POST-OPERATIVE ENDOTRACHEAL REINTUBATION RATES

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Abstract

Immediate post-operative endotracheal reintubation after major abdominal surgery a significant patient safety concern due to the potential for failure to rescue, or other adverse outcomes such as altered mental status, aspiration, and hypoxia due to respiratory or cardiac arrest if left unrecognized. To facilitate major abdominal surgery (outside of a cesarean section performed under spinal anesthesia), the patient must be anesthetized, pharmacologically paralyzed, and endotracheally intubated to facilitate ventilation via mechanical respiration. Those steps create the optimal environment to allow the abdominal muscles to relax, and permits the surgeon obtain appropriate exposure of the abdominal cavity. An induced chemical paralysis is commonly achieved by a medication named rocuronium, which is an intermediate-acting neuromuscular blocking medication, which is one of the most frequently used paralytic medications used in clinical practice for surgical patients. When the abdomen is closed and surgery is complete, the usual course of action is to pharmacologically reverse the muscle relaxant, stop anesthesia, endotracheally extubate, and awaken the patient so that he or she can be transferred to the post-anesthesia care unit (PACU, also known as the recovery room), or less commonly remain sedated and intubated for the PACU or intensive care unit.

The standard of practice in the Unites States is to provide a reversal agent for the neuromuscular relaxant. Muscle relaxants are also known as paralytic medications or neuromuscular blocking agents (NMBAs). The purpose of this project is to assess the safest and most efficient reversal agent for avoiding endotracheal reintubation in the PACU. Surgical laparotomy patients were chosen because it is well known that patients with open abdominal surgery are already at risk for post-operative hypoventilation due to surgical pain and associated co-morbidities.

PICOT question: Do adult surgical patients undergoing laparotomy procedures who received rocuronium and are reversed with sugammadex as compared with neostigmine require endotracheal reintubation prior to post-anesthesia care unit (PACU) discharge at similar rates?

Key words

Neuromuscular blocker, neuromuscular blocker reversal, laparotomy, surgery

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Chapter One

Post-Operative Endotracheal Reintubation Rates

Post-operative surgical endotracheal reintubation rates were assessed to identify practice gaps related to quality for specific demographic locations for adult patients undergoing laparotomy. This quality improvement project was a secondary analysis of deidentified data aimed to provide guidance on medication selection with the goal of creating lasting implications for practice. The potential use of certain medications was evaluated and correlated with a set of identified parameters along with associated patient outcomes to ascertain need for change or to continue current practice. The data was obtained with permission from an anesthesia group, representing cases from January 1, 2019, to December 31, 2022, that provided greater insight into clinical documentation than the intended goal of medication comparison related to outcome.

Patient safety, satisfaction, cost, and budgeting are all impacted when new evidence is explored, implemented, and evaluated. Sugammadex is the latest, most clinically significant medication in the anesthesia market today. Studies were individually evaluated for specific endpoints on how they related to recommending or not recommending change in current anesthesiology practice. The issue discussed here is not one unique to the particular anesthesiology group, as this is a global issue. Different healthcare markets such as The United States and Europe have different experiences with the neuromuscular blocker reversal agents that have been affected by regulatory approval agencies in the respective geographic areas. A common nondepolarizing neuromuscular blocking medication such as rocuronium is a quaternary ammonium compound, which is an intermediately acting, highly ionized drug that is administered intravenously. Rocuronium does not undergo metabolism into active metabolites and has extremely limited lipid solubility. This drug does not pass the blood-brain barrier,

placental barrier, or other lipid membrane barriers. Neuromuscular blocking agents have no effects on the central nervous system, no measurable impact on a fetus, and ineffective absorption if given orally. Conditions such as hypothermia, hypovolemia, volatile anesthetic agents, and renal as well as hepatic disease prolong the effects of rocuronium (Jain et al., 2022); (International Anesthesia Research Society, 2009).

Two types of neuromuscular blocking reversal agents were referenced in this DNP project. Neostigmine is an anticholinesterase that has historically been a common intravenous reversal medication for pharmacologically induced neuromuscular blockade. Neostigmine prevents the metabolism of acetylcholine in the synapse by blocking the action of cholinesterase, by increasing the level of acetylcholine in the synaptic cleft, which overpowers the neuromuscular blockade of non-depolarizing drugs such as rocuronium (Jain et al., 2022). Sugammadex is another type of neuromuscular blocker reversal agent that is a novel gamma-cyclodextrin molecule that works by encapsulating a steroidal neuromuscular blocker such as rocuronium. This mechanism of action produces a complete reversal of neuromuscular blockade by surrounding the neuromuscular blocking medication (rocuronium) and interrupts the action of such blockade at the neuromuscular junction. Sugammadex is eliminated through biliary clearance and excreted via the urine (Jain et al., 2022). Sugammadex became available outside of the United States in 2008 (Brull & Kopman, 2017), and was approved by the Federal Drug Administration for the United States market on December 15, 2015, (Dubovoy et al., 2020).

The purpose of this project was to assess the best reversal agent for avoiding endotracheal reintubation prior to discharge from the post-anesthesia care unit. There are variations for a few words in the PICOT question. Laparotomy search results could also be found under abdominal surgery, exploratory laparotomy, diagnostic laparotomy, and major surgery. Rocuronium was

also be found to be referenced as Zemuron® (brand name), muscle relaxant, and paralysis. Sugammadex was found to be referenced as Bridion® (brand name) and neuromuscular reversal agent. Neostigmine was found to be referenced as Bloxiverz® (brand name) and neuromuscular reversal agent. (Lu et al., 2022). Cost is discussed in a variety of ways.

Anesthesia practices have a vested interest in the conduct of this inquiry given the need for providing evidence-based care and best practices, that endorses reputable and appropriate medications to manage a patient's condition while undergoing significant surgical procedures. Anesthesiology groups are focused on decreased complications and the promotion of efficient anesthesia delivery, as well as the complete reversal of neuromuscular blocking agents to enhance outcomes associated with anesthesia cost savings in a time efficient manner.

The anesthesia group that was consulted for this project prides itself on providing quality services furnished by Certified Registered Nurse Anesthetists and physician anesthesiologists. Given the emphasis on continuous monitoring and improvement practices, this project was positioned to identify practice behaviors and outcomes while assessing the feasibility of making practice changes based on outcomes identified in this project. The anesthesiology group was instrumental in providing accessible data and necessary resources required to carry out the quality improvement project aimed at the specific outcomes defined for this project.

Problem Statement

The project was implemented to identify the prevalence of post-laparotomy unplanned endotracheal reintubation that occurred in the operating room or the post-anesthesia care unit as it is a significant patient safety issue that incurs considerable additional costs. These issues are significant to healthcare and nursing as they are primary drivers related to payment, quality, and healthcare providers.

Purpose Statement

The purpose of this project was to assess for the best neuromuscular blocking reversal agent for avoiding endotracheal reintubation in the operating room or PACU (prior to PACU discharge), and the mission of this project was to identify endotracheal reintubation rates at given hospitals by reviewing the neuromuscular blocking agent used and analyzing the neuromuscular blocking reversal medication used, be it sugammadex or neostigmine.

Chapter Two

Findings from the literature searches demonstrated that CINAHL had less results than initially expected when searching for a combination of terms. Once the search was completed with PubMed, the realization that the topic had more to do with clinical decision making regarding medication selection opposed to nursing interventions occurred, and thus it was logical that a medical-based journal would have more pertinent information. The evaluation of Cochrane Reviews revealed limited data due to the nature of that database being a systematic review of literature. Scopus indexed journals provided a wealth of data given the nature of being "the largest abstract and citation database of peer-reviewed literature" (Elsevier, 2022, p. 2).

The literature was reviewed, analyzed, and critically appraised to assess topic relevance of neuromuscular blocking reversal agents. Most literature was published within the past 10 years. There is controversy and debate over the various definitions of pulmonary complications, specific drug cost versus overall cost of therapy, clinical significance, and recommendations for further inquiry. Many clinicians reported to prefer sugammadex over neostigmine to reverse induced neuromuscular blockade from rocuronium. Some of the studies reviewed show superiority of sugammadex over neostigmine, while others discuss the topic of neuromuscular blockade and reversal in generalized terms or non-superiority depending on the particular study goal or end point. The latest study published recommends sugammadex over neostigmine for neuromuscular blockade that resulted from rocuronium (Thilen et al., 2023). This recommendation is significant to nursing because the practice of anesthesiology is an internationally recognized nursing function. Patient safety related to medication selection, ordering, and administration plays a significant role within the profession as related to the advancement of evidence-based practice. Certified Registered Nurse Anesthetists provide over

50 million anesthetics per year in The United States (American Association of Nurse Anesthetists, 2022).

There were economic forces that contributed to the success of this project. Despite a higher medication sales price of sugammadex versus neostigmine, there were other costs to be considered. Operational costs to an organization included the time of surgery completion to endotracheal extubation, the time from endotracheal extubation to anesthesia recovery (PACU), the time spent in PACU, the cost of a recovery nurse and ancillary services. Cost also had many denotations with this project, which included actual drug costs, direct patient care costs, unintended consequences or unplanned events, cost savings, high-risk versus low-risk patients, and variables such as local markets (Dubovoy et al., 2020). The costs for the neuromuscular blocking reversal medications varied based on contract negotiations, with the average wholesale price being $97.01 USD for sugammadex 200 mg/2mL, and $4.71 USD for neostigmine 10 mg/10mL, and $2.41 USD glycopyrrolate 0.2 mg/1mL (neostigmine is co-administered with an anticholinergic medication such as glycopyrrolate to balance neostigmine's cholinergic side effects), at an institution's wholesale pharmaceutical distributor (Jiang et al., 2021), (Lu et al., 2022). Lu et al. reviewed the actual cost of medications (sugammadex, neostigmine, and glycopyrrolate), as statistically significant, but acknowledged that the total cost of care considering those medications was not statistically significant (2022). Supply and demand, manufacturing, and the availability of drugs have also impacted stakeholders. Operating room time was cost variable, with an average cost per operating room per minute cited as $32.49 USD (Hurford et al., 2020). Another study cited operating room cost at $50 USD per minute (Lu et al., 2022). The literature discussed the value of operating room time, and the difficulty associated in how time value could be calculated. Sugammadex use has been associated with faster discharge

from the operating room to the PACU (Jiang et al., 2021), (Putz et al., 2016). This is important because time savings can translate to money savings, and this article cited sugammadex as appearing "to be the most significant saving in cost analyses" (Hurford et al., 2020, p. 6). It is important to note that when time was not considered as a factor, the literature did not favor sugammadex over neostigmine (Hurford et al., 2020). Multiple studies were cited with conflicting data on PACU time, time to discharge, and disagree on statistical significance while acknowledging that certain time savings does not equate to time savings from end of procedure to PACU arrival, or time to PACU discharge (Lu et al., 2022), (Putz et al., 2016). A patient that has incomplete recovery from neuromuscular blockers is considered "weak" and needs both pharmacological and airway support. The cost of unplanned mechanical ventilation that was attributed to post-operative residual neuromuscular blockade was estimated to be $2,631.85 USD (Hurford et al., 2020). In one study, PACU endotracheal reintubation was 1.18% of all surgeries and was related to increased morbidity and mortality as well as overall healthcare costs (Belcher et al., 2017), (Grosse-Sundrup et al., 2012). This same study discussed patients that received a neuromuscular blocking medication without a reversal agent needed PACU endotracheal reintubation 5.5 times more than patients that had received a reversal agent and that finding highlighted that institution's stance on reversing all post-operative patients that are PACU bound. One study discussed how post-procedure endotracheal reintubation that lead to an unplanned hospital admission would be considered a serious complication and exposing the patient to increased risk of hospital death, although it was not specified if the cause was specifically due to post-operative residual neuromuscular blockade (Grosse-Sundrup et al., 2012). Another study highlighted post-surgery endotracheal reintubation as it related to increased costs and mortality (Grosse-Sundrup et al., 2012). Lu et al. found that there was no statistically significant

endotracheal reintubation incidence on post-surgical patients that received either sugammadex or neostigmine in their study (2022). That same study acknowledges literature that has found both non-statistically and statistically significant post-operative endotracheal reintubation rates. Sugammadex versus neostigmine use has been shown to have the potential for less post-operative nausea and vomiting in a study, which is a potential savings of $98.62 per patient as an associated surgery cost (Hurford et al., 2020). Residual neuromuscular blockade after a surgical procedure is associated with post-operative pulmonary complications (Dubovoy et al., 2020), (Gaszynski et al., 2012), (Grosse-Sundrup et al., 2012), (Martini et al., 2022). Throughout the literature review, "post-operative pulmonary complications" was not well defined or inconsistently defined (Li et al., 2021). Post-operative pulmonary complications were less for individuals that received sugammadex prior to endotracheal extubation (Abd-Elfattah, 2019), (Colquhoun et al., 2023), (Hurford et al., 2020), (Kheterpal et al., 2020). Interestingly, individuals that received neuromuscular blocking agents that developed post-operative pulmonary complications did not have improved outcomes whether the individual received sugammadex, neostigmine, or no neuromuscular blocker reversal agent at all (Kirmeier et al., 2019). A criticism of the 2019 study by Kirmeier et al. was that the study was limited by certain definitions, as pulmonary complications were much more broadly defined and less than half of the patients in that study received no neuromuscular blocking reversal agent (Kheterpal et al., 2020). A 2021 study by Li et al. concluded that the use of the neuromuscular blocking reversal agent sugammadex or neostigmine was not associated with post-operative pulmonary complications, but note that Li et al. references the 2019 study by Kirmeier, and suggests potential bias in the 2020 study by Kheterpal. Post-operative pulmonary complications have been estimated as a weighted average cost (per episode) at almost $58,000 USD (Jiang et al., 2021).

Residual neuromuscular blockade continues to be a complication of nondepolarizing neuromuscular agents (Li et al., 2021), (Ruetzler et al., 2022), (Saager et al., 2019). The incidence rate regarding residual neuromuscular block after sugammadex administration is low relative to neostigmine, and this is attributed to the strong pharmacological binding of sugammadex to neuromuscular blocking agents (Abd-Elfattah, 2019), (Jiang et al., 2021), (Li et al., 2021). One hypothetical cohort study predicted great economic value for the use of sugammadex over neostigmine in terms of reducing post-operative pulmonary complications and thus associated overall healthcare costs due to the number needed to treat with sugammadex versus neostigmine compared to the cost of a post-operative pulmonary complication (Jiang et al., 2021). A study of 70,790 patients looked at neostigmine versus sugammadex (with the major complications being bronchospasm and bradycardia) and concluded that between the two medications, neostigmine was identified as superior to sugammadex and the number needed to harm equals 250 patients that would have had to receive neostigmine versus sugammadex to avoid a minor complication such as bronchospasm or bradycardia (Ruetzler et al., 2022). Faster rates of recovery from neuromuscular blockers (once the reversal agent was administered) was observed in sugammadex versus neostigmine (Abd-Elfattah, 2019), (Jiang et al., 2021), (Putz et al., 2016), (Wu et al., 2014). A quality of sugammadex that is superior to neostigmine is the ability to reverse a neuromuscular blocker at any point in the block, as compared to neostigmine, since neostigmine can only be given once spontaneous neuromuscular recovery is detected (Gaszynski et al., 2012), (Li et al., 2021). During the literature review, one fascinating finding revealed that it was common anesthesiology practice in the United States to reverse the effects of neuromuscular blockers post-procedure as compared to anesthesiology practice in Europe, where reversing the neuromuscular blocking agent was less common (Grosse-Sundrup et al., 2012).

The European practice was highlighted by a study that included 13,631 patients and was acknowledged that pharmacological reversal of neuromuscular blockade was uncommon (less than a quarter of patients were reversed, and of those, 99.9% received sugammadex), and was reserved for patients that were older, obese, higher illness severity, and short procedures (Martini et al., 2022). A patient that has achieved full, spontaneous recovery that is subsequently given neostigmine can actually exhibit increased weakness on a both the neuromuscular and functional level, which may lead the inexperienced clinician to believe the patient is inadequately reversed, which could lead to an error in judgement for treatment (Jiang et al., 2021); this increased weakness is not observed when sugammadex is administered.

Needs Assessment

The need for this project originated from clinical event observations that called attention to the frequency of unplanned post-operative endotracheal reintubation in the operating room or PACU. In examining the events that occurred, prolonged stay in the PACU or transfer to the intensive care unit, along with the associated use of additional medications, supplies, staffing, and other resources called for the reassessment of endotracheal reintubation post-procedure. As a direct result of these events, and the proliferation of a new medication into the market that was intended to reduce the likelihood residual neuromuscular blockade was investigated. The potential for this project to identify the current practices and the incidence and prevalence of the need for endotracheal reintubation created the discussion and opportunity to study the feasibility of improving the anesthesia practices of using the newer neuromuscular blocking reversal agent.

Organizational Assessment of Readiness

Organizational assessment is key in developing a plan for change. The climate for change was overall positive within the for-profit anesthesiology group as assessed by the Organizational

Readiness for Knowledge Translation Questionnaire. The anesthesiology group structure from the top down is led by a president, an executive board that includes a chief operating officer, multiple senior vice presidents, a vice president and senior vice president of operations, local physician-partner leaders, and a chief nurse anesthetist. Additional positive impacts on change included the availability of financial resources, senior leadership support, and motivation for change that supports the patient's experience. Areas that needed consideration for improvement included the development of staff innovation, and the increased support of a culture that permits staff to feel empowered and encouraged to change daily practice habits. As a collective group of individuals, the anesthesiology group has made some modifications that facilitated the practice grow as a collective team.

The anesthesiology group is self-described as a high quality anesthesia delivery organization that prides itself on best practices with regard to anesthesia patient care delivery. The organization operates across state lines, and is comprised of forward thinking clinicians that serve on fully functional quality improvement committees, local governance, and use sophisticated data collection tools that allow for the capture, analysis, and quality improvement throughout the practice as well as providing customized data reports for contracted sites of service.

Resource

The anesthesiology company's quality improvement program provided customized data queries specific to the monitoring of the endotracheal reintubation of the population of patients that fit certain parameters.

Project Team

The project team includes a DNP-prepared, registered nurse principal investigator (UNLV faculty), a DNP-prepared, Certified Registered Nurse Anesthetist co-investigator, a MSN-prepared, Certified Registered Nurse Anesthetist DNP student investigator, a DNP-prepared, Certified Registered Nurse Anesthetist (UNLV faculty), and a PhD-prepared public health expert (UNLV faculty).

Project Overview

The scope of this project had the potential to improve both patient and provider experience, decrease overall costs, increase PACU throughput, patient safety, and potentially decrease morbidity and mortality. The purpose of this project was to assess the best reversal agent for avoiding endotracheal reintubation prior to PACU discharge, and the mission of this project was to identify endotracheal reintubation rates at given hospitals by assessing a specific neuromuscular blocking agent used (rocuronium) and subsequently analyzing the use of sugammadex or neostigmine as the neuromuscular blocking reversal agent. A goal surrounding this project included increasing provider awareness regarding the outcome of this secondary analysis as a way to improve patient outcomes.

Target Population

The target population and source of retrospective, de-identified data were individuals 18 and older, that were surgical patients who had undergone a laparotomy in a hospital setting during the years of 2019-2022. Enrolled individuals would have had to receive the neuromuscular blocking medication rocuronium and reversal agent either sugammadex or neostigmine to qualify. The data source was obtained from the anesthesia group's electronic health record (proprietary) database. The respective facilities' data on post-operative endotracheal reintubations was not obtainable, citing privacy and liability concerns. This

information may have given additional perspective for data analysis or comparison relative to the anesthesia group's health records. The variable styles of documentation impeded accurate assessment of key endpoints to allow for meaningful conclusions on practice implications or recommendations.

Project Economic Parameters and Impact

The mission of this project was to first assess the rate of PACU endotracheal reintubation rates and then determine associated or causative factors. According to published literature, it is estimated that up to 40% of patients demonstrate objective signs of residual neuromuscular blockade on arrival to PACU (Brull & Kopman, 2017). Receiving support from facilities and key stakeholders such as facility administrators and pharmacy staff regarding the drug cost versus benefit and the overall cost of this issue was crucial for practice change. In order to support new guidelines practice recommendations, a full analysis of direct and indirect costs would have been needed to create cost modeling to support practice change recommendations, but the data available was not consistent to create such modeling.

The project's value was assessed in many ways. Functionally, time savings can be measured in actual minutes saved from total operating room time post-procedure to extubation or PACU discharge was considered for analysis. Medication administration was simplified because sugammadex reversal is a single administration versus the drug neostigmine, which must be co-administered with an anticholinergic medication, which adds additional preparation time, potential for medication error, and cost. An organizational switch to the newer drug sugammadex does have higher pharmacy costs, but could have potentially saved the facility significant dollars in the long term due to decreased PACU endotracheal reintubation rates and its associated costs. The new drug integrated new knowledge and pharmacology technology into standards of

practice. With rapid neuromuscular blocker reversal, the readiness of endotracheal extubation becomes quickly apparent to both providers and staff. From a quality perspective, there is little concern regarding residual paralysis for the patient when sugammadex is used at the recommended dose, as the clinician notices an objective transformation of the patient's condition within minutes.

Emotionally, both patients and providers have reduced anxiety in the absence of residual neuromuscular blockade, increased patient satisfaction, and both provider and staff reassurance of complete neuromuscular blocker reversal. There is high therapeutic value for sugammadex implementation which is attractive to providers and nursing staff through both the convenience and safety profile. Sugammadex has been endorsed as the standard of care by a professional anesthesiology organization, which should lead to greater adoption and usage (Thilen et al., 2023).

Life changing impacts of this drug affect both nursing and medicine by changing the paradigm and advancing evidence-based practice through drastic changes in anesthesia delivery and quality of care. The immediate impact of seeing medication work for the first time is quite remarkable. Having a patient with a complete, chemically-induced paralysis, and then reversed to baseline within minutes provides hope and instills confidence in both providers and nursing staff. There have been instances where surgical procedures have been cancelled shortly after the patient had been anesthetized and paralyzed with rocuronium, and historically mandated a waiting period for spontaneous recovery from the neuromuscular blocker before neostigmine could be administered. With sugammadex, efficiency is created with the immediate reversal of neuromuscular blockade at any point when rocuronium is administered. The risk for injury is

decreased for patients that have been chemically paralyzed that are unable to be ventilated or intubated during an unexpected difficult airway when sugammadex was used as a rescue drug.

The Quadruple Aim describes a goal and is a framework consisting of four problems of interest (Bradshaw & Vitale, 2020). The issues related to cost are more than the isolated dollar amount. Although the actual cost of the drug to both patients and the healthcare system is significantly more than neostigmine (including the associated anticholinergic co-administration), the cost savings in terms of decreased post-operative endotracheal reintubations, reduced pulmonary complications, and potential time savings for earlier discharge, could significantly promote sugammadex as the new standard of care. Population health regarding resource utilization on a national level could be realized as decreased post-operative endotracheal intubations may mean decreased intensive care unit admissions, decreased nursing staff use, all while simultaneously supporting resources and finances. The patient is integral to the problem as he or she is the reason care is administered. Subjective assessment of adequate breathing may lead to decreased anxiety that could be resultant from complete neuromuscular blocker reversal. Anecdotal provider satisfaction surrounding patient safety is paramount. The importance of PACU nursing staff understanding that incomplete reversal of paralysis is extremely rare with sugammadex use, and may decrease their stress, worry, and fear related to respiratory decompensation when caring for the post-operative laparotomy patient. Formal assessment of patient anxiety and provider satisfaction was not scrutinized as an objective of this DNP project.

Scope of the Project

This quality improvement project intended to identify practice patterns, complications, and medication usage for the induced chemical paralysis/muscle relaxation and associated neuromuscular blocking reversal agent, the patient's disposition, and cost-analysis implications.

The patient data/variables considered for assessment consisted of age, gender (male or female), body-mass index (BMI), American Society of Anesthesiologists physical status classification system (ASA score, a tool for universal assessment of patient acuity), PACU time, operating room time, patients transferred to an intensive care unit, bradycardia/tachycardia, bronchospasm, endotracheal reintubation (operating room vs PACU), rocuronium use, and neuromuscular blocking reversal agent received (sugammadex or neostigmine). Formal statistical analysis was not appropriate due to available documentation integrity and quality issues surrounding the patients that met inclusion criteria for this project. Current practices with recommendations from literature and the anesthesiology group trends were contrasted.

Goal and Objectives

The goal of this DNP project was to have PACU endotracheal reintubation rates and data from January 1, 2019, through December 31, 2022, reviewed and analyzed to identify causative factors and outcomes of current clinical practices regarding the use of neuromuscular blocking reversal agents by November 1, 2023.

Objectives:

The submission to UNLV institutional revied board (IRB) occurred May 2023. An exemption was given for this quality improvement project August 2023. The data was reviewed by the DNP project team, sorted within Microsoft Excel®. The data abstract and poster presentation have been submitted to the Western Institute of Nursing's April 2024 conference for review. The student investigator has scheduled a final, oral defense March 28, 2024 with the UNLV School of Nursing.

Chapter Three

When designing the project and looking at the potential for organizational impact, Kurt Lewin's Change Theory chosen was recognized. This theory is commonly used in nursing projects and studies (Petiprin, 2020). Petiprin defined the theory as "a dynamic balance of forces working in opposite directions with the three-concept model of change known as unfreezing-change-refreeze mode that requires prior learning to be rejected and replaced" (2020, p. 1). The three concepts that make up this theory include driving and restraining forces as well as equilibrium, as there is a cause for a change in the direction of occurrence, the forces that are opposite of the driving forces, and equilibrium where the driving and restraining forces are net neutral, and thus no change occurs. The unfreezing aspect of this theory is where individuals and groups find a way to unlearn old habits and patterns. The change aspect or movement includes taking the appropriate steps to change "thoughts, feeling, behavior, or all three" to become more productive (Petiprin, 2020, p. 1). The refreezing aspect is accomplished through the maintenance of the new habits, and this ensures that old habits will not be revisited. The theory was assessed for actualization when change in clinical practice based on aggregate data of the new medication sugammadex opposed to neostigmine if given the opportunity. Clinical staff were empowered to remain up to date on the latest medications, treatments, and research. Individuals would utilize published data, patient safety, and outcomes in addition to personal experience to utilize this Theory.

Implementation of alternate medication utilization requires a major investment in resources. Staff would need to be educated on the anesthesiology group's practice behaviors as well as the latest standards of care based in current literature. A practice change could not be identified nor supported based on this project's analysis of available data. The identification of

clinical documentation deficits, was shared with the quality improvement division of the anesthesiology group, along with an emphasis regarding on-going quality improvement surveillance of the practice's clinical documentation behaviors. This project highlighted the need to have complete and appropriate documentation available to support practice changes as well as offer associated recommendations. In recent studies, two large academic medical centers could not find a statistically significant reason to justify the change from neostigmine to sugammadex (Li et al., 2021), (Ruetzler et al., 2022); this conclusion was cited based on complete, comprehensive, and consistently available clinical documentation.

Chapter Four

The project setting for this study was as a retrospective review of an anesthesia group's proprietary health record documentation of anesthesia management during surgical laparotomy procedures. The corresponding medical facilities' health records were not available to the project team. The data source used was extracted as a query with specifically identified parameters that were analyzed in those patients that also experienced endotracheal reintubation due various variables that occurred in the operating room or in the post-anesthesia care unit.

The data for this DNP project represented two metropolitan hospitals located within the same city in the United States. Both hospitals have anesthesiology physician residents and student nurse anesthetists that comprise the care team, which complement the attending physician anesthesiologists and Certified Registered Nurse Anesthetists. The data included parameters that looked at the current anesthesia practice regarding usage of the neuromuscular blocking agent rocuronium and selected neuromuscular blocking reversal agents (sugammadex and neostigmine), as well as the incidence of operating room or PACU endotracheal reintubation rates. Inclusion data was laparotomy procedure for adult, non-obstetric patients ages 18 and older, gender, BMI, and The American Society of Anesthesiologists physical status classification system score for the data query and analysis. In accordance with procedures, an approval letter was obtained from the anesthesiology service that acknowledged approval for the student to use the anesthesiology group's data for analysis and publication in addition to providing the actual data of the specific patient population of this study. The University of Nevada Las Vegas's Institutional Review Board was the IRB of record after successful completion of the Project Proposal Defense which occurred May 2023. The anesthesiology group's quality data query included the measure of endotracheal reintubation events that were self-reported by providers

that elicited patient-specific data that was correlated against specific surgical cases. Endotracheal reintubation reports identified in the data query were reviewed then analyzed for any potential endotracheal reintubation activity in the operating room or post-anesthesia care unit retrospectively from January 1, 2019, through December 31, 2022. The investigation team compared endotracheal reintubation rates based on muscle relaxant reversal used. The project itself was budget neutral. The fiscal impact of the project has future implications that each institution would adjust according to their specific cost modeling with formula variances for individual institutional costs for the drug, staffing and operational costs. Prima facie, overall dollar cost to the facility and pharmacy budget would be substantially increased if sugammadex use increases.

Potential risks and threats contemplated regarding effect on this project included early termination due to budgetary constraints from respective facilities, lack of provider engagement, medication unavailability, and lack of significant data to evaluate and subsequently reach a conclusion for practice change. It was realized October 2023 that the lack of quality, consistent, and usable data became a significant barrier to recommend the best neuromuscular blocking reversal agent for the avoidance of post-operative endotracheal reintubation prior to PACU discharge to the anesthesiology group involved. The practice behaviors and trends gathered from this project will be presented during the final DNP Project Defense, March 28, 2024. Additional dissemination opportunities include publishing the findings, presentation to the Western Institute of Nursing conference, and an educational offering to the anesthesiology group. It is important to reaffirm that the costs associated with this project are budget neutral, excluding time invested, as well as considering organizational development and implementation of this work from the project team. The project impact had potential fiscal and practice implications that are discussed

in the findings and illustrated from the data analysis. Project timeline considerations included the Institutional Review Board submission and subsequent decision process as well as the project data collection and analysis began upon approval from the IRB.

An abstract proposal was submitted October 2023 to the Western Institute of Nursing conference to be held April 2024. The data analysis was performed and completed October 2023. Culminating all the project data analysis, interpretation and conclusions, the final paper will be completed and take the form of a final manuscript May 2024.

As a contribution with impact to nursing and within the anesthesiology profession, the best evidence-based research is intended to be used to guide future practice, as trends in healthcare are constantly changing. The goals for patient care were providing safe, cost-effective, and high quality care. The plan-do-study-act model is a framework to drive the improvement process and effectuate change. As new medications and procedures come into widespread practice, Certified Registered Nurse Anesthetists must adapt accordingly and personalize care to specific patient and surgeon needs.

Chapter Five

The project summary described an outcome that was defined as one of the project's limitations, but certainly not expected given the wealth of data received at the beginning of the data collection phase. Published literature reviewed had conflicting data regarding the recommendation of sugammadex as a standard of care to reverse induced neuromuscular paralysis for selected surgical patients. The variables included lack of uniform definitions for post-operative pulmonary complications, various reporting of the associated times regarding anesthesiology care, hospital type (teaching versus non-teaching), and targeted outcomes. The initial plan for the data analysis included the sorting and organizing thousands of patient encounters and looking for trends/patterns that could lead the project team to draw meaningful conclusions on the recommendation to use sugammadex or neostigmine to reverse induced neuromuscular paralysis based on the outcomes of post-operative endotracheal reintubation rates in selected laparotomy patients. Upon data review and analysis, the results were quite unexpected, as the data quality was questionable given the absent, incomplete, or contradictory documentation that skewed the ability to draw any meaningful conclusion for the given goal of this quality improvement project.

The results of the data analysis highlighted the need for improved clinical documentation. It appears as if the templated responses of the electronic anesthesia record may have played a significant role in the contradictory documentation. The mission of the project was not achieved, but directed the project team to propose future inquiry with respect to identifying clinical documentation gaps.

Without accurate documentation of care given, it is impractical to suggest practice recommendations that are evidence-based at this time. Lessons learned with this DNP quality

improvement project highlighted the importance of accurately documenting care given in order to evaluate best practices for patient care. The familiar saying "if it's not documented, it's not done" is certainly evident. From a nursing quality perspective, it is imperative that the health record accurately reflects care given. Precise documentation significantly impacts payor reimbursement, as well as potential legal implications surrounding unanticipated outcomes and subsequent chart reviews.

A sustainable quality improvement project that focuses on accurate documentation through provider education, provider accountability, chart audits, and clear identification of clinical events would certainly create a robust dataset which could be used to ascertain best practices for clinical management of laparotomy patients that required endotracheal reintubation prior to PACU discharge. The anesthesiology group shall remain unidentified as to shield potential liability from the findings of this project, but results of this secondary analysis were shared with the anesthesiology group to highlight potential gaps in their data collection, reporting, and analysis methods.

Appendix A: Tables

Table 1 Evidence/Evaluation table

Citation	Setting / Sampling	Research Design	Data Analysis	Results	Level of Evidence	Comments
Abd-Elfattah, A.-E. (2019). Reversal of rocuronium neuromuscular blockade in elderly patients undergoing elective open abdominal surgery: Comparative study of sugammadex versus neostigmine. *Research and Opinion in Anesthesia and Intensive Care, 6*(1), 64.	King Abdullah Hospital / 142 male patients	Cohort study	Not disclosed	Sugammadex effective, satisfactory, safe, faster recovery, less critical respiratory events vs neostigmine.	Two	Statistics not disclosed
Belcher, A. W., Leung, S., Cohen, B., Yang, D., Mascha, E. J., Turan, A., Saager, L., & Ruetzler, K. (2017). Incidence of complications in the post-anesthesia care unit and associated healthcare utilization in patients undergoing non-cardiac surgery requiring neuromuscular blockade 2005–2013: A single center study. *Journal of Clinical Anesthesia*, *43*, 33–38.	Cleveland Clinic Hospital / 128,886 pts	Cohort study	Exact binomial method, 95% CI, P<0.001	Most frequent PACU complications= endotracheal reintubation, unplanned ICU admit. Justification for routine use of neuromuscular reversal.	Two	
Dubovoy, T. Z., Saager, L., Shah, N. J., Colquhoun, D. A.,	University of Michigan	Cohort study	Pearson Chi-square,	Sugammadex used	Two	

Mathis, M. R., Kapeles, S., Mentz, G., Kheterpal, S., & Vaughn, M. T. (2020). Utilization patterns of perioperative neuromuscular blockade reversal in the United States: A retrospective observational study from the multicenter perioperative outcomes group. *Anesthesia & Analgesia*, *131*(5), 1510–1519.	Medical School / 934,798 pts		Mann-Whitney U tests 95% CI, P<0.001	preferentially in cases with higher risk factors for residual neuromuscular blockade or postoperative pulmonary complications.		
Gaszynski, T., Szewczyk, T., & Gaszynski, W. (2012). Randomized comparison of sugammadex and neostigmine for reversal of rocuronium-induced muscle relaxation in morbidly obese undergoing general anaesthesia. *British Journal of Anaesthesia*, *108*(2), 236–239.	Medical University Hospital of Lodz / 70	RCT	Student's *t*-test, p<0.05	Sugammadex significantly faster in reversing rocuronium-induced neuromuscular block than neostigmine.	Two	
Grosse-Sundrup, M., Henneman, J. P., Sandberg, W. S., Bateman, B. T., Uribe, J. V., Nguyen, N. T., Ehrenfeld, J. M., Martinez, E. A., Kurth, T., & Eikermann, M. (2012). Intermediate	Massachusetts General Hospital / 18,579	Cohort study	Multivariable logistic regression model P<0.05 95% CI	Use of intermediate acting neuromuscular blockade with anesthesia =	Two	

acting non-depolarizing neuromuscular blocking agents and risk of postoperative respiratory complications: Prospective propensity score matched cohort study. *BMJ*, *345*(oct15 5), e6329–e6329.				increased risk of respiratiory complications.		
Jiang, Y., Bash, L. D., & Saager, L. (2021). A clinical and budgetary impact analysis of introducing sugammadex for routine reversal of neuromuscular blockade in a hypothetical cohort in the us. *Advances in Therapy*.	Hypothetical / 100,000	Cohort study	One-way sensitivity analysis	Cost of sugammadex expensive, cost offset by improved outcomes associated with fewer postoperative pulmonary complications.	Two	
Kheterpal, S., Vaughn, M. T., Dubovoy, T. Z., Shah, N. J., Bash, L. D., Colquhoun, D. A., Shanks, A. M., Mathis, M. R., Soto, R. G., Bardia, A., Bartels, K., McCormick, P. J., Schonberger, R. B., & Saager, L. (2020). Sugammadex *versus*	Multiple facilities (tertiary care univeristy hospitals and private community hospitals / 30,026	Cohort study	Multivariable conditional logistic regression	Use of sugammadex associated with clinically and statistically significant lower inciden	Two	

neostigmine for reversal of neuromuscular blockade and postoperative pulmonary complications (stronger). *Anesthesiology*, *132*(6), 1371–1381.				ce of major pulmonary complications.		
Li, G., Freundlich, R. E., Gupta, R. K., Hayhurst, C. J., Le, C. H., Martin, B. J., Shotwell, M. S., & Wanderer, J. P. (2021). Postoperative pulmonary complications' association with sugammadex *versus* neostigmine: A retrospective registry analysis. *Anesthesiology*, *134*(6), 862–873.	Vanderbilt university medical center / 10,491	Cohort study	Logistic regression and sensitivity analysis 95% CI	Sugammadex or neostigmine used for reversal of neuromuscular blockade was not associated with occurance rate of postoperative pulmonary complications.	Two	
Lu, H., Feldman, E. A., Seabury, R. W., Probst, L. A., Darko, W., & Miller, C. D. (2022). A single center analysis of sugammadex and neostigmine/glycopyrrolate utilization for post-operative neuromuscular	Upstate NY university hospital / 284	Cohort study	Student's *t*-test, Mann-Whitney *U* test, Chi square, Fisher's exact test P<0.05	No difference in endotracheal reintubation rates sugammadex vs	Two	

blockade reversal. *Trends in Anaesthesia and Critical Care*, *45*, 21–27.				neostigmine; total cost not statistically significant.		
Martini, C. H., Honing, G., Bash, L. D., Olofsen, E., Niesters, M., van Velzen, M., Dahan, A., & Boon, M. (2022). The use of muscle relaxants and reversal agents in a setting without cost restrictions: Experience from a tertiary academic hospital in the netherlands. *Therapeutics and Clinical Risk Management*, *Volume 18*, 379–390.	Leiden University Medical Center / 13,631	Cohort study	Univariate logostic regression analysis	Pharmacologic reversal of neuromuscular blocker uncommon, preferred sugammadex over neostigmine.	Two	
Putz, L., Dransart, C., Jamart, J., Marotta, M.-L., Delnooz, G., & Dubois, P. E. (2016). Operating room discharge after deep neuromuscular block reversed with sugammadex compared with shallow block reversed with neostigmine: A randomized controlled trial. *Journal of Clinical Anesthesia*, *35*, 107–113.	Catholic university of Louvain / 100 women	RCT	Wilcoxon rank sum test P<0.05, 95% CI	Time until operating room discharge shorter and more predictable with sugammadex versus neostigmine.	Two	
Ruetzler, K., Li, K.,	Clevelan	Cohort	95% CI	Sugam	Two	

Chhabada, S., Maheshwari, K., Chahar, P., Khanna, S., Schmidt, M. T., Yang, D., Turan, A., & Sessler, D. I. (2022). Sugammadex versus neostigmine for reversal of residual neuromuscular blocks after surgery: A retrospective cohort analysis of postoperative side effects. *Anesthesia & Analgesia*, *134*(5), 1043–1053.	d Clinic / 70,690	study		madex compared to neostigmine, neostigmine found to be superior (minimally) with less side effects than sugammadex.		
Saager, L., Maiese, E. M., Bash, L. D., Meyer, T. A., Minkowitz, H., Groudine, S., Philip, B. K., Tanaka, P., Gan, T., Rodriguez-Blanco, Y., Soto, R., & Heisel, O. (2019). Incidence, risk factors, and consequences of residual neuromuscular block in the United States: The prospective, observational, multicenter recite-us study. *Journal of Clinical Anesthesia*, *55*, 33–41.	Multicenter 10 community and academic U.S. hospitals / 255	Cohort study	P<0.05, 95% CI *t*-test, Fisher's exact test	Clinical care could be improved by considering use of quantitative neuromuscular monitoring for routine care.	Two	
Wu, X., Oerding, H., Liu, J., Vanacker, B., Yao, S., Dahl, V., Xiong, L., Claudius, C., Yue, Y., Huang,	Multicenter; 230 Chinese subjects, 59	RCT	Two-sided 97.5% CI calculated using	Both Chinese and Caucasian	Two	

Y., Abels, E., Rietbergen, H., & Woo, T. (2014). Rocuronium blockade reversal with sugammadex vs. neostigmine: Randomized study in chinese and caucasian subjects. *BMC Anesthesiology*, *14*(1).	Caucasian subjects		Hodges-Lehmann estimator for treatment effect and Moses for CI of estimated treatment effect.	subjects recovered from NMB significantly faster after sugammadex vs neostigmine, with a ~5.7 times faster recover with sugammadex vs neostigmine in Chinese subjects.		

Table 2 Synthesis Table

Do adult surgical patients undergoing laparotomy that are endotracheally extubated in the operating room that received rocuronium and are reversed with sugammadex as compared with neostigmine need to be endotracheally reintubated prior to post-anesthesia care unit discharge at similar rates?

Study Author	Year	Number of Participants	Mean Age (or Other Sample Characteristic That Is Pertinent to to Your Question)	Study Design	Intervention	Major Finding that Addresses Your Question and Direction of Outcome
Abd-Elfattah, A.-E.	2019	142	65.7 +/- 3.5 years old	Cohort Study	Sugammadex vs neostigmine	Sugammadex effective, satisfactory, safe, faster recover, less critical respiratory events vs neostigmine.
Belcher, A. W., Leung, S., Cohen, B., Yang, D., Mascha, E. J., Turan, A., Saager, L., & Ruetzler, K.	2017	128,886	Undefined age	Cohort Study	Reversal vs no reversal	Patients receiving neuromuscular blocking reversals had lower risk for endotracheal reintubation.
Dubovoy, T. Z.,	2020	934,798	>/18	Cohort	Sugamm	Sugammad

Saager, L., Shah, N. J., Colquhoun, D. A., Mathis, M. R., Kapeles, S., Mentz, G., Kheterpal, S., & Vaughn, M. T.			years old	Study	adex vs neostigmine	ex use preferred in cases with higher degrees of neuromuscular blockade before reversal and patients with more comorbidities.
Gaszynski, T., Szewczyk, T., & Gaszynski, W. (2012).	2012	70	19-63 years old	RCT	Sugammadex vs neostigmine	Sugammadex provides fast recovery of neuromuscular function and prevents postoperative residual curarization in morbid obese and neostigmine does not.
Grosse-Sundrup, M., Henneman, J. P., Sandberg, W. S., Bateman, B. T., Uribe, J. V., Nguyen, N. T., Ehrenfeld, J. M., Martinez, E. A., Kurth, T., & Eikermann, M.	2012	18,579	<10>80 years old	Cohort Study	Use of neostigmine to chemically reverse neuromuscular paralysis	Use of neuromuscular blockers and anesthesia associated with increased risk for respiratory complications.
Jiang, Y., Bash, L. D., & Saager, L.	2021	100,000	>/ 18 years old	Cohort Study	Use of sugamma	Reduction of overall

(2021).					dex vs neostigmine	costs when sugammadex used.
Kheterpal, S., Vaughn, M. T., Dubovoy, T. Z., Shah, N. J., Bash, L. D., Colquhoun, D. A., Shanks, A. M., Mathis, M. R., Soto, R. G., Bardia, A., Bartels, K., McCormick, P. J., Schonberger, R. B., & Saager, L.	2020	30,026	>/ 18 years old	Cohort Study	Sugammadex vs neostigmine	Sugammadex associated with clinically and statistically significant lower incidence of major pulmonary complications.
Li, G., Freundlich, R. E., Gupta, R. K., Hayhurst, C. J., Le, C. H., Martin, B. J., Shotwell, M. S., & Wanderer, J. P.	2021	10,491	>/ 18 years old	Cohort Study	Sugammadex vs neostigmine	Sugammadex or neostigmine use not associated with the occurrence of postoperative pulmonary complications.
Lu, H., Feldman, E. A., Seabury, R. W., Probst, L. A., Darko, W., & Miller, C. D.	2022	284	>/ 18 years old	Cohort Study	Sugammadex vs neostigmine	No differences in endotracheal reintubation rates, total cost not statistically different.
Martini, C. H., Honing, G., Bash, L. D., Olofsen, E., Niesters, M., van Velzen, M., Dahan,	2022	13,631	>/ 18 years old	Cohort Study	Sugammadex vs no reversal	Sugammadex preferred by clinicians.

A., & Boon, M.						
Orabi, D., Naples, R., Brundidge, D., Snyder, K., Gohar, M., Agarwal, D., Govindarajan, S., Tu, C., Fung, K., Argalious, M., Mathur, P., & Asfaw, S. H.	2022	466	>/ 18 years old	Case-control Study	Laparotomy and postoperative respiratory failure	Identified pre-and intra-operative risk factors for post-operative respiratory failure.
Putz, L., Dransart, C., Jamart, J., Marotta, M.-L., Delnooz, G., & Dubois, P. E.	2016	100	18-80 years old	RCT	Sugammadex vs neostigmine	Operating room discharge shorter and more predictable with sugammadex but did not affect PACU time. Better for deep block and sugammadex vs shallow block and neostigmine.
Ruetzler, K., Li, K., Chhabada, S., Maheshwari, K., Chahar, P., Khanna, S., Schmidt, M. T., Yang, D., Turan, A., & Sessler, D. I.	2022	70,690	57 +/- 19 and 55 +/- 19	Cohort Study	Sugammadex vs neostigmine	Sugammadex and neostigmine comparably safe.
Saager, L., Maiese, E. M., Bash, L. D., Meyer, T. A., Minkowitz, H., Groudine, S., Philip, B. K., Tanaka, P., Gan, T., Rodriguez-Blanco, Y., Soto, R.,	2019	255	>/ 18 years old	Cohort Study	Qualitative vs quantitative assessment of neuromuscular	Qualitative neuromuscular monitoring and clinical judgement often fail to detect

& Heisel, O.					block	residual neuromuscular blockade after neostigmine reversal.
Thilen, S. R., Weigel, W. A., Todd, M. M., Dutton, R. P., Lien, C. A., Grant, S. A., Szokol, J. W., Eriksson, L. I., Yaster, M., Grant, M. D., Agarkar, M., Marbella, A. M., Blanck, J. F., & Domino, K. B.	2023	17,150	46.6 years old	Cohort Study	Sugammadex vs neostigmine	Recommend using sugammadex over neostigmine.
Wu, X., Oerding, H., Liu, J., Vanacker, B., Yao, S., Dahl, V., Xiong, L., Claudius, C., Yue, Y., Huang, Y., Abels, E., Rietbergen, H., & Woo, T.	2014	289	39.9 sd 10.8 39.4 sd 10.8 52 sd 10.3 51.9 sd 7.3	RCT	Sugammadex vs neostigmine	Faster recovery from neuromuscular blockade with sugammadex.

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Curriculum Vitae

Robert Anthony Erickson, DNP(c), MSN, BSN, CRNA
robert.erickson3@gmail.com

EXPERIENCE:

Certified Registered Nurse Anesthetist:

US Anesthesia Partners, Nevada.
Las Vegas and Carson City, Nevada. March 2015 – May 2024
Chief CRNA January 2019 – November 2023.

Sun Valley Surgery Center.
North Las Vegas, Nevada. August 2015 – March 2021.

Registered Nurse:

University Medical Center, Surgical/Neuro, Level I Trauma ICU.
Las Vegas, Nevada. March 2015 – November 2016.

City and County of San Francisco /
San Francisco General Hospital, Surgical/Neuro, Level I Trauma ICU.
San Francisco, California. February 2011 – August 2012.

Agency Nursing, Medical/Surgical/Neuro/Coronary, Level II Trauma ICUs.
San Francisco Bay Area. July 2010 – February 2011.

Cleveland Clinic Health System, Medical/Surgical, Level II Trauma ICUs.
Cleveland, Ohio. May 2008 – July 2010.

EDUCATION:

Doctor of Nursing Practice, May 2024 *(candidate)*.
University of Nevada Las Vegas, Las Vegas, Nevada.

Master of Science in Nursing, December 2014.
Youngstown State University, Youngstown, Ohio.

Certificate in Nurse Anesthesia, December 2014.
St. Elizabeth Health Ctr., School for Nurse Anesthetists, Youngstown, Ohio.

Bachelor of Science in Nursing, August 2009.
Cleveland State University, Cleveland, Ohio.

Diploma in Nursing, May 2008.
Huron Hospital, East Cleveland, Ohio.

Associate of Science, May 2007.
Cuyahoga Community College, Cleveland, Ohio.

Associate of Arts, May 2006.
Cuyahoga Community College, Cleveland, Ohio.

LICENSURE:

CRNA/RN Oregon State Board of Nursing: active / unrestricted

CRNA*/RN Nevada State Board of Nursing: active / unrestricted
*Nevada issues a certificate, not a license for CRNAs

CRNA/RN California Board of Registered Nursing: active / unrestricted

CRNA/RN Ohio Board of Nursing: active / unrestricted

CERTIFICATIONS:

American Burn Association: ABLS
(Advanced Burn Life Support 2015– 2019)

American Association of Nurse Anesthetists: CRNA
(Certified Registered Nurse Anesthetist 2015 – current & certified)

American Association of Critical-Care Nurses: CCRN
(Certified Critical-Care Registered Nurse, 2011– 2017)

Emergency Nurses Association: TNCC, ENPC
(Trauma Nursing Core Course 2011 – 2019
(Emergency Nursing Pediatric Course 2013 – 2017)

American Heart Association: BCLS, ACLS, PALS
(basic cardiac life support 2004 – current)
(advanced cardiac life support 2008 – current)
(pediatric advanced life support 2011– current)

AWARDS:

Magna Cum Laude Graduate
Cleveland State University, BSN

Honors Graduate
Huron Hospital – Huron School of Nursing, Diploma

Huron Hospital Medical Staff Award recipient
Academic achievement, clinical excellence, involvement with extracurricular activities

Magna Cum Laude Graduate
Cuyahoga Community College, AA, AS

COMMITTEES/VOLUNTEERING:

Student Registered Nurse Anesthetist Clinical Coordinator
(2021 – 2023)

Nominating Committee, Nevada Nurses Association
(2019 – 2020)

CRNA Leadership Committee, US Anesthesia Partners, Nevada
(2019 – 2023)

Medical Mission: Anesthesia for general surgery, Dominican Republic
(2018)

Clinical Quality & Compliance, US Anesthesia Partners Nevada
(2016 – 2018)

Nevada Association of Nurse Anesthetists
State President
(2017 – 2019)
Federal Political Director
(2015 – current)

Alumni Representative, Class of 2008, Huron School of Nursing
(2008 – current)

Student Affairs Committee class representative, student tutor
(2007 – 2009)

Class President, National Student Nurses Association, Huron School of Nursing
(2007 – 2008)

National Student Nurses Association member
(2006 – 2008)

Phi Theta Kappa: Honor Society member, officer Cuyahoga Community College (2005 – 2007)

MEMBERSHIPS:

American Nurses Association / Nevada Nurses Association (2017 – current)
Nevada Association of Nurse Anesthetists (2015 – current)

International Anesthesia Research Society (2014 – 2018)

American Association of Nurse Anesthetists (2012 – current)

Society of Critical Care Medicine (2012 – 2016)

Cleveland State University Alumni Association (2009 – current)

Huron Road Hospital School of Nursing Alumni Association (2008 – 2021)
Alumni Association officially dissolved 2021

American Association of Critical Care Nurses (2008 – 2016)

INTERESTS:

Nursing quality and patient safety

Nursing research and education

Non-opioid anesthesia, regional anesthetic techniques