Quasi-experimental Study with the Undergraduate Nursing Program Using Simulation Learning to Reduce Medication Errors

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Abstract

Medication errors in the nursing practice are not only costly but may harm or kill a patient. The problem addressed in this study is the relationship that exists between the lack of medication administration skills taught to students in an undergraduate nursing program. The purpose of this quantitative quasi-experimental study with a two-group pretest-posttest design was to examine if the addition of medication-simulated learning was associated with improved medication administration knowledge compared to a traditional Pharmacology classroom setting. The constructivism concept utilizes the aspect of building on previous knowledge and the collaboration of the instructor and student during the simulation process can help to build on the traditional classroom learning. The research study design was a quantitative, quasi-experimental research pre/post-test designed, a correlational study included first-year nursing students in the Associate Degree Nursing program who are enrolled in traditional pharmaceutical and medication administration simulation learning curriculum. The quasi-experimental research design is also the best choice for the pre-and post-medication simulation knowledge test. Analysis and interpretation of the results of the pre/posttest results and how it correlates to the impact of simulation learning in the undergraduate program for medication administration and increased the student's knowledge base which in effect reduced medication errors. Four participants in each group volunteered and given the pre and post medication quiz. There were not enough participants to provide accurate research results but there was a slight increase in correct answers in the post-test for nursing students who had taken simulation learning of 0.01%. Due to lack of supportive data the Null hypothesis was accepted. Further research on simulation learning in medication and decreasing medication errors would need to be completed in the future to assess results.

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Table of Contents

List of Figures

List of Tables

Chapter 1: Introduction

One of the most dangerous and deadly health problems in the United States are medication errors (Rodziewicz & Hipskind, 2020). Hundreds of thousands of adverse reactions and complications related to medication errors go unreported every year (Tariq & Scherbak, 2020). The Journal of Community Hospital Internal Medicine Perspective (2016) estimates that more than 7 million patients are impacted, and the cost is almost $21 billion from preventable medication errors in all health care settings annually. The group of nurses that are most likely to make medication errors are the new inexperienced nurses, the nurses are not able to focus effectively related to the increased visual and auditory stimulus in the clinical setting and they have not had enough practice to develop their critical reasoning (Thomas, 2016). Preventable medication errors that threaten patient safety are termed as a sentinel or near sentinel events when reported to governing agencies.

All sentinel events are required to be reported to the facility and the JACHO and an immediate investigation and review of the event and determination of the severity of disciplinary action will be made after the completion of the investigation (Joint Commision, 2016). Due to the severity and frequency of medication errors The National Nursing League has developed goals and strategies to create more accountability for health providers and investing in enhancing education in nursing programs to prevent medication errors and injuries to patients (Rodziewicz & Hipskind, 2020). Medication errors during medication administration are underestimated as it is estimated that the number of errors is under-reported by approximately 90% (Durham, 2014). Simulated medication program education in the early curriculum of the undergraduate nursing program may reduce the number and severity of medication errors (Durham & Alden, 2008). There are 3.3 million patient visits to medical facilities and doctors and 3.8 million

hospitalizations each year in the U.S. that were caused by serious preventable medication errors (NEHI, 2008).

The cost of preventable medication errors in 2007 was estimated at 20.6 billion dollars (NEHI, 2008). In the United States, various medication errors were the third leading cause of death in 2016 (Gopalan, 2017). The nursing student needs to have clinical laboratory practice with the patient medication administration, medication actions, uses, and side effects for oral medications, gastric tubes, nasogastric tubes, intravenous, and central line administration which enabled a foundation of knowledge and practice before actual patient care in a clinical setting, this decreased adverse and dangerous events with actual patient care. Incorporating simulation learning early in the nursing school curriculum created a seasoned graduate nurse that can reason, problem-solve, were better equipped for new medical technology (Aebersold, 2018).

Statement of the Problem

The problem addressed in this study was the relationship that exists between the lack of medication administration skills taught to students in an undergraduate nursing program and increased medication errors when caring for patients in the clinical setting. Lack of preparation leads to medication errors in the hospital or facility setting (Musharyanti et al., 2019). Each year, in the United States, 7,000 to 9,000 people die as a result of medication errors and countless reactions and complications related to medication errors go unreported (Tariq & Scherbak, 2020). The undergraduate nursing students need instruction in the administration, usage, effect, and preparation of medication before performing any administration for ‘live’ patients. The delivery of safe and effective nursing care relies heavily on pharmaceutical treatments and the knowledge of all aspects of medication management (American Nursing Association, 2020), but this is adversely affected by a shortage of nurse educators and a lack of clinical settings (Hansen

& Bratt, 2017). Consequently, student nurses do not have an instructional environment in which to practice their hands-on aptitudes and develop their critical thinking skills. Training barriers include a decrease in faculty as opposed to an increase in students; advancements in patient care and acuity that need to be taught; and a lack of clinical sites in which to practice new skills (Hansen & Bratt, 2017). Medication errors are becoming more serious as patient care becomes more complex and technical, and the consequences for errors can be deadly (Escrivá et al., 2019). Stress and anxiety along with the lack of medication knowledge from the pre-licensure student nurse enhance the risk for the potential of medication errors in the clinical setting (Green, 2018). With the increasing prevalence of medication errors or near misses in the undergraduate student nurses in a clinical program, the need for practice in medication competencies would increase medication safety in the clinical rotation (Musharyanti et al., 2019).

Purpose Statement

The purpose of this quantitative quasi-experimental study with a two-group pretest-posttest design was to examine if the addition of medication-simulated learning is associated with improved medication administration knowledge compared to a traditional Pharmacology classroom setting. Seventy-five first-year Associate Degree Nursing program students from a southern community college may voluntarily participate. The sampling method is convenient. The first-year nursing students that took the mandatory Medication Simulation course and signed a consent to participate in the medication administration simulation learning program and a second undergraduate nursing group took Pharmacology without the addition of simulation learning. A G*Power analysis indicated that the sample size should be 13 students for the intervention group and 13 students for the comparison group for this research study. The information used for the input for the G*Power calculation were a paired T-test. Currently, the n

or the sample is 26 students, and the G*Power calculation result determined that size that was significant in being effective for a measured meaningful study. A 25-question multiple-choice test that includes the National Council Licensure Examination medication questions were administered before and after for the intervention group that participated in the pharmacology course with simulation course and the comparison group of the traditional pharmacology class. The pre and post-test NCLEX test scores from intervention and comparison group data was inserted into the Statistical Package for Social Sciences statistical (SPSS) software. The paired T-test was used to analyze the data as the scores from two pre-tests and two post-tests for each group of nursing students.

Conceptual Framework

Utilizing simulation learning in the undergraduate program to teach medication administration skills beyond the traditional classroom setting employs several key concepts to provide a positive result in the academic outcome for the nursing students. Constructivism integrates using the learner's previous experience and previous knowledge to influence learning new knowledge (Mcleod, 2019). The undergraduate nursing students took the traditional pharmaceutical class in a classroom setting and then used that knowledge in the practice of their skills simulation medication administration lab. Integrating both the visual and tactical learning the nursing student pulled from this knowledge effectively when providing live clinical setting (Mangold et al., 2018). The instructor in the constructivism concept creates a collaborative problem-solving environment and is a facilitator, the nursing student is an active participant in their learning, and simulation classes are typically small (Mcleod, 2019). This lays a strong learning foundation for a safer more critical thinking student nurse when performing medication administration in the clinic setting.

The constructivism concept is the foundation for the problem and purpose statement and research questions. The aspect of building on previous knowledge and the collaboration of the instructor and student during the simulation process it helped to build on the traditional classroom learning. The nursing student were active in their learning and did what they have learned in the classroom setting. Student nurses learned visually and tactically to create a safer medication administration when in the live clinical setting, therefore, decreasing medication errors.

Research Questions

The two research questions and associated hypotheses were developed to determine if there is an improvement in medication administration and a decrease of medication errors if a medication simulation learning was completed in coordination with the traditional classroom pharmacology course in the undergraduate nursing course. The purpose would be to establish if the addition of the medication simulation course would increase the medication knowledge, post-simulation test scores, reduce medication errors when in the clinical setting, and if the student nurses that have had prior nursing skills experience have an impact on the medication test scores.

RQ1

What is the difference between NCLEX medication administration knowledge pretest-posttest scores when utilizing the simulation lab verses no addition of the simulation lab in a traditional Pharmacology course?

Ho

The medication simulation learning will not correlate with NCLEX medication administration knowledge pretest-posttest scores when utilizing the simulation lab verses no addition of the simulation lab in a traditional Pharmacology course.

Ha

The medication simulation learning will correlate with NCLEX medication administration knowledge pretest-posttest scores when utilizing the simulation lab verses no addition of the simulation lab in a traditional Pharmacology course.

RQ2

What is the difference in the medication simulation post-test scores from the pretest after taking the medication simulation lab?

Ho

The medication simulation post-test score will not correlate with the completion of medication simulation learning.

Ha

The medication simulation post-test score will have a positive correlation with the completion of medication simulation learning.

Introduction to Research Methodology and Design

The research study design was a quantitative, quasi-experimental research pre/post-test designed, a correlational study that included first-year nursing students in the Associate Degree Nursing (ADN) program who are enrolled in traditional pharmaceutical and the NCLEX medication administration simulation learning curriculum at a small accredited southern university. The data analysis was completed by extracting the results of the pretest before the

intervention and comparison groups begin their courses and the posttest after the intervention and comparison groups have completed their courses. The test scores were compared to determine if the simulation course increased the pharmaceutical knowledge and ability to perform medication administration is enhanced. Quantitative researchers observe the impact of occurrences that will affect individuals (Allen, 2017). Based on a G* Power analysis of 26 participants were needed to provide an appropriate sample size to achieve statistical power for the results of the pre and post-tests of the medication simulation tests.

The quasi-experimental design was chosen as participants was not random, the intervention group were ADN nursing student who took the mandatory Pharmacology and Medication simulation course and a comparison group that only participated in the traditional Pharmacology group. The quasi-experimental research design was also the best choice for the pre-and post-medication simulation knowledge test. I analyzed and interpreted the results of the pre/posttest results and how it correlates to the impact of simulation learning in the undergraduate program for medication administration and increased the student's knowledge base which in effect will reduce medication errors. The research questions allowed the researcher insights into the impact of the instruction on the test scores with simulation learning and traditional pharmaceutical class.

The criterion sampling was not random, and the population was limited to the student nurses that participate in the medication simulation program with traditional pharmacology course and the group that only participates in the pharmacology class. The students were voluntary, and their participation had no impact on their grades in the class. The students took a 25-question test, and each question was worth four points each to equate to 100-points. The pre and post-test equivalency test was based on sections of an NCLEX-RN® study book related to

medication questions that appeared on the final licensure exam. The pre-test was performed at the beginning of the course and the post-test was administered immediately after the course had concluded. The paired T-test was used to compare the pre-test and the post-test results from those in medication simulation and from those who took only the pharmacology course. The paired T-test revealed if significant knowledge was gained following the completion of the simulation course.

The validity of the instrument, NCLEX exam questions for the pre/post-test, is accurate as it measures at the national level nursing standards for all student nurses after the completion of all their mandatory training. The pre and post-test allow knowledge measurement based on the NCLEX-RN® study book. The research was reliable as it can be replicated by any researcher by utilizing the same NCLEX-RN® study book questions, question value, T-test, and the pre-test and post-test measured the growth of knowledge of the research participants. The research could be limited by the actual number of individuals willing to participate. Permission was obtained by Northcentral University Institutional Review Board, the participating college, and the participating college's nursing department before the beginning of the research study. The participating college's review board approved the study as a quality improvement study. The study was described in detail to the participants and written consent was obtained from the participants. The instructors were not evaluators in the student's classes, they had no formal evaluation in the medication simulation course, and there were no punitive results for not participating in the research. The surveys were stored by following the university policy and were be destroyed per university policy.

The rationale for choosing the quantitative, quasi-experimental research pre/post-test designed, a correlational study allows the focus of the data to focus on the problem of medication errors in nursing, the use of simulated medication lab to increase skills and knowledge of medication use, action, and side effects as well as all routes of medication administration, and allowing the data from pre/post-test results to valid if the simulation medication class increases the post-test scores.

Significance of the Study

Medical errors are a serious public health problem and a leading cause of death in the United States (Rodziewicz & Hipskind, 2020). Treiber and Jones (2018) published the results of their online survey mixed-methods items that included perceptions of the adequacy of preparation in nursing education of 168 new graduate nurses. Fifty-five percent admitted to making medication errors and only 24% reported their errors (Treiber & Jones, 2018). The National Council of State Boards of Nursing has found that new RNs make more errors and report more negative safety practices than experienced RNs (Thomas, 2016). Preventable medication errors that threaten patient safety are termed as a sentinel or near sentinel events when reported to governing agencies.

Due to the severity and frequency of medication errors The National Nursing League has developed goals and strategies to create more accountability for health providers. Investing in enhancing education in nursing programs may prevent medication errors and injuries to patients (NLN, 2020). Simulated medication program education in the early curriculum of the undergraduate nursing program may reduce the number and severity of medication errors and should no longer be considered an add-on course to the nursing curriculum (Aebersold, 2018). In the United States each year serious preventable medication errors occur in 3.8 million inpatient

admissions and 3.3 million outpatient visits (Karlovitch, 2020). The cost of preventable medication errors in 2007 was estimated at 20.6 billion dollars (Karlovitch, 2020).

Providing medication simulation during an undergraduate nursing program prepares a nurse with advanced critical thinking skills. Early practice before patient medication administration could be the foundation for decreasing adverse and dangerous events with patient care. Medication errors increase with a lack of knowledge and an environment that may be more apt for miscommunication later in the nurse's practice without a strong foundation during nursing school (Treiber & Jones, 2018). Incorporating simulation learning early in the nursing school curriculum will create a seasoned graduate nurse that can reason, problem-solve, and will be better equipped for new medical technology (Aebersold, 2018).

Definition of Key Terms

Associate Degree Nurse (ADN)

An Associate Degree Nurse is a 2-year undergraduate nursing program in an accredited college that allows students to gain core knowledge and clinical skills in the field of nursing (Nursing License Map. 2020).

Clinicals

Clinicals in nursing school are the application of the skills that are learned in lab settings and traditional classrooms. The student nurses are given a patient caseload and they provide treatments, medication, assessments, and care to these patients (Ameritech College of Health Care, 2020).

NCLEX-RN®

The National Council Licensure Examination (NCLEX-RN® exam) is the National exam that the graduate nurse completes obtaining their licensure. The test determines if the graduate

nurse is safe to practice as an entry-level nurse and tests the graduate nurse's ability to use critical thinking and make nursing judgments (Kaptest, 2020)

Near Sentinel Event

A near sentinel event is a patient safety event that can potentially cause injury to a patient can be resolved. These events are reported by medical facilities and the data is monitored and collected by the Joint Commission (The Joint Commission, 2020).

Sentinel Event

A sentinel event is a patient safety event that results in death, permanent injury, or severe injury that may be temporary. These events are reported by medical facilities and the data is monitored and collected by the Joint Commission (The Joint Commission, 2020).

Summary

Medication errors are sentinel or near sentinel events that occur frequently in the facility setting. They can cause injury or death to a patient, as well as legal and financial damage to the healthcare facility. To prevent errors the undergraduate nurse would benefit from the addition of a simulation lab alongside the traditional pharmacology class. The problem identified is there a significant correlation that exists between the lack of medication administration skills taught to students in an undergraduate nursing program and increased medication errors when caring for patients in the clinical setting. The purpose of this quantitative quasi-experimental study with a two-group pretest-posttest design was given to a group of undergraduate nurses from a southern college that has medication simulation as a mandatory lab in conjunction with the traditional pharmacology class was given a pre and post-test. The test was taken directly from the NCLEX exam and was 25 questions worth 4 points each. The pre-and post-test results was compared to determine if there was an improvement of scores after the simulation lab. The criterion sampling

was not random and was one of convenience. The research questions asked if there a correlation and improvement of test scores after attending the simulation lab with the traditional pharmacology class.

Medication errors are the number on reason for the death of patients in the United States (Rodziewicz & Hipskind, 2020). Lack of knowledge, a need for additional training before a student nurse attends clinical, and a need to provide an addition to the curriculum beyond the traditional class setting. A positive move forward would be to add a simulation lab as part of the training and not think of it as an add on class. By using simulation learning early in the nursing school curriculum it developed a graduate nurse that understood medications, side effects, usage, and administration routes as well as, using evidence-based practice and a critical thinker, which will lead to reduced medication errors (Aebersold, 2018).

Chapter 2: Literature Review

The problem addressed in this study is the lack of medication administration skills taught to students in an undergraduate nursing program is associated with increased medication errors when caring for patients the clinical setting. The purpose of this quantitative quasi-experimental study with a two-group pretest-posttest design is to examine if the addition of medication-simulated learning is associated with improved medication administration knowledge compared to a traditional pharmacology classroom setting. Medication errors have increased into an epidemic that is detrimental and can be deadly to patients. Burden and Pukenas's (2018) research stated that these errors occur many times because of human error, inadequate knowledge, and system failures leading to adverse events or the patient's death. Treiber and Jones's (2018) research concluded that student nurses did not feel adequately prepared in school, admitted to making medication errors, and did not report them. Medical errors are a serious public health problem and a leading cause of death in the United States (Rodziewicz & Hipskind, 2020). Various medication errors were the third leading cause of death in 2016 in the United States (Gopalan, 2017). Each year, in the United States alone, 7,000 to 9,000 people die due to medication errors (Tariq, 2020). Preventing the problem before it occurs is the key to improving medication errors and providing safer care for the patient.

The review of literature included multiple topics focused on simulation learning and how to use simulation learning to prevent future medication errors. The accessed databases were Sage, Roadrunner, WGU Library, NCU Library, Proquest, ScienceDirect Journals, EBSCO, ERIC, PubMed, Google Scholarly, and CINAHL. The keywords utilized for this literature review were *advances in nursing education, conceptual framework, constructivism, critical thinking in nursing, debriefing, simulation, simulation learning, effects of medication errors,*

facilitating in debriefing, medication errors, nursing, preventing medication errors, simulation in nursing simulation, and *simulation learning to prevent medication errors*. The publications were within 5 years of 2021. The publications included opinion articles on healthcare professional's involvement in simulation learning and medication errors and academic or peer-reviewed journal articles. However, there was some information that was only available in the journals that were prior to 5 years. Simulation learning has only recently become a topic of research, and therefore, current data was limited. Although not all literature shows that simulation learning is advantageous to the learning curriculum, many offer the promise and success of simulation learning in enhancing learning.

Conceptual Framework

A conceptual framework is used by the researcher to guide their research study. The use of conceptual framework helps organize the study's components and variables to address a relevant problem within the real world. The conceptual framework or construct of research begins with a deductive assumption that a problem exists, known as the research problem, why it is a problem, and how it will be resolved (Zackoff et al., 2019). The constructivism theory is well-known and was developed from Piaget's (1936) research on children and the active learning process. Piaget's constructivism theory is built on student-driven learning and prior experiences (McLeod, 2018). Constructivism integrates using the learner's previous experience and knowledge to influence learning new abilities (Mcleod, 2019).

The study was based on the constructivism theory to increase student nurses' knowledge through simulation learning to reduce medication errors. The conceptual framework of the clinical simulation program provides a structured learning model that allows students to understand, apply, and process their learned knowledge and potentially replace the live clinical

experience (Chu et al., 2019). The constructivism approach allows the instructor to create a collaborative problem-solving environment and become a facilitator instead of an instructor. This conceptual framework provides guidance for understanding the simulation experience that builds the collaborative, interactive, and learner-centric model for learning (Chu et al., 2019).

A key aspect of constructivism is the active effort required for obtaining knowledge; therefore, this study may provide support for improving patient outcomes by utilizing simulation learning of medication administration early in the nurse's educational process. The nursing student is an active participant in their learning, and simulation class size are typically small to allow for improved individual learning (Mcleod, 2019). Simulation classes lay a strong learning foundation for a more efficient student nurse capable of critical thinking when administering medication in the clinic. Chernikova et al. (2020) analyzed 145 studies related to simulation-based learning and found that a significant percentage of the studies had a positive overall effect of learning with nursing students. Providing application of constructivism within the simulation learning format may assist with decreasing the possibility of medication errors with the practicing nurse (Chernikova et al., 2020).

Recent Application of Constructivism Theory in Simulation Learning

Constructivist theory has been utilized in multiple simulation learning methods in the nursing field. Jeffries Simulation Framework is the primary simulation framework in the nursing field and is utilized in conjunction with the constructivism framework (Chu et al., 2019). Jeffries Simulation Framework uses the conceptual framework to ensure that best practices are in place to maximize learning, safety, and outcome in simulation learning (Cowperthwait, 2020). Shepherd and Burton (2019) conducted a survey of 30 simulation centers to determine if use of a conceptual framework was appropriate to examine simulation learning and teaching in healthcare

education. The results indicated that healthcare education simulation learning increases when a conceptual framework is employed (Shepherd & Burton, 2019).

Hung et al.'s (2021) research included seventy-nine senior undergraduate nursing students and considered the effects of repeated simulation learning on confidence, competence, and education fulfillment. The research is built on the students' knowledge to ensure that they are confident, knowledgeable, and satisfied with their nursing skills. Two groups of students took the repeat course three times, either in the fall or spring semester, in emergency and critical care nursing (Hung et al., 2021). The results showed that most learning took place over the first simulation, but students continued to build self-confidence, improve skills, and were satisfied with their level of learning (Hung et al., 2021). This study employed the constructivism conceptual framework and reinforced simulation learning to build on the student's knowledge, provide visual and tactile learning to enhance nursing skills, critical thinking, and give the students gratification with their education experience.

Mangold et al. (2018) provided 2,071 nurses at all nursing levels, ages, and education with a survey to measure preferred and practical learning styles—guided by the constructivism conceptual framework of learning by visual and tactile learning. The nurses reported an 11% higher preference for visual and tactile learning over verbal learning. When nursing students integrate visual and tactical learning with simulation learning, they will effectively derive this knowledge when administering medication in a live clinical setting (Mangold et al., 2018). The researchers also examined that 50% of the nursing population is over 50 years old. An effective learning model will need to be in place for continued training for nurses and nursing students to replace their positions (Mangold et al., 2018).

Rattani et al. (2020) conducted a quasi-experimental study to examine 42 nursing students for end-of-life care patients. No control group was used, and the 42 students took an assessment tool focused on the dying patient before and after the simulation learning. After completing the simulation learning, results indicated that simulation learning improved student nurses' communication skills for addressing the holistic care of and needs of the patient's and their families for end-of-life care.

Overall, the evidence reviewed indicated that the process of learning by building upon the student's knowledge could improve students nursing skills by the act of practicing them in the simulation environment (Chu et al., 2019; Cowperthwait, 2020; Hung et al., 2021; Mangold et al., 2018; Rattani et al., 2020). Providing the student nurse, a safe place to practice prior to performing procedures in the clinical setting not only potentially improved the student's confidence but may have decreased the potential for adverse events. The above research supported using the constructivist theory in student nurse's education to help create a nurse that could work safely as the medical climate changes.

Alternative Frameworks for Research

The constructivist theory aligns with simulation learning as it provides student-centric and hands-on learning to improve the student nurses' skills. Alternative models that could have been utilized are adult learning and cooperative learning models. The adult learning model is a learning model that focuses on the learner's needs and experiences. Adult learning is student-centric, as is constructivism; however, the educator must consider adult learners' skills, educational level, and life experiences (Assefa, 2021). Many nursing students are young adults and have not developed skills and many life experiences.

Cooperative learning is another framework that could be considered to understanding simulation learning. Cooperative learning allows the student to learn through cooperative interaction, achieving new knowledge, and gaining knowledge through the group of learners (Yu & Yuizono, 2021). The student groups are small and dependent on the cooperation of the entire learning group. For nursing students, the learning model needs the expansion of a facilitator to guide learners. This study of improving student nursing skills for medication administration through simulation learning requires collaboration between a knowledgeable instructor and a student utilizing the simulation process and building on the traditional classroom learning (Aebersold, 2018).

Improving Nursing Education through Simulation Learning

Simulated learning began during World War II to teach medical personnel how to treat emergencies and perform procedures (Aebersold, 2018). Historically, the first simulations were performed on other personnel or on mannequins in the undergraduate program to teach nursing skills (Aebersold, 2018). For decades, colleges have provided clinical settings in hospitals and low technology simulation learning for medical-surgical, pediatrics, and most classes required clinical instruction to be performed in hospitals (Joolaee, 2016). Historically, pharmacology has lacked simulated learning for nursing students, and even currently, nursing schools with simulation learning are limited (Aebersold, 2018). Advances to current patient treatment, genomic testing for accurate medication usage, a wide variety of intravenous medications, and many pharmacological uses for the same medication. Simulation learning is a practical approach for teaching high-risk nursing skills, creating an optimal environment for developing communication and teamwork, reducing stress during crisis resource management, and providing a safer patient environment (Hughes & Hughes, 2020).

Simulation training has rapidly advanced with the use of technology. Nursing skills have advanced with the introduction of computer programs that allow the assessment and treatment of computer-simulated patients. Nursing programs are now investing in mannequins that enable advanced skills such as wound care, gastric tube, nasogastric tubes, colostomies, ventilators, wound care, and medication simulation machines (Aebersold, 2018). Simulation learning provides a safe environment for learning and provides immediate feedback from the instructor (Cupples, 2018). Simulation learning creates a format that incorporates the use of increased technology and its advances, making it a safe and effective tool for nursing students' procedural techniques.

Blended Learning: Mix of Traditional and Simulation Learning

Blended learning is a teaching model that incorporates face-to-face learning with online learning (Hrastinski, 2019). Burna et al. (2020) compared two groups, one control and one group that completed blended learning. The group that completed blended learning, in this case, was traditional teaching and computer simulation, scored higher on the standardized assessment (Burna et al., 2020). Twenty undergraduate students were interviewed by Heilporn et al. (2021) to determine the behavioral, emotional, and cognitive impact that variety of blended learning had on their education. Students that took blended learning classes with teachers that enhanced the computer activities with the face-to-face classroom activities experienced the most relevance, integration, and a deeper understanding of content (Heilporn et al., 2021).

Muse et al. (2021) examined a multi-method study of 89 undergraduates suggested that if educators created a harmoniously blended learning plan with educators and peer support, the students had a deep and meaningful learning experience. A study by Harris et al. (2021) focused on the effects of blended learning on the learning environment. Harris et al. (2021) interviewed

279 undergraduate students who preferred the blending model of learning and were more enthusiastic if the teacher was engaged. The academic year of 2020–2021 was disrupted and forced educators to find an alternative way to teach in higher education which mandated a curriculum that could be engaging in a mixed learning model environment (Harris et al., 2021). Blended learning came to the forefront of education out of need because of the unforeseen changes and restrictions related to the COVID-19 pandemic.

COVID-19 Pandemic Impact on Simulation Learning

The World Health Organization (WHO) declared a worldwide pandemic on March 11, 2020; with countries locked down, there were travel bans and stay-at-home orders (Lin & Peng, 2021). March 2020 changed the traditional classroom world for a year and beyond. Without warning, educators had to create a replacement for traditional classrooms with a different instruction format in higher education. All nursing programs include classroom instruction and maintaining clinical hours without direct patient care (Shea & Rovera, 2021). Shea and Rovera (2021) engaged nursing students at one university who needed 50% of direct patient care hours for their curriculum. The nursing students' direct care hours had to replace their clinical hours with virtual simulation and telehealth simulation. The total encounters per student was 466, and the total simulation hour that was acquired was 18,403 hours. Shea and Rovera (2021) recommended that nursing schools include remote and virtual simulation permanently in the curriculum not only because of the success in students learning nursing skills but also for any future closure caused by catastrophe or pandemics.

Hospital education was over-capacity, including intensive care units (ICU) and progressive care units (PACU), with an unknown and ever-changing disease (Alban et al., 2020). Nursing staff in ICUs and PACUs began to use simulation learning to manage the patients, the

beds, and ventilators (Alban et al., 2020). The Canadian hospital system in Alberta implemented simulation learning to prepare healthcare workers with emergent COVID-19 education with over 30,000 healthcare providers (Dubé et al., 2020). The hospitals utilized the eSims simulation learning to teach new processes, procedures, and management of COVID-19 patients (Dubé et al., 2020). This simulation program students utilize online avatars to diagnose and respond to realistic medical situations. Using the eSim program potentially saved lives and provided unexpected support for simulation learning (Dubé et al., 2020). Simulation learning broadened the educational limits from the pandemic and helped provide a positive outcome for simulation in education.

Medication Errors

Medication errors and potential harm to patients are increasing at a high rate in the clinical setting (AHRQ, 2019). Simulation learning is utilized for the nursing student to positively impact patient care and patient outcomes (AHRQ, 2019). Simulation programs are becoming more common for hands-on instruction in a safe environment. However, monetary constraints and the utilization of additional faculty hours still prevent some colleges from initiating a simulation program (Lohrman, 2018). However, smaller colleges may not be able to afford the simulated program or faculty (Lohrman, 2018). A handful of colleges have begun to utilize the medication administration simulated tools for nursing students (Lohrman, 2018). Still, even fewer have initiated a complete pharmaceutical simulation program to coordinate with the classroom pharmacology (Lohrman, 2018). Medication errors are elevated with miscommunication and medication knowledge deficits but providing a solid medication administration foundation in the nursing program provides the strong groundwork and diminishes the potential for medication errors as practicing nursing (Treiber & Jones, 2018).

Ultimately, the need for a solution to curtail medication errors is imperative. Caboral-Stevens et al. (2020) completed a study with 147 nursing student participants. The purpose of the study was to estimate the risk of error for medication errors using the scores from a pharmacology test and self-rated certainty test. The study's findings found that undergraduate student nurses have inadequate knowledge of pharmacology, and the risk of medication errors has increased (Caboral-Stevens et al., 2020). Simulation learning combined with traditional pharmacology classes in the undergraduate nursing program may effectively decrease medication errors in the future.

Nursing Skills and Simulation Learning

Simulation serves as a complement for traditional learning, and simulation software has been increasingly used as an additional educational tool (Costantino et al., 2012). Interdisciplinary academic disciplines value simulation benefits because of the increased positive outcomes of their students' learning (Ören et al., 2017). Campos et al. (2020) conducted a meta-analysis to examine simulation as a tool for practical knowledge and teaching through online interactions that imitate realistic situations and the experience it provides to the student. Military, police, fire, and medical simulated education opportunities can offer challenges and opportunities that traditional education does not offer (Bruzzone & Massei, 2017). Academic institutions are developing simulation-based laboratories to enhance students' learning experience and improve their preparation for their professional careers (Leathrum et al., 2018). Nursing skills simulation provides students with opportunities to practice their clinical and decision-making skills through various real-life simulated experiences (Kim et al., 2016).

Simulation programs offer computer-based presentation of real-life situations (Campos et al., 2020). Simulation improves an actors' knowledge, understanding, and skills through the simulation experience (Campos et al., 2020). The use of simulation software and associated simulation tools provides a practical understanding of complex systems. Simulation gives the nursing student the ability to enhance their learning experience and engage in hands-on activities created by their instructors (Juan et al., 2017).

Simulation programs have become more common for firsthand learning and skills in nursing education (Ham, 2016). Employing simulation provides an environment where no harm can come to patients, and the students feel that it is a safe place to make mistakes without sentinel or near sentinel events and determine their knowledge gaps (Ham, 2016). When the simulation experience reaches the educational objectives and design, it expands the participants ability and creates an environment of contextual and emotional reliability (Cowperthwait, 2019).

Unver et al. (2018) examined the use of hybrid simulation learning. Hybrid simulation is the use of different methods of delivery of learning, such as computer simulation and face-to-face lecture. Seventy-nine second-year nursing students were given pre and post-test regarding their simulation learning and coordinating lecture to evaluate if simulation learning impacted their learning and self-confidence (Unver et al., 2018). The simulation focus was cardiopulmonary resuscitation, standardized patient care, and intravenous insertion and care. After the scenario and debriefing, the nursing students were given the questionnaire. The simulation learning experience results were above 90% in nearly all the students participating in the hybrid learning. The students reported improved clinical decision-making skills, critical thinking, and self-confidence in the clinical setting (Unver et al., 2018). The students who

participated in the simulation group and the debriefing felt that it gave them a better understanding and tools for the real-world clinical setting (Unver et al., 2018).

Díaz-Agea et al. (2021) focused on the student's perspective of simulation learning. One hundred one nursing students taking simulation learning were placed in seven focus groups. The participants required at least 100 hours of simulation learning and be enrolled in a simulation learning course (Díaz-Agea et al., 2021). Each group had opened-ended questions regarding the motivation of their simulation experience. The results showed that a higher level of motivation in the simulation learning directly correlated with the facilitator, the comfort of the nursing student, and the structure of the simulation environment (Díaz-Agea et al., 2021).

Traditional nursing education lecture along with simulation learning can develop a highly functioning student nurse and future nurse. Simulation can be presented in several forms, computer simulation, live actor simulation, or mannequin simulation (Aebersold, 2018). All forms of simulation learning can be successful, but it provides a safe learning environment for the student nurses that makes the learning effective (Aebersold, 2018).

Simulation Learning Provides Nursing Students a Safe Learning Environment

Instructors are responsible for creating an environment where nursing students begin to think for themselves, be problem solvers under stressful patient scenarios, and be critical thinkers (Jamshidi et al., 2016). The nurse educators allow the student to take ownership of their learning. Utilizing patient simulated learning decreases the initial stress of learning procedures and tasks (Mitchell, 2020). Immediate feedback allows the instructor to correct potential medication errors (Hardavella, 2017). The simulation setting provides builds on traditional classroom method by taking acquired knowledge and performing it in simulation learning free from harming a live patient (Harper & Hadden, 2020).

Simulation learning in the nursing program may improve nurses' knowledge about complex patient situations and confidence in their skills, thereby possibly reducing adverse medical events in the real world of patient care (Kiernan, 2018). Kiernan assessed 40 nursing students in a clinical skills simulation learning lab, which improved the nursing students' perceived clinical competence and confidence and increased their post-test scores by 37.26% (Kiernan, 2018). Simulation learning may enhance students' education by providing real-life scenarios that helped them improve their knowledge base and be effective critical thinkers. Simulation learning can create a strong knowledge base to increase the potential to be safe and effective nurses when providing patient care that has become more complex and higher in technology (Kiernan, 2018). Simulation learning experiences are created to meet specific objectives and have optimal achievements of the educational outcome (Cowperthwait, 2020). Simulation learning has the potential to expand pharmacology knowledge, increase skills, which can decrease medication errors. Simulation in nursing education provides a wide variety of enhancements to the student nurse's clinical skills and knowledge.

Simulation learning provides an opportunity for students to develop self-confidence by honing skills in the campus lab before implementing them with clients in the clinical setting, thus helping to ensure clients' safety (Moyer et al., 2017). Simulation allows for safe realism; enabling the student nurse to perform skills and enhance their abilities without endangering patients’ lives (Lavoie & Clarke, 2017). The use of a simulated learning environment has increased because of increased concerns with patient safety, patient litigation, and the lack of a safe clinical environment for students to gain clinical experiences. The challenge is to find nurse educators who are proficient in simulation learning and effective debriefing. Because of a reduced number of clinical settings, the prelicensure programs potentially replace the clinical

setting and replace it with simulation learning (Lavoie & Clarke, 2017). The students encountered simulated participants or simulated patients. Nursing students would be given a chance to interact in a realistic environment with actual behavior or conditions that students face in their clinical placement: the Simulated patients or simulated participants (Chu et al., 2019).

Simulation learning's great advantage is it provides the nursing students the ability to perform skills, complex techniques, and an interactive environment in a safe educational environment (Eyikara & Baykara, 2017). Eyikara and Baykara (2017) reviewed numerous studies regarding stimulation impact on nursing students and found that increased teamwork, confidence, communication, and skills. Collins and Gratton (2017) wanted to enhance the students' clinical skills, improve their critical thinking and reflective strategies, and develop leadership and management techniques. These researchers performed a skills gap analysis to identify their learning needs and then compiled an appropriate simulated practice learning setting. Each session evaluation utilized debriefings and discussions with the nursing students afterward (Collins & Gratton, 2017). Although it contained a small local group, the pilot project demonstrated that the simulated learning sessions increased the nursing student's ability to plan, facilitate, develop mentoring skills, and develop their clinical skills (Collins & Gratton, 2017).

Yoneda et al. (2017) studied 69 first-year nursing students utilizing simulation learning for medical accidents, such as fall during transfers, proper body mechanics when moving or transferring patients, as well as other hands-on accident prevention skills. The presurvey nursing students revealed that 40%–70% of them had near miss medical accidents with their patients in their clinical training (Yoneda et al., 2017). After two simulation classes of 90 minutes the second survey was provided to the students and showed a significant improvement in their skills (Yoneda et al., 2017). The survey was scored 0–5 and all students improve their scores 1–2

points (Yoneda et al., 2017). These studies and reviews hold hope for nursing students taking simulation learning as it can increase their skills in a safe environment, allowing them to approach their patients in the clinical setting with confidence.

Cohen and Boni's (2016) research study focused on two components within nursing programs, the merging of skill and knowledge acquisition in the care of the patients as whole beings. The author's concluded there needed to be more simulation learning in holistic care. Simulation learning has recently been initiated into curriculum in order to develop the emotional development of student nurses, particularly empathy. The student nurse would learn the importance of empathy between the nurse and patient but in a simulated learning environment to understand it from the nurse's perspective and the patient's perspective. The research utilized four themes, they were endurance, silent scream for attention, fear, and confrontation from patients in the simulated learning lab (ter Beest et al., 2018). The simulation learning was considered successful, and it would have been improbable to learn empathy in a clinical setting (ter Beest et al., 2018). Literature supports the need for simulation learning, although it needs to be utilized in several areas of nursing study, including psychiatric nursing in assisting with the different learning strategies for nursing students, especially when learning about nursing in the regions that are unfamiliar to them (Jacobs & Venter, 2017). Simulation learning is used with nursing students for alcohol and drug abuse patients, it provides the nurse educator the ability to use a safe tool to allow students to learn before entering unknown situations, including psychiatric nursing, to assist with the different learning strategies for nursing students, especially when learning about nursing in unfamiliar areas (Fioravanti et al., 2018).

Utilization of simulation learning in training in medically critical and emergencies situations, the simulation may take the place of clinical experience, ensuring the required

exposure to emergency situations and adverse events and strengthening patient safety (Reime et al., 2017). Simulation learning allows the learner to learn the skills in a safe environment without potentially harming a patient. Unlike traditional learning, simulation learning is acquired through personal experience followed by structured debriefing, reflection, and discussion (Reime et al., 2017). Reime et al. (2017) wanted to demonstrate that a legitimate observer role in simulation learning can provide for a large group of students and, with limited faculty time, can provide students with hands-on opportunities to help them become more confident in their roles. Safety in the clinical setting is a concern for facilities and educating student nurses is the way to decrease safety issues (Jamshidi et al., 2016).

Providing a safe environment to practice their skills reduces sentinel events and near sentinel events. Simulation learning provides an environment where student nurses can develop their skills, from essential to high technology. The student gets immediate instructor feedback, which allows the student to learn tasks correctly. The student can make mistakes, ask questions, and develop critical thinking skills in a safe environment free from potentially harming a patient (Jamshidi et al., 2016). Simulation learning, practicing skills before the clinical experience and having an open learning platform allow the simulation program to succeed.

Student-Driven Facilitation in Simulation Learning

It is the responsibility of the nurse educators to create an empowered novice nurse (Sodidi & Jardien-Baboo, 2020). Nurse educators are responsible for creating nursing students to think for themselves, be independent problem solvers under stressful patient scenarios, and be critical thinkers (Jillings, 2018). Utilizing patient simulated learning decreases the initial stress of learning procedures and tasks; the instructor can give immediate feedback and help correct potential errors in inpatient care (Higham & Baxendale, 2017).

The educators provide tools to challenge preconceived beliefs, assumptions, and values (Chernikova et al., 2020). The simulation setting provides intense procedure practice beyond the classroom by taking that knowledge and performing it in simulation learning free from harming a live patient (Chernikova et al., 2020). Providing educators with the tools to build the student's clinical knowledge, communication skills, and confidence allowed the new nurse to perform in a stressful and ever-changing medical environment.

Parker and Grech's (2018) created a unique practice-based learning model to prepare undergraduate nursing students for clinical placement. Practice-based learning models are designed to immerse students in an authentic clinical environment to achieve a deeper understanding in preparation for safe clinical practice (Parker & Grech, 2018). Instructors use lessons and activities based on the students' prior knowledge; this allows both cognitive and social-emotional realms to create safe, nurturing learning environments for critical thinking (Darling et al., 2019). By including critical thinking and problem-solving skills, the capacity to find, analyze, synthesize, and apply knowledge to clinical situations allows the student to work with others and engage effectively with others. Simulation learning allows a student to develop self-direction their abilities. Further, this learning method would enable them to work in complex situations, competently find resources, and use tools to provide an elevated level of medical care (Darling et al., 2020).

Simulation learning enhances the traditional classroom instruction and provides the opportunity for nurses to expand their critical thinking, communication skills, familiarity with urgent situations, and more vital decision-making skills (Aebersold, 2018). The nurse educator becomes the facilitator and clinical supervisor, and this process must reflect the "learning during an authentic clinical placement experience situated in an authentic practice" (Chu et al., 2019, p.

11). The simulation instructors help to develop the scenario, the character, the learning experience, and serves as the advocate, ensuring the students are safe (Cowperthwait, 2020). The instructors and peers provide feedback, this feedback provides a learning opportunity that builds on the students become critical thinkers (Cowperthwait, 2020). Nursing students take on different roles, assuming a character or personality profile and interacting and participating in diverse and complex learning settings by utilizing simulation as a learning tool (INACSL Standards Committee, 2016). The nurse educator's responsibility is to prepare nursing students for success in the live clinical setting, and simulation learning gives the nurse educator the tools for success in teaching. The nurse educator as the facilitator is an intricate part of the simulation learning process; enhancing that experience is completed with pre-briefing and debriefing.

Pre-briefing and Debriefing

Pre-briefing and debriefing are essential tools for the student and the educator to enhance the simulation learning experience. Pre-briefing discusses with the student nurse what the key components are of the activity to be performed, the session's goals, and objectives (Hughes & Hughes, 2020). Pre-briefing sets the learning tone and decreases the stress of the unknown for the students and the instructors' expectations for their learning experience (Hughes & Hughes, 2020). Debriefing for simulation learning is a guided reflection or facilitation in the cycle of simulation learning (Chu et al., 2019). In the simulation process, debriefing influences learning experiences (Chu et al., 2019). Debriefing is initiated when the simulation session is completed, the instructor and student provide input on the events. The student became responsible for their learning and received immediate feedback on the proper application of the skills that were performed.

Pre-briefing and debriefing allow students to feel comfortable and safe in their learning environment, especially making and learning from mistakes (Hughes & Hughes, 2020). Pre-briefing assists with developing complex thinking and developing the beginning of clinical judgment (Yang, 2021). Students need to be actively involved with the instructor and other nursing students, but they can lead with the debriefing; this allows for a broader experience for everyone (Coomes, 2019). Debriefing enables the educator to assess the student's comprehension after the scenario (Góes & Jackman, 2020). The student can openly discuss and ask questions to understand the scenario and develop their evaluation skills, clinical judgment, proficiency in a new skill, and critical thinking skills (Jillings, 2018).

The facilitator's role is to develop dialogue beyond just talking and talking about the learned experience. The facilitator should ask open-ended questions, know how to turn the silence into a productive conversation, and enable the student to understand what skills were enhanced in the simulation session (Macdiarmid et al., 2020). Through experience, facilitators learn to respond to whatever has occurred in the session and encourage them to think beyond the immediate situation and understand their nursing roles in depth (Macdiarmid et al., 2020). Debriefing allows the student to develop confidence within their group and with their skills. Debriefing builds self-efficacy and supports self-regulation of behavior (Burke & Mancuso, 2012). Debriefing is essential to develop and evaluate the success of the student and the learning from the scenario. Oh et al. (2021) researched 56 junior level nursing students to determine if debriefing would improve problem-solving and critical thinking over a 4-week period. Debriefing in simulation learning showed improved scores compared to those nursing students who did not have a debriefing with simulation learning (Oh et al., 2021).

Debriefing can be designed around a particular group of nursing students to improve critical thinking, problem-solving, and clinical judgment outcomes (Oh et al., 2021). These are fundamental to nursing education in preparation for the care of patients (Oh et al., 2021). The nursing instructors using a structured debriefing ensured that nursing students acquiring learning in simulation learning will have meaningful knowledge and feedback, leading to the adoption of safer and quality patient care (Dreifuerst, 2020). Simulation learning supported the traditional classroom and allowed for advancement and confidence of nursing skills for the student.

Simulation Preparation for the Clinical Setting

Simulation preparation for each nursing competency is crucial to focusing on the skills that are needed for the clinical situations for the nursing student. A quantitative research study showed the effectiveness of simulation training in improving performance during rapid patient deterioration (Borg et al., 2018). Borg et al. (2018) researched the effectiveness of simulation teaching trained nurses in a critical situation how to think and increase their performance with a patient who was are a rapid decline in health critically. The study found that the simulation program improved the post-test scenario knowledge test scores by 19.7 % (Borg et al., 2018). Kim et al.'s (2016) research explored the development and evaluation of the results of a simulated nursing skills package designed using a problem-based learning approach with general nursing. The results indicated that the simulated learning environment increased knowledge, clinical skills, and confidence from practicing in a safe environment.

In the United States, Kim et al. (2016) utilized nursing students who took the nursing fundamentals classes. These nursing students participated in simulated learning with high-fidelity human patient simulators and traditional clinical experiences (Kim et al., 2016). The study's results indicated that simulation-based nursing educational interventions have strong

educational effects, especially in the psychomotor domain (Kim et al., 2016). The simulation-learning environment potentially could improve student nurse clinical outcomes, retention of information and confidence, and critical thinking skills (Kim et al., 2016). Simulation learning develops the student nurse's critical thinking and nursing skills, allowing the student to practice in a safe environment. In contrast to nursing students learning in a hospital clinical environment which can impact their learning by increasing anxiety, providing overstimulation in the learning environment, and leads to ineffective learning (Carey and Rossler, 2021).

Simulation Learning Creates a Successful Student Nurse

Nursing students must take on different roles as nurses, assume a character or personality profile, and interact and participate in diverse and complex learning settings by utilizing simulation as a learning tool (INACSL, 2016). Nursing students who participate in simulated patient care scenarios gain experience, above-average critical thinking, and problem identification techniques, learning and refining skills, and developing competencies; this competency is accomplished without fear of harming a live patient (Eyikara & Baykara, 2017). In a variety of simulation settings, it is advantageous to allow student-led simulated practice learning sessions. Nursing students are engaged as partners in their learning, enhances their knowledge and skills, and promotes self-directed learning (Brown et al., 2017).

Simulation learning is being utilized to develop the emotional development of student nurses. Borg (2018) focused the study on developing empathy for student nurses in the clinical setting. Empathy is an essential factor in the relationship between a nurse and a patient. The simulated learning environment can create a dependency to help the student nurse experience empathy. The student nurse would learn the importance of empathy between the nurse and patient, challenging in the nursing education program. The simulation learning successfully

developed an emotion that would have been impossible to learn on the hospital floor. Borg's research findings show improved post-test scores in the knowledge of rapidly deteriorating patients of those who completed the simulated visual learning (Borg, 2018). The results supported that simulated learning positively affected student nurses in situations not typically seen in their clinical setting (Borg, 2018).

Simulation learning in a safe environment and produces well-trained and floor-ready nurses. These nurses were confident, highly developed, problem solvers with well-developed critical thinking skills. The new nurse had the advantage of advanced skills. The facilities hired a ready to go nurse. Most importantly, the patients these nurses treated were safer and had fewer sentinel or adverse events occurrences. Implementing simulation learning early in the nursing program created a seasoned graduate nurse who were better equipped for new medical technology and a critical thinker and analytical person (Aebersold, 2018). Simulation learning increases nursing competence through better training and, in turn, provides a high-quality nursing staff, decreasing staff renewal rates as confidence in skills increases (Lopreiato, 2017). Higher levels of knowledge, confidence in nursing skills, and practice of medication administrationhad a positive impact on medication errors.

Detrimental Effects of Medication Errors

Simulation can be produced to decrease medication errors in the clinical setting. Medication takes on many forms in the healthcare system (Rodziewicz et al., 2021). The wrong medication is given, or the wrong patient is given medication, but it can also be from omission (Rodziewicz et al., 2021). Examples of omission are not giving a medication, not recognizing an allergy, or not assessing a patient after administering a new medication (Rodziewicz et al., 2021). Errors of the commission would be giving a patient the medication knowing that the patient is

allergic to that medication (Rodziewicz et al., 2021). Medication errors can be preventable lead to adverse events, near misses, or sentinel events (Rodziewicz et al., 2021).

Medication administration is an integral part of the nurse's role, and medication safety is essential to ensuring positive patient outcomes in Mariani et al.'s (2017) focused their research study utilized 86 baccalaureate nursing students; 43 participants were the control group performing the traditional medication curriculum, and 43 participants completed simulation learning in conjunction with the medication curriculum (Mariani et al., 2017). The post-test results found that the nursing students with simulated learning scored significantly higher (Mariani et al., 2017). Mariani et al. (2017) and Eyikara and Baykara (2017) concluded that it was crucial to place an even higher emphasis on teaching medication administration to undergraduate nurses to decrease medication errors.

Nursing students communicate observations regarding medication errors or concerns related to medication concerns is essential for the student nurse, graduate nurse, and practicing nurse to prevent adverse or sentinel medication events (QSEN, 2018). Medication errors are not limited to administering the wrong medicine; errors also occur when ordering the medication. The nurse must be aware of prescriptions that do not fall within the norm and voice their concerns (AHRQ, 2019). When the medicine order is transcribed by a physician or pharmacist, it must be legible and correctly interpreted, thus ensuring that the correct prescription is filled (AHRQ, 2019). The nurse must check the medication for interactions and allergies and make sure the medication is as prescribed. Medication administration must be given to the right patient, at the right time, with the right medicine, and the right dose (AHRQ, 2019).

Treiber and Jones (2018) completed a survey that included 168 new graduate nurses; 55% had admitted medication errors. The graduates felt that the errors occurred because of

inexperience, rushing, patient acuity, technology, and staffing. Out of the 168 new nursing graduates, 24% did not report their errors. The nursing environment requires improved education in the early portion of the nursing program, providing skills to cope with medication errors, varied and more time in the clinical environment, rigorous pharmacological preparation, and support among the nursing staff (Treiber & Jones, 2018). The Joint Commission has validated aspects of this study by indicating that it can create medication errors due to rushing, inexperience, staffing vs. patient acuity, and technology issues (The Joint Commission, 2017).

McCarthy et al. (2017) studied 416 hospitalization cases of medication errors. The authors found that the cost to the hospital was $13,481–$40,580 per patient, thus leading to adverse events to the patient and increased hospitalization related to the medication error. The cost for the patient's health is high, as is the financial burden that impacts each institution resulting from medication errors (Addison, 2017). Medication errors causing injury or death have a profound financial impact and consequences (APF, 2020). Medication error morbidity and mortality in the United States have an estimated financial cost of between $1.56 billion and $5.6 billion dollars (APF, 2020). The economic impact of medication errors impacts the hospitals. Increased financial burden from medication errors decreases the funds available for staffing and new technology, increases insurance rates, and ultimately diminishes hospital reputations related to adverse events (Rodziewicz et al., 2021).

Research studies indicate that the impact of medication errors can be catastrophic (Addison, 2017; APF, 2020; McCarthy et al., 2017; Rodziewicz, 2021). The impacted patients lose their trust in the healthcare providers, creating physical harm or even death. The fiscal impact is overwhelming and creates millions in a financial burden to the healthcare system and impacts those potential finances. The need for a solution to curtail medication errors is actively

being sought by nursing professionals. Simulation learning in the undergraduate program may assist in decreasing medication errors in the future.

Simulation in Medication Administration Learning

Before all the medical and pharmaceutical advancements, the acceptable process was for the nurse to read from a medication administration card created based on the medicine orders from the doctor. Medication advancements, including precision medication treatments, genomic testing for accurate medication usage, a wide variety of intravenous medications, and many pharmacological uses for the same medication, have elevated the need to advance pharmaceutical training (Seyhan & Carini, 2019). The use of pharmaceutical simulation as a teaching strategy and classroom instruction can enhance patient safety and optimize care outcomes by providing student nurses a safe environment to learn and make errors. Providing motivation and engagement with simulation increases as students work with real-life situations requiring decision-making that reflects the complexity of the healthcare environment (Parker & Grech, 2018). The National Council of State Boards of Nursing and top-tier research embrace the positive impact on patient care and patient outcomes using simulation teaching incorporated into nursing classrooms (Hemming et al., 2016).

The shortfall in the proper medication administration education can be attributed to the shortage of nurse educators, high student-to-faculty ratios, deficits of clinical locations, and the higher technology of medical care (Hansen & Bratt, 2017). Allowing the nursing student to learn with computerized models has shown to be effective in helping them to understand medication use and medication actions (Dubovi et al., 2018). The use of medication simulation learning will provide a student nurse with much-needed practice skills and develop the students' medication knowledge which is essential to decreasing errors (Dubovi et al., 2017).

Medication simulation potentially being incorporated into a nursing program allows a nursing student to participate in the same advanced decision-making skills and critical thinking skills required in actual clinical practice and provides a student nurse to safely complete medication administration in the inpatient setting. Nursing students who have learned medication mathematics in the simulated math environment could resolve issues with proportional reasoning (Dubovi et al., 2018). The use of simulation learning enhanced their abilities to understand other contexts of medication (Dubovi et al., 2018). Allowing the nursing student to learn with computerized models has shown to be effective in helping them to understand medication use and medication actions (Dubovi et al., 2018). The use of medication simulation learning will provide a student nurse with much-needed practice skills and develop the students' medication knowledge which is essential to decreasing errors (Dubovi et al., 2017).

Nurse educators constantly seek strategies that incorporate simulation technology into their curriculum, better preparing their students for their first day on the floor. The simulated learning environments have advanced over the years, significantly as technology has advanced. Advancements in technology in education allow the nurse educators to be better equipped to assess learning, disseminate a better educational format, enhance academic curriculum, and enhance student preparation, allowing the student to have higher quality skills, become competent and critical thinkers, and enabling them to provide more effective patient (Jeffries et al., 2016).

Tillman's (2019) research study examined incorporating simulation learning to assist nurses in identifying medication errors and learning from them. The study results showed that the pretest scores ranged from 78%–90%, and post-test results ranged from 88%–97% (Tillman, 2019). The results suggest that medication error identification accuracy increased (Tillman, 2019).

Student nurses require highly developed medication administration skills (Parker & Grech, 2018). Medication simulation learning requires problem-solving, critical thinking, independent thinking, understanding of adverse effects of medication, the multiple uses for the different disease processes, and the increased technology involved with medication administration (Parker & Grech, 2018).

Breitkreuz et al.'s (2016) focused their research study found that after utilizing simulation learning for medication administration and the nursing students having made medication errors, they became more cautious and provided feedback after six months that they continued to remain more cautious (Breitkreuz et al., 2016). Ten medical students, two physician assistant (PA) students, 21 nursing students, and 15 pharmacy students participated in four medication simulation scenarios with a debriefing (Motycka et al., 2018). The findings showed that as the students participated in the scenarios, they became more competent at meeting most learning objectives (Motycka et al., 2018). A research study that reviewed 21 simulation learning studies that focused on reducing medication errors, errors in preparing medications, managing medication crisis, or enhancing communication skills was completed by Sarfati et al. (2018). The study concluded that having a well-designed simulation learning effectively trained staff and "preventing iatrogenic risk related to medication errors" (Sarfati et al., 2018. p. 18). The studies in the above paragraph show a trending support to utilization of simulation learning to prevent medication errors.

Craig et al.'s (2021) research examined a quasi-experimental study using 83 third-year baccalaureate nursing students. The study had two groups, one control and one group that added medication simulation learning to their curriculum. The intervention group was taught safety, documentation, medication administration, reassessing the patient after medication, and received

a 30-minute debriefing from the instructor (Craig et al., 2021). A pre and post-test was given, and a confidence survey was to both groups. The results found that the intervention group scored higher on the post-test and confidence survey (Craig et al., 2021). The correlation of these studies is simulation learning can be effective at exposing student nurses to medication administration, enabling them to become comfortable with the unknown process, and helps them remember when in the clinical setting to be alert and cautious to prevent medication errors (Breitkreuz et al., 2016; Craig et al., 2021; Motycka et al., 2018; Sarfati et al., 2018).

Although there is no one clear solution to preventing medication errors, it has become an epidemic. The danger to patients is widespread, and the WHO has plans to reduce medication errors by 50% in 5 years (WHO, 2017). One step to prevent medication errors among nurses should be improved education, starting from the basics and providing academic resources to incorporate simulation learning with the traditional pharmacology class in the undergraduate nursing student. Allowing the nurses to practice and apply what they learn in the classroom, improving critical thinking, improving medication knowledge, and decreasing risks for near sentinel or sentinel events with their patients. Healthcare systems and higher education are the responsibility of healthcare systems to invest in ensuring that the investment is provided into education for preventing medication errors (Zimmerman & House, 2016). Integrating simulation learning is cost-effective considering the cost of medication errors, and the healthcare system will see a return on their investment (Zimmerman & House, 2016).

Summary

This chapter included a review of the literature regarding simulation learning, the advancement of simulation learning, simulation learning as it applies to nursing, how to make simulation learning successful, and how to use simulation learning to prevent future medication

errors among nurses. Simulation learning in higher education serves as a complement for traditional learning, and simulation software has, over the last decades has been increasingly used as an additional educational tool (Costantino et al., 2012). The advancement of technology has created a high definition of simulation learning, effective in tactile learning and problem-solving. The use of simulation software and tools provides a practical understanding of complex systems. Implementing simulation learning in the nursing curriculum provides the student an ability to enhance their learning experience and develop hands-on activities created by their instructors (Juan et al., 2017). Implementing simulation learning in the nursing program may create effective nurses knowledgeable about complex patient situations and confident in their skills (Kiernan, 2018). The use of simulation learning in nursing students allows those who participate in simulated patient care scenarios to gain experience, above-average critical thinking, and problem identification techniques, learning and refining skills, and developing competencies; this is accomplished without fear of harm to a live patient (Eyikara & Baykara, 2017).

The use of simulation learning is an essential tool to curb a catastrophic event in the medical system, medication errors. Medication administration must be given to the right patient, at the right time, with the right medicine, and the right dose (AHRQ, 2019). At any point in the process, distractions, unclear medication orders, or nurse inexperience can create a medication error. The error comes at a cost to the patient's safety and health and an economic impact on the healthcare system. Medication errors have become widespread and addressed by the WHO, which has plans to reduce medication errors by 50% in 5 years (WHO, 2017).

One solution is to incorporate medication simulation learning into the undergraduate nursing program during the pharmacology class. The simulation class provided a step above the

traditional classroom by taking that knowledge and performing it in simulation learning free from harming a live patient (Harper & Hadden, 2020). Nursing students learned and practiced in the simulation lab. They learned aspects of medication, medication administration in all routes, side effects, adverse effects, multiple uses of medication, genetically created medicines for specific patients and their disease process and monitoring for allergic reactions of medication and how to treat them. Implementing simulation learning early in the nursing program will create a seasoned graduate nurse who will be better equipped for new medical technology and a critical thinker and problem-solver (Aebersold, 2018).

The nurse educators were responsible for creating nursing students to think for themselves, be problem solvers under stressful patient scenarios, and be critical thinkers (Jillings, 2018). Simulation learning provided a safe environment that is free from fear of harming a patient. The instructor gave a pre-briefing, debriefing and provided immediate feedback on performance. Pre-briefing sets the learning tone and decreases the stress of the unknown for the students and the instructors' expectations for their learning experience (Hughes & Hughes, 2020). After debriefing the simulation session was done, the instructor and student provided input on the events. The student nurse became accountable for their learning as a partner in the simulation learning. The use of pharmaceutical simulation as a teaching strategy and classroom instruction enhanced patient safety and optimized care outcomes by providing student nurses a safe environment to learn and make errors. Providing motivation and engagement with simulation increases as students work with real-life situations requiring decision-making that reflects the complexity of the healthcare environment (Parker & Grech, 2018).

Convincing academic institution to financially support simulation programs requires proof in numbers. The colleges want to know they got a return on their investment. My research

study provided input on the success of adding simulation learning to the traditional pharmacology class. The research study was a quantitative quasi-experimental study with a two-group pretest-posttest design to examine if the addition of medication-simulated education was associated with improved medication administration knowledge compared to a traditional pharmacology classroom setting. The results contributed to the past research to utilize simulation learning in the undergraduate nursing program.

Chapter 3: Research Methods

There is an ever-growing danger in the nursing fields' clinical setting, medication errors occurring in all medical settings, by new nurses, and by experienced nurses. A resolution to this issue can be resolved early in the student nurse's pharmacology studies. The problem addressed in this study was the relationship between the lack of medication administration skills taught to students in an undergraduate nursing program and increased medication errors when caring for patients in the clinical setting (Hung et al., 2021). The purpose of this quantitative quasi-experimental study with a two-group pretest-posttest design was to examine if the addition of medication-simulated learning was associated with improved medication administration knowledge compared to a traditional Pharmacology classroom setting.

Chapter 3 includes the research methodology, design, population, sample, instrumentation, variables, study procedure, data analysis, assumptions, limitations, delimitations, and ethical assurances. The study must be valid and repeatable to demonstrate the actual effects of how simulation learning with traditional pharmacology classes impacted future medication errors—creating a solution to sentinel or near sentinel events with medication errors to provide an environment of safety for every patient.

Research Methodology and Design

The research study was a quantitative, quasi-experimental research pre/post-test design, correlational study. Medication errors in nursing have created a challenge for patients' proper and safe treatment. The addition of simulation learning early in the nursing education process may improve medication understanding by nursing students. To enhance nursing students' knowledge of the broad spectrum of medications and their administration and using the testing to measure

their aptitude. Using a quantitative design assisted in examining this topic; other methodologies were considered but deemed not appropriate.

Approaching the study using a qualitative research methodology would not provide generalizable information on preventing medication errors among nurses. Qualitative research, such as case studies, includes interviews and observations designed to gather specific details related to the topic. Qualitative methods and designs allow researchers to look at insight and behavior and break them into smaller sections to draw meaningful interpretations. A quantitative research design allowed for comparisons between the results for nursing students taking pharmacology and those taking pharmacology with simulated learning. Using a quantitative research method provided the study with understanding if adding simulation learning increased a nursing student's knowledge of medication usage, actions, side effects, and prevent medication errors (Tillman, 2019).

Population and Sample

The study population includes Associate degree freshman nursing students from two colleges in the southern United States enrolled in pharmacology courses. The first college will have freshman nursing students who take only the traditional pharmacology course. The second college will have the freshman nurses who take the traditional pharmacology with the medication simulation class. The sampling frame were freshman nursing students that took the pharmacology classes or registered for pharmacology and Medication Simulation learning. The sample size a convenience sample of a minimum of 26 students. The power analysis that was used is G*power, and the T-Test was conducted using SPSS. The type of power analysis was A priori and one-tailed. The statistical test was the difference between two dependent means or matched pairs. The alpha was less than 5% to reject the null hypothesis. The power was at 80%

so that it would yield a significant result. The effect size d was .5 or medium deviation. The err probability was inputted at .05, and the output was a noncentrality parameter is 2.5980762, and critical t is 1.7056179. The Df or degrees of freedom is 26. The n or the potential sample population is 26 students, and the G*Power calculation result determined that size that was significantly effective for a measured meaningful study.

Participation were voluntary and will not impact students' grades. Recruitment included a written notification provided to each student in the Associate Degree undergraduate nursing program in the two colleges taking the pharmaceutical and pharmaceutical classes with simulation learning per email invitation. Two weeks prior to class beginning, there was a reminder invitation for any students who have not responded. Those who had positively responded received a follow-up email with details of the study and consent, as well as confirmation that they are first-time participants in the pharmacy classes. The inclusion criteria for this study were nursing students enrolled at one of the two study schools who took the pharmacology course or pharmacology course with simulation learning for the first time. The exclusion criteria included any nursing student who has previously taken a pharmacology course or simulation education or not enrolled in one of the two participating colleges. The nursing students signed a consent to participate, and the authorization explained the purpose, research study, and how the information from the test results was utilized. Each participant received an anonymous number identification, and their names will be unknown.

Instrumentation

The research instrument was the medication portion of the NCLEX-RN test (Smith Glasgow, 2019). The test consisted of 25 medication questions worth four points each. Tests measured the knowledge skills of the nursing students before the pharmacology class (with and

without the simulation learning) and evaluated their knowledge after the completion of the courses. The exam was the conglomerate of all the knowledge that the student nurse has learned in the nursing program and passing the NCLEX provided the student nurse with their Board of Nursing Registered Nurse license. Passing NCLEX required a score of 900. In the study of the success of NCLEX as a nursing knowledge exit exam, there were 5,038 students represented, 2,084 (41.4%) scored 900 and above on the NCLEX exam 37 failed, which yielded a predictive accuracy of 98.26% (Barton et al., 2014). The NCLEX is utilized as an exit exam to address the importance of assessing nursing students and focusing on minimum competency learned throughout their nursing program (Smith Glasgow, 2019). The medication portion of the NCLEX was used to test the student's medication knowledge, which produced numerical scores, the higher the numerical score, the more the students' aptitude for medication knowledge. The NCLEX exam was utilized to develop the medication test as it has one purpose: To determine if it is safe to begin practice as an entry-level nurse, it is taken after completing all requirements for the nursing program are fulfilled (Smith et al., 2019).

Operational Definitions of Variables

Independent Variable Pharmacology Classes

The independent variable is the two-course options of the pharmacology class and the pharmacology and simulation learning taken by two groups of nursing students. These two groups are operationalized as a dichotomous variable. The first group is nursing students taking the traditional pharmacology course, and the second group of nursing students taking the conventional pharmacology course and the medication simulation course. The two groups consisted of freshman nursing students; however, the first group was only have a traditional pharmacology class. The second group was the pharmacology and Medication Simulation

learning. Candidate students were of any age, gender, ethnicity, and there is no relevance in their financial status. The independent variable was nominal.

Dependent Variable NCLEX

The Dependent Variable is the NCLEX based test scores, which are numeric. The scaling for measurement for the dependent variable was used as a ratio variable (0–100). A score of 0 represented the least amount of medication knowledge, and 100 represented the highest amount of medication knowledge. The dependent variable was a composite variable of 0–100 in four-point increments. The test questions was 25 questions worth 4 points apiece; therefore, scores was 0, 4, 8, and so forth up to 100. The dependent variable indicated that a higher score indicates a higher aptitude for medication.

Study Procedures

I received approval from NCU's Institutional Review Board (IRB) prior to data collection. The research utilized human subjects, and each participant was assigned a research number, allowing for complete confidentiality and anonymity. The study involved minimal risk to participants, and there were no ethical issues as each student took the pre/post-test without using their name, only their research numbers. Once the research numbers were assigned, participants, researchers, or others did not identify the participants. The data was stored in safe, locked place, accessible only to the researcher and other approved members of the research team. According to Northcentral University policy, the materials were to be destroyed after three years utilizing an IRB-approved method.

The study began by sending out flyers to Associate Degree nursing students taking a pharmacology course and nursing students who took the pharmacology course with a medication simulation learning. I utilized flyers to explain the study, reasoning, and how the information

was used, and the procedure for anonymity. The participants were of convenience as they were undergraduate Freshman nursing students in the associate degree programs from the 2021–2022 academic class of two accredited nursing colleges. A pre and post-test was created using the National Council Licensure Examination (NCLEX-RN®) (Smith Glasgow, 2019). The research participants completed the pre and post-tests via online testing prior to starting the course and immediately after completing the course.

Data Analysis

Processing included exporting, transforming, coding, addressing outliers and missing values, and when using this test, there are four assumptions that should be considered. Each assumption was briefly discussed. The first assumption was that the dependent variable (pretest and post-test) will be measured at a continuous level. The measurement was 0 to100 in increments of four. The second assumption was that the independent variables are related groups. This study were groups of freshman nursing students in the Associate Nursing Degree program; these are also known as dichotomous variables. The third assumption was that there will be no significant differences in the two related groups. The values of the test scores were the same for the pretest and the post-test, 0-100 points. The fourth and final assumption was that there should be a normal distribution between the two related groups. The sample size from both groups were equal or near equal number of participants from each group.

The numerical data from the pre/post-test scores was utilized in the T-test to detect whether the mean score for the post-test is higher or lower than for the pretest and if the students that had the students that performed the addition of the simulation learning were higher than those who only took the pharmacology class. The paired-samples t-test was used to determine whether the difference is statistically significant. The descriptive statistics helped to identify

what the differences are in terms of the mean scores and standard deviations (Laerd Statistics, 2013).

Assumptions

In this research study, it is the assumption of the researcher that the students would answer all test questions honestly and without deception. Each test question was focused on the pharmaceutical portion of the NCLEX exam and was the same for both groups, allowing neutral questions which would not give either group an unfair advantage. The students had the ability to receive an email, understand the information given, be willing and able to take the pretest and post-test per computer, and have no feeling of obligation to participate in the research study.

Limitations

A major limitation of this study was those study participants are utilized from two nursing colleges, and the participation is voluntary, which may have the potential for self-selection bias. The selection of the classes was not randomly selected and may not be representative of other populations, which may impact the generalizability of the results and data analysis conclusions. Therefore, this limitation must be considered when interpreting the findings. Another limitation was there two different colleges being utilized, and their pharmacology class may vary by university policy. Although the instrument was reliable, the small number of nursing students and the potential for participants to not perform their best on the tests can alter the potential for accurate data study, and the results could vary with the student's willingness to commit to the study.

Delimitations

The participants were limited to only those nursing students who had not taken the classes previously. Limiting the study to first-time pharmacology students reduced the potential

of an unfair advantage and would skew the scores of the NCLEX test for increased knowledge of medication knowledge. If this limits the number of participants, an additional college would be added to the study.

Ethical Assurances

This research study received approval from Northcentral University's Institutional Review Board (IRB) prior to data collection. I followed the guidelines and ethical principles as outlined in the Belmont Report. The research participants were volunteers from the two southern university's nursing programs taking the pharmacology class or the class with medication simulation. The research study participants had minimal risks and were unidentifiable except by assigned number at the consent process, and this reduced any risk to the participants. No student was at ethical risk, nor was the study impact their grade. The participants were respected and were within the boundaries of research and not practice.

Pharmacology instructors did not know who is participating in the research study and did have not access to the results of the pretest and post-tests. Only I had access to any information regarding participants and scorekeeping confidentiality and anonymity. I did not discuss or share any information with any staff of the participating colleges, administration, or students. The participants were be treated ethically and maximized the potential benefits and minimized potential harm with the research study (Office of Human Research Protection, 1979). The participants were given the information with the consent form regarding the study, the use of the information, and the opportunity to discontinue their participation in the study without fear of negative repercussions.

The study participants were allowed time to read and comprehend the information and will be allowed to ask questions of the researcher at any point in the study. The scores were non-bias, and the scores were inserted into the SPSS tool and provide minimal risk to the participants. The test results and completed t-Test comparison were be stored in a safe, locked place, accessible only to the researcher and other approved members of the research team. According to Northcentral University policy, the materials were to be destroyed after 3 years utilizing an IRB-approved method.

Summary

The focus of this study was to determine if there was a difference in medication aptitude with the addition of simulation learning while taking the nursing pharmacology class during their freshman year in their Associate degree nursing program. The instrument that was utilized was a 25 question pre/post-test obtained from the NCLEX test. Minimum sampling was 26 and was determined by G*power analysis. The participants were from a convenience sampling from two participating southern universities. A T-test was used to process the numerical data from the pre/post-test scores. The T-test was detect if the mean score for the post-test is higher or lower than for the pretest and if the students that had the students that performed the addition of the simulation learning were higher than those who only took the pharmacology class. The paired-samples t-test was used to determine whether the difference is statistically significant. Ethical standards were utilized throughout the research process. Within Chapter 4 the finding were be shared, and implications and conclusion were drawn in Chapter 5.

Chapter 4: Findings

The purpose of this quantitative quasi-experimental study with a two-group pretest-posttest design was to examine if the addition of medication-simulated learning was associated with improved medication administration knowledge compared to a traditional pharmacology classroom setting. The problem addressed in this study the relationship that exists between the lack of medication administration skills taught to students in an undergraduate nursing program and increased medication errors when caring for patients in the clinical setting. The goal of the research was to determine if there was any significant increase in test results between the two teaching formats. Two southern colleges were utilized, one completed the pharmacology course with simulated learning and the other using the traditional classroom format.

RQ1. What is the difference between NCLEX medication administration knowledge pretest-posttest scores when utilizing the simulation lab verses no addition of the simulation lab in a traditional Pharmacology course?

RQ2. What is the difference in the medication simulation post-test scores from the pretest after taking the medication simulation lab?

Northcentral University Institutional Review Board approved the research study, and the nursing pharmacology department leaders at the colleges were emailed the consents, pre- and post-tests, and recruitment materials. The instructors disseminated the materials to the undergraduate nursing students. The college with simulated learning provided information to sixty-five nursing students and the traditional pharmacology course provided the information to 45 nursing students. Students that met criteria for participation had not yet taken a pharmacology course in their undergraduate program. Each NCLEX pre- and post-test was returned to the department leader with a 4-number identification based on the participant's phone number; this

number was for comparison of pre- and post-rest results and to ensure no replication of test taker data. The researcher was never in contact nor had knowledge of the nursing students name or other information. The institutions preferred complete student confidentiality.

Validity and Reliability of the Data

The validity of the data was an accurate measurement by the NCLEX pre-test and post-test. The NCLEX tests were designed to measure the nursing student's knowledge prior to the completion of their class and how much knowledge was gained at the end of their class. The test measures the knowledge of pharmacology, and the question are the same for each test and each student. NCLEX tests were utilized in Tillman's (2019) research study but not an NCLEX based exam. The research examined incorporating simulation learning to assist nurses in identifying medication errors and learning from them. The study results showed that the pretest scores ranged from 78%–90%, and post-test results ranged from 88%–97% (Tillman, 2019). The results suggest that medication error identification accuracy increased (Tillman, 2019). Motycka 's (2019) study performed a student survey to determine if simulation learning student nurses felt more competent in medication knowledge. findings showed that as the students participated in the scenarios, they became more competent at meeting most learning objectives (Motycka et al., 2018).

There was no prior research to confirm the reliability of NCLEX. There were no other studies found where data was collected utilizing this tool. The response to the test was based on each college's course content and the nursing student's learning style, fatigue, test taking ability, and level of attention to provide accurate results. The NCLEX research test could be replicated utilizing the same testing materials, but the test subjects could change depending on the colleges, nursing program, degree level, number of volunteers, and their trustworthiness.

In this research study the data did not meet the assumptions of the statistical test. The colleges had a total of 110 potential research participants and only eight volunteers for the research study. This made the ability to have an adequate testing number void. There were four nursing students from simulation learning and four from traditional classroom learning. Both groups were provided the opportunity to take the same 25 question pre- and post-NCLEX test.

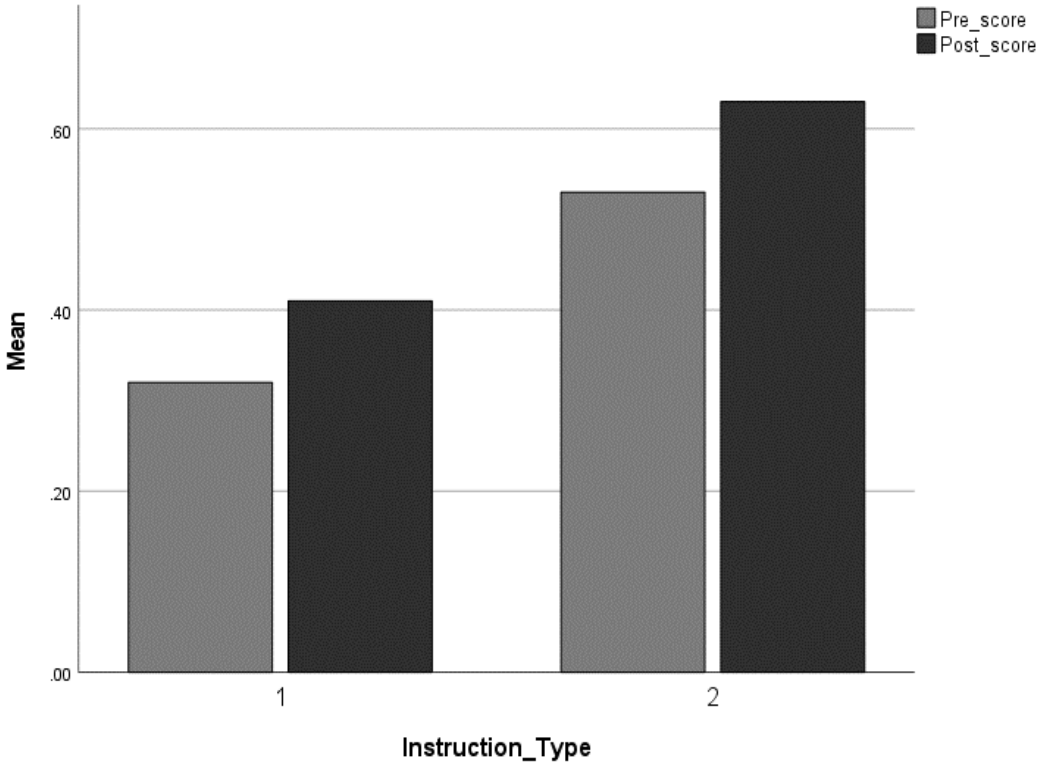
Results

The research study began 2 years prior to the initiation of the study. The Nursing school with the simulation learning agreed to participate prior to the pandemic. Prior to, during, and as the study began the attempts to find a nursing college to agree to participate in the research study was difficult. Fourteen colleges declined and three nursing programs from a university associated with Northcentral University agreed but after weeks of attempts were unable to find any nursing students to agree to participate. The assistant dean and chairperson meet with the researcher to combine ideas for recruitment. The second college was obtained and only four nursing students participated.

The pre and post-test for both groups were entered into SPSS to determine research test results. The test results had 0.01 significance which created a null hypothesis. Figure 1 shows the difference in test results between simulation learning and traditional classroom.

Figure 1

Pre and Post-Test Results for Simulation and Traditional Instructional Types



Note. Instructional type 1 represents the traditional classroom learning. Instructional type 2 represents the simulation learning. The study was completely confidential and there was no age, gender, or race.

Research Question 1

What is the difference between NCLEX medication administration knowledge pretest-posttest scores when utilizing the simulation lab verses no addition of the simulation lab in a traditional Pharmacology course?

An independent-samples t-test was completed to determine if there were differences in pre-and post-test results for traditional pharmacology class and simulation learning class for nursing students. The population was too small to provide an accurate and usable amount of data.

However, in the information that was obtained, there was a slight increase in the scores for the simulation learning students (*M=0.1000*, *SD* = 0.2309) than traditional pharmacology (*M* = 0.0900, *SD* = 0.3830). The data is not considered significant, and the mean difference was 0.01%, $t(6) = -0.447$, $p = 0.670$.

The research data was not significant because of the participation size. The researcher attempted for 2 years to obtain college participation for the traditional pharmacology class. Once the pharmacology and simulation classes were obtained, the participants in both classes totaled eight. Participation, physical location, and college curriculum was impacted by the pandemic, staff, and program cuts, as well as the lack of desire of the students to participate.

Research Question 2

What is the difference in the medication simulation post-test scores from the pre-test after taking the medication simulation lab?

The difference in the pre-test score from the post-test scores for the four participants as seen in Table 1 equate to 0.34. I realize that a larger participant group would provide a better representation of the difference in the simulation pre- and post-test scores. Table 1 shows the difference for both classes for pre-and post-tests. The simulation learning student nursing showed a 0.84 better score than in the pre-test than the traditional class nursing students. A paired t-test, as seen in Table 2, indicates a result of 0.670.

Table 1

Pre-and Post-test results for Traditional and Simulation Pharmacology

ID	Instruction Type	Pre-score	Post-score	Difference
1	Traditional	0.24	0.28	0.04
2	Traditional	0.2	0.28	0.08
3	Traditional	0.36	0.48	0.12
4	Traditional	0.48	0.6	0.12
5	Simulation	0.44	0.56	0.12
6	Simulation	0.8	0.88	0.08
7	Simulation	0.48	0.6	0.12
8	Simulation	0.4	0.48	0.08

Evaluation of the Findings

The research data is not significant, and the variances are not equal, the Null hypothesis would be accepted (see Table 2). There is no other obtainable research that utilizes the NCLEX nursing test questions so a comparison of research or the conceptual framework are unable to be interpreted. The difficulty with creating usable data is having the number of participants that would create a relevant amount of data to process. A G*Power analysis indicated that the sample size should have been 13 students for the intervention group and 13 students for the comparison group for this research study. The actual number of students that participated was eight. The difference in the NCLEX test score for the nursing students in Traditional pharmacology and simulation lab were 0.01%. This number is not adequate to validate either hypothesis.

Table 2

Independent Samples Test for Pre and Post-Test Results

Leven's Test for Equality of Variances		t-test for Equality of Means			
F	Sig	t	Sig. (2-tailed)	Mean Difference	Std. Error Difference
1.500	0.267	-0.447	0.670	-0.1000	0.02236

Summary

The goals for this research study were to obtain data to see if there was a difference in the 25 question NCLEX pre-and pot-test between the traditional pharmacology nursing class and the simulation pharmacology nursing class. There were only eight student nurses total that were willing to participate in the research study. The Chairperson and Assistant Dean were made aware of the difficulty finding a second college and with the suggestion of using alternative methods a second college agreed to participate in the research study. The students received all participation information, consent, and pre-and post-test via their instructors by way of their department leaders. The nursing students were provided information in advance and were encourage by their instructors each class to participate in the research. The researcher's email was provided for questions or clarification. The colleges only identified the student by a 4-digit identification number and no demographics or information was provided about the students. The colleges wanted completed confidentiality in regard to the student participant's identity. The lack of student participation deemed the research study to be an educational exercise and not a viable research study. Approval to proceed with eight participants was obtained by the researcher's chairperson and associate dean, with the knowledge that all avenues had been tried to obtain higher numbers of participants and staying within the University's standards and ethics. The data that was obtained was run through SPSS and the difference in scores between the traditional and simulation class were 0.01%. Due to lack of supportive data the Null hypothesis was accepted.

Chapter 5: Implications, Recommendations, and Conclusions

The purpose of this quantitative quasi-experimental study with a two-group pretest-posttest design is to examine if the addition of medication-simulated learning is associated with improved medication administration knowledge compared to a traditional pharmacology classroom setting. The problem addressed in this study is the relationship that exists between the lack of medication administration skills taught to students in an undergraduate nursing program and increased medication errors when caring for patients in the clinical setting. The goal of the research was to determine if there was any significant increase in test results between the two teaching formats. Two southern colleges were utilized, one completed the pharmacology course with simulated learning and the other using the traditional classroom format.

The research study was a quantitative, quasi-experimental research pre/post-test design, correlational study. Medication errors in nursing have created a challenge for patients' proper and safe treatment. The addition of simulation learning early in the nursing education process may improve medication understanding by nursing students. To enhance nursing students' knowledge of the broad spectrum of medications and their administration and using the testing to measure their aptitude. The quantitative design was used in examining this topic.

A quantitative research design was to allow for comparisons between the results for nursing students taking pharmacology and those taking pharmacology through simulated learning. If the number of subjects would have been significant for the study, the quantitative research method would have provided the study with the research data to determine if the taking simulation learning would have increased a nursing student's knowledge of medication usage, actions, side effects, and prevent medication errors.

There were several unavoidable situations that negatively impacted the overall success of the research study. Though the simulation college that researcher was partnered with a year prior to the pandemic, the institution was negatively impacted with staff cuts, program changes, and pandemic protocol changes. The pandemic had a substantial impact on all realms of academia and the world in overall. The ability to obtain a traditional pharmacology class for undergraduate nursing was almost nonexistent. Prior to the pandemic it was difficult to get a nursing school to commit, having had eight schools decline but after the pandemic four additional nursing programs declined, including our sister college. A college was obtained by being creative and reaching out to anyone who would listen, even at work, to obtain a connection to a nursing program that had the traditional pharmacology classes.

In reviewing the implications, recommendations, impact, and future recommendations it is with a hope of a greater impact on obtaining subjects and securing adequate data to clearly assess if there is a pattern of improvement to have simulation learning in partnership with the pharmacology class in undergraduate nursing programs. Incorporating simulation learning early in the nursing school curriculum will create a seasoned graduate nurse that can reason, problem-solve, and will be better equipped for new medical technology (Aebersold, 2018).

Implications

Unfortunately, due to the study hurdles and limitations, no significant data was gathered through this research study. The research data was not significant, and the variances were not equal, the Null hypothesis would be accepted. A G*Power analysis indicated that the sample size should be 35 students for the intervention group and 35 students for the comparison group for this research study. The actual number of students that participated was eight. The difference in the NCLEX test score for the nursing students in Traditional pharmacology and simulation lab

were 0.01%. There was no other obtainable research that utilizes the NCLEX nursing test questions so a comparison of research or the conceptual framework was unable to be interpreted. The number was not adequate to validate either hypothesis. There were not adequate subjects to determine if there was any impact with having the addition of simulation lab with the traditional pharmacology class. The limited amount of data neither supported the hypothesis, showed there was no difference based on academic set up for class, or if traditional classes showed higher results of success. The factors that influenced the results were the pandemic, the effects the pandemic had on colleges and their programs, the lack of desire of nursing programs in other colleges to support graduate education nurses in their research, and the lack of commitment of nursing students to participate in the research study even with the encouragement of their instructors.

In theory and with successful participation from the nursing students the hope was for the study to have shown a higher test score for the addition of simulation lab with traditional pharmacology as was shown in the studies by Dubovi et al. (2018). This study showed that the use of simulation learning enhanced their abilities to understand other contexts of medication (Dubovi et al., 2018). Allowing the nursing student to learn with computerized models has shown to be effective in helping them to understand medication use and medication actions (Dubovi et al., 2018). The use of medication simulation learning will provide a student nurse with much-needed practice skills and develop the students' medication knowledge which is essential to decreasing errors (Dubovi et al., 2017). Unfortunately, this research did not have enough participates to create any results to support the research questions or hypothesis. However, in the research information that was obtained, there was a slight increase in the scores for the simulation learning students ($M = 0.1000$, $SD = 0.2309$) than traditional pharmacology

($M = 0.0900$, $SD = 0.3830$). The data is not considered significant, and the mean difference was 0.01%, $t(6) = -0.447$, $p = 0.670$.

Research Questions / Hypotheses

RQ1

What is the difference between NCLEX medication administration knowledge pretest-posttest scores when utilizing the simulation lab verses no addition of the simulation lab in a traditional Pharmacology course?

Ho

The medication simulation learning will not correlate with NCLEX medication administration knowledge pretest-posttest scores when utilizing the simulation lab verses no addition of the simulation lab in a traditional Pharmacology course.

Ha

The medication simulation learning will correlate with NCLEX medication administration knowledge pretest-posttest scores when utilizing the simulation lab verses no addition of the simulation lab in a traditional Pharmacology course.

RQ2

What is the difference in the medication simulation post-test scores from the pretest after taking the medication simulation lab?

Ho

The medication simulation post-test score will not correlate with the completion of medication simulation learning.

Ha

The medication simulation post-test score will have a positive correlation with the completion of medication simulation learning.

With minimum research participants the results were a null hypothesis. Although, even with the minimum results there was some evidence that there was benefit of having the simulation learning with the traditional pharmacology class. Simulation classes lay a strong learning foundation for a more efficient student nurse capable of critical thinking when administering medication in the clinic. Chernikova et al. (2020) analyzed 145 studies related to simulation-based learning and found that a significant percentage of the studies had a positive overall effect of learning with nursing students. Hung et al. (2021) included seventy-nine senior undergraduate nursing students and considered the effects of repeated simulation learning on confidence, competence, and education fulfillment. The research is built on the students' knowledge to ensure that they are confident, knowledgeable, and satisfied with their nursing skills. Two groups of students took the repeat course three times, either in the fall or spring semester, in emergency and critical care nursing (Hung et al., 2021). The results showed that most learning took place over the first simulation, but students continued to build self-confidence, improve skills, and were satisfied with their level of learning (Hung et al., 2021). Further research studies with ample participants will be needed in future research.

Due to low participation rate in this study the results were not profound; however, there was an indication that medication knowledge was improved with medication simulation. The implications that simulation labs improve the critical thinking and overall knowledge of medication is essential for creating safe treatments for patients and decreasing overall medication errors. Burden and Pukenas (2018) stated that these errors occur many times because of human

error, inadequate knowledge, and system failures leading to adverse events or the patient's death. Simulation learning can bridge the gaps in medication knowledge deficits and vastly decrease the financial costs, harm to patients, and legal consequences. Chernikova et al. (2020) analyzed 145 studies related to simulation-based learning and found that a significant percentage of the studies had a positive overall effect of learning with nursing students. Simulation learning provides a tool against medication errors before they become detrimental to a patient. Simulation labs provide a safe environment to learn, experiment without consequences, and debrief with experienced professionals. All of these benefits improve retention of medication knowledge and enhance critical thinking skills.

Recommendations for Practice

One of the most dangerous and deadly health problems in the United States are medication errors (Rodziewicz & Hipskind, 2020). Hundreds of thousands of adverse reactions and complications related to medication errors go unreported every year (Tariq & Scherbak, 2020). The Journal of Community Hospital Internal Medicine Perspective (2016) estimates that more than 7 million patients are impacted, and the cost is almost $21 billion from preventable medication errors in all health care settings annually. Medication errors during medication administration are underestimated as it is estimated that the number of errors is under-reported by approximately 90% (Durham, 2014). Simulated medication program education in the early curriculum of the undergraduate nursing program may reduce the number and severity of medication errors (Durham & Alden, 2008).

The results from this research study cannot be utilized to support or not support the addition of simulation lab with pharmacology class to improve knowledge of medications. The limited results cannot be utilized in a potential tool to assist with decreasing medication errors at

the beginning of the nursing practice or as an ongoing training tool. It is humbling that hard work and persistence cannot create a successful research study for such an important safety issue. However, since beginning this study before and through the pandemic more research data has become available for the effects of simulation learning in pharmacology. The nursing programs has had to used simulation as a work around for clinical settings during a period of limitations in clinics, hospitals, and having to perform classes online. The pandemic may have closed many roads, but it has also opened highways for creativity to obtain knowledge.

Recommendations for Future Research

The problem addressed in this study is that a lack of preparation leads to medication errors in the hospital or facility setting (Musharyanti et al., 2019). Each year, in the United States, 7,000 to 9,000 people die as a result of medication errors and countless reactions and complications related to medication errors go unreported (Tariq & Scherbak, 2020). Research will need to focus on why this is happening and how to resolve this problem. Simulation learning, whether in a live lab or a computer lab, can be an asset for student nurses to be prepared for their nursing practice. Simulation learning allows nursing students to engage as partners in their learning, enhance their knowledge and skills, and promote self-directed learning (Brown et al., 2017). Simulation learning is an effective tool for continuing education in medication knowledge as treatments, administration, and technology are ever-changing. Simulation learning is a practical approach for teaching high-risk nursing skills, creating an optimal environment for developing communication and teamwork, reducing stress during crisis resource management, and providing a safer patient environment (Hughes & Hughes, 2020).

There are several specific possible future studies based on the findings of this study:

- Invested focus group

- Utilizing archival research
- Changes in research technique during pandemic
- Going beyond the university

Utilizing the above recommendations can assist future researchers in creating a successful and participant supported study.

Recommendations for future research are first a foremost, obtaining a group of research participants that are invested in wanting to improve the nursing field and patient safety. The students may be better invested if the research belongs to a college that supports the research. Having a face to face with the participants to allow for questions and to develop a familiarity with the researcher.

Utilizing archival research and creating a mixed research study will provide the best of qualitative and quantitative research. During the last 2 years there has been more focus on research studies on simulation learning. Gleaning from strong research studies can strengthen other researchers own studies. Educating on the severity and changing legal environment for nurses who have critical medication errors and the repercussions.

The World Health Organization (WHO) declared a worldwide pandemic on March 11, 2020; with countries locked down, there were travel bans and stay-at-home orders (Lin & Peng, 2021). This worldwide event made it difficult to complete the research study during the height of a pandemic. However, devastating events in the world cannot be avoided. Research cannot stop when the world does. The global pandemic shook the world and shut cities down; new rules for gathering, learning, and in our basic living routine where changed. The pandemic was a large hurdle but now that it has occurred, researchers have learned a few things from it. Creativity and thinking outside the norm are needed to obtain research subjects and data. The academic design

of universities changed and continue to change related to the pandemic. All nursing programs include classroom instruction and maintaining clinical hours without direct patient care (Shea & Rovera, 2021). Shea and Rovera (2021) engaged nursing students at one university who needed 50% of direct patient care hours for their curriculum. The nursing students' direct care hours had to replace their clinical hours with virtual simulation and telehealth simulation.

Searching for future research participants will go beyond depending on university students attending the course in the research study. Researchers should seek alternative contexts for locating participants, such as Facebook, colleagues, or other means beyond the college campuses. Prior to the research study, contemplate if utilization of archival research would keep the study moving forward. Creativity and tenacity are the key to success. There is a need for this research and working toward a solution to medication errors can be life or death to a patient.

Conclusions

The problem of medication errors in the nursing practice is real. It is under-reported and limited in the solutions to help improve medication errors. Medication errors is the most dangerous and deadly health problems in the United States are medication errors (Rodziewicz & Hipskind, 2020). Hundreds of thousands of adverse reactions and complications related to medication errors go unreported every year (Tariq & Scherbak, 2020). *The Journal of Community Hospital Internal Medicine Perspective* (2016) estimates that more than 7 million patients are impacted, and the cost is almost $21 billion from preventable medication errors in all health care settings annually. Medication errors and its impact on patients' lives are at a critical point. With the prosecution of the Vanderbilt nurse, it is now in the forefront of the public eye. It is imperative that an effective solution to education and train nurses to improve their knowledge, effective medication management, and safe administration is initiated soon. Research studies are

the keystone of finding a solution and providing the power of numbers to support the initiation of a sound solution to save lives.

The study may have not had significant data to utilize; however, it did show a small trend with the numbers that were obtained. It showed a slight improvement in the NCLEX score of those student nurses that had taken simulation labs. Simulation learning during nursing college and in continued education could be a tool that could decrease sentinel or near sentinel events in patient care. There are other factors to medication errors, such as understaffing, nurse fatigue and burn out, and increasing technology. Nursing skills simulation provides students with opportunities to practice their clinical and decision-making skills through various real-life simulated experiences (Kim et al., 2016).

In 2023, the NCLEX will change drastically, demonstrated by a rebranding to the Next Generation NCLEX (NCSBN, 2023). The new questions will require critical thinking by the graduate nurse to be successful. Critical thinking is a critical component of keeping patients safe and providing better outcomes with patient care. By changing the NCLEX test, the Council of the State Board of Nursing will evaluate the graduate nurses' ability to function on an entry level nursing position (NCSBN, 2023). Giving hands-on experiences in a live lab or computer setting will enhance the success of the student nurse to use their skills and succeed on the NCLEX and in their future nursing practice.

With direct learning and medication familiarity the nurse can be confident in their medication knowledge even during low staffing and fatigue. The auditory, tactile, and visual learning that simulation learning provides give the student confidence, critical thinking, and strength in their knowledge of medications. Providing simulation can increase nurses' knowledge and decrease medication errors.

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Appendix A

Recruitment Letter

My name is Gigi Lohrman RN, and I am a doctoral student at Northcentral University (NCU). I am conducting a research study to determine if simulation learning in pharmacology class for the nursing program improves post-test scores.

You may participate in this research if you meet all of the following criteria:

1. Undergraduate Nursing students actively enrolled in Nursing Pharmacology classes or Nursing Pharmacology with Pharmacology Simulation lab. Participants should be taking Nursing Pharmacology for the first time and not having repeated the course. The Nursing Pharmacology courses may be in the Associate Degree Nursing program or Baccalaureate Nursing Degree Nursing program.
2. Are age 18 or older

If you decide to participate in this study, you will be asked to do the following activities:

1. Participants will obtain a pre-test NCLEX Pharmacology consisting of 25 questions.
2. Participants will return the pre-test per email within 24 hours of receiving to Gigi Lohrman @ g.lohrman4521@o365.ncu.edu
3. Participants will receive a post-test NCLEX Pharmacology consisting of 25 question 8 weeks from completing pre-test. Post-test should be completed within 24 hours from receiving to Gigi Lohrman @ g.lohrman4521@o365.ncu.edu.
4. Each participant will be provided an identification number that will provide anonymity for test results. Please use this number on pre-test and post-test.

Thank you,

Gigi Lohrman RN, MSN
g.lohrman4521@o365.ncu.edu
NCU Doctoral Candidate

Appendix B

Consent Letter

Introduction

My name is Gigi Lohrman RN, and I am a doctoral student at Northcentral University (NCU).

I am conducting a research study to determine if simulation learning in pharmacology class for the nursing program improves post-test scores. The name of this research study is "Quantitative Quasi-experimental Study with the Undergraduate Nursing Program Using Simulation Learning to Reduce Medication Errors" I am seeking your consent to participate in this study.

Please read this document to learn more about this study and determine if you would like to participate. Your participation is completely voluntary, and I will address your questions or concerns at any point before or during the study.

Eligibility

You may participate in this research if you meet all of the following criteria:

1. Undergraduate Nursing students actively enrolled in Nursing Pharmacology classes or Nursing Pharmacology with Pharmacology Simulation lab. Participants should be taking Nursing Pharmacology for the first time and not having repeated the course. The Nursing Pharmacology courses may be in the Associate Degree Nursing program or Baccalaureate Nursing Degree Nursing program.
2. Are age 18 or older

I hope to include 26 people in this research. 13 participants from traditional Nursing Pharmacology and 13 participants from Nursing Pharmacology with Simulation lab.

Activities

If you decide to participate in this study, you will be asked to do the following activities:

1. Participants will obtain a pre-test NCLEX Pharmacology consisting of 25 questions.
2. Participants will return the pre-test per email within 24 hours of receiving to Gigi Lohrman @ g.lohrman4521@o365.ncu.edu
3. Participants will receive a post-test NCLEX Pharmacology consisting of 25 question 8 weeks from completing pre-test. Post-test should be completed within 24 hours from receiving to Gigi Lohrman @ g.lohrman4521@o365.ncu.edu.
4. Each participant will be provided an identification number that will provide anonymity for test results. Please use this number on pre-test and post-test.

During these activities, you will be asked questions to assess your:

- Pharmacology knowledge prior to course

- Pharmacology knowledge at 8 weeks of participating in course

All activities and questions are optional: you may skip any part of this study that you do not wish to complete and may stop at any time.

If you need to complete the activities above in a different way than I have described, please let me know, and I will attempt to make other arrangements.

Risks

There are no foreseeable risks or discomforts associated with this study. You can still skip any question you do not wish to answer, skip any activity, or stop participation at any time. All participants will be provided an identification number that will provide anonymity for the participant.

Benefits

If you participate, there are no direct benefits to you. This research may increase the body of knowledge in the subject area of this study.

Privacy and Data Protection

I will take reasonable measures to protect the security of all your personal information, but I cannot guarantee confidentiality of your research data. In addition to me, the following people and offices will have access to your data:

- My NCU dissertation committee and any appropriate NCU support or leadership staff
- The NCU Institutional Review Board

This data could be used for future research studies or distributed to other investigators for future research studies without additional informed consent from you or your legally authorized representative.

I will securely store your data for 3 years. Then, I will delete electronic data and destroy paper data.

How the Results Will Be Used

I will publish the results in my dissertation. I may also share the results in a presentation or publication. Participants will not be identified in the results.

Contact Information

If you have questions, you can contact me at: g.lohrman4521@o365.ncu.edu.

My dissertation chair's name is Dr. Julia Watkins. They work at Northcentral University and are supervising me on the research. You can contact them at: jwatkins@ncu.edu.

If you have questions about your rights in the research or if a problem or injury has occurred during your participation, please contact the NCU Institutional Review Board at irb@ncu.edu or 1-888-327-2877 ext 8014.

Voluntary Participation

If you decide not to participate, or if you stop participation after you start, there will be no penalty to you: you will not lose any benefit to which you are otherwise entitled.

Thank you,
Gigi Lohrman RN, MSN
NCU Doctoral Candidate

Appendix C

NCLEX Pharmacy Pre- Test/ Post-Test

Student ID Number:

Please complete all 25 questions, read questions carefully, and when completed please save and return to _____ Thank you for participating! You will receive the post-test in ___ weeks.

1. A patient with type I diabetes asks the nurse why he can't take the new diabetic drug that he sees on the commercials. Which of the following is the best explanation for the nurse to give the patient?

    - ☐ "The cells that make insulin have been completely destroyed in your body, so drugs won't work. You can only receive shots of insulin."
    - ☐ "The new medications don't work as effectively as the old ones."
    - ☐ "Type 1 diabetes only responds minimally to medication."
    - ☐ "I don't see why you couldn't. Let's talk to the doctor."

2. The nurse notes that a physician new to the hospital's computer system has input three out of four orders INCORRECTLY for a patient. Which of the following medications is CORRECT for a patient with the following criteria: Diabetes Insipidus, Dehydration, Hypertension?

    - ☐ DDAVP.
    - ☐ Furosemide.
    - ☐ Insulin.
    - ☐ Hypertonic saline.

3. A busy, harried-looking physician comes onto the floor and writes out four orders in less than one minute. He leaves, shoving over a stack of the nurse's charting on the way out the door. Which of the following four orders should the nurse question?

    - ☐ Heating pad for a patient with rheumatoid arthritis.
    - ☐ Cold compresses and elevation for a patient whose IV infiltrated two hours ago.
    - ☐ Sitz bath for a patient recovering from an episiotomy.
    - ☐ Heating pad for a diabetic patient with a foot ulcer.

4. The nurse gives discharge teaching to a patient going home on Doxycycline. Which of the following patient statements, if made by the patient to the nurse, requires further teaching?

   SELECT ALL THAT APPLY:

   - ☐ "I am glad that, unlike most antibiotics, I won't have to use a backup method of birth control."
   - ☐ "I will use sunscreen when I plan on spending time outdoors."
   - ☐ "If I get a white coating on my tongue, I will immediately stop the medication."
   - ☐ "I will follow up with my doctor visits and get my labs checked every month."
   - ☐ "I should take this medication after I eat a meal."

5. A graduate nurse prepares a patient to undergo a liver biopsy. The graduate nurse administers what pre-op medication?

   - ☐ Vitamin A.
   - ☐ Vitamin B-12.
   - ☐ Coumadin.
   - ☐ Vitamin K.

6. A patient with tuberculosis asks why he must take two drugs for his one disease. The nurse explains that:

   - ☐ "The drug companies want more money."
   - ☐ "We use two medications against tuberculosis to reduce the amount of time it takes to make your condition non-transmissible."
   - ☐ "The combination of two drugs against tuberculosis will help eliminate resistance from forming against the medications."
   - ☐ "It works better with two medications. No one knows why."

7. A patient with tuberculosis asks why he must take two drugs for his one disease. The nurse explains that:

   - ☐ "The drug companies want more money."
   - ☐ "We use two medications against tuberculosis to reduce the amount of time it takes to make your condition non-transmissible."
   - ☐ "The combination of two drugs against tuberculosis will help eliminate resistance from forming against the medications."
   - ☐ "It works better with two medications. No one knows why."

8. A patient who is taking Lasix knows that he should increase intake of what food?

    - ☐ Cantaloupe.
    - ☐ Iceberg lettuce.
    - ☐ Apples.
    - ☐ Plums.

9. A patient has the following medication orders: Pantaprozole 40mg PO qAM, Metoprolol 50mg PO bid, Lorazepam 0.5mg PO now, Albuterol 1 puff PRN. The patient's medical history includes high cholesterol and asthma. Which of the orders should the nurse question?

    - ☐ Albuterol.
    - ☐ Lorazepam.
    - ☐ Metoprolol.
    - ☐ Pantaprozole.

10. The nurse works on a medical/surgical unit and cares for a patient receiving Lanoxin (Digoxin) and Furosemide (Lasix). The nurse knows that which of the following, if reported by the patient, must be assessed IMMEDIATELY?

    - ☐ Stomach upset and headache.
    - ☐ Vomiting and halos around lights.
    - ☐ Night sweats and headache.
    - ☐ Low blood pressure and dark urine.

11. A patient is started on a daily amount of Phenytoin (Dilantin) 200mg PO in two divided doses. What instruction, if given by the nurse to the patient, is INCORRECT?

    - ☐ "You will need annual labs to determine the medication level in your body."
    - ☐ "Remember to never skip a dose of this medication."
    - ☐ "You need to increase your intake of vitamin D while taking this medication."
    - ☐ "Maintain good oral hygiene and visit your dentist regularly."

12. A patient taking Fluoxetine Hcl (Prozac) asks the nurse when the medication will start to work. The patient started this medication two weeks ago. The nurse's response is CORRECT if she states:

- ☐ "Prozac works as soon as you take it and should be working now."
- ☐ "It should be another day or two. Then you will feel much better."
- ☐ "Prozac needs three months to work, so you will need to give it more time."
- ☐ "In another two weeks, you should start to feel a difference in your mood."

13. A patient is ordered to receive omeprazole (Prilosec) 40mg PO daily. The pharmacy dispenses Prilosec 20mg capsules. How many capsules should the nurse administer to this patient for a single dose?

- ☐ 1.5 capsules.
- ☐ ½ a capsule.
- ☐ 1 capsule.
- ☐ 2 capsules.

14. A nurse is caring for a patient with 2nd degree burns all over her body. The nurse knows that which of the following measures is appropriate when the patient is prescribed application of silver sulfadiazine cream?

SELECT ALL THAT APPLY:

- ☐ The nurse checks the patient's chart for allergies to sulfa medications.
- ☐ The nurse tells the patient, "I'm going to apply the cream the doctor ordered. It won't hurt a bit."
- ☐ The lab technician draws blood specimens the day after the cream has been applied.
- ☐ The nurse gives the patient pain medication after the cream has been applied.
- ☐ The nurse uses sterile technique to care for the patient.
- ☐ The patient signs a consent form to be able to apply the cream.

15. A patient takes Nardil for depression and is confused by the dietary restrictions and allowances that are required with the medication. Which food on the list below is NOT permitted when taking Nardil?

    SELECT ALL THAT APPLY:

    - ☐ Cheddar cheese and crackers.
    - ☐ A four (4) ounce glass of wine.
    - ☐ An apple and a cup of tea.
    - ☐ Sandwich with fresh lunchmeat.
    - ☐ Miso soup.
    - ☐ Smoked salmon and cream cheese on a bagel.

16. A patient on the psychiatric unit has been taking Haldol for three days as ordered by the physician. During the nurse's shift, she enters the patient's room to find the patient in a prolonged muscle spasm, with his eyes looking upward, and a fever of 103.5 degrees. Which of the following actions, if performed by the nurse, would be considered CORRECT?

    SELECT ALL THAT APPLY:

    - ☐ Withhold the next dose of Haldol.
    - ☐ Retrieve a cooling blanket for the patient.
    - ☐ Call the physician.
    - ☐ Withhold all medications.
    - ☐ Prepare the patient to move to ICU (intensive care unit).

17. A patient on several medications is being cared for on a medical/surgical unit by the nurse. Which of the following laboratory values, if reported to the nurse, would require follow-up?

    SELECT ALL THAT APPLY:

    - ☐ Blood sugar of 103 mg/dL.
    - ☐ Lithium level of 1.3mEq/L.
    - ☐ Potassium level of 5.5 mEq/L.
    - ☐ Digoxin level of 2.4 mEq/L.
    - ☐ Calcium 8.5 mg/dL.
    - ☐ Urine specific gravity of 1.016.

18. The nurse on an oncology unit is administering Cisplatin to a patient. The nurse knows that which of the following symptoms, if reported by the patient, is expected with this type of medication?

    SELECT ALL THAT APPLY:

    - ☐ Lower backache.
    - ☐ Numbness in hands and feet.
    - ☐ Alterations in vision.
    - ☐ Alopecia.
    - ☐ Nausea.
    - ☐ Diarrhea.

19. A patient has been taking a heavy aspirin regimen for the past two months. Which side effects, if noted by the patient, are directly related to overdose of aspirin?

    SELECT ALL THAT APPLY:

    - ☐ Tinnitus.
    - ☐ Confusion.
    - ☐ Increased INR.
    - ☐ Edema.
    - ☐ Blood in stools.

20. The nurse cares for a patient on the medical/surgical unit. The patient rings the call bell and exclaims, “My urine has been orange today! What medication is doing this to me?” Which of the following medications, if noted in the patient’s chart, would explain this side effect?

    SELECT ALL THAT APPLY:

    - ☐ Pyridium.
    - ☐ Bleomycin.
    - ☐ INH (Isoniazid).
    - ☐ Pantoprazole.
    - ☐ Rifampin.

21. A patient has been prescribed the medication spironolactone (aldosterone). When preparing the patient for discharge, the nurse should include which of the following instructions?

SELECT ALL THAT APPLY:

- ☐ "Do not take this medication before bedtime."
- ☐ "This medication will make you urinate more often."
- ☐ "It is important to increase your intake of dark leafy greens."
- ☐ "Check your weight daily and keep a record to bring with you to your next appointment."
- ☐ "Remember to eat salt substitutes instead of actual sodium."
- ☐ "Be sure to take this with meals."

22. A 40-year-old client who is receiving a MAOI is going home on a weekend pass. Considering the drug, the nurse plans to instruct the client to avoid?

SELECT ALL THAT APPLY:

- ☐ Banana peel.
- ☐ Peanut butter.
- ☐ Cheddar cheese.
- ☐ Ice cream and milk.
- ☐ Beer.
- ☐ Chocolates.

23. The nurse is reviewing the client's medications and she noticed a prescription of Versed. Which medication is important to have available for clients who have received Versed?

- ☐ flumazenil (Romazicon)
- ☐ naloxone (Narcan)
- ☐ diazepam (valium)
- ☐ florinef (Fludrocortisone)

24. A patient is sent home on prescribed Nitroglycerin, to be taken as needed for angina. Which of the following instructions, if stated by the patient to the nurse, would require further teaching?

    SELECT ALL THAT APPLY:

    - ☐ "I will take my blood pressure pill at the usual time even if I have taken nitroglycerin in the past hour."
    - ☐ "I will keep the nitroglycerin sublingual tablet under my tongue without swallowing it."
    - ☐ "I sometimes take Viagra to enjoy spending time with my wife."
    - ☐ "If I become pale and light-headed, this is a normal side effect."
    - ☐ "I will place this drug in the sunlight before I take it to make it easier to digest."

25. A client with myasthenia gravis is instructed to take anticholinesterase medications on time to eat meals 45-60 minutes later. The client asks the nurse why the timing of the medication is so important. What is the nurse's best response?

    - ☐ "The timing allows the medication to have its greatest effect, so it is easier for you to chew, swallow, and not choke."
    - ☐ "The timing prevents your blood sugar level from dropping too low and causing you to be at risk for falling."
    - ☐ "The medication is very irritating to your stomach, and you could develop ulcers if you take it too early before meals."
    - ☐ "The medication can cause nausea and vomiting. By waiting a while to eat after you have taken the medication, you are less likely to vomit."

Questions obtained from Nursing Pharmacology Practice Questions & Test Bank for NCLEX By Matt Vera, BSN, R.N. (2021).