DNP Project Proposal: Utilizing a Pediatric Emergency Drug Sheet to Enhance Clinical Preparedness and Self-Efficacy in Medication Administration

Martha Renteria & Arianna Sinkovich
Rutgers, The State University of New Jersey-School of Nursing

DNP Chair: Maureen McCartney-Anderson, DNP, CRNA, APN

DNP Team Member: Michael McLaughlin, DNP, CRNA, APN

Date of Submission:
# Table of Contents

Abstract ......................................................................................................................... 4

Introduction .................................................................................................................... 5

Background and Significance ......................................................................................... 7

Needs Assessment ........................................................................................................... 10

Problem Statement ......................................................................................................... 13

Aims and Objectives ....................................................................................................... 13

Review of Literature ...................................................................................................... 14

Theoretical Framework ................................................................................................. 27

Methodology .................................................................................................................. 28

  Setting
  Study Population
  Subject Recruitment
  Study Interventions
  Outcome Measure
  Risks or Harms
  Consent Procedure
  Subject Costs and Compensation
  Project Timeline
  Resources Needed/Economic Consideration

Evaluation Plan ............................................................................................................... 34

  Data Analysis
  Data Maintenance/Security
Abstract

Purpose of study: To enhance clinical preparedness of PACU and endoscopy registered nurses (RN) during pediatric emergencies by increasing self-efficacy and effective use of the pediatric emergency drug sheet for safe medication administration. This was measured via a pre- and post-survey as well as using clinical scenarios to simulate medication preparation and administration.

Methodology: The education group was informed face to face by the researchers with the guidance of a PowerPoint presentation, the pediatric emergency drug sheet, and mock syringes and supplies. Pre- and post-intervention surveys were distributed.

Results: One hundred percent of the participants were able to use the drug sheet appropriately and complete a return demonstration of correct dosage in mg and mLs for a patient less than 10 kg. Statistically significant findings were seen in the pre- and post-survey responses, showing an increase in clinical self-efficacy. The median pre survey scores demonstrated the RNs were already inclined to use the drug sheet and found it easy to use.

Implications for practice: We hope our project will be sustained via an annual pediatric drug sheet competency. An annual competency will indirectly reduce medication errors in a vulnerable patient population and enhance patient safety. We recommend creating an updated policy for the use of the pediatric emergency drug sheet, as well as references added to the drug sheet itself. Healthcare providers must not only comply but be able to translate such policies into practice.
Errors related to medications are the most common form of iatrogenic error and are a well-defined cause of preventable adverse events. Preventable drug errors within the pediatric population is approximately three times higher than hospitalized adults (Joint Commission, 2008). The increased need for calculations, dilutions, and handling of pediatric medications, coupled with patient-specific dosing by age and weight predisposes pediatric patients to medication errors throughout the medication administration process. Dosage “miscalculations are the most common type of medication error in pediatric patients” (Conroy et al., 2007, p. 1111). The need for decimal points and fractional dosing pose an additional risk of error.

The perioperative continuum of care is a complex and dynamic environment requiring meticulous attention to pediatric patients’ response to surgical procedures, sedation, and general anesthesia. Health care providers caring for pediatric patients throughout the perioperative period lack many of the safeguards existing in inpatient units (e.g., independent verification and pre-filled patient specific medications). Health care providers caring for pediatric patients during emergency situations are unique for having total accountability of the medication handling process without the checks and balances of computer feedback or pharmacy support that assists providers in areas.

The medication error rate rises in emergency situations in which providers need to act quickly and simultaneously complete multiple interventions (e.g., intubation, cardiopulmonary resuscitation), deliver rescue breaths, calculate, draw up, and administer numerous medications. According to Larose et al. (2016), an accidental tenfold higher amount of a drug suspension is frequently administered during pediatric resuscitation efforts and in the case of epinephrine is likely lethal. Given the brittle nature that arises when pediatric patients are recovering from procedures requiring anesthesia, the Post Anesthesia Care Unit (PACU) is a vulnerable area in
which resuscitation situations may transpire rapidly. The high-volume, fast turn over, and anesthetic state of pediatric patients on arrival to PACU nourishes an environment in which medication errors may occur. The sizable percentage of adverse pediatric medication errors in the PACU (i.e., 20%) is concerning, particularly in the context of overall harmful errors (i.e., 6%) because these errors are severely under-reported (Payne et al., 2007). Given this distinction, healthcare institutions must facilitate reporting of errors, identify the cause of these events, and institute policies and procedures to prevent their occurrence.

Multiple evidence-based measures are available to decrease and prevent medication errors in pediatric emergencies by reducing provider cognitive load (i.e., mental effort). Reducing cognitive load is achieved by simplifying the steps needed to calculate drug dosages. A pre-printed patient-specific weight-based emergency drug sheet mitigates cognitive load by eliminating uncertainty and consequently reduces medication errors. With such a tool, the provider has one less decision to make as the sheet includes patient specific dosage, concentration, milliliters per kilogram, volume to be administered, and maximum allowable dosage.

However, provider’s struggle not solely with dosage calculation in milligrams but also the volume of drug to draw up and the actual dilution process of medications (Luten et al., 2002); especially when diluting epinephrine during cardiac arrest (Kaufmann, Wolf, Becke, Laschat, Wappler, Engelhardt, 2017). Moreover, most medications are in adult-dosage formulations, requiring providers to complete multiple calculations to obtain the final desired dosage.

An institution with a current pediatric emergency drug sheet was identified. Although, a pediatric emergency drug sheet is placed in every patient’s chart that is 40kg or less the sheet appeared to be underutilized. Moreover, a needs assessment in the PACU revealed the majority
of PACU nurses feel uncomfortable caring for pediatric patients. Research has shown that this unease especially comes into play during calculation and administration of medications during emergencies (i.e., epinephrine and atropine).

The pediatric emergency drug sheet is only as useful as the providers ability to apply it in clinical practice. This project aimed to enhance PACU nurses’ clinical preparedness and self-efficacy in calculating and administering medications in emergency scenarios.

To enrich PACU nurses’ clinical preparedness, a pharmacology review regarding epinephrine and atropine dosing, dilution, and administration during pediatric resuscitation was provided. The PACU nurses completed two pediatric case scenarios. The providers used the pediatric emergency drug sheet to solve the case scenarios. It is crucial for healthcare institutions to provide techniques to aid in reducing medication errors, such as the pediatric emergency drug sheet. However, healthcare providers must be able to appropriately apply said tools to truly reduce sources of medication errors and provide optimal pediatric health care. This project intended indirectly prevent medication errors and improve patient safety by improving nursing self-efficacy and boosting PACU nurses’ clinical preparedness by effectively utilizing the pediatric emergency drug sheet.

**Background and Significance**

Pediatric patients are unlike any other patient population that providers care for. From how providers communicate with this population to the differences in their physiology, pediatric patient care is specialized. This includes administration of medications. Most pediatric patients are in need of weight-based administration of medications. Medication errors in the pediatric population are more common than adults and these errors can be seen in excess during emergency situations (Appelbaum et al., 2019). Errors can occur throughout the preparation and
administration periods. Some patient care areas are more vulnerable to medication errors. The perioperative period including intraoperative and postoperative care are one of the more sensitive areas because of the time that is spent with a patient and the emergencies that can occur during this critical period. PACU nurses have very little time to orient themselves to their patients. The postoperative period is a critical time where significant harm can occur to a pediatric patient if timely interventions are not initiated. Dias, Dave, Chiluveru, and Garasia (2016) found that over a one year period in the PACU the incidence of critical events were at 8.9%. These incidents included, but were not limited to, airway emergencies, cardiovascular events and medication-related incidents. Moreover, the occurrence of these incidents was about 1 in every 10 pediatric patients (Dias et al., 2016). Critical medication errors occur during emergency situations. Presently, research has been executed in the pediatric population with a focus on medication errors from anesthesia providers during the intraoperative period, but little has been performed during the post anesthesia recovery time. Hicks, Becker, Windle and Krenzischek found half of the drug errors in the post anesthesia area occurred during the administration phase; recommendations included performance improvement activities and medication reconstitution and administration (2007).

Pediatric medication errors are severely under reported. Lack of reporting obscures the rate of pediatric medication errors which may occur as often as “one in every 20 medication orders” (Payne et al., 2007, p. 731). Given this discrepancy, health care institutions must uncover the cause of these events in order to better understand the risks and deploy solutions that prevent errors. Kaufmann et al. (2017) reviewed multiple strategies that can be incorporated into the hospital environment to decrease medication errors along with their feasibility and cost. Their findings state that the cost of these interventions over time will be less than the costs the hospital
will endure secondary to multiple medication errors. When analyzing medication errors, an institution has to be aware of not only patient safety and financial costs of overall outcomes, but the reputation of the institution if errors are not addressed appropriately.

As stated above, pediatric drug errors are under reported. In some institutions, the focus may not be on pediatric drug errors due to lack of provider reporting. Policies and procedures will not be created and implemented without evidence that there is an institutional issue. Without knowing the cause of pediatric drug errors and the true rate of errors, new policies and procedures cannot be realized and patients will continue to suffer. Self-reporting databases are available online and critical incident reporting systems are in place at many large university hospital settings. An example of one self-reporting database is “Wake Up Safe”, a quality improvement initiative by the Society of Pediatric Anesthesia. The purpose of Wake Up Safe is to enhance processes of care and outcomes of newborns, infants, and children throughout the perioperative period. The initiative created a registry of adverse events in pediatric perioperative care in efforts to gather data and develop quality improvement systems within Departments of Pediatric Anesthesia (Tyler, 2010). While having a reporting system in place is important, if providers are not aware of under or overdosing medications rates occurring, there is no way of mitigating these events.

Two interventions implemented in multiple large university hospitals are a patient specific weight-based drug sheet and pediatric emergency code simulations. Both of these interventions have shown to be effective in reducing drug errors. Larose et al. compared the use of a tool specifying pre-calculated medication dosages versus a card providing mg/kg dosing amongst residents throughout simulated pediatric codes; the pre-calculated dosage tool was linked to a lower risk of tenfold error for bolus medications (2016). Appelbaum (2019) used
simulation to assess pediatric drug errors and found that when unfamiliar with medication doses and calculations more errors were made. If simulations were implemented more frequently and with more emphasis placed on drug reconstitution and administration, it is more beneficial for providers.

Although using a pediatric drug sheet has been found to be effective in reducing drug errors, knowledge deficit with emergency medications within this population poses a significant risk of medication under and/or overdosing. Most drug manufacturers are producing medications in concentrations for the general population instead of concentrations specific to the pediatric population. This results in emergency medications having to be reconstituted or drawn up in lesser amounts by a provider when a patient is under a certain weight. During emergency situations a provider who lacks familiarity with pediatric doses and reconstitutions is prone to incorrect drug reconstitution and/or taking a prolonged period of time to reconstitute the correct dose. Applebaum et al. (2019) found during pediatric emergency simulations that converting milligrams to milliliters of an undiluted drug was contributing to medication errors. This study also found that a delay in medication administration was due to searching online references for correct dosing and preparation of the undiluted medications.

Despite advances made in measures that reduce pediatric drug errors, current research continues to find that even with the use of these additional tools errors are occurring. To address the issue of pediatric drug errors, institutions must create policies and procedures to prevent pediatric medications errors, ensure staff compliance, and continuously assess where improvements can be made.

**Needs Assessment**
Pediatric drug errors are a global issue, much of the research performed on pediatric drug errors are occurring throughout the world. Researchers everywhere are suggesting similar actions to be taken to prevent further mistakes. Anderson (2018) estimates that 50% of medication errors occurring are preventable and although national guidelines can be suggested and some enforced, most changes need to occur at the institutional level to make any significant difference. The American Society of Anesthesiologists (2016) and the American Society of PeriAnesthesia Nurses (Hicks et al., 2007) both have similar recommendations for pediatric drug safety. However, institutions are not mandated to produce policies and procedures for each guideline provided. As Merry and Anderson (2011) state, “it is the responsibility of the institutional leadership to introduce such strategies and of individual practitioners to engage in them” (p.743).

The perioperative period is especially vulnerable to medication errors due to multiple hand-offs between providers and practitioners of differing experience levels caring for these patients. When caring for pediatric patients in the intraoperative period it is imperative to recognize that the timing of pediatric airway emergencies is most likely to occur during induction and recovery from anesthesia (Von Ungern-Stemberg, 2014). Staff must be properly trained to handle these emergency situations, including the proper preparation and administration of emergency medications to pediatric patients.

An academic medical center, consisting of 646 inpatient beds, is seeing more pediatric patients in the PACU than ever before. This medical center contains a children’s hospital, identified as such since 2002, but more recently was given the designation of a level II pediatric trauma center in 2018, one of three in the entire state of NJ. Pediatric Trauma designation requires 24/7 pediatric provider coverage which in turn allowed for an increase in surgical cases both emergent and non-emergent to be performed because pediatric providers are now
continuously available in-house. In the first quarter of 2020, four PACU beds were classified as pediatric, a new description. The PACU nursing staff must be clinically prepared for the subsequent increase of pediatric general and specialty surgical caseloads. When informally interviewing the PACU RNs, a little over 30% of the nursing staff verbalized they feel clinically unprepared to care for pediatric patients. This is an estimate as only 10 of the 30 nurses were informally interviewed, suggesting that a larger portion of the staff could be feeling similarly. At this time, a yearly pediatric competency is not required for PACU RNs. A pediatric code cart has always been available as well as the pediatric drug sheet binder with weight-based drug doses. However, the issue is not lack of supplies or resources, instead it is lack of clinical preparedness for emergency situations for pediatric patients. Not every nurse that is working in the PACU has had experience with pediatric patients or an introduction to the pediatric emergency drug sheet. In addition to the increase in volume of pediatric patients in the PACU, the endoscopy suite is transitioning to accepting pediatric patients.

Currently, all endoscopy procedures for pediatric patients are completed in an ambulatory care center. But in the near future, all endoscopy procedures will be performed in the endoscopy suite, including pediatrics. Some education regarding pediatric anatomy, airway, and anesthetic devices has been provided by the clinical nurse educator. However, without prior pediatric experience, a need for education on the pediatric emergency drug sheet is needed. When informally speaking with endoscopy RNs, they expressed feeling uneasy about caring for pediatric patients. This unease comes from the nurses’ infrequent interactions with pediatric patients. For this reason, the nurse educator, PACU nurses and the endoscopy unit nurses sought avenues to increase clinical preparedness and confidence in caring for pediatric patients to assure patient safety and positive outcomes. During the Fall of 2020, a pediatric education day was held.
at this large university hospital by the nurse educator for endoscopy and PACU. After speaking with both the pediatric nurse educator and the nurse educator for PACU and endoscopy, it was decided that this education initiative should be provided during this time as an additional part of the pediatric resuscitation station.

The American Academy of Pediatrics developed a policy in 2015 on essential components for the perioperative anesthesia environment which states “important considerations in the training of such personnel (nursing and technical personnel) include the ability to formulate drugs and infusions in appropriate doses, concentrations, and volumes for pediatric patients” (p.1202). Research supports the use of pre-populated dosage forms in reducing drug errors during emergency medication administration, but without staff compliance and clinical preparedness it is ineffective (Burton, Woodman, Harclerose, Engelhardt, & PATRN Committee, 2018).

**Problem Statement**

In a children’s hospital, will education on the use of a pediatric emergency drug sheet increase PACU and endoscopy RN’s clinical preparedness and self-efficacy during a pediatric resuscitation?

**Aims and Objectives**

**Aim**

The project aim is to enhance clinical preparedness of PACU and endoscopy RN’s during pediatric emergencies by increasing self-efficacy and effective use of the pediatric emergency drug sheet.

**Objectives**
1. To assess change in behavioral intention after delivery of an educational session regarding use of the pediatric emergency drug sheet via a pre- and post-intervention survey.

2. To increase clinical preparedness of PACU nurses by applying the pediatric drug emergency sheet in two simulated clinical scenarios, measured by whether RN’s provide the correct dosages (mg and mLs) for each scenario.

3. To increase clinical self-efficacy in using the pediatric emergency drug sheet measured via a pre- and post-intervention survey.

**Review of Literature**

The Ottawa model is the framework used to formulate this study. The literature review is the one of the first steps in identifying the innovation process and verifying why this study is necessary. The innovation must be, “a change that constitutes something new to those who will use it. It is informed by valid research and is combined with the clinical judgement of the practitioner” (Rycroft-Malone and Bucknall, 2010, p. 88). The development process in the Ottawa model includes the steps taken while reviewing the literature that brought about the formulation of the studies interventions. Outlined below is the critical appraisal of research, validating the issue being addressed in addition to the creation of the studies’ interventions.

**Literature Search**

The literature search was completed with the help of a research librarian. Publications and reports related to pediatric medication errors, from 1998-2020, were identified to prepare our reference list. A computerized search involved the following databases: CINAHL, MEDLINE, SCOPUS, Google Scholar, and Rutgers University Smith Library. Keywords included *anesthesia, anaesthesia, pediatrics, paediatrics, drug errors, medications errors, software,*
software tools, electronic medical record, electronic health records, calculator, calculation, drug sheet, resuscitation, cardiopulmonary resuscitation, cardiorespiratory resuscitation, emergency scenario, emergency situation. The British and English spellings of the search terms were included.

The initial search which included terms anesthesia and anesthesia revealed 7,382 articles. The search results were decreased to 506 when keywords medication errors, drug administration error, and drug error were included. Once Pediatrics, Paediatrics, software, software tools, electronic health record, electronic medical record were included in the key terms, and the search was limited to the English language, the results decreased to 196 articles. The added search terms calculator, calculation, drug sheet, resuscitation, cardiopulmonary resuscitation, cardiorespiratory resuscitation, emergency scenario, emergency situation, resulted in 94 articles. A total of 94 articles were reviewed thoroughly and 19 were kept. The reference section of every article was surveyed to distinguish any other relevant publications, and 22 articles were obtained. The method of reference checking was repeated until no other pertinent articles could be identified. After reviewing all pertinent information, 41 articles were ultimately kept. See Appendix A for a graphic depiction of the search strategy used, and Appendix B for a Table of Evidence that summarizes the relevant literature to this study.

Medication Error History

In 2000, Err is to Human, published by Institute of Medicine (IOM), played a pivotal role in spreading the word regarding preventable adverse events in the United States. In particular, it highlighted the financial burden of medication-related errors. For example, “two percent of admissions experienced a preventable adverse related drug event” at two esteemed teaching
hospitals, “resulting in [an] average increased hospital costs of $4,700 per admission or about $2.8 million annually for a 700-bed teaching hospital” (IOM, 2000, p. 2).

The possibility for preventable drug errors within the pediatric population is approximately three times higher than hospitalized adults (Joint Commission, 2008). According to NewsBank Inc (2008) actor Dennis Quaid’s twins suffered from an overdose of over 1,000 times the prescribed dose of the anticoagulant heparin. Although the twins lived, the California Department of Public Health discovered the hospitals’ personnel did not fulfill safe medication administration policies and procedures. In response to the Quaid twins’ adverse drug errors among others, the Joint Commission specifically addressed the issue of preventable pediatric medication errors and offered methods to reduce their risk. The Joint Commission (2008) recommends a standardized approach to pediatric care by incorporating the following: (1) a pre-printed dosage calculation sheet for every individual pediatric patient with emergency medications (2) dedicated pediatric personnel (3) separation of pediatric and adult inpatient areas (4) pediatric patients be weighed in kilograms on arrival to the hospital and “within four hours of admission in emergency situations” (5) pediatric training programs regarding medication administration for providers caring for this population (6) implementation of pediatric medication policies and procedures for administration practices and prescriptions (7) promote a non-punitive environment for reporting medication errors and systems to analyze such errors.

**Source of Errors**

*Epinephrine and Atropine*

Epinephrine even in a prefilled syringe is still one of the most frequently over and under dosed medications. The potential for harm with epinephrine is extensive without proper education and experience with administration of epinephrine. Currently, at the large university
hospital where this study will take place epinephrine is provided in prefilled bristojets with concentrations of 1mg/10mL (0.1mg/mL). Although this lower concentration, in comparison to the 1mg/mL bristojet, helps staff administer more accurate dosages it still requires some approximation when administering to any patient under 10kg because the dose of epinephrine for pediatric patients is 0.01mg/kg. A 0.1mg/10mL bristojet is available for purchase, but as stated earlier these costs are not always practical for a hospital.

Grigg et al. (2017) found that even with the addition of a medication template epinephrine was second only to atropine for highest medication errors. Their control group used a 0.1mg/mL prefilled syringe whereas the experimental group used a 0.01mg/mL prefilled syringe. They found that the providers had increased medication errors in the control group, which could be attributed to calculation and dilution errors due to a more concentrated dose of epinephrine. This was also one of the limitations of their experiment because there is now no way of knowing if having a smaller concentration syringe was the reason for the reduction in medication errors or if it was because of their intervention of an addition of an anesthesia medication template. Although this was a limitation it can be deduced that the time until administration would still be lessened for the group that had a more dilute medication and administration would be more accurate. Kaufmann et al. (2017) agree it is important for diluted drugs, like epinephrine, to have clearly outlined directions for preparation and administration. However, no references were given for their recommendations for dilution.

Kaufmann et al. (2018) stated that during emergency resuscitations a tenfold increase in drug amount for administration is common. This study specifically looked at epinephrine administration for this reason, epinephrine administered at these excessive doses would be catastrophic in a pediatric patient. The authors suggest that because of the chaotic nature of the
environment in which epinephrine is usually administered and its potential for harm; providers need to have familiarity with doses for pediatric patients as well as a prepopulated weight-based dosing guide for administration. Larose et al. (2016) found similar results with epinephrine administration occurring with ten-fold errors and out of all medications used, epinephrine had the most errors associated with it.

Atropine has also been documented in the literature as a major source of medication errors in pediatric resuscitations where weight-based calculations are a common place. Grigg et al. (2017) found a significantly higher number of calculation errors with atropine followed by epinephrine in simulated emergency scenarios involving anaphylaxis and laryngospasm in the operating room.

**Adult Medication Packaging**

Pediatric medications are often prepared and packaged in adult concentrations. Thus, providers must prepare such medications in smaller volumes and concentrations before administering them to pediatric patients. When modifying the original concentration, the provider must complete a sequence of weight-specific calculations and steps. Every individual step increases the chance for mistakes to occur. Prefilled syringes from an institution’s pharmacy or bought from a pharmaceutical company would be the safest option for administering proper dosages and decreasing time to administration (Stevens et al., 2015). This is not always cost effective for many institutions as emergency medications may expire before use, therefore other alternatives such as reconstitution of emergency medications are still performed (Kaufmann et al., 2017).

**Transitions of Care**
Transitions of care are well documented in the literature for being high risk situations for drug-related errors. Transitions of care happen when a patient is transferred between institutions, area of care, and health care providers. According to the World Health Organization (2017) transitions of care increase the possibility of communication errors, which can lead to adverse drug events. For example, an emergency may arise during PACU handoff and a new provider (e.g., PACU nurse) has to administer epinephrine because the pediatric patient is experiencing a severe bronchospasm. Without a standardized approach to handoffs, vital communication such as a patient’s weight and epinephrine dose can be lost in translation during transitions of care. Without knowing the patients’ weight, the PACU nurse is unable to draw up the correct dose of epinephrine and wastes valuable time searching for it in the patients’ chart. The presence of multiple interruptions, distractions, and paucity of standardization may further take away from effective interdisciplinary communication. Failing to include vital patient details due to individual provider preferences as to what is important to include or not during PACU handoff can lead to devastating patient outcomes such as “loss of function, delayed discharge, and death” (Lambert & Adams, 2018, p. 361).

**Volume of Medication**

Inadvertent administration of additional medication is seen more often when a small volume of medication is to be administered. In the pediatric population, administering small volumes of 0.5 and 0.25 mLs is a common occurrence. Muffly et al. (2017) found one in four providers gave more than double the prescribed injection volume at 0.025 mL and almost double the prescribed injection at 0.05mL. This study was performed with pediatric anesthesiologists as well as pediatric PACU nurses showing that throughout the operative period medication errors are likely to occur due to multiple handoffs and differing medication preparation strategies.
Under-reporting of Errors

Grigg et al. (2017) mental math, interruptions, task overload, time constraints, disorganized workspace, and lack of standardized medication processes all contribute to medication errors. Ehsani et al. (2013) investigated the medication error reporting rate, type, and cause among nurses in an emergency department via an anonymous questionnaire. The questionnaire revealed 46.8% of the nurses had committed medication errors in the past year and 30.9% attributed these errors to inadequate education and training in pharmacology. However, 72.7% of those nurses failed to report medication errors to their managers. The lower rate of reporting as compared to the actual medication errors is concerning. In another study, even though nurses understood that “missed doses” are a type of medication error, they did not explicitly consider missed doses a reportable error (Alomari et al., 2018). Prot et al. (2005) found nurses failed to report medication errors because they felt errors are not detected, usually hidden, easily fixed, or because there is a fear of the consequences of reporting. When there is a lack of a uniform understanding and definition of what a medication error entails, nurses tend to accept medication errors as part of their daily practice. Therefore, it is evident that data from reporting systems does not reflect the true rate of errors, making it difficult to analyze causes and implement solutions to enhance patient safety.

Medication Error Prevention Recommendations

Greater Pharmacy Support

Greater pharmacy support may help prevent pediatric medication errors. Institution pharmacies should stock medication bottles with lower strengths and/or pre-filled syringes of dilute medication to minimize the amount dilution steps providers must accomplish to reach a final concentration. The latter may reduce the risk of human error. Muffly et al. (2017) authors
suggest that any small volume medication should be diluted to a larger mL dose to better quantify how much medication is being given to the patient.

**Combating Errors during Transitions of Care**

Key issues in relation to a patient’s clinical status and medication regimen are communicated verbally and/or written during “handoff” (i.e., a transition of care). In most inpatient clinical areas, a written handoff sheet provides brief points regarding significant clinical changes that occurred during the providers’ shift (Alomari et al., 2018). However, anesthesia provider to PACU nurse handoff, usually entails an informal verbal report of significant clinical information and changes that occurred throughout intraoperative period (e.g., patient allergies, pertinent medical history, procedure type, type of anesthesia, blood loss, urine output, medications administered, vasopressor requirements if any, and imitation of postoperative pain management). According to Lambert & Adams (2018) “handoffs between anesthesia providers and PACU registered nurses (RNs) have been reported as inadequate and inconsistent” (p. 361). Milby et al. (2014) led an observational study of 790 handoffs among anesthesia providers and PACU RNs and determined that the majority lacked vital patient information. For instance, during handoff, 12% of the anesthesia providers failed to report the initiation of post-operative pain regimen and in 15% fluid management to the PACU RN. Omitting important information can lead to higher rates of patient complications. Ultimately, standardization of a written anesthesia handoff tool can lead to enhanced interdisciplinary communication and patient safety (Lambert & Adams, 2018).

**Pre-printed medication Drug Sheet**

Pediatric dose calculators are not new to hospital settings. They’ve been used in neonatal and pediatric intensive care units to assist health care providers in complex calculations. While
they are beneficial in such settings, they are also invaluable in clinical areas where emergency situations arise (e.g., emergency department and PACU). The calculator is able to display 72 calculations instantly by solely keying in the patient's age and weight into a Microsoft Excel document (Reed & Fothergill, 2007). The calculator is able to support resuscitation efforts, analgesic, intravenous fluid and antibiotic management, rapid sequence intubation, and the treatment of cardiac disorders, seizures, anaphylaxis, asthma, and many other pediatric disorders (Reed & Fothergill, 2007). Calculating complex math in high-stress clinical situations such as pediatric resuscitations leads to medication errors. Multiple resuscitation aids have been reported in the literature to address medication safety in pediatric resuscitation. Appelbaum et al. (2019) recommends the use of a pediatric drug sheet to support formulation and administration of pediatric dosages. Shannon et al. (2002) found provider’s utilizing a computerized patient-specific emergency drug calculator during simulated pediatric resuscitations achieved the correct dosage three times faster and were 21.4% more accurate compared to traditional paper-based calculation methods. By removing the need to recall formulas, drug dosages, and calculate medications during resuscitation, pre-printed weight-based pediatric emergency drug sheets free the provider of logistical barriers and permit room for critical thinking (Luten et al., 2002).

**Pharmacological Education**

Medication errors in emergency clinical environments are high. Since nurses are oftentimes the provider administering medications during emergency situations, intravenous medication errors are a significant problem for nurses in the emergency department. Education that promotes awareness of medication errors and possible solutions is indispensable for providers who administer intravenous medications. Ehsani et al. (2013) recommends modifying
nurses’ education processes by incorporating annual pharmacology training courses to enhance nurse’s clinical preparedness for drug administration in the emergency department.

**Error Reporting**

Since most studies utilize self-reporting methods to calculate the rate of medication errors among healthcare providers, it is impossible to know the true rate and harm caused by such errors. Healthcare institutions must cultivate a non-punitive environment in which health care providers are encouraged to report medications errors without fear of punishment. Ehsani et al. (2013) urges “hospital managers to respond to errors in a constructive manner in order to enhance patient safety” (p. 1). All healthcare providers caring for pediatric patients should be engaged as key stakeholders, ensuring their perspectives are heard, and they can share their ideas on why medication errors occur and how they can be reduced. Alomari et al. (2018) supports an approach in which management “works with” staff instead of “working on” staff to create innovative ideas for improving medication safety and preventing medication errors.

**Cognitive Load**

**Definition**

Measures of mental effort or “cognitive workload” are used in various fields to detect causes of error and improve performance (Byrne, 2011). Although a standardized definition of mental effort has not been established, it is described as “the amount of mental effort involved in performing any given task” (Byrne, 2010, p. 768). Because every person has a maximum mental workload threshold (i.e., mental capacity), mental workload is the fraction of that capacity being used at any given point in time and will fluctuate depending on the task being done (Byrne, 2010). Mental workload is a measure of productivity that has been used extensively to evaluate the usability of products where completing a task is time-dependent and errors rates must be low
to ensure safety. For instance, “in-vehicle systems, systems in aircrafts, and control panels for safety critical processes” (Byrne, 2010, p. 768). The greater the mental workload level needed to accomplish a task, the greater the risk for error. Excessive mental effort is linked to poor performance, error in practice, and inefficient learning in educational settings. Tactics to reduce cognitive load have been used effectively in other fields such as aviation and can be employed in health professions to improve safety (Byrnes, 2010).

**Cognitive Load and Error Rates in Anesthesia**

Byrne (2010) measured the mental effort of anesthetists by quantifying their response times to a “wireless vibrotactile device and a NASA TLX subjective workload score during routine surgical procedures” (p. 768). Increased reaction times were seen during stressful phases in anesthetic practice such as induction of anesthesia where multiple tasks are done (i.e., placing patient monitors on, taking vital signs, mental math computation and medication administration, mask ventilation, maneuvering anesthetic depth via anesthesia machine, intubation, verifying endotracheal tube placement, and documentation) in comparison to maintenance and emergence of anesthesia.

**Cognitive Load and Pediatric Resuscitation**

Pediatric resuscitation is a complex incident that involves the successful completion of multiple tasks. These tasks, of varying levels of complexity, must occur simultaneously for optimum patient outcomes. In contrast to adults, these tasks are not solely determined by the clinical scenario, but also by weight and age-related considerations that are unique to each child. Each task requires varying degrees of cognitive load. According to Luten et al. (2002) an automatic task requires little conscious effort and is very familiar to the provider (e.g., a nurse places a blood pressure cuff); a non-automatic task is more involved and requires integrative
knowledge and critical thinking (e.g., prioritization and calculation of drug dosages). In adult resuscitations, most providers are well acquainted with medication dosages, frequently used equipment sizes (e.g., endotracheal tube and laryngeal mask airway size), and normal anatomy and physiology. This is because these considerations have become automatic tasks and the provider no longer has to access, recollect, or calculate these elements.

In the setting of resuscitation, cognitive load refers to the collective demands for each individual task, and decisions around practical intervention (e.g., medication administration and intubation). In children, degree of complexity and, thus, cognitive load is increased by the variability of pediatric age and size, presenting logistical considerations, many of which include medication calculations. There is an “abundant amount of evidence that physicians and nurses’ abilities to calculate drug dosages in an emergency are error prone” (Luten et al., 2002, p. 842). Errors can be reduced by implementing resuscitation aids that simplify tasks during pediatric resuscitations.

**Reducing Cognitive Load**

In order to maintain accuracy and prevent interruptions in decision making and clinical interventions, a practical tactic is to simplify. Simplification decreases the cognitive load or effort and thus allows provider precision to be maintained and/or enhanced. Resuscitation aids are utilized to reduce the complexity presented by age and weight related considerations in pediatric resuscitation. “Pre-printed drug/equipment cards, charts, and computer assisted aids” offer “pre-calculated variables, thereby eliminating the necessity of performing this [task] during the resuscitation” (Luten et al., 2002, p. 845). By removing barriers such as drug dosing, resuscitation aids decrease the load of nonautomatic activities (e.g., mental math) and create
room for critical thinking. Consequently, practical intervention time is reduced, and medication errors are avoided.

**Strategies for Improvement in Nursing Knowledge**

**Surveys**

Surveys and questionnaires allow organizations to assess nurses’ self-efficacy with medication administration as well as creating a safe avenue for nurses to communicate where they believe knowledge is lacking. Légaré et al. (2014) created a reliable and validated questionnaire for assessing change in behavioral intention after a continuing professional development activity; this validated tool was used in a professional development activity in 2017, displaying its use in clinical application. In 1995, Schwarzer and Jerusalem created a questionnaire assessing self-efficacy; adaptations of this survey have been used in studies conducted in multiple languages and countries around the world. It’s validity and reliability have been confirmed and permission to use this questionnaire is provided in Appendix C. In 2019, two studies used validated questionnaires to conclude that there is a knowledge gap in medication administration with nursing staff in multiple hospital units (Marques-Hernandez et al.; Zyoud et al.). These studies support the use of questionnaires to justify the need for continued education and training sessions for medical personnel.

**Case Scenarios as Continuing Educations Aids**

A solid knowledge base in pharmacology is imperative for safe medication administration. But, for nurses, the mechanical task of drawing up and administering medications is of equal importance. Appelbaum et al. (2019) found despite obtaining correct dosages, mistakes were made when preparing and diluting medications. Thus, additional training should be provided in medication preparation and administration; especially during times of significant
stress. Guidelines in the medical field are constantly changing. To ensure nursing staff knowledge is up to date, hospitals can implement continuing education methods such as simulated case scenarios. Case scenarios simulating a pediatric code provide a non-punitive environment where nursing staff can practice medication administration skills without compromising patient safety. They also provide an opportunity for staff to seek clarification and self-evaluate their practice for potential knowledge gaps in drug preparation.

Theoretical Framework

The proposed study was formed using the Revised Ottawa Model of Research Use (OMRU) framework. The OMRU has been proven to be an appropriate model for implementing policies and procedures in the health care setting. The Ottawa model was first created to aid in bringing evidence-based research to practice. It was created specifically with hospital and research settings in mind and allowed for research to be translated into evidence-based practice (Rycroft-Malone & Bucknall, 2010). Each step of the model interacts and affects the preceding and succeeding step, allowing for constant reevaluation (Graham & Logan, 2004). The three phases of the OMRU are assessing barriers and supports for the study, monitoring the process and degree of use and finally evaluating the impact of the implementation (Graham & Logan, 2004). The assessment phase is further broken down into the barriers and support for the innovation, adopters and practice environment. The second monitoring phase assesses the initial implementation of the evidence-based intervention and sustained use of the intervention. Finally, the evaluating stage documents the outcomes of the intervention on the patient, practitioner and lastly the system.

Specific to this project, the assessment phase focused on a rigorous literature review where evidence was given for the use of a validated questionnaire and return demonstration of
medication dilutions. During this phase the adopters were made aware of the intervention and attitudes/concerns regarding the intervention will be addressed. The cooperation of nursing research, the PACU nurse manager, and the educator for the PACU was essential for implementation, but without the PACU nurses’ willingness to engage in the intervention this project would have been ineffective. Potential barriers to this intervention were PACU nurses’ eagerness to engage in an interactive session on pediatric emergency medications and inclination to take skills taught in the interactive session into practice. During the monitoring phase, changes were made to the implementation to assure initial and sustained adoption of these practice changes. Lastly, evaluation of the intervention was completed by assessing the staff’s ability to adequately and accurately use the pediatric drug sheet in the case scenarios. See Appendix D for the adapted framework.

Methodology

Setting

This study was conducted at [Redacted] during the pediatric Fall 2020 competency days held by the nurse educator for PACU and endoscopy. The education session took place in the PACU and surgical prep area.

Study Population

The study population included PACU nurses and endoscopy nurses who participated in the case scenario group sessions. The entire nursing staff were expected to attend the Fall pediatric competency; a total of thirty PACU nurses and eleven endoscopy nurses were expected to be in attendance over the two days.
Inclusion into the study is on a voluntary basis and will consist of registered nurses (RNs) and licensed practical nurses (LPNs) who meet the following inclusion criteria: currently working in the PACU or endoscopy area; and speak and read English.

Exclusion criteria will be: 1) do not currently work in the PACU or endoscopy area 2) float pool staff; 3) agency staff; 4) do not speak and read English.

**Subject Recruitment**

The subjects were informed of the proposed study verbally by the co-investigators during the scheduled staff meeting. The recruitment flyer was posted in the nurse’s lounge of both the PACU (Appendix E) and the endoscopy suite (Appendix F). Recruitment also occurred at the Fall pediatric competency day where all nurses from both units were expected to attend. The information displayed in Appendix G was provided during both recruitment efforts.

**Consent Procedure**

The Information for Participation in Research form was printed and brought to the case scenario group sessions. Each subject partaking in the study was given the Information for Participation in Research form (Appendix H). The elements of the information sheet include: an explanation of the purpose of the study, an explanation that there will be no financial benefits and minimal risks to participation, an assurance of confidentiality, and assurance of the participant’s right to choose not to participate or to terminate participation at any time. Participants were informed that their participation in the study served as their consent to participate.

**Study Instrument Change in Behavioral Intention and Self-Efficacy**

Légaré et al. (2014, 2017) created a validated questionnaire to assess change in behavioral intention after completing a continuing professional development activity. The article is an open
access article that gives “unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited” (Légaré et al., 2017, p.1). This questionnaire was adapted as part of the pre survey and post survey (one-month post intervention) to assess if there was a behavioral change that occurred after the educational session. The behavioral change that was assessed was the use of the pediatric drug sheet. The pre survey questionnaire (Appendix I), was sent to each participant’s hospital email via the nurse educator one week prior to the Fall competency. If not completed prior to the implementation, five minutes was provided at the start of each session for each participant to complete the pre survey. Computers in PACU were available for the completion of the pre surveys before the intervention. In addition to the three adapted questions obtained from the Légaré et al., seven additional questions were added to assess nurses' self-efficacy using the pediatric emergency drug sheet, focusing on epinephrine and atropine preparation and administration. The seven additional questions adapted from the generalized self-efficacy scale (GSES) created by Schwarzer and Jerusalem (1995). Permission to use the GSES was obtained and provided in Appendix C. The GSES has been shown to be valid and reliable in estimating self-efficacy, thus it will allow for assessment of self-efficacy in PACU and Endoscopy nurses. When adapting these questions, guidelines from Artino et al. (2014) were followed as well as obtaining input from DNP faculty. The pre and post survey have 2 additional demographic questions, regarding participants' age and years worked in PACU and or endoscopy setting. It took approximately five minutes to complete each pre and post survey.

**Study Procedure**

In the Fall of 2020, study recruitment took place during the pediatric competency day. The pre surveys didn’t have any identifiers or coding associated with them and paper copies of
the information sheet for participation was provided to each participant. At the Fall 2020 competency days, the researchers conducted multiple 20-minute informative education sessions about the pediatric emergency drug sheet and how to properly use it. There were two individual days where the pediatric competency was held, and this education was provided as a station within the competency. When the nurses arrived, they were invited to participate and were given the Information Sheet for Participation in Research and asked to complete the pre survey that was previously sent to each hospital email if not already done so. The session included a review of where on the code cart to find the pediatric emergency drug sheet. Also, the pediatric emergency drug sheet was explained thoroughly to familiarize PACU nurses with medications and guidelines for use. A review of the medications as well as doses and concentrations of epinephrine and atropine provided in the pediatric code cart were discussed. Case scenarios, described in detail below, simulated the use of the pediatric emergency drug sheet in a non-threatening manner. There was also an optional return demonstration of preparation of epinephrine and atropine for an 8kg patient. This return demonstration provided a low stress environment for nurses to acknowledge the small volume that is needed from a 0.1mg/mL concentration of both atropine and epinephrine for an 8kg child. A Qualtrics link with the post survey and an information sheet for participation in research was sent out one-month post intervention. The nurse educator sent out an email from the researchers inviting all PACU and endoscopy nurses to complete the post survey. One additional question was placed on the post survey asking if the nurse taking the post survey participated in the intervention or not (Appendix J). The data collected from the pre survey questionnaire was compared to the data of the post survey questionnaire one-month after the educational session. The medians of each
question was analyzed between the pre survey and post survey questionnaires by SPSS technology.

**Outcomes to be Measured**

*Informative Education Session, Part I Review*

A verbal overview of the components of the pediatric emergency drug sheet itself was provided. The goal was to familiarize RNs with the drug sheet outside of an emergency situation. This review occurred prior to the case scenarios. The pediatric emergency drug sheet for a 8kg patient was provided to attendees. The researchers reviewed the medications on the drug sheet as well as the details given next to each drug. For epinephrine and atropine, the drug dosages and concentrations available in the code cart were examined in detail.

*Informative Education Session, Part II Clinical Preparedness*

Clinical preparedness was assessed through visualization of correct usage of the pediatric drug sheet during two separate case scenarios. The nurses, in groups assigned by the clinical nurse educator, were given an emergency scenario. Each case scenario included the patient’s age, weight, background (e.g., procedure prior to arrival to PACU), vital signs, clinical problem (e.g., laryngospasm), and the drug (i.e., atropine or epinephrine) that was to be administered. The researchers provided a paper copy of the pediatric emergency drug sheet (a 40kg example is provided in Appendix K) with the correct patient weight to each group. It was the group's objective to utilize the emergency drug sheet provided, to solve and verbalize the correct dose (in milligrams and milliliters based on the concentration that is provided in the pediatric code carts) that needed to be drawn up. The subjects participated in an optional return demonstration of the dilution and preparation of the medication. ‘Mock’ epinephrine and atropine syringes (filled with water), 1 mL and 3 mL syringes, 18-gauge blunt needles, and 100 mL bags of normal saline
(supplied by Rutgers University Simulation Lab) were provided to each group. One case scenario focused on the drug epinephrine and the other focused on the drug atropine. The researchers documented for each group whether the group was able to come to the correct dose to be administered for each scenario. As stated above, one-month post intervention the post survey was sent via a Qualtrics link to all endoscopy and PACU nurses via hospital emails from the nurse educator. The only difference in the post survey was one additional question asking whether the individual participated in the intervention or not. The results from the pre survey were compared to the post survey with no coding being used from pre to post survey.

**Project Timeline**

Over a two-month period from September 1st, 2020 until October 30th, 2020, the subjects completed a pre survey before intervention and then participated in education on the pediatric emergency drug sheet. During the month of November 2020, after the intervention, an email provided by the researchers was sent by the nurse educator to all endoscopy and PACU nurses, with a Qualtrics link to fill out the post survey. Data analysis occurred during November and December of 2020. The final written paper was completed in January of 2021 and will be presented at a date determined by the Rutgers Nurse Anesthesia Program (RNAP) faculty later in that year. A depiction of the proposed project timeline is seen in Appendix L.

**Risks/Benefits**

Participation in the research study enriched participants’ clinical practice by preparing them to care for pediatric patients and subsequent improvement in patient outcomes. The survey results permitted the researchers to quantify the participants' sense of self-efficacy and usefulness of the pediatric emergency drug sheet before and after the simulated case scenario group
sessions. Due to the positive results, the intervention could be incorporated in a yearly clinical competency for PACU and endoscopy nurses.

**Subject Costs and Compensation**

No compensation was made for participating in this study. Participation was voluntary.

**Resources Needed**

As stated above, the researchers needed the help of the PACU and endoscopy nurse educator to help with email subject recruitment and distribution of the email for the pre and post survey link. The researchers used their own personal computers to create the pre and post survey questionnaires using the free Qualtrics software available through Rutgers University. Copies of the pediatric emergency drug sheet were provided by the researchers. The researchers needed the support of the faculty for use of the simulation lab equipment. Mock epinephrine and atropine syringes, three 1mL, three 3mL, three 18G-blunt needles, and two 100mL NS bags were needed from the RNAP simulation lab.

**Evaluation Plan**

To ensure sustainability of the intervention, the researchers asked the participants to fill out a post survey questionnaire one-month after the initial educational session.

**Data Analysis**

Data Analysis was completed using SPSS software and Microsoft excel. The analysis for the pre- and post-surveys was completed using SPSS online software to obtain descriptive statistics and statistical analysis. To address the possibility of participants not answering all of the survey questions, Schwarzer and Jerusalem (1995) suggest that a score should still be analyzed as long as no more than three questions are skipped. The medians and means of the pre- and post-survey were assessed to see if there were any statistically significant changes in self-
efficacy and behavioral intent. These results assessed if there was any likelihood of behavioral change, specifically compliance in using the pediatric drug sheet one-month after implementation. The information is displayed in both graph and table format.

**Data Maintenance & Security**

All data collected from participants is confidential and free of personal identifiers. Data was collected and stored within password locked files on the co-investigator’s computers. This information is password protected and is only accessible by the co-investigators and the project chairman. Any downloaded data is kept in password protected files. Any electronic documents, including Qualtrics software survey data will be erased three years after completion of the research study.

**Results**

The project aim was to enhance clinical preparedness of PACU and endoscopy RNs during pediatric emergencies by increasing self-efficacy and effective use of the pediatric emergency drug sheet. This was measured via a pre- and post-survey as well as using clinical scenarios to simulate medication preparation and administration.

A total of 35 nurses took the presurvey, but greater than three questions were left missing by three participants therefore a total of 32 surveys were kept for the pre survey. After the intervention took place, 32 total post surveys were completed.

Prior to the educational session, some participants disclosed they were unaware the pediatric emergency drug sheet existed or had only glanced at it during their orientation period. Moreover, the participants verbalized feeling anxious regarding mental math calculations and the inability to recall epinephrine and atropine resuscitation dosages. Most of the nurses’ stated they
felt clinically unprepared to complete mental math and administer medications during a pediatric code correctly.

After our educational session, every nurse in attendance was able to appropriately use the pediatric emergency drug sheet to verbally demonstrate correct dosing for administration of epinephrine and atropine. During the two clinical scenarios each nurse was asked to use the pediatric emergency drug sheet to prepare epinephrine and or atropine for an 8kg child. In addition to verbally stating their actions, each nurse was able to appropriately prepare and demonstrate the mLs that they would administer to an 8 kg patient: demonstrating an increase in clinical preparedness.

Appendix M displays response percentages for questions one through seven. The higher the score the greater the self-efficacy, four being the highest score. In the presurvey, the percentage for a score of four, was always less than fifty percent of the participants. In comparison the post survey percentages displayed scores of four for greater than fifty percent for questions one through seven showing an increase in clinical self-efficacy. Appendix N, O and P show response percentages for questions eight through ten. These questions correspond to the aim of a change in behavioral intention after an educational session. There was not as drastic of a change between the pre survey scores and the post survey scores for these questions.

Statistical analysis was conducted using SPSS software and Excel. Descriptive statistics as well as an exact sign test was performed on the pre- and post-data. The descriptive statistics for all questions can be found in Appendix Q. Using the exact sign test, median data points for questions one through seven were compared (Appendix R). The exact sign data for questions one through seven show that there is a statically significant difference median scores of the Likert scale in the pre- and post-survey as a significance level of 0.05. This statically significant change
shows an increase in clinical self-efficacy for nursing staff after the intervention. A Spearman’s rho correlation coefficient was completed to assess whether there was any relationship between age or years worked. None of the responses to the questions had a strong correlation, positive or negative to age or years worked in either nursing area.

To assess change in behavioral intention the last three questions of the survey were analyzed. Using SPSS data analysis software and an exact sign test, at a significance level of 0.05 there was found to be no difference in median scores between the pre- and post-survey (Appendix R). The median pre-survey scores showed that nursing staff were already inclined to use the pediatric emergency drug sheet and found it easy to use.

**Discussion**

Previous literature has highlighted the importance of reviewing dosing and preparation of pediatric resuscitation medications due to continued errors in administration (Appelbaum et al., 2019). It is important to note that pediatric emergency drug sheets have been in use for many years, but unless a provider is comfortable and confident in preparing these medications the drug sheet has minimal use. The impact of a lack of confidence was displayed through this study. While nursing staff stated in their pre-survey that the majority were inclined to use the pediatric drug sheet and thought it was easy to use, they also stated how uneasy they were about preparing and administering small doses of epinephrine and atropine. Therefore, although the nursing staff stated that the drug sheet was easy to use and they were already inclined to use it prior to the study; it is evident that no matter the ease of a tool without consistent use or familiarity it does not have a use. Similar to what was found by Larose et al. (2016) was that when provided the pediatric emergency drug sheet nursing staff felt it was easy to come to the correct conclusion regarding how many mg/mLs to administer to the patient, but when it came to preparing the
medication some hesitancy was seen. Larose et al. (2016) found that residents were making less medication errors when using the emergency drug sheet, but they felt that error rates would be significantly reduced if training on the drug sheet was given to residents.

One of the objectives, to determine if a change in behavioral intention was present, did not show to be statistically significant. Although this was not the anticipated finding for the study, what these responses did highlight is that a high-quality tool, such as the pediatric drug sheet, is useless without clinical preparedness and self-efficacy. After implementation of the DNP project, there was a statically significant change in self-efficacy within this population of nurses. The nurses felt that they were able to use the pediatric emergency drug sheet with ease, but when it came down to evaluating their ability to prepare medications and administer correct dosages the pre survey results demonstrated that the nursing staff were not confident in their abilities. The post survey results did however show significant improvement in self-efficacy for preparing epinephrine and atropine for patients less than 10kg.

One key facilitator to this project’s objectives being met was the nurse educator for both PACU and endoscopy. The nurse educator was able to relay communication between the nursing staff and DNP copartners. She also provided a place, the pediatric Fall competency, where nursing staff could be educated outside of their time at work. This allowed for the nursing staff to focus on the education being provided during the intervention without interruption. Without the pediatric fall competency day, it would have been very difficult to have reached as many individual nurses. One of the barriers impacting the project’s objectives was that a portion of the staff did not attend the Fall pediatric competency day and therefore were unable to attend the intervention. Another barrier was filling out the survey online, as some staff stated they were unable to use a computer or their phone to do so.
A limitation associated with this project is that the pre- and post-surveys were not coded, therefore a personal evaluation of each participant could not be completed; instead, the medians of the questionnaires were compared. This still provides an appropriate evaluation of the impact of the project on this population, but further analysis could be completed if coding is used in the future. Another limitation was that no control group was used. If done again, the nurses could act as their own control before the implementation began on the first case scenario. Lastly, it would be prudent to continue with a three-month post implementation survey with the nursing staff, as well as another optional return demonstration. This would more accurately assess the longevity of the information provided. If a decrease in clinical self-efficacy or clinical preparedness was seen at the three month mark it would give additional evidence to the importance of a yearly pediatric emergency drug sheet review and return demonstration.

Implications for Clinical Practice

The results of this study show a positive influence of the intervention on self-efficacy in the PACU and Endoscopy nursing staff. We recommend a continuation of the pediatric competency day and suggest that it be offered at least twice a year, at different points in the year, as to allow for better attendance from staff. If feasible, a mock code style workshop should be added into the pediatric competency day, as this would allow for the proper use of the pediatric drug sheet outside of an emergency situation. At the minimum, a review of the pediatric emergency drug sheet and case scenarios should be conducted. In the future it would be appropriate to make the pediatric competency day mandatory as it is mandatory to go to the adult competency day once a year for this hospital.

Implications for Healthcare Policy
Currently, the hospital policy associated with the use of the pediatric emergency drug sheet has expired. We suggest the hospital create an updated policy associated with the proper use of the pediatric emergency drug sheet. In addition, references should be displayed on the emergency drug sheet or in the policy for where the dosages were obtained. Lastly, the pediatric emergency drug sheet for each kg should be hyperlinked to the hospital policy.

**Implications for Quality and Safety**

Since most studies use self-reporting methods to calculate the rate of medication errors among healthcare providers, it is hard to know the actual rate and complications caused by such errors. Administrators should cultivate a non-punitive atmosphere in which nurses are encouraged to report medications errors without fear of punishment and practice medication administration skills without putting patients in harm's way. Nurses feedback should be included to improve the annual pediatric competency day. For example, an anonymous survey that asks which components of the pediatric competency day they feel are the most and least valuable. The clinical nurse educator was receptive to working with staff to create innovative ideas for improving medication safety and preventing medication errors.

**Implications for Education**

Education that promotes awareness of medication errors and possible solutions is invaluable for nurses who administer intravenous medications. We recommend modifying nurses’ education processes by incorporating annual pharmacology training in pediatric emergency drug administration to enhance nurse’s clinical preparedness and self-efficacy. Continuing an annual pediatric emergency drug sheet competency day will provide nurses the opportunity to seek clarification and self-evaluate their clinical skills for potential knowledge gaps in drug preparation and administration.
**Sustainability**

The utilization of the pediatric drug sheet has the potential to continue beyond the period of interest in this study. The enhanced self-efficacy in the nurses use of the pediatric emergency drug sheet, speaks to the value of this project in preventing medication errors in clinical practice. An annual competency day will indirectly reduce medication errors in a vulnerable patient population and enhance patient safety. We received positive feedback from the participants regarding the practicality and ease of use of the pediatric drug sheet in clinical practice. To ensure sustainability the initiative requires hospital leadership and nursing staff support and engagement. We suggest incorporating the pediatric emergency drug sheet into a hospital policy that allows for the weight specific sheet to be printed and attached to the patients’ crib and chart on admission and follow the patient throughout their hospital stay. A chart review to ensure individual weight-based pediatric drug sheets are used, printed, and placed in the patients’ charts can be conducted every six months. Nursing staff should be asked for feedback to improve the pediatric drug sheet policy (i.e., level of satisfaction with the pediatric drug sheet).

**Plans for Future Scholarship**

This quality improvement project can be used as the foundation of a legacy project. The feedback obtained from PACU and endoscopy nurses regarding ways to improve our project can be used to strengthen functional and operational areas in our initiative. A future project could be involved in the construction of a policy for the use of the pediatric emergency drug sheet and following up with compliance post approval. Another proposal that was suggested in part by the nursing staff was bringing together multiple areas of the pediatric competency day to create mock pediatric codes. These mock codes would allow for a nonpunitive environment where
nursing staff can work as a group and practice preparing and administering emergency medications.

Our goal is to publish our study results. We will be submitting for review to a peer reviewed journal. Ultimately, we hope that organizations that do not have a pediatric emergency drug sheet policy and competency day in place, find value in implementing our quality improvement initiative based on our study design and results. Boosting nurse’s self-efficacy and clinical preparedness in medication administration and preparation is crucial to reduce medication errors and enhance patient safety.

Conclusion

Medication errors are a well-defined cause of preventable adverse events in the pediatric population. Our results demonstrate that our project accomplished its aim to indirectly prevent medication errors and improve patient safety by enhancing nursing self-efficacy and boosting PACU nurses’ clinical preparedness in administering medications during pediatric resuscitations via the pediatric emergency drug sheet. Moreover, the PACU nurses showed a willingness to use and found value in applying the drug sheet in clinical practice. However, without a hospital policy, compliance of the pediatric drug sheet use is impractical. This quality improvement project highlights how crucial it is for healthcare institutions to provide cognitive aids and establish policies that promote pediatric safety and ensure optimal patient outcomes by supporting nursing staff to translate knowledge into practice.
References


Byrne, A. J., Oliver, M., Bodger, O., Barnett, W. A., Williams, D., Jones, H., & Murphy, A.


Perioperative Registered Nurses Journal, 85(4), 731-744. doi:10.1016/S0001-2092(07)60147-1


Appendix A

Literature Search Strategy

PRISMA 2009 Flow Diagram

Records identified through database searching CINAHL, MEDLINE, SCOPUS, Google Scholar, and Rutgers University Smith Library (n = 506)

Keywords included anesthesia, anaesthesia, pediatrics, paediatrics, drug errors, medications errors, software, software tools, electronic medical record, electronic health records

Inclusion criteria: 2000-2020, English-language
Screened for additional terms: calculator, calculation, drug sheet, resuscitation, cardiopulmonary resuscitation, cardiopulmonary resuscitation, emergency scenario,

Records screened (n = 196)

Records excluded (n = 310)

Records excluded because of title and/or abstract, irrelevance, poor data (n = 102)

Full-text articles assessed for eligibility (n = 94)

Studies included in tables of evidence (n = 19)

Records excluded (n = 75)

Studies included in Grey Literature (n = 22)

Records excluded (n = 34)
## Appendix B

### Table of Evidence

<table>
<thead>
<tr>
<th>Article #</th>
<th>Author &amp; Date</th>
<th>Evidence Type</th>
<th>Sample, Sample Size, Setting</th>
<th>Study Findings that help answer EBP Question</th>
<th>Limitations</th>
<th>Evidence Level &amp; Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Alomari, A., Wilson, V., Solman, A., Bajorek, B., &amp; Tinsley, P. (2018).</td>
<td>Mixed methods study -Direct Observation -Audit Tool -Findings explored with nursing staff (Focus Groups)</td>
<td>n=4 Focus Groups (total of 33 RNs, two enrolled nurses and one assistant nurse that was employed on the ward) Complex Medical Ward in a large Australian pediatric teaching hospital</td>
<td>-Nurses are aware of the need to follow a policy, but shortcuts are often used to get the medication to the patient in a timely manner. -Failing to report medication errors because they are not detected or easily fixed -Even if a policy or guideline is evidence-based, if it is not comprehensive or practical nurses are prone to create workarounds. -Bedside nurses need to be involved in creating protocols and guidelines that are realistic and appropriate to follow</td>
<td>Direct observations of nurses could encourage staff to act abnormally when administering medications. The authors did notice that after the first week of the observer being present, nurses went back to normal behaviors. This is part one of a two part research paper, therefore results were preliminary</td>
<td>Level III Good Quality</td>
</tr>
<tr>
<td>2.</td>
<td>Appelbaum, N., Clarke, J., Feather, C., Franklin, B., Sinha, R., Pratt, P., … Darzi, A.. (2019).</td>
<td>Prospective, observational study</td>
<td>These simulated pediatric resuscitation scenarios were conducted in a large English teaching hospital. Fifteen resuscitation teams were</td>
<td>This study reestablishes the fact that during emergency situations medication errors are more likely to occur. During drug preparation even when calculations were correct, wrong</td>
<td>Simulation environment may not be completely comparable to an emergency pediatric resuscitation. Participants knew that they were going to be</td>
<td>Level II High Quality</td>
</tr>
</tbody>
</table>
made consisting of two doctors and two nurses for each team. Each team performed one or two different scenarios.

|剂量|被错误地抽取和施用。沟通|与医护人员的沟通是至为重要的。作者建议应向医护人员提供额外的教育，以正确准备和施用急救药物。

|非实验|n=46例行手术案例，为期3个月

| Byrne, A. J., Oliver, M., Bodger, O., Barnett, W. A., Williams, D., Jones, H., & Murphy, A. (2010) | Non Experimental | n=46 routine surgical cases over a 3 month period | The time to react to the vibrating device on the subject's arm was statistically significant between induction and maintenance. Mental workload was increased during induction and emergence and had statistically significant delay times. Showing that during times of stress or mental capacity, the subjects were unable to focus on pressing the vibrating button at the same time. Increased workload can lead to errors due to being unable to comprehend any additional information. | No randomization of which subjects were selected to wear vibrating devices. Therefore subjects could all be people interested in performing well for the study. Subjects may also have been more or less inclined to hit the vibrating button quickly, this is person specific and therefore may make these methods less valid. No true baseline was taken. | Level III High Quality |

<p>| Byrne, A. (2011) | Systematic Review | 33 studies were identified as being relevant | Mental workload is a significant component of Multiple definitions of mental | Level III Good Quality |</p>
<table>
<thead>
<tr>
<th>5.</th>
<th>Ehsani, S. R., Cheraghi, M. A., Nejati, A., Salari, A., Esmaeilpoo r, A. H., &amp; Nejad, E. M. (2013)</th>
<th>Descriptive study</th>
<th>n=94 nurses in the Emergency department of a large educational and therapeutic hospital complex in Iran</th>
<th>Inadequate pharmacological knowledge, fatigue from high workload, and nursing shortage were among the reasons for medication errors. Lack of pharmacological knowledge is a significant factor in medication errors occurring. Retraining courses are recommended</th>
<th>There could be significant differences in nursing school pharmacology courses from the US to Iran. The study did not announce any limitations throughout the article. The questionnaire used to survey the RNs was not provided in the article.</th>
<th>Level III Good Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.</td>
<td>Grigg, E. B., Martin, L. D., Ross, F. J., Roesler, A., Rampersad, S. E., Haberkern, C., . . . Martin, L. D. (2017)</td>
<td>Phase 1: Controlled randomized study</td>
<td>Phase 1: Randomized controlled simulated reproducible OR environment in Seattle. n=41</td>
<td>Even with prefilled medication syringes, without a formalized set-up, errors continued to occur. Dilution of epinephrine 100mcg/mL was shown to be a cause of errors. Simplifying calculations, using prefilled syringes with standardized sizes was shown to decrease error rates. Using cognitive aids to decrease cognitive load during times of emergency were</td>
<td>Phase one was a simulated environment with mannequins used for each emergency scenario. This could lead to less cognitive load because anesthesia providers feel as though it is not as critical. In phase two the reporting of medication errors was done on a voluntary basis. Once the AMT</td>
<td>Level I High quality</td>
</tr>
<tr>
<td>7.</td>
<td>Kaufmann, J., Roth, B., Engelhardt, T., Lechleuthner, A., Laschat, M., Hadamitzky, C., Wappler, F., &amp; Hellmich, M. (2018)</td>
<td>Pre and Post intervention study. No randomization took place because of the positive impact the PaedER had on decreasing errors, ethical barrier to randomization. A historical control group was used.</td>
<td>n= prospective 91 total patients, 50 per each drug evaluated. n=437 children in the historical group</td>
<td>The pediatric emergency ruler was found to have statistically significant decreases in pediatric drug errors in the prehospital setting. All administrations of epinephrine occurred excessively (deviation from recommended dose &gt;300%) in pre-intervention &amp; none in the post interventional group. This study displayed that not only is epinephrine frequently dosed inappropriately, but the dosing of epinephrine differed significantly more than other drugs when compared to the correct doses to be administered.</td>
<td>The study’s power sample was 200 participants for the prospective group, but only 91 were able to be placed in the study. This was completed in the prehospital environment which is not the setting of this proposed project. Payment was made to participants who filled out study forms.</td>
<td>Level II Good Quality</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>8.</td>
<td>Kaufmann, J., Wolf, A.R., Becke, M., Laschat, F., Wappler, F., &amp; Engelhardt, T. (2017)</td>
<td>Systematic Review of Literature</td>
<td>N/A</td>
<td>Significant errors are made when small volumes are taken from “stock” solutions. Feasibility was assessed in this article, taking into</td>
<td>Some articles included in the review were greater than 10 years from the article publication date, but all information</td>
<td>Level III High Quality</td>
</tr>
</tbody>
</table>
consideration the cost of interventions and practicality of implementation. The authors state that some drugs, specifically epinephrine, should have clear written out directions for correct dilution. Lastly, review of drug preparation and administration is essential for all staff.

from guidelines and articles are still relevant to today’s practice.

Post hand-off CRNA to PACU RN n= 217  
Pre hand-off CRNA to CRNA n=37  
Post hand-off CRNA to CRNA n=50 | Hand-off between CRNAs and PACU RNs has been inadequate. A structured format allows for closed loop communication between providers as well as a decrease in information inadvertently being omitted. Medication errors are likely to occur when patient information is not given to the next provider. | Convenience sampling was used and the participants knew that they were a part of a study. Participants may have been more compliant with use of the handoff tool, knowing they were enrolled in this study. | Level III High Quality |

<p>| 10. | Larose, G., Levy, A., Bailey, B., Cummins-McManus, B., Lebel, D., &amp; Gravel, J. (2016) | Randomized Controlled Trial | High Fidelity simulation with residents rotation in the pediatric ED. Each resident performed two scenarios. The first counted as the control without the intervention | This study found a decrease in 10-fold errors in the simulations when using the clinical aid. This study also found that there was a 10-fold error in epinephrine administration, similar to | Sample size was based off of previous studies, a power sample was not conducted. Residents were not offered training in how to use | Level I High Quality |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Clinical aid of the precalculated pediatric drug doses. n=40 residents completing a total of 160 scenarios</th>
<th>Findings of other studies. They attribute this to differing doses of epinephrine as well as the concentration differences seen in prefilled syringes. This study found an increase in resident confidence in prescribing medications with the help of the clinical aid. The authors suggest additional education strategies to lower the rate of medications errors</th>
<th>the clinical aid before the simulations which meant that the tool was not used appropriately at times by residents. This was a simulated environment, the level of stress may not be the same as that in the clinical setting.</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.</td>
<td>Légaré, F., Borduas, F., Freitas, A., Jacques, A., Godin, G., Luconi, F., Grimshaw, J., &amp; the CPD-KT team. (2014)</td>
<td>Mixed Methods Study: Phase 1: Systematic Review Phase 2: Expert Review Phase 3: creation of a questionnaire from experts Phase 4: assessment of the reliability and validity of the new theory-based instrument - nonexperimen tal n=70 registered international experts</td>
<td>This study attempted to create a preliminary instrument (questionnaire) that is valid and reliable. The researchers were only able to look at instruments that they were able to obtain a copy of and therefore able to be examined. Some instruments may have been missed because of this.</td>
<td>Level III High Quality</td>
</tr>
<tr>
<td>12.</td>
<td>Légaré, F., Freitas, A., Turcotte, S., Borduas, F., Jacques,</td>
<td>Prospective mixed-methods study Pre and Post Survey n=376 health professionals</td>
<td>Researchers used this validated questionnaire to conclude that the questionnaire was able to help</td>
<td>There was no control group in this study. There was a loss of subjects</td>
</tr>
<tr>
<td>Source</td>
<td>Type</td>
<td>Description</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>------</td>
<td>-------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Luten, R., Wears, R. L., Broselow, J., Croskerry, P., Joseph, M. M., &amp; Frush, K. (2002)</td>
<td>Expert opinion</td>
<td>Providers experience higher cognitive load in pediatric resuscitation due to complex demands. In pediatrics the greater level of task intricacy increases cognitive load because of the unique component of variability of pediatric age, size, &amp; multiple calculations. Pre-calculated sheets/computerized tool eliminate calculations &amp; transforms cognitive burden into automatic activity by simplifying (reducing steps) thus reducing cognitive load &amp; allowing accuracy to be maintained &amp;/or improved. Resuscitation systems should incorporate precalculated mLs of available concentrations.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marques-Hernandez,</td>
<td>Phase One: validation of a hospital-based</td>
<td>A Chronbach’s alpha of 0.849 It would be difficult to</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Level IV High Quality</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>V. V., Fuentes-Colmenero, A. L., Canadas-Nunez, F., Di Muzio, M., Giannetta, N., &amp; Gutierrez-Puertas, L. (2019)</td>
<td>questionnaire on knowledge, attitudes and behaviors (KAB) in the administration of intravenous medications Phase two: Cross-sectional study</td>
<td>nursing professionals participated in the study in Spain</td>
<td>was found for validation of this questionnaire. This statistic is higher than that found in the original study (alpha= 0.776). Staff nurses stated that specific and continuous training on IV medication is absolutely necessary. A positive association was found between knowledge and attitudes. Staff stated that knowledge of drug doses and calculations would lead to a decrease in medication errors.</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>15.</td>
<td>Milby, A., Böhmer, A., Gerbershagen, M. U., Joppich, R., &amp; Wappler, F. (2014)</td>
<td>Prospective observational study</td>
<td>n= 790 postoperative handovers in a PACU in Germany</td>
<td>PACU handoff from anesthesia staff to PACU RN is incomplete more times than not. Omission of patient information can lead to errors in the postoperative area. For example, out of all of the handoffs performed only 44% of them included allergies as part of the handoff.</td>
</tr>
<tr>
<td>16.</td>
<td>Muffly, M.K.,</td>
<td>Quasi experimental</td>
<td>n= 10 attending pediatric</td>
<td>The authors found that as the Injection technique was Level III</td>
</tr>
<tr>
<td>Study ID</td>
<td>Authors</td>
<td>Study Type</td>
<td>n</td>
<td>Observations</td>
</tr>
<tr>
<td>----------</td>
<td>---------</td>
<td>------------</td>
<td>---</td>
<td>--------------</td>
</tr>
<tr>
<td>17.</td>
<td>Chen et al.</td>
<td>Study</td>
<td>58</td>
<td>Anesthesiologists and 10 pediatric PACU nurses in a Children's hospital in California. Injections were given into a simulated patient IV setup. This was not completed in a patient care area.</td>
</tr>
<tr>
<td>17.</td>
<td>Prot et al.</td>
<td>Prospective direct-observation study</td>
<td>1719</td>
<td>Lack of training and limited familiarity with pediatric drug administration was found to increase the risk of drug errors occurring. The authors believe that evaluation of drug preparation and administration is urgently needed. Nurses are less likely to report errors for fear of retaliation.</td>
</tr>
<tr>
<td>18.</td>
<td>Reed &amp; Fothergill</td>
<td>Short Report</td>
<td>N/A</td>
<td>This use of the pediatric drug calculator reduced error rates and allowed for a quicker time to prescribing.</td>
</tr>
<tr>
<td>19.</td>
<td>Shannon et al.</td>
<td>Prospective Controlled</td>
<td>20</td>
<td>The mean time for completing</td>
</tr>
<tr>
<td>d, A., Southward, D., Hildreth, A. (2002)</td>
<td>Trial</td>
<td>department and pediatric staff members. Staff members were asked to calculate resuscitation requirements for three patients. Then they were shown the computer based resuscitation calculator to complete the same calculations.</td>
<td>the calculations on their own was 16:7 and the mean time for the computer model was 05:12, about three times faster on average. The computer based system provided a faster and more accurate way of prescribing.</td>
<td>actual resuscitation simulation therefore there was no added stress of a resuscitation when calculating dosages.</td>
</tr>
</tbody>
</table>
Appendix C

Permission to Use Generalized Self-Efficacy Scale

Permission granted
to use the General Self-Efficacy Scale for non-commercial research and development purposes. The scale may be shortened and/or modified to meet the particular requirements of the research context.

http://userpage.fu-berlin.de/~health/selfscal.htm

You may print an unlimited number of copies on paper for distribution to research participants. Or the scale may be used in online survey research if the user group is limited to certified users who enter the website with a password.

There is no permission to publish the scale in the Internet, or to print it in publications (except 1 sample item).

The source needs to be cited, the URL mentioned above as well as the book publication:

Appendix D

Theoretical Framework (Adopted from the Revised Ottawa Model of Research)

Assess
- Barriers: Not all PACU and endoscopy nurses are receptive to taking care of pediatric patients. Nurses may not have the time during their shift to participate in an interactive session.
- Supportive: PACU management requiring the interactive session. PACU nurses endorsing the 2-hr interactive session. Nursing leadership signing off on the education session.

Monitor
- Interactive case scenarios using pediatric drug sheet.
- Preparation and review of epinephrine and atropine dosing during case scenarios.
- Pre-intervention questionnaire completed.

Evaluate
- Use of post-survey to determine ways to improve interactive session and intent to use pediatric emergency drug sheet in the future.
- Evaluate success of interactive session in bridging knowledge gap in pediatric emergency medication administration.

Evidence-Based Innovation
- Validated questionnaire on intended use of pediatric drug sheet after intervention.
- Review of pediatric drug sheet and guidelines for use.
- Research-based innovation session on the use of the pediatric drug sheet and preparation of pediatric doses of epinephrine and atropine.

Potential Adopters
- All PACU and Endoscopy nurses.
- Assess the nurses' feelings on having an interactive session.
- Nurses have differing levels of experience with pediatric patients. Assess level of interest in those that have pediatric experience.

Implementation Intervention Strategies
- Identify reasons why the pediatric drug sheet is not currently being used.
- Identify the best time period to administer the interactive session for PACU nurses.
- Explain to staff that questionnaires are confidential.
- Speak with PACU educator about having this interactive session become apart of yearly pediatric competency.

Adoption
- Monitor how many PACU nurses are willing to participate in interactive education session.
- Acknowledge any new barriers that may be preventing PACU nurses from attending.
- Make changes to interactive session to improve the experience for providers.

Outcomes
- Use of pediatric drug sheet with all pediatric patients.
- Correct preparation and administration of pediatric epinephrine and atropine doses for children.
- Continuation of drug administration interactive session in pediatric competency every year.
- Reduction in pediatric drug errors during emergencies.
- Increase in practitioners' clinical preparedness with administration of pediatric emergency medications and using pediatric drug sheet.

Practice Environment
- Enforcement of this project by PACU leadership is essential.
- Low-stress environment in PACU with small groups of staff members, all questionnaires are confidential.
Appendix E

PACU Recruitment Flyer

Utilizing a Pediatric Emergency Drug Sheet to Enhance Clinical Preparedness in Medication Administration

Seeking PACU Nurses Caring for Pediatric Patients

Research Study Purpose

- To enhance nurses’ clinical preparedness by increasing effective use of the pediatric emergency drug sheet

Design

- 30-minute group session
- Review of the pediatric emergency drug sheet policy
- Nurses will work in groups and use the drug sheet to solve case scenarios and prepare emergency medications
- ‘Mock’ syringes and calculators will be provided.
- Participation requires completion of pre- and post-intervention surveys

Date and Location

- XXX at 7AM
- Main Operating Room PACU Nurses Station

Boost Clinical Confidence

Principal Investigator:
Maureen McCartney Anderson, DNP, CRNA/APN

Co-Investigators:
Arianna Sinkovich, RRNA, CRNA, APN
Martha Rentaria, RRNA, CRNA, APN

Version Number: # 3 Version Date: 4/13/20
Utilizing a Pediatric Emergency Drug Sheet to Enhance Clinical Preparedness in Medication Administration

Seeking Endoscopy Nurses Caring for Pediatric Patients

Research Study Purpose
- To enhance nurses’ clinical preparedness by increasing effective use of the pediatric emergency drug sheet

Design
- 20-minute group session
- Review of the pediatric emergency drug sheet policy
- Nurses will work in groups and use the drug sheet to solve case scenarios and prepare emergency medications
- ‘Mock’ syringes will be provided
- Participation requires completion of pre- and post-intervention surveys

Date and Location
- XXX, at 8AM
- PACU and Surgical Prep Area

Principal Investigator:
Maureen McCartney Anderson, DNP, CRNA/APN

Co-investigators:
Arianna Sinkovich, RRNA
Martha Rentaria, RRNA

Boost Clinical Confidence
Good Morning PACU and endoscopy nurses,

We are two Rutgers University Nurse Anesthesia graduate students, Martha Renteria and Arianna Sinkovich, and our project chair is Dr. Maureen McCartney Anderson. Today, we are speaking to you regarding an invitation to participate in their doctoral research study called: “Utilizing a Pediatric Emergency Drug Sheet to Enhance Clinical Preparedness in Medication Administration”.

Project Aim
❖ To enhance clinical preparedness of PACU and endoscopy RN’s during pediatric emergencies by increasing clinical preparedness and self-efficacy when using the pediatric emergency drug sheet.

Time Requirement
❖ 20-minute case scenario group session

Design
❖ Overview of the pediatric emergency drug sheet
❖ The participants will work in groups to solve pediatric case scenarios.
❖ ‘Mock’ syringes, and supplies will be provided.

Eligibility
❖ PACU and endoscopy nurses currently or anticipating taking care of pediatric patients

Date and Time and Location
❖ XXX at 8AM, PACU and surgical prep area
❖ XXX at 8AM, PACU and surgical prep area

Please reach out to Arianna Sinkovich at [Contact Information] or Martha Renteria at [Contact Information] with any questions.

Best Regards,

Martha Renteria and Arianna Sinkovich
INFORMATION SHEET FOR PARTICIPATION IN RESEARCH

You are being asked to participate in a research study conducted at [Redacted] by Martha Renteria, BSN, RN and Arianna Sinkovich, BSN, RN DNP students from Rutgers University. You are being asked to participate in this study because you are currently working with pediatric patients in a post anesthesia environment. The purpose of this study is to increase clinical preparedness for pediatric emergencies using the pediatric emergency drug sheet.

Please read the information below and ask questions about anything you do not understand before deciding whether or not to participate. Your participation in this research study is completely voluntary.

If you decide to participate, you will be asked to complete a pre survey online questionnaire which will take approximately five minutes and join an educational session about the pediatric emergency drug sheet which will take approximately 20 minutes. You will also be asked to complete a post survey questionnaire one month after the intervention which will take approximately five minutes to complete. These surveys will be sent by the PACU and endoscopy nurse educator via hospital emails.

By completing a pre- and post-survey as well as an interactive education session, you are agreeing to participate in this research study. There are no other alternatives to the study other than not participating. Participation is voluntary and whether you participate or not will not affect your employment in any way. You have the right to decide not to fill out the surveys or participate in the education session.

Your answers to the survey are confidential and cannot be linked back to you in any way. If you do not want to answer a question for any reason you are free to skip it.

The survey results will permit the researchers to quantify the participants' sense of clinical preparedness and usefulness of the pediatric emergency drug sheet before and after the simulated case scenario group sessions. There are no foreseeable risks because the surveys will be kept confidential as to those who decide to participate in the study. All responses will be reported as aggregated data only.
If you have any questions, concerns, or complaints about the research please contact Martha Renteria or Arianna Sinkovich. The co-investigators will be glad to answer any of your questions. Martha Renteria’s phone number is [redacted] and Arianna Sinkovich’s phone number is [redacted].

If you have questions about your rights as a research participant, or concerns or complaints about the research, you may contact the [redacted] Institutional Review Board (IRB) Research Integrity Office at [redacted]. You may also call this number in the event the research staff cannot be reached or you wish to talk to someone else.

In addition, you may also call the [redacted] at [redacted] to anonymously report any concerns you have related to the Study or research.

Thank you for considering participating in this study. If you decide to participate, please keep this sheet and retain it for your records.

Martha Renteria and Arianna Sinkovich
Co-investigators
Appendix I

Pre Survey for PACU and Endoscopy Nurses

Perceived Self-Efficacy and Change In Behavioral Intention with the Pediatric Emergency Drug Sheet

- How many years have you worked in PACU or Endoscopy as a RN
  - 0-1 year
  - 1-5 years
  - 5-10 years
  - > 10 years
- What is your age?
  - 20-30
  - 30-40
  - 40-50
  - 50-60
  - 60-70
  - over 70

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I can always manage to solve difficult problems using the pediatric emergency drug sheet if I try hard enough.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[Not at all true]</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2. I can solve most pediatric drug administrations of epinephrine with the use of the pediatric emergency drug sheet if I invest the necessary effort.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[Not at all true]</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3. I can solve most pediatric drug administrations of atropine with the use of the pediatric emergency drug sheet if I invest the necessary effort.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[Not at all true]</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4. I am confident that I could locate the pediatric emergency drug sheet during unexpected events.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[Not at all true]</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5. I am confident that I could efficiently treat pediatric patients during unexpected events.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[Not at all true]</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
6. I can usually handle preparing resuscitation doses of epinephrine for a patient weighing less than 10 kg.

[Not at all true]  1  2  3  4  [Exactly true]

7. I can usually handle preparing resuscitation doses of atropine for a patient weighing less than 10 kg.

[Not at all true]  1  2  3  4  [Exactly true]

8. I plan to use the pediatric emergency drug sheet.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

9. For me, using the pediatric emergency drug sheet would be

| Very Difficult | Difficult | Neutral | Easy | Very useful   |

10. Overall, I think that for me using the pediatric emergency drug sheet would be

| Very Useless | Useless | Neutral | Useful | Very useful   |

Survey questions (1-7) adapted from the General Perceived Self-Efficacy Scale (Schwarzer & Jerusalem, 1995).

Appendix J

Post Survey for PACU and Endoscopy Nurses

Perceived Self-Efficacy and Change in Behavioral Intention with the Pediatric Emergency Drug Sheet

- How many years have you worked in PACU or Endoscopy as a RN
  - 0-1 year
  - 1-5 years
  - 5-10 years
  - > 10 years
- What is your age?
  - 20-30
  - 30-40
  - 40-50
  - 50-60
  - 60-70
  - over 70

1. I can always manage to solve difficult problems using the pediatric emergency drug sheet if I try hard enough.
   [Not at all true]  1  2  3  4  [Exactly true]

2. I can solve most pediatric drug administrations of epinephrine with the use of the pediatric emergency drug sheet if I invest the necessary effort.
   [Not at all true]  1  2  3  4  [Exactly true]

3. I can solve most pediatric drug administrations of atropine with the use of the pediatric emergency drug sheet if I invest the necessary effort.
   [Not at all true]  1  2  3  4  [Exactly true]

4. I am confident that I could locate the pediatric emergency drug sheet during unexpected events.
   [Not at all true]  1  2  3  4  [Exactly true]

5. I am confident that I could efficiently treat pediatric patients during unexpected events.
   [Not at all true]  1  2  3  4  [Exactly true]
6. I can usually handle preparing resuscitation doses of epinephrine for a patient weighing less than 10kg.

[Not at all true] 1 2 3 4 [Exactly true]

7. I can usually handle preparing resuscitation doses of atropine for a patient weighing less than 10 kg.

[Not at all true] 1 2 3 4 [Exactly true]

8. I plan to use the pediatric emergency drug sheet.

Strongly Disagree Disagree Neutral Agree Strongly Agree

9. For me, using the pediatric emergency drug sheet would be

Very Difficult Difficult Neutral Easy Very useful

10. Overall, I think that for me using the pediatric emergency drug sheet would be

Very Useless Useless Neutral Useful Very useful

11. Did you participate in the Utilizing a Pediatric Emergency Drug Sheet to Enhance Clinical Preparedness and Self-Efficacy in Medication Administration during the Fall pediatric competency?

Yes No

Survey questions (1-7) adapted from the General Perceived Self-Efficacy Scale (Schwarzer & Jerusalem, 1995).

### Appendix K

Pediatric Emergency Drug Sheet Example

#### Pediatric Weight-Based Emergency Reference

**Weight:** 40 kg

<table>
<thead>
<tr>
<th>DRUG (Concentration)</th>
<th>Route</th>
<th>Dose</th>
<th>Dose (amt)</th>
<th>Dose (volume)</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intubation Medications</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atropine (0.1 mg/mL)</td>
<td>IV, IO, ET</td>
<td>0.02 mg/kg</td>
<td>0.5 mg max single dose</td>
<td>5 mL</td>
<td>Rapid injection; May repeat once in 3-5 min; Maximum cumulative dose = 1 mg</td>
</tr>
<tr>
<td>Fentanyl (50 mg/mL)</td>
<td>IV, IO</td>
<td>1 microgram/kg</td>
<td>40 mcg</td>
<td>0.8 mL</td>
<td>Slow IV push over 3.5 min (too rapid injection can cause rigid chest syndrome)</td>
</tr>
<tr>
<td>Ketamine (50 mg/mL)</td>
<td>IV, IO</td>
<td>1 mg/kg</td>
<td>40 mg</td>
<td>0.8 mL</td>
<td>General anesthetic must be administered by pediatric intensivist or anesthesia personnel</td>
</tr>
<tr>
<td>Midazolam (Versed®) (1 mg/mL)</td>
<td>IV, IO</td>
<td>0.1 mg/kg</td>
<td>4 mg</td>
<td>4 mL</td>
<td>Administer slowly over 2-5 minutes; Maximum dose = 10 mg</td>
</tr>
<tr>
<td>Succinylcholine (20 mg/mL)</td>
<td>IV, IO</td>
<td>Infant: 2 mg/kg</td>
<td>80 mg</td>
<td>4 mL</td>
<td>Depolarizing neuromuscular blocking agent; Rapid IV injection; May be repeated every 5-10 minutes; Maximum total dose = 150 mg; Risks = Malignant Hyperthermia, Bradycardia with hypotension, cardiac arrhythmias, and cardiac arrest; Use with extreme caution in patients with hypokalemia, severe burns or severe trauma</td>
</tr>
<tr>
<td>Child: 1 mg/kg</td>
<td>40 mg</td>
<td>2 mL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vecuronium (Norcuron®) (1 mg/mL)</td>
<td>IV, IO</td>
<td>0.2 mg/kg</td>
<td>8 mg</td>
<td>8 mL</td>
<td>Non-depolarizing neuromuscular blocking agent; Rapid IV Injection</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resuscitation Medications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epinephrine (1:10,000) (1 mg/mL)</td>
</tr>
<tr>
<td>Epinephrine (1:1000) (1 mg/mL)</td>
</tr>
<tr>
<td>Adenosine (Adenocard®) (3 mg/mL)</td>
</tr>
<tr>
<td>2nd dose 0.2 mg/kg</td>
</tr>
<tr>
<td>Amiodarone (50 mg/mL)</td>
</tr>
<tr>
<td>Non-Arrest 1 mg/kg</td>
</tr>
<tr>
<td>Atropine (0.1 mg/mL)</td>
</tr>
<tr>
<td>Lidocaine 2% (20 mg/mL)</td>
</tr>
</tbody>
</table>
Pediatric Weight-Based Emergency Reference

**Weight:** 40 kg

### Drug Dosing

<table>
<thead>
<tr>
<th>Drug</th>
<th>Route</th>
<th>Dose</th>
<th>Dose (amt)</th>
<th>Dose (volume)</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procainamide (100 mg/mL)</td>
<td>IV, IO</td>
<td>15 mg/kg</td>
<td>600 mg</td>
<td>6 mL</td>
<td>Dilute loading dose with 0.9% NS 4 mL to a concentration of 20 mg/mL. Give over 30-60 minutes with continuous ECG and blood pressure monitoring.</td>
</tr>
<tr>
<td>Calcium Chloride 10% (100 mg/mL)</td>
<td>IV, IO</td>
<td>20 mg/kg</td>
<td>800 mg</td>
<td>8 mL</td>
<td>Give over 3-5 minutes. Maximum dose = 2,000 mg. May repeat in 10 minutes if needed; Avoid extravasation; Central line preferred.</td>
</tr>
<tr>
<td>Dextrose 10% (100 mg/mL)</td>
<td>IV, IO</td>
<td>&lt; 6 months: 200 mg/kg, &gt; 6 months: 500 mg/kg</td>
<td>8000 mg</td>
<td>80 mL</td>
<td>1st check blood glucose level</td>
</tr>
<tr>
<td>Dextrose 25% (250 mg/mL)</td>
<td>IV, IO</td>
<td>500 mg/kg</td>
<td>20,000 mg</td>
<td>80 mL</td>
<td>1st check blood glucose level. Maximum single dose = 25 grams</td>
</tr>
<tr>
<td>Lorazepam (Ativan*) (2 mg/mL)</td>
<td>IV, IO</td>
<td>0.1 mg/kg</td>
<td>4 mg</td>
<td>2 mL</td>
<td>Slow IV over 2-5 minutes (maximum rate 2 mg/min); May repeat dose every 10-15 minutes. Watch for respiratory depression.</td>
</tr>
<tr>
<td>Naloxone (Narcan*) (0.4 mg/mL)</td>
<td>IV, IO</td>
<td>Full reversal: 0.1 mg/kg Resp depression: 3 micrograms/kg</td>
<td>2 mg max dose</td>
<td>full strength max dose</td>
<td>* May be administered full strength * Full reversal for opioid intoxication (overdose); Reversal of respiratory depression for therapeutic opioid dosing; Repeat dosing every 2-3 minutes as needed based on response; Monitor patient closely for respiratory depressions, may need to repeat dosing every 20-60 minutes.</td>
</tr>
<tr>
<td>Phenobarbital (130 mg/mL)</td>
<td>IV, IO</td>
<td>15 mg/kg</td>
<td>600 mg</td>
<td>4.62 mL</td>
<td>Do not inject faster than 1 mg/kg/min with a maximum of 30 mg/min; Maximum dose = 1,000 mg/dose; May repeat in 15 minutes; Maximum total dose = 40 mg/kg; Respiratory support may be needed; Avoid extravasation</td>
</tr>
<tr>
<td>Fosphenytoin (Cerebyx*) (50 mg/mL)</td>
<td>IV, IO</td>
<td>15 mg/kg</td>
<td>600 mg</td>
<td>12 mL</td>
<td>Based on phenytoin equivalents (PE). Can administer loading dose undiluted. Administer at 1-3 mg PE/kg/min to max of 150 mg PE/min.</td>
</tr>
<tr>
<td>Phenytoin (Dilantin*) (50 mg/mL)</td>
<td>IV, IO</td>
<td>15 mg/kg</td>
<td>600 mg</td>
<td>12 mL</td>
<td>Dilute with NS to a concentration of 1-10 mg/mL; use an in-line 0.22 micron filter; Administer slowly, infusion rate x 3 mg/kg/min; Follow bolus with NS flush; Avoid extravasation; Follow with maintenance therapy.</td>
</tr>
<tr>
<td>Cardioversion</td>
<td>External Paddles</td>
<td>1 joules/kg, 2 joules/kg</td>
<td>*50 J</td>
<td>*100 J</td>
<td>Shock 1</td>
</tr>
<tr>
<td>Defibrillation</td>
<td>External Paddles</td>
<td>2 joules/kg, 4 joules/kg</td>
<td>*100 J</td>
<td>*200 J</td>
<td>Shock 1</td>
</tr>
</tbody>
</table>

### Emergency Equipment

<table>
<thead>
<tr>
<th>Ambu Bag</th>
<th>Laryngoscope Blade</th>
<th>ETT</th>
<th>ETT Insertion Length</th>
<th>Suction Catheter</th>
<th>NGT</th>
<th>Urinary Catheter</th>
<th>Chest Tube</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child</td>
<td>3 straight or curved</td>
<td>6.5 cuffed</td>
<td>18.5-19.5 cm</td>
<td>10-12 F</td>
<td>16-18 F</td>
<td>12 F</td>
<td>32-38 F</td>
</tr>
</tbody>
</table>

References:
Appendix L

Project Timeline

Utilizing a Pediatric Emergency Drug Sheet to Enhance Clinical Preparedness in Medication Administration

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Start Date</th>
<th>Duration (Days)</th>
<th>End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Planning</td>
<td>1/21/20</td>
<td>68</td>
<td>3/29/20</td>
</tr>
<tr>
<td>Proposal Presentation</td>
<td>4/27/20</td>
<td>1</td>
<td>4/28/20</td>
</tr>
<tr>
<td>IRB Submission</td>
<td>4/28/20</td>
<td>60</td>
<td>6/27/20</td>
</tr>
<tr>
<td>Post Flyers</td>
<td>7/1/20</td>
<td>30</td>
<td>7/31/20</td>
</tr>
<tr>
<td>Implementation</td>
<td>8/3/20</td>
<td>60</td>
<td>10/2/20</td>
</tr>
<tr>
<td>Data Collection</td>
<td>11/2/20</td>
<td>30</td>
<td>12/2/20</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>12/2/20</td>
<td>23</td>
<td>12/25/20</td>
</tr>
<tr>
<td>Requirement</td>
<td>Date</td>
<td>Page</td>
<td>Approval Date</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------</td>
<td>------</td>
<td>---------------</td>
</tr>
<tr>
<td>Evaluation and Final</td>
<td>12/21/20</td>
<td>18</td>
<td>1/8/21</td>
</tr>
<tr>
<td>Paper</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dissemination</td>
<td>1/11/21</td>
<td>20</td>
<td>1/31/21</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix M

Percentage of Pre and Post Survey Responses Questions One through Seven

Questions 1-7 Pre and Post Results
Appendix N

Question Eight Pre and Post Percentage Responses

Q8 Pre and Post Results

- **STRONGLY AGREE**: 66% (Pre), 56% (Post)
- **EASY**: 22% (Pre), 3% (Post)
- **NEUTRAL**: 9% (Pre), 34% (Post)
- **DISAGREE**: 3% (Pre), 3% (Post)
- **STRONGLY DISAGREE**: 3% (Pre), 3% (Post)
Appendix O

Question Nine Pre and Post Percentage Responses

Question 9 Pre and Post Results

- **VERY USEFUL**:
  - Pre: 56%
  - Post: 97%

- **EASY**:
  - Pre: 3%
  - Post: 0%

- **NEUTRAL**:
  - Pre: 34%
  - Post: 0%

- **DIFFICULT**:
  - Pre: 3%
  - Post: 0%

- **VERY DIFFICULT**:
  - Pre: 3%
  - Post: 3%
Appendix P

Question Ten Pre and Post Percentage Responses

Q10 Pre and Post Results

- **VERY USEFUL**: Q10 Pre 75%, Q10 Post 94%
- **USEFUL**: Q10 Pre 9%, Q10 Post 3%
- **NEUTRAL**: Q10 Pre 13%, Q10 Post 0%
- **USELESS**: Q10 Pre 3%, Q10 Post 3%
- **VERY USELESS**: Q10 Pre 0%, Q10 Post 0%
### Appendix Q

Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Median</th>
<th>Mode</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1 Pre</td>
<td>32</td>
<td>2.66</td>
<td>3.00</td>
<td>3</td>
<td>0.971</td>
</tr>
<tr>
<td>Q1 Post</td>
<td>32</td>
<td>3.38</td>
<td>4.00</td>
<td>4</td>
<td>0.907</td>
</tr>
<tr>
<td>Q2 Pre</td>
<td>32</td>
<td>2.72</td>
<td>3.00</td>
<td>2</td>
<td>0.958</td>
</tr>
<tr>
<td>Q2 Post</td>
<td>32</td>
<td>3.66</td>
<td>4.00</td>
<td>4</td>
<td>0.653</td>
</tr>
<tr>
<td>Q3 Pre</td>
<td>32</td>
<td>2.69</td>
<td>3.00</td>
<td>2</td>
<td>0.931</td>
</tr>
<tr>
<td>Q3 Post</td>
<td>32</td>
<td>3.72</td>
<td>4.00</td>
<td>4</td>
<td>0.634</td>
</tr>
<tr>
<td>Q4 Pre</td>
<td>32</td>
<td>2.72</td>
<td>3.00</td>
<td>4</td>
<td>1.085</td>
</tr>
<tr>
<td>Q4 Post</td>
<td>32</td>
<td>3.63</td>
<td>4.00</td>
<td>4</td>
<td>0.660</td>
</tr>
<tr>
<td>Q5 Pre</td>
<td>32</td>
<td>2.41</td>
<td>2</td>
<td>2</td>
<td>0.946</td>
</tr>
<tr>
<td>Q5 Post</td>
<td>32</td>
<td>3.47</td>
<td>4</td>
<td>4</td>
<td>0.761</td>
</tr>
<tr>
<td>Q6 Pre</td>
<td>32</td>
<td>2.06</td>
<td>2</td>
<td>1</td>
<td>1.045</td>
</tr>
<tr>
<td>Q6 Post</td>
<td>32</td>
<td>3.53</td>
<td>4</td>
<td>4</td>
<td>0.761</td>
</tr>
<tr>
<td>Q7 Pre</td>
<td>32</td>
<td>2.06</td>
<td>2</td>
<td>1</td>
<td>1.045</td>
</tr>
<tr>
<td>Q7 Post</td>
<td>32</td>
<td>3.41</td>
<td>4</td>
<td>4</td>
<td>0.837</td>
</tr>
<tr>
<td>Q8 Pre</td>
<td>32</td>
<td>4.50</td>
<td>5</td>
<td>5</td>
<td>0.803</td>
</tr>
<tr>
<td>Q8 Post</td>
<td>32</td>
<td>4.81</td>
<td>5</td>
<td>5</td>
<td>0.592</td>
</tr>
<tr>
<td>Q9 Pre</td>
<td>32</td>
<td>4.06</td>
<td>5</td>
<td>5</td>
<td>1.162</td>
</tr>
<tr>
<td>Q9 Post</td>
<td>32</td>
<td>4.88</td>
<td>5</td>
<td>5</td>
<td>0.707</td>
</tr>
<tr>
<td>Q10 Pre</td>
<td>32</td>
<td>4.56</td>
<td>5</td>
<td>5</td>
<td>0.840</td>
</tr>
<tr>
<td>Q10 Post</td>
<td>32</td>
<td>4.88</td>
<td>5</td>
<td>5</td>
<td>0.554</td>
</tr>
</tbody>
</table>
## Appendix R

### Statistical Analysis

<table>
<thead>
<tr>
<th>Question</th>
<th>Alpha level</th>
<th>Significance Level</th>
<th>Standard Error</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1-7 Self-Efficacy</td>
<td>0.05</td>
<td>0.016</td>
<td>1.323</td>
<td>Reject the Null Hypothesis</td>
</tr>
<tr>
<td>Q8-10 Change in Behavioral Intention</td>
<td>0.05</td>
<td>0.250</td>
<td>0.866</td>
<td>Retain the Null Hypothesis</td>
</tr>
</tbody>
</table>