
- **Parenteral/Intravenous Therapies**
- **Pharmacological Agents/Actions**
- **Pharmacological Interactions**
- **Pharmacological Pain Management**
- Total Parenteral Nutrition

Reduction of Risk Potential

- Diagnostic Tests
- **Lab Values**
- Monitoring Conscious Sedation
- Potential for Alterations in Body Systems
- Potential for Complications of Diagnostic Tests/Treatments/Procedures
- Potential for Complications from Surgical Procedures and Health Alterations
- **System Specific Assessments**
- Therapeutic Procedures
- **Vital Signs**

Physiologic Adaptation

- **Alterations in Body Systems**
- Fluid and Electrolyte Imbalances
- Hemodynamics
- Illness Management
- Infectious Diseases
- Medical Emergencies
- Pathophysiology
- Radiation Therapy
- Unexpected Response to Therapies

Scenario Progression Outline

Timing (approximate)	**Manikin Actions**	**Expected Interventions**	**May Use the Following Cues**
5 minutes	Temp 37.5º C HR 78 bpm Resp 22/min BP 142/74 SpO2 96% Lung sounds normal diminished on right volume 3	Pain assessment VS Ask about pain level Assess for anxiety	Patient cue: I am having a lot of pain (rate it a 6 or 7) Is it time for my pain medications? Also demonstrate anxiety, asking lots of questions and altered breathing pattern. State that you have anxiety if asked. You will also want Morphine and Ativan. "I want the meds in IV"
14 minutes	VS increase in HR to 85, BP to 148/78 and Resp to 26	Prepare mediations: MS 2 mg IVP Lorazapam 0.5 mg tablet (will come up as IV in the pyxis, it needs to be PO- call pharmacy) Administer the PO medication after checking wrist band (wrong DOB & MRN on wrist band). Administer MS IVP after checking compatibility with KCL. Push med over 2 min.	**Role member providing cue:** **Pt. Cue:** **What are you giving me?** **Why am I getting (name of medication)?** May continue to be anxious.

15 Minutes		Document medication on MAR in EHR.	

Debriefing / Guided Reflection Questions for This Simulation

Questions to ask the participants the following question.

h. How did you feel throughout the simulation experience?

i. What went well?

j. Were there any challenges?

k. Describe the patient's pain assessment. Was there anything you would change or add? Ask observers if there was anything they observed.

l. Describe your technique on preparing and administering the medications? Was there anything you would change or add? Ask observers if there was anything they observed.

m. Review 6 rights of medication administration. Tell me about your documentation of the medications. Ask observers if there was anything they observed.

n. Is there anything you would like to add?

Observation Checklist

Karen Johnson – R Lung Cancer – Medication Administration

Learning Objective	**Behavior**	**Met:**
Demonstrate appropriate pain assessment.	Performs compete pain assessment including onset, location, duration, characteristics, factors affecting pain and severity.	
5. Prepare medications to be administered (correct drug, dose, route and time)	Checks medication orders Checks Morphine and Lorazapam for correct med, dose, route and time. Checks compatibility of MS and KCL	
Demonstrate proper technique in medication administration (Morphine and Lorazapam).	Checks wrist band to identify patient, scans wristband and medication bar code (DOB and MRN do not match the MAR). Administers PO medication with fluid. Pushes MS in port over 23 minutes, flushes with 10 mL NS before and after IVP Monitors patient for allergic rxn.	
6. Demonstrate documentation of medications administered on the MAR	Documents medication given on the MAR in the EHR.	

Appendix J

Medication Safety Knowledge Assessment

4 Digits 1 Letter ID Code #: _____

Today's Date: _____ Clinical Instructor:_____

Directions: Please **circle** the correct answer. There are 5 pages to this MSKA.

1. The nurse has an order to administer polymixin two drops OD. The nurse will administer the drug:

    a. every morning
    b. once a day
    c. in the left eye
    d. in the right eye

2. A physician's order reads: "Heparin 2,500 units subcutaneously bid." Heparin is available 5,000 units/mL. How many mLs should the nurse administer?

    a. 0.5 mL
    b. lmL
    c. 1.5 mL
    d. 2 mLs

3. A verbal order should only be accepted by the nurse:

    a. in an emergency
    b. when the prescriber is too busy to get on the computer
    c. in an emergency or when under sterile conditions
    d. when the nurse has computer access

4. When administering medications to a patient, the nurse should:

    a. provide a website for the patient to learn more about the medication
    b. explain the name of the medication, the indication for its use, and possible side effects
    c. give the patient an information sheet to read on the medication
    d. provide as little information as possible so the patient does not get confused

5. The nurse is administering a sustained-release pill to the client; however, the client states that it is hard to swallow a large pill. The nurse's best course of action would be to:

    a. split the pill in half and have the client take half at a time
    b. call the healthcare provider to get the order changed
    c. dissolve the pill in water, so that the client can swallow it
    d. hold the medication until the healthcare provider makes rounds

6. The patient is ordered: Amoxicillin 250 mg po bid. The pharmacy only has available an Amoxicillin 500 mg tablet. The nurse will:

- **a. administer 1/2 the tablet**
- **b. administer 2 tablets**
- **c. send it back to the pharmacy for a replacement dose**
- **d. call the healthcare provider to order a different medication**

7. When accepting a telephone order the nurse should do all <u>EXCEPT</u>:

- **a. validate the patient's name and date of birth**
- **b. identify yourself and the prescriber prior to accepting the order**
- **c. repeat back the telephone order**
- **d. write/enter the order on the chart and read back the order**

8. The nurse is having difficulty reading the physician's order on the chart. The nurse knows that this physician is busy and hates to be bothered. The nurse should:

- **a. contact the physician and ask to have the order clarified prior to administering it**
- **b. ask if the charge nurse is able to read the order**
- **c. contact the pharmacy to further clarify the order**
- **d. ask if the patient has taken this medication before and if the dose is correct**

9. An adverse drug reaction is evidenced by:

- **a. an allergic reaction following the incorrect administration of an antibiotic**
- **b. respiratory arrest after an overdose of sleeping medicine**
- **c. a medication error that results in unexpected patient harm**
- **d. an untoward reaction to a medication given in the proper manner**

10. Which of the following medications should NOT be crushed?

- **a. Metroprolol (Lopressor) 25 mg/tab**
- **b. Furosemide (Lasix) 40 mg/tab**
- **c. Diltiazem SR (Cardizem) 150 mg/tab**
- **d. Acetaminophen (Tylenol) 500 mg/tab**

11. Which medication order is written correctly?

- **a. Metoprolol 25 mg by mouth QD**
- **b. Metoprolol 25 mg po daily**
- **c. Metoprolol 25 milligrams by mouth QD**
- **d. Metoprolol 25 mg po QD**

12. The electronic medication administration record (eMAR) reads:

Humulin Insulin 100 units/mL
Accucheck q 6 hours
Administer 4 units subcutaneously with each meal and at HS

How much insulin should the patient receive at bedtime?

a. 4 units
b. 6 units
c. 12 units
d. 100 units

13. When administering medications to a patient, the nurse should do all EXCEPT:

a. ask the patient's name and room number, and confirm the information on the identification band
b. confirm the patient's allergy information
c. ask the patient to state their name and birthdate and check the patient's identification band
d. compare the patient's name and birthdate on the identification band with the medication administration record

14. When administering medications for two patients, the nurse should:

a. prepare medications for one patient at a time
b. label all syringes with the patient's room number
c. ask another nurse to administer medications to one of the patients
d. identify each patient using one patient identifier

15. If the nurse believes an ordered medication may be wrong for a particular patient, the nurse should:

a. contact the healthcare practitioner and receive clarification prior to administering the medication to the patient
b. administer the medication since it is likely that the healthcare practitioner wanted the patient to receive this medication
c. hold the medication, and make a notation in the patient's chart as to why it was held
d. contact the nursing supervisor to receive clarification about whether to administer the medication to the patient

16. When preparing oral medications for administration through a PEG (feeding) tube, the nurse should:

a. crush medications prior to entering patient's room
b. mix all crushed medications together with 30 mL water
c. use only liquid medications
d. crush each medication individually at the patient's bedside

17. Medication errors are often defined as:

- **a. unintentional mistakes made when prescribing a medication that results in serious patient harm**
- **b. wrong medications being given at the wrong time to the wrong patient**
- **c. unusual circumstances that occur during the administration of a medication that ultimately results in patient death**
- **d. unintentional mistakes that involve the prescription, transcription, dispensing, administration, or monitoring of a drug**

18. To measure and administer 0.5 mL of an oral liquid antibiotic, the nurse should use a(n):

- **a. dosage cup**
- **b. teaspoon**
- **c. oral syringe**
- **d. tuberculin syringe**

19. The patient has an order for 2 tablespoons of Milk of Magnesia. The nurse knows that the equivalent measure to this amount is:

- **a. 15 mL**
- **b. 30 mL**
- **c. 45 mL**
- **d. 60 mL**

20. When a vesicant (irritating) medication leaks from an IV site into surrounding tissue, this is called:

- **a. anasarca**
- **b. anaphylaxis**
- **c. extravasation**
- **d. exsanguination**

21. Which medication order is written correctly?

- **a. ZOLOFT 50 mg po daily**
- **b. ZOLOFT 50 mg daily**
- **c. ZOLOFT 50 mg po QD**
- **d. ZOLOFT 50.0 mg po QD**

22. If a nurse is interrupted during medication administration, the best course of action is

- **a. leave the medication at the patient's bedside for the patient to self-administer**
- **b. ask a family member to administer the medication**
- **c. give the medication to another nurse to administer**
- **d. take the medication and return to administer when able**

23. Which medication order is written correctly?

- **a. Digoxin 0.125 mg po daily**
- **b. Digoxin . 125 mg po daily**
- **c. Digoxin . 125 mg po qd**
- **d. Digoxin 0.125 mg po qd**

24. Preventable medication errors are usually:

- **a. rare**
- **b. due to careless practitioners**
- **c. manifested as an allergic reaction**
- **d. multi-factorial in nature**

25. High-alert medications:

- **a. are medications involved in the most errors**
- **b. require special precautions by practitioners**
- **c. are costly to the patient**
- **d. are less harmful than high-risk medications**

Appendix K

Permission for Medication Safety Knowledge Assessment

From: Bette Mariani <bette.mariani@villanova.edu> 5/30/2017 2:21:...
Subject: Re: Permission to use survey tool (MSKA)
To: **Deborah Eremita**
Cc: Bette Mariani <bette.mariani@villanova.edu>

Dear Deborah:

I do not see that this would be a problem. The MSKA was mostly a knowledge/critical thinking assessment of students through the use of a multiple-choice question test. We used it as a criterion-referenced test with a cut score pass rate, as opposed to a total norm referenced score. I am just back from vacation, so give me a few days and I will get the MSKA to you with a statement about the reliability (although that should be in our article). If you do not hear from me by the end of the week, please remind me. We start summer classes tomorrow, so I am immersed in getting ready for the start of the semester.

Thank you for your interest in the MSKA, and I am really anxious to hear about your study.

Bette Mariani, PhD, RN
Associate Professor of Nursing
Villanova University College of Nursing
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800 E. Lancaster Avenue
Villanova, PA 19085
Office: 610-519-6354

E-mail: Bette.Mariani@villanova.edu

From: Deborah Eremita <Deborah_Eremita@umit.maine.edu>
Date: Tuesday, May 30, 2017 at 1:59 PM
To: Bette Mariani <bette.mariani@villanova.edu>
Subject: Permission to use survey tool (MSKA)

Appendix L

Healthcare Professionals Patient Safety Assessment

Curriculum Survey

Instructions

Circle the number on the answer sheet that corresponds to your level of agreement with the following statements:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. Making errors in healthcare in inevitable.	1	2	3	4	5
2. Competent healthcare professionals do not make medical errors that lead to patient harm.	1	2	3	4	5
3. Healthcare professionals should routinely spend part of their professional time working to improve patient care.	1	2	3	4	5
4. Only physicians can determine the causes of a medical error.	1	2	3	4	5
5. Healthcare professionals should not tolerate uncertainty in patient care.	1	2	3	4	5
6. The culture of healthcare makes it easy for healthcare professionals to deal constructively with errors.	1	2	3	4	5
7. Learning to improve patient safety is an appropriate use of time in health programs in school.	1	2	3	4	5
8. Healthcare professionals routinely share information about medical errors and what caused them.	1	2	3	4	5
9. In my clinical experiences so far, faculty and staff communicate to me that the patient safety is a high priority.	1	2	3	4	5
10. Healthcare professionals routinely report medical errors.	1	2	3	4	5
11. Reporting systems do little to reduce future errors.	1	2	3	4	5
12. Physicians should be the healthcare professionals that report errors to an affected patient and their family.	1	2	3	4	5
13. Effective responses to errors focus primarily on the healthcare professional involved.	1	2	3	4	5
14. If there is no harm to a patient, there is no need to address an error.	1	2	3	4	5
15. If I saw a medical error, I would keep it to myself.	1	2	3	4	5

16. Most errors are due to things that healthcare professionals can't do anything about.	1	2	3	4	5
17. After an error occurs, an effective strategy is to work harder to be more careful.	1	2	3	4	5
18. There is a gap between what we know as 'best care' and what we provide on a day to day basis.					

Instructions

Circle the number on the answer sheet that corresponds to your level of comfort with doing the following:

	Very Uncomfortable	**Uncomfortable**	**Neutral**	**Comfortable**	**Very Comfort.**
19. Accurately completing an incident report.	1	2	3	4	5
20. Analyzing a case to find the causes of an error.	1	2	3	4	5
21. Supporting and advising a peer who must decide how to respond to an error.	1	2	3	4	5
22. Disclosing an error to a faculty member.	1	2	3	4	5
23. Disclosing an error to another healthcare professional.	1	2	3	4	5

Instructions

Circle the number on the answer sheet that corresponds to your best answer:
In the past:

24. Have you observed a medical error in your clinical experiences?	1) Yes	2) No
25. Have you disclosed a medical error to a faculty member?	1) Yes	2) No
26. Have you disclosed a medical error to a staff member?	1) Yes	2) No
27. Have you disclosed a medical error to a fellow student?	1) Yes	2) No
28. Have you reported an error using an incident report?	1) Yes	2) No
29. Did your nursing program of study provide sufficient coverage on the topic of patient safety?	1) Yes	2) No

COMMENTS:

Permission to use these materials is granted with acknowledgement

Chenot, T. & Daniel, L. (2010). Frameworks for Patient Safety in the Nursing Curriculum. *Journal of Nursing Education, 49*(10), 559-568.

Appendix M

Permission for Healthcare Professional Patient Safety Assessment Curriculum Survey

From: "Chenot, Theresa" <tchenot@ju.edu> 6/20/2017 6:29:03 PM

Subject: Re: Permission to use survey tool

To: **Deborah Eremita**

Cc: "Chenot, Theresa" <tchenot@ju.edu>
"Wendy.Madigosky@ucdenver.edu" <Wendy.Madigosky@ucdenver...

Hi Deborah - thank you for your interest in the instrument. Yes, you have my permission with acknowledgements. I have included Dr. Wendy Madigosky, PI of the original instrument, for her permission too. Please keep us updated on your findings/publications. Here is the link to my doctoral dissertation. The instrument is on page 134. Teri

http://digitalcommons.unf.edu/etd/236/

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Appendix N

Creighton Competency Evaluation Instrument

Student Name:	0= Does not demonstrate competency	Date: /
Staff Nurse Instructor Name:	1 = Demonstrates competency	
	NA= Not applicable	

ASSESSMENT	Circle Appropriate Score tor at Applicable Criteria ■ tf not applicable, circle NA	COMMENTS:
1. Obtains Pertinent Data	0 1 NA	
2. Performs Follow-Up Assessments as Needed	0 1 NA	
3. Assesses the Environment in an Orderly Manner	0 1 NA NA	
COMMUNICATION		
4. Communicates Effectively with Intra/Interprofessional Team (TeamSTEPPS, SBAR, Written Read Back Order)	0 1 NA	
5. Communicates Effectively with Patient and Significant Other (verbal, nonverbal, teaching)	0 1 NA	
6. Documents Clearly, Concisely, & Accurately	0 1 NA	
7. Responds to Abnormal Findings Appropriately	0 1 NA	
CLINICAL JUDGMENT		
9. Interprets Vital Signs (T.P, R, BP, Pain)	0 1 NA	
10. Interprets Lab Results	0 1 NA	
11. Interprets Subjective/Objective Data (recognizes relevant from irrelevant data)	0 1 NA	
12. Prioritizes Appropriately	0 1 NA	
13. Performs Evidence Based Interventions	0 1 NA	
14. Provides Evidence Based Rationale for Interventions	0 1 NA	
15. Evaluates Evidence Based Interventions and Outcomes	0 1 NA	
16. Reflects on Clinical Experience	0 1 NA	
17. Delegates Appropriately		
PATIENT SAFETY		
18. Uses Patient Identifiers	0 1 NA	
19. Utilizes Standardized Practices and Precautions Including Hand Washing	0 1 NA	
20. Administers Medications Safely	0 1 NA	
21. Manages Technology and Equipment	0 1 NA	
22. Performs Procedures Correctly	0 1 NA	
23. Reflects on Potential Hazards and Errors	0 1 NA	

COMMENTS	Total:	
Revised for DEU use 8/20/2013	Tota Applicable Items:	

Appendix O

Training Tool for Creighton Competency Evaluation Instrument

ASSESSMENT Discussion Worksheet
Obtains pertinent subjective data General patient status Asks about allergies
Obtains pertinent objective data Vital signs and pain assessment Checks medication order
Assesses the Environment in an Orderly Manner Checks IV pump, tubing and if water in the room
COMMUNICATION Discussion Worksheet
Communicates effectively with patient Explains what medication giving and why
Documents clearly and accurately Documents on MAR correctly
Responds to abnormal findings appropriately Toner: wrong rate on Heparin drip, question if OK to give cefazolin with allergy to PCN Johnson: wrong DOB on wristband, Lorazapam will be ordered PO but pyxis delivers IV
Clinical Judgment
Prioritizes Appropriately
Completes assessment before medication administration
Performs Evidence Based Interventions Follows 6 rights of medication administration (pt, drug, dose, route, time, doc)
Patient Safety
Uses Patient Identifiers
Checks name, DOB and Medical Record Number
Uses Standard Precautions
Washes hands Maintains sterility with IV administration
Administer Medication Safely
Follows 6 rights of medication administration
Manages Technology and Equipment Uses IV pump correctly and documents in EHR Tutor
Performs procedures Correctly Ignores distraction from outside source

Appendix P

Clinical Medication Administration Assessment Tool

ID Code/Time	# of Meds/Route	Adm. Prob. Code 0 = No problems 1= Rt. PT 2= Rt. Drug 3= Rt. Dose 4=Rt. Time 5=Rt. Route 6= Rt. Doc.	Description of rights missed	Comments
	_____PO _____SC _____IM _____IVP _____IVPB _____Top ___Main. IV			
	_____PO _____SC _____IM _____IVP _____IVPB _____Top ___Main. IV			
	_____PO _____SC _____IM _____IVP _____IVPB _____Top ___Main. IV			
	_____PO _____SC _____IM _____IVP _____IVPB _____Top ___Main. IV			

BIOGRAPHY OF THE AUTHOR

Deborah Eremita was born in Bangor, Maine on March 10, 1961. The daughter of William and Jane Chapman, she was raised in Brewer, Maine. After graduating from Brewer High School in 1979, she attended the University of Maine in Orono. She married her husband Mark while in nursing school and started her family. Upon receiving her Bachelors of Science degree in Nursing in May, 1986, she began working on the oncology unit at Eastern Maine Medical Center. While working on the oncology unit and working part time as a home health nurse for New England Home Health Care, she began working as a clinical adjunct for the University of Maine, School of Nursing.

While raising her three children, Sarah, Jason and Kristin, she attended graduate school at the University of Maine in Orono. At that time she was inducted into the Omicon Xi Chapter-at-Large of Sigma Theta Tau, the international honor society for nurses. After graduating in December, 2001 with a Master of Science in Nursing, she became a full time lecturer for the University of Maine, School of Nursing. Positions she held while working as a lecturer have included Clinical Simulation Educator and currently she is in the position of Undergraduate Curriculum Coordinator. Membership in professional organizations include the Maine Nursing Practice Consortium and the Maine Nurse Education Collaborative. While at the University of Maine, she began interdisciplinary doctoral studies in the fields of nursing and education. She is a candidate for the Doctor of Philosophy degree Interdisciplinary in Nursing and Education from the University of Maine in May 2018.