An Educational Intervention for Anesthesia Handoff and Recovery in the ICU

By

Wingate Williamson

A DNP Project Submitted to
the Faculty of The School of Nursing at
The University of North Carolina at Greensboro
in Partial Fulfillment
of the Requirements for the
Doctorate in Nursing Practice

Greensboro
2022

Approved by

Dr. Nancy Shedlick DNAP, MSN, CRNA	Project Team Leader
Dr. Vadim Korogoda, DNP, CRNA	Project Team Co-Leader
Dr. Lori Lupe, DNP CCRN, NEA-BC	DNP Program Director

Table of Contents

Abstract

Background: Despite advancements in pharmaceuticals and patient monitoring, postoperative complications remain common. As more patients are transferred from the operating room to the intensive care unit, staff should be aware of potential complications and treatments for patients following anesthesia. **Purpose:** The purpose of this project was to provide an educational intervention to members of the ICU team on the components of an anesthesia handoff, postoperative complications, and appropriate management of these complications. **Methods:** A pre intervention survey consisting of Likert style questions assessing confidence levels during handoff and management of patients following anesthesia was distributed to bedside nursing staff of a 15-bed ICU within an urban hospital in North Carolina. A standardized handoff tool and an educational video were provided to staff. One month after education, nurses were asked to complete a survey containing Likert style questions assessing confidence levels and practice change. **Results:** Sixty percent of nurses who responded agreed that they felt more confident receiving handoff from the anesthesia team with the use of the tool. Eighty percent agreed that the handoff tool will be helpful during future transfer of care events with the anesthesia team. Eighty percent agreed that the educational information provided would be beneficial during future management of the postoperative patient following anesthesia. **Recommendations and Conclusions:** The standardized handoff tool should be used to assist in improving the transfer of care process and to help reduce the omission of information. Information about the recognition and management of post anesthesia complications should be integrated into education for ICU nurses.

Keywords: Post anesthesia complications, post-operative recovery, post anesthesia recovery, PACU handoff, transfer of care, handoff tool.

Background and Significance

In 2018, it was estimated that over 36 million surgical operations were performed in the United States (Kellner et al., 2018). Due to advancements in both pharmaceuticals and patient monitoring, anesthesia administration is generally considered safe. However, despite improved care, postoperative complications remain common (Belcher et al., 2017). For nurses who may not routinely care for patients immediately following anesthesia such as those in the intensive care unit (ICU), it is important to be aware of potential complications and how to appropriately manage this patient population.

Postoperative complications can be a product of multiple factors including the specific surgical procedure, intraoperative medications, exacerbations of preexisting medical conditions, and errors in handoff communication can all play a role (Kellner et al., 2018). One prospective study of over 18,000 patients entering the post anesthesia care unit (PACU) found that at least one complication occurred in 23.7% of patients (Hines et al., 1992). Many of the complications that occur in the PACU are considered minor; however, the occurrence of postoperative complications has been shown to negatively impact patient-centered outcomes including length of stay, discharge disposition, need for reoperation, and readmission rates (Tevis & Kennedy, 2013). A 2012 survey found that the most common complications occurring in the PACU included respiratory depression, cardiovascular complications (hypotension, hypertension, tachycardia), postoperative nausea and vomiting, hypothermia, and impaired emergence (Faraj et al., 2013). Patients admitted to the ICU are typically more complex and the potential for serious postoperative complications is more likely.

Historically, ICU nurses and providers may not frequently take care of patients immediately following surgery. It is imperative that staff in the ICU have the knowledge and

skills to recover patients following anesthesia. The ability to perform a thorough handoff, recognize potential postoperative complications, and provide appropriate interventions is of paramount importance for managing this patient population. Intensive care orientation training may not adequately address the care of patients following anesthesia, which can lead to increased stress among nurses caring for these patients (Hegedus, 2013). The purpose of this project is to provide an educational intervention to members of the ICU team on the components of an anesthesia handoff, potential postoperative complications, and appropriate management of these issues.

Review of Current Literature

Search Method

A literature search was conducted utilizing CINAHL and PubMed. Search terms included: post anesthesia recovery, post anesthesia complications, airway management, post anesthesia care unit handoff, post anesthesia handoff, transfer of care and surgery, effective post anesthesia handoff, postoperative complications, and neurosurgery. The Boolean operators AND as well as OR were utilized to narrow search results. Inclusion criteria included the ability to access the full text, articles written in English, and studies published within the last 10 years. Seminal works over 10 years of age were also included. Articles reviewed included meta-analyses, systematic reviews, controlled trials, observational studies, and quality improvement works. Exclusion criteria included studies without access to the full text, articles not written in English, case reports, commentaries, and studies older than 10 years. The main themes focused on the handoff process, postoperative complications, and management of these complications.

Provider Handoff

The transfer of care between staff represents a critical event that can often pose a significant threat to patient safety. During a handoff there is an exchange of critical information between unfamiliar people during a potentially stressful and demanding time. Along with the transfer of information there are often monitors and equipment that must be adjusted and transferred. These factors contribute to errors in communication which can lead to increased morbidity and mortality. It is estimated that 80% of adverse events are attributed to a communication breakdown during the transfer of patient care (Bruno & Guimond, 2017; Wright, 2013). A meta-analysis of 31 studies found that common barriers to effective postoperative handoffs included: incomplete transfer of information, inaccurate or inconsistent information, distractions, inconsistent teams, inefficient execution of clinical tasks, and poor standardization (Segall et al., 2012). In the ICU, these potential barriers may be magnified. The receiving ICU team may be unfamiliar with members of the OR team. Patients being admitted directly to the ICU have increased acuity and are at a higher risk for decompensation. At the time of handoff, there are many bedside distractions including equipment and alarms impacting transfer of care.

Benefits of standardized checklists to improve the transfer of care process is a topic of extensive research. Standardizing the patient handoff process improves care by increasing the efficacy of the handoff, ensuring accuracy, as well as increasing the thoroughness of information. Multiple studies have concluded that the use of a handoff checklist improves information transfer during care transitions and could improve patient outcomes (Halterman et al., 2019; Segall et al., 2012; Wright, 2013). A complete, standardized checkoff can enhance comfort level of ICU staff and improve patient outcomes. The handoff checklist should include medical history, allergies, pertinent laboratory results, airway devices, ventilator settings, intraoperative medications

administered, intake and output, and any critical events during the procedure (Segall et al., 2012).

Postoperative Complications and Patient Management

Post anesthesia recovery is a time when adverse events are common and may increase postoperative morbidity and mortality. Patients experiencing at least one postoperative complication ranged from 4.25% - 54.5% (Faraj et al., 2013; Hines et al., 1992; Manninen et al., 1999; Tevis & Kennedy, 2013). Patients that are admitted to the ICU are at an increased risk of postoperative complications because of their requirement for a higher level of care. Manninen et al. (1999) found that 80% of patients directly admitted to the ICU experienced at least one postoperative complication. Staff in the intensive care unit should be trained to identify and treat potential complications following surgery. Preventing postoperative complications has a positive impact on the course of recovery by reducing morbidity, mortality, length of stay, and level of supportive care the patient may need at discharge (Tevis & Kennedy, 2013).

Common postoperative complications included: respiratory complications, postoperative nausea and vomiting, cardiovascular complications, neurological complications, and hypothermia. Factors that increase the occurrence of complications following surgery were the physical status classification, anesthetic technique, type and duration of surgery, and emergent surgery (Faraj et al., 2013; Hines et al., 1992; Manninen et al., 1999; Tevis & Kennedy, 2013).

Recognition and management of respiratory complications postoperatively are of the utmost importance for the ICU nurse. The incidence of some form of respiratory complications ranged from 2.8% - 41.66%, which makes it very common in the postoperative patient (Faraj et al., 2013; Hines et al., 1992; Manninen et al., 1999; Tevis & Kennedy, 2013). The most common respiratory complications were hypoventilation and upper airway obstruction.

Hypoventilation is described as a SpO2 less than 90% and a reduction in respiratory rate. Postoperative patients are at risk of respiratory compromise leading to inadequate oxygenation and ventilation (McMurray et al., 2020). Comorbid conditions contributing to an airway obstruction such as obesity, sleep apnea, and advancing age are on the rise; therefore, the ability to recognize and manage respiratory complications in the postoperative period is vital.

The utilization of airway manipulation techniques such as chin lift and jaw thrust as well as adjunct airway devices such as oral and nasal airways can increase airway patency. The average duration of airway support either by jaw thrust or insertion of an oral or nasal airway in the post-operative period was 39.9 minutes (Hines et al., 1992). Close observation and monitoring as well as comprehensive knowledge of airway management is an important clinical skill for those providers involved in the recovery of post-surgical patients.

Postoperative nausea and vomiting (PONV) is identified as the most common complication that occurred following surgery in multiple studies (Hines et al., 1992; Manninen et al., 1999). Manninen et al. (1999) found that 38.7% of surgical patients experienced PONV but the patients did not routinely have antiemetics administered intraoperatively. ICU nurses should know which patients are at increased risk for PONV and be prepared with treatments or nursing interventions. Factors that put a patient at an increased risk of experiencing nausea and vomiting postoperatively include female gender, nonsmokers, undergoing gynecological procedures, surgical duration longer than 60 minutes, a history of motion sickness, previous history of PONV, and intraoperative uses of anesthetic gases and opioids (Faraj et al., 2013). More recent utilization of a multimodal approach to decrease PONV has been successful in prevention and treatment as well as decreasing the amount of time spent in recovery. A regimen for the prevention and treatment of nausea and vomiting may commonly include ondansetron,

dexamethasone, antihistamines, metoclopramide, and scopolamine (Feil & Irick, 2016; Puccinelli et al., 2020).

Cardiovascular complications are a source of increased morbidity and mortality for patients perioperatively and frequently involve hypotension, tachycardia, or hypertension. Hypotension in the postoperative period is commonly the result of hypovolemia, blood loss, and medication side effects (Faraj et al., 2013). Of the patients experiencing hypotension, 80% of patients responded to volume administration and only 20% of patients required the administration of a vasopressor (Hines et al., 1992). Colloids and isotonic crystalloids are commonly utilized for volume replacement. Vasoactive medications used to increase blood pressure include epinephrine, phenylephrine, ephedrine, vasopressin, or norepinephrine. Tachycardia and hypertension can often accompany postoperative pain and can increase myocardial oxygen demand and risk of ischemia. If vasoactive medications are needed in the postoperative period, hypertension and tachycardia are commonly managed using beta blockers and calcium channel blockers (Ayrian et al., 2015; Brooks, 2015). Cardiovascular complications have been associated with increased ICU admission and mortality, so it is important for ICU nurses to know how to properly intervene (Faraj et al., 2013).

A 2013 study revealed that 40 out of 266 patients analyzed experienced emergence delirium in recovery (Xará et al., 2013). Patients experiencing hyperactive emergence delirium were shown to have an increased incidence of PONV as well as higher pain scores. Hypoxemia should be considered the cause of emergence delirium until it can be ruled out. Utilization of various oxygen delivery systems can be used in the management of hypoxemia in the ICU patient. Evidence also supported hypoactive delirium attributed to an increase in PONV as well as increased respiratory complications, a lower core body temperature, and a longer duration of

hospitalization (Xará et al., 2013). The most common causes of delayed awakening include prolonged action of anesthetic drugs, metabolic causes, and neurologic injury. Recognition and intervention of these behavioral disturbances by the ICU nurse can positively impact the clinical condition of patients (Xara et al., 2013).

Hypothermia in the postoperative setting can lead to an increased length of hospital stay, shivering, increased metabolic rate, increased myocardial oxygen demand, and ischemia, which may contribute to postoperative morbidity, mortality, and length of stay (Faraj et al., 2013; Hines et al., 1992; Tevis & Kennedy, 2013). Recognition of shivering and prompt treatment is vital to reduce complications. Management of hypothermia includes forced air warming blankets, increasing the room temperature, and warming of IV fluids (Ayrian et al., 2015).

Gaps in the Literature

While there is ample evidence on handoff and complication rates in the post anesthesia care unit (PACU), literature is sparse regarding these topics in the ICU setting. This could be because most patients are admitted to the PACU following surgery. Manninen et al. (1999) included ICU patients in their study and noted an increased occurrence of postoperative complications. This supports the need for an educational intervention on post-anesthesia recovery for ICU nurses to enhance monitoring and care provided to the patients in the critical care setting. Additionally, further studies focused on the handoff and complication rates of postoperative patients in the ICU are needed.

Theoretical Framework

Lewin's Theory of Planned Change was used to guide this project in implementing an educational intervention to address staff knowledge deficits. First developed in 1951, Lewin described three phases in which change must occur as well as various ways in which forces can

affect change (Mitchell, 2013). Lewin's theory helps the change agents, such as advanced practice nurses, to navigate common pitfalls that impede success of the implemented change and provides a framework to guide the change process (Shirey, 2013).

Lewin's three-step change theory is described in the stages of unfreezing, moving, and refreezing (Shirey, 2013). The first stage, unfreezing, involves the identification of an issue and the need for change. Nursing leadership in the ICU identified the need for further education about postoperative recovery among nurses. A preintervention survey was distributed to nurses working in the ICU to identify areas for education and to further facilitate unfreezing. The second phase, moving, is where an action is taken and changes are made (Mitchell, 2013). The purpose of this project was to provide an evidence-based, educational intervention to nurses in the intensive care unit at an urban hospital regarding post anesthesia care and anesthesia recovery. A tailored SBAR handoff tool was also created to increase the comfort level of the providers caring for patients following anesthesia. The goal of the education and handoff tool was to provide the nurses with materials to move towards a change in practice when receiving and caring for this patient population. The third phase, refreezing, involves stabilizing the change so that it becomes cemented into the culture and practice of the organization (Shirey, 2013). A post intervention survey was distributed to collect feedback on potential barriers and future improvements to facilitate practice retention.

Lewin also analyzed the forces that can effect change, describing these forces as either driving forces towards change or restraining forces that hinder change. While providing the educational intervention of this project, the goal was to optimize the driving forces to facilitate the implementation of change while limiting the restraining forces such as staff hesitation and resistance. The education was delivered through a video link so staff could view on their own

time and as many times as desired. Utilizing this method, the education was able to be distributed to more staff to drive forces toward change.

Methods

Design

This DNP project utilized a quantitative and qualitative mixed methods design to provide an educational intervention targeting the handoff and recovery of patients in the intensive care unit following anesthesia. The goal of this intervention was to provide a handoff tool to enhance the safety of the patient transfer process and to provide education on post anesthesia recovery in the ICU. The voluntary participants were recruited from a convenience sample of ICU nurses working on a 15-bed intensive care unit of a local urban hospital in central North Carolina.

Evidence-Based Practice Model

The Iowa Model is the evidence-based practice model used in the implementation of this project. This model is intended for use by point of care clinicians that are seeking to improve the quality of care through the systematic use of evidence (Iowa Model Collaborative, 2017). Utilizing this model, the researcher first identifies a clinical question or issue and determines its priority. Then the researcher can appraise and synthesize the evidence, design and pilot the practice change, and finally integrate and sustain the practice change (Iowa Model Collaborative, 2017). The problem addressed in this DNP project was the transfer of care and recovery of patients following anesthesia in the intensive care unit. The literature indicates that the transfer of care process can pose a significant threat to patient safety and that postoperative complication rates are higher in the intensive care unit compared to the PACU. The education intervention and handoff tool created were distributed to staff to integrate into future practice. The resulting

practice change will help to streamline the handoff process and better prepare nurses to recognize and treat common post-anesthesia complications.

Setting and Sample

Permission was obtained from the implementation site and documentation was provided via the signed support letter. Institutional Review Board (IRB) approval was granted from the University of North Carolina Greensboro and the facility.

The participants were composed of a convenience sample of nurses working in a 15-bed ICU within a local urban hospital. Subjects were recruited to participate in a survey designed to determine the individual's confidence level and understanding of patient handoff and recovery of patients following anesthesia. Management was contacted via email to gauge participation interest in this quality improvement project. Nursing management agreed to distribute a participation email to staff explaining the purpose and requirements of the project. Inclusion criteria included ICU nurses with a valid North Carolina nursing license directly caring for patients following anesthesia in the immediate postoperative period. Exclusion criteria included other staff within the ICU not providing patient care and staff recovering postoperative patients in other settings of the hospital.

Intervention

A handoff tool and educational presentation were created and distributed to staff. The handoff tool (Appendix B) was designed with the purpose of streamlining the transfer of care between staff and improving the ICU nurses' confidence when receiving post-surgical patients. The tool included information regarding the patient's past medical history, vital signs, and preoperative lab work. Also included were various components of the surgical course such as airway and lines, intraoperative fluids, medications administered, and any post-operative plans or

monitoring parameters. The educational presentation was created to assist nurses in recognizing and intervening on various complications seen following anesthesia. The education was distributed to staff as a video link to allow for multiple viewings during times convenient to staff. The video included visual demonstrations of various airway management techniques as well as a narrated PowerPoint presentation discussing some post anesthesia complications that ICU nurses may encounter (Appendix C). The video was 10 minutes in length.

Data Collection

A mixed-methods survey using a Likert scale and qualitative free text space was used for the preintervention survey (Appendix A). Surveys were distributed via an email from nursing management. The email contained a link to each survey which was stored within Qualtrics. Survey participation was voluntary, and completion of the survey served as informed consent. No harm was posed to participating subjects. Along with demographics including age, degree, and years of experience, each survey contained eight Likert style questions and a qualitative text box. Twenty-one participants completed the initial survey. Gaps in knowledge and points of concern were used from the preintervention surveys to create the educational intervention. Following distribution of the education, a follow-up survey was distributed to gauge the effectiveness of the intervention, changes in practice, and barriers to implementation (Appendix D).

Data Analysis

Quantitative data collected within the surveys were analyzed using descriptive statistics, specifically, the age, degree type, and ICU experience of each nurse. Utilizing Microsoft Excel, independent samples t-tests were used to analyze self-reported confidence in the management of various post anesthesia complications both before and after the educational intervention.

Results

Demographic Results

The pre-intervention survey was distributed to staff as a Qualtrics link within an email distributed by nurse management. A total of 21 nurses voluntarily completed the survey. A large proportion of participants, 55% (n=11), reported they were between 20-29 years of age. The majority of respondents, 90% (n=18), received their bachelor's degree in nursing. Out of the 21 nurses who completed the survey, 45% (n=9) reported having less than one year of ICU experience and 35% (n=7) reported 1-5 years of experience. Demographic data are presented in Table 1.

Self-Reported Confidence

For reporting purposes, "somewhat agree" and "strongly agree" were grouped together and reported as agree, and "somewhat disagree" and "strongly disagree" were grouped together and reported as disagree. When asked if they felt confident receiving handoff from the anesthesia team, 28.6% (n=6) disagreed. Over 90% (n=19) of respondents agreed that having a standardized handoff tool on the unit would be beneficial. Respondents reported mixed results when asked to report their confidence in the management of various postoperative complications. When asked if they were open to receiving educational information regarding post anesthesia patient management, 90.5% (n=19) agreed they would be willing to receive information. The frequency and percentages of the results from the pre intervention Likert questions are presented in Table 2.

Five nurses completed the post intervention survey via a Qualtrics link. Sixty percent of nurses who responded agreed that they felt more confident receiving handoff from the anesthesia team with the use of the tool. Eighty percent of those respondents agreed that the handoff tool will be helpful during future transfer of care events with the anesthesia team. Sixty percent

agreed that they would utilize the provided handoff tool in their future practice. Eighty percent of the nurses who completed the post survey agreed that the educational information provided would be beneficial during future management of patient's following anesthesia. Regarding reported confidence levels in the management of various post anesthesia complications, the overall mean response before and after the educational intervention were 4.18 and 4.4 respectively, however; the independent samples t-tests did not find a statistical significance between the two groups (Table 3).

Discussion

This DNP project sought to increase the confidence of ICU nurses in the handoff and management of patients following anesthesia through a handoff tool and educational video. Results from the questionnaires indicated an increase in self-reported confidence during the handoff and post-operative care of patients following anesthesia, although no statistical significance was identified. The small sample size likely contributed to the lack of statistical significance.

Current research demonstrates that well-executed patient handoffs are correlated with improved levels of patient safety, patient satisfaction, and clinician satisfaction (Slade et al., 2018). The use of checklists can assist in the successful exchange of information and execution of these transfer of care events. The standardized handoff tool developed during this DNP project was distributed to staff for utilization during handoff with the anesthesia team. The majority of survey results from the nurses indicated that they felt more confident in the handoff process when using the tool and believed this handoff tool would be beneficial in their future practice. This aligns with research by Uhm, Ko, and Kim (2019), who found that the implementation of a standardized communication tool during handover improved the users' handover confidence

levels. In addition to confidence, the use of handoff aids could improve patient safety, collaboration, communication, team dynamics, and increase the ability of nurses to manage clinical handoffs (Pakcheshm et al., 2020). Results from this project help to demonstrate the positive impact that checklists can have during the transfer of care process for both providers and patients and support the implementation of similar tools moving forward.

The ability to recognize potential postoperative complications and provide appropriate interventions is of paramount importance when managing patients following anesthesia. Providing nurses with continued education can be beneficial in helping nurses develop the skillset to manage these patients. Pei-Lin and Chen (2020) found that completion of an evidence-based practice program improved the knowledge levels, skills, and self-efficacy of a certain subset of nurses. In this project, nurses reported increased confidence levels when managing various post anesthesia complications following the delivery of the educational video. Although the results were not of statistical significance, these findings support the notion that more evidence-based education may be beneficial and should be provided on the management of this patient population, especially to less experienced staff. This information should be included in future staff orientation programs to provide education to new employees.

Nearly half of the participants in this study had less than one year of experience. As hospitals experience increased staff turnover due to the ongoing pandemic, it is likely to have nurses with less bedside experience compose a larger portion of unit staff. Ortiz (2016) found that many new nurses lack professional confidence during their first year of practice. Integration of supportive strategies to promote increased confidence and self-efficacy is beneficial to the professional development of nursing staff. The handoff tool and post-anesthesia education provided in this

project can be utilized moving forward in efforts to increase the confidence of new or experienced staff when caring for this patient population.

Lewin's Theory of Planned Change (Mitchell, 2013) as well as the Iowa Practice Model (Iowa Model Collaborative, 2017) were utilized in this project. With the combination of these frameworks, the handoff and post anesthesia care of surgical patients in the ICU was the clinical issue first identified for improvement. An intervention was designed to facilitate movement toward a change in practice. The implementation plan consisting of a handoff tool and educational video was integrated into practice and the results were analyzed. Future studies can be performed and follow-up data collected to investigate the sustainability of the tools for integration into clinical practice.

Limitations

A major limitation throughout this project was COVID-19. Determining the most effective delivery method of the educational material proved difficult due to the pandemic. Initially, an in-person workshop with hands-on demonstration was the goal; however, social distancing guidelines and restrictions would have made scheduling and execution difficult. To effectively target the largest sample size possible, an educational video was distributed for viewing. The lack of face-to-face interaction could have negatively impacted staff engagement in the project.

Another potential limitation was the fact that nearly half of the nurses participating in this study were novices, having been in practice less than one year. This could be attributed to a variety of factors, such as an increased rate of nurse turnover and burnout in more experienced nurses. It could be suggested that newer nurses are more likely to seek educational resources to

better increase their skills during the beginning years of their careers. A larger more diverse sample of experienced nurses to novice nurses may have provided more valuable results.

The decreased response rate of the follow-up survey could have been attributed to multiple factors. The decision to ultimately disseminate the project materials virtually rather than in person could have hindered participation. Rice and Schroeder (2021) found that military personnel training in a virtual setting were more likely to experience lower levels of trust in both their instructor and themselves. They also found that these participants experienced lower overall satisfaction with the virtual training than those who participated in in-person training (Rice & Schroeder, 2021). The use of online surveys has been shown to demonstrate both decreased response rates as well as increased item omissions (Roster et al., 2007). The use of offline surveys may have produced a higher participation rate, but again, the ongoing COVID-19 pandemic presented many challenges. Bedside nursing shifts in the ICU can often be extremely busy with a multitude of interruptions that could have prevented nurses from completing the survey. The distribution of the post-intervention survey took place in November and December, around the holiday season. Distractions and other priorities that often accompany that time of year could have resulted in a lower response rate.

Pre and post surveys were not linked to increase anonymity, however, this potentially impacted data analysis. A repeated-measures analysis with linked responses could have provided the project with more objective data. Lastly, survey questions were not assessed for construct or content validity prior to distribution.

Recommendations for Practice and Study

Based on the results of this DNP project, it is recommended that a standardized handoff tool be utilized during the transfer of care to improve nurses' confidence levels and to help reduce the

omission of information. Evidence-based education should be provided to ICU nurses and other staff providing care to patients following anesthesia. An effective strategy could be to include information about the management of this patient population into unit orientation programs. Using this project and supporting literature, future DNP students can continue to investigate the sustainability of these educational tools in nursing education to facilitate practice change.

More research should be done to determine effective ways to implement material on post anesthesia patient recovery into ICU orientation and continuing education. Additional feedback could be useful to determine methods to increase staff engagement and assist in cultivating strategies to provide more meaningful results in future projects. If possible, simulation-based education and training should be utilized when educating nurses on the management of patients following anesthesia. Borggreve, Meijer, Schreuder, and Ten Cate (2017) found simulation to be effective in increasing both the confidence and performance of medical students participating in trauma-based scenarios. Recommendations for DNP students implementing a similar handoff tool would be to follow up at 60- and 90-day intervals post implementation as well. Not all staff had the opportunity to utilize the handoff tool following distribution before the post survey was distributed one month later.

Conclusion

The goal of this project was to provide an educational intervention to members of the ICU team on the components of an anesthesia handoff, potential postoperative complications, and appropriate management of these issues. Although limited by the small sample size, responses indicated improvement in nurse confidence during the handoff and post-operative management of patients following anesthesia. Therefore, the implementation of a standardized

handoff tool as well as nurse education programs on post anesthesia is recommended. Nurses could be better prepared to receive and intervene on these patients should a complication arise.

As direct admits to the ICU from the operating room become a more common occurrence, the importance of continued education for bedside nurses can't be stressed enough. Frequent education impacts patient outcomes by increasing skills and confidence thereby improving patient outcomes. It is the hope that continued research such as this DNP project will continue to assist nurses in their implementation of safe and effective patient interventions.

References

Ayrian, E., Kaye, A. D., Varner, C. L., Guerra, C., Vadivelu, N., Urman, R. D., Zelman, V., Lumb, P. D., Rosa, G., & Bilotta, F. (2015). Effects of Anesthetic Management on Early Postoperative Recovery, Hemodynamics and Pain After Supratentorial Craniotomy. *Journal of clinical medicine research*, *7*(10), 731–741. https://doi.org/10.14740/jocmr2256w

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. https://doi.org/10.1016/j.jclinane.2017.09.005

Borggreve, A. S., Meijer, J., Schreuder, H., & Ten Cate, O. (2017). Simulation-based trauma education for medical students: A review of literature. *Medical Teacher*, *39*(6), 631–638. https://doi.org/10.1080/0142159X.2017.1303135

Brooks C. (2015). Critical care nursing in acute postoperative neurosurgical patients. *Critical care nursing clinics of North America*, *27*(1), 33–45. https://doi.org/10.1016/j.cnc.2014.10.002

Bruno, G. M., & Guimond, M. E. (2017). Patient Care Handoff in the Postanesthesia Care Unit: A Quality Improvement Project. *Journal of Perianesthesia Nursing: Official Journal of the American Society of PeriAnesthesia Nurses*, *32*(2), 125–133. https://doi.org/10.1016/j.jopan.2015.10.002

Faraj, J. H., Vegesna, A. R., Mudali, I. N., Khairay, M. A., Nissar, S., Alfarhan, M., Sabir, K., El-Imam, F., Anto, L., & Go, T. (2013). Survey and management of anaesthesia

related complications in PACU. *Qatar Medical Journal*, *2012*(2), 64–70. https://doi.org/10.5339/qmj.2012.2.15

Feil, M., & Irick, N. A. (2016). Principles of Neuro-anesthesia in Neurosurgery for Intensive Care Unit Nurses. *Critical care nursing clinics of North America*, *28*(1), 87–94. https://doi.org/10.1016/j.cnc.2015.10.004

Halterman, R. S., Gaber, M., Janjua, M., Hogan, G. T., & Cartwright, S. (2019). Use of Checklist for the Postanesthesia Care Unit Patient Handoff. *Journal of perianesthesia nursing: official journal of the American Society of PeriAnesthesia Nurses*, *34*(4), 834–841. https://doi.org/10.1016/j.jopan.2018.10.007

Hegedus, M. (2003). Taking the Fear Out of Postanesthesia Care in the Intensive Care Unit. *Dimensions of Critical Care Nursing, 22*(6), 237-244.

Hines, R., Barash, P. G., Watrous, G. & O'Connor, T. (1992). Complications Occurring in the Postanesthesia Care Unit. *Anesthesia & Analgesia, 74*(4), 503–509.

Iowa Model Collaborative, Buckwalter, K. C., Cullen, L., Hanrahan, K., Kleiber, C., McCarthy, A. M., Rakel, B., Steelman, V., Tripp-Reimer, T., Tucker, S., & Authored on behalf of the Iowa Model Collaborative (2017). Iowa Model of Evidence-Based Practice: Revisions and Validation. *Worldviews on evidence-based nursing*, *14*(3), 175–182.

Kellner, D. B., Urman, R. D., Greenberg, P., & Brovman, E. Y. (2018). Analysis of adverse outcomes in the post-anesthesia care unit based on anesthesia liability data. *Journal of clinical anesthesia*, *50*, 48–56. https://doi.org/10.1016/j.jclinane.2018.06.038

Manninen, P. H., Raman, S. K., Boyle, K., & el-Beheiry, H. (1999). Early postoperative complications following neurosurgical procedures. *Canadian Journal of Anaesthesia*, *46*(1), 7–14.

McMurray, R., Becker, L., Olsen, K. F., & McMurray, M. (2020). Airway Management for Deep Sedation: Current Practice, Limitations, and Needs as Identified by Clinical Observation and Survey Results. *AANA Journal*, *88*(2), 123–129.

Mitchell, G. (2013). Selecting the best theory to implement planned change. *Nursing Management (through 2013), 20*(1), 32-37.

Ortiz, J. (2016). New graduate nurses' experiences about lack of professional confidence. *Nurse Education in Practice, 19*, 19-24. https://doi.org/10.1016/j.nepr.2016.04.001

Pakcheshm, B., Bagheri, I., & Kalani, Z. (2020). The impact of using "ISBAR" standard checklist on nursing clinical handoff in coronary care units. *Nursing Practice Today*, *7*(4), 266–274.

Pei-Lin, H., & Chen, S. (2020). Effectiveness of an Evidence-Based Practice Educational Intervention among School Nurses. *International Journal of Environmental Research and Public Health, 17*(11), 4063. https://doi.org/10.3390/ijerph17114063

Puccinelli, C. L., Moore, E. J., Yin, L. X., Price, D. L., Janus, J. R., Weingarten, T. N., & Van Abel, K. M. (2020). Anesthesia for TORS for Oropharyngeal Carcinoma: Factors Associated with Prolonged Phase I Postanesthesia Recovery. *Otolaryngology--head and neck surgery: official journal of American Academy of Otolaryngology-Head and Neck Surgery*, *163*(3), 531–537.

Rice, V. J., & Schroeder, P. J. (2021). In-Person and Virtual World Mindfulness Training: Trust, Satisfaction, and Learning. *Cyberpsychology, Behavior and Social Networking*, *24*(8), 526–535. https://doi.org/10.1089/cyber.2019.0590

Roster, C. A., Rogers, R. A., Hozier, George C.,,Jr, Baker, K. G., & Albaum, G. (2007). Management of Marketing Research Projects: Does Delivery Method Matter Anymore in Survey Research? *Journal of Marketing Theory and Practice, 15*(2), 127-144.

Santafé Colomina, M., Arikan Abelló, F., Sánchez Corral, A., & Ferrer Roca, R. (2019). Optimization of the neurosurgical patient in Intensive Care. *Medicina Intensiva*, *43*(8), 489–496. https://doi.org/10.1016/j.medin.2019.02.011

Segall, N., Bonifacio, A. S., Schroeder, R. A., Barbeito, A., Rogers, D., Thornlow, D. K., Emery, J., Kellum, S., Wright, M. C., Mark, J. B., & Durham VA Patient Safety Center of Inquiry (2012). Can we make postoperative patient handovers safer? A systematic review of the literature. *Anesthesia and Analgesia*, *115*(1), 102–115. https://doi.org/10.1213/ANE.0b013e318253af4b

Shirey, M. R. (2013). Lewin's Theory of Planned Change as a Strategic Resource. *JONA: The Journal of Nursing Administration, 43*(2), 69–72.

Slade, D., Murray, K. A., Pun, J., & Eggins, S. (2019). Nurses' perceptions of mandatory bedside clinical handovers: An Australian hospital study. *Journal of Nursing Management*, *27*(1), 161–171. https://doi.org/10.1111/jonm.12661

Tevis, S. E., & Kennedy, G. D. (2013). Postoperative complications and implications on patient-centered outcomes. *The Journal of Surgical Research*, *181*(1), 106–113. https://doi.org/10.1016/j.jss.2013.01.032

Uhm, J.-Y., Ko, Y., & Kim, S. (2019). Implementation of an SBAR communication program based on experiential learning theory in a pediatric nursing practicum: A quasi-experimental study. *Nurse Education Today*, *80*, 78–84. https://doi.org/10.1016/j.nedt.2019.05.034

Weingarten, T. N., Jacob, A. K., Njathi, C. W., Wilson, G. A., & Sprung, J. (2015). Multimodal Analgesic Protocol and Postanesthesia Respiratory Depression During Phase I Recovery After Total Joint Arthroplasty. *Regional Anesthesia and Pain Medicine*, *40*(4), 330–336. https://doi.org/10.1097/AAP.0000000000000257

Wheeler, K. E., Grilli, R., Centofanti, J. E., Martin, J., Gelinas, C., Szumita, P. M., Devlin, J. W., Chanques, G., Alhazzani, W., Skrobik, Y., Kho, M. E., Nunnally, M. E., Gagarine, A., Ergan, B. A., Fernando, S., Price, C., Lewin, J., & Rochwerg, B. (2020). Adjuvant Analgesic Use in the Critically Ill: A Systematic Review and Meta-Analysis. *Critical Care Explorations*, *2*(7), e0157.

Wright, S.M. (2013). Examining Transfer of Care Processes in Nurse Anesthesia Practice: Introducing the PATIENT Protocol. *AANA Journal*, *81*(3), 225-232.

Xará, D., Silva, A., Mendonça, J., & Abelha, F. (2013). Inadequate emergence after anesthesia: emergence delirium and hypoactive emergence in the Postanesthesia Care Unit. *Journal of Clinical Anesthesia*, *25*(6), 439–446. https://doi.org/10.1016/j.jclinane.2013.02.011

Zayed, Y., Kheiri, B., Barbarawi, M., Rashdan, L., Gakhal, I., Ismail, E., Kerbage, J., Rizk, F., Shafi, S., Bala, A., Sidahmed, S., Bachuwa, G., & Seedahmed, E. (2020). Effect of oxygenation modalities among patients with postoperative respiratory failure: a pairwise and network meta-analysis of randomized controlled trials. *Journal of Intensive Care*, *8*, 51. https://doi.org/10.1186/s40560-020-00468-x

Zhao, L. H., Shi, Z. H., Chen, G. Q., Yin, N. N., Chen, H., Yuan, Y., Cao, W., Xu, M., Hao,

J. J., & Zhou, J. X. (2017). Use of Dexmedetomidine for Prophylactic Analgesia and Sedation in Patients with Delayed Extubation After Craniotomy: A Randomized Controlled Trial. *Journal of Neurosurgical Anesthesiology*, *29*(2), 132–139.

Table 1

Patient Demographics	n (%)
Age	
20-29	11(55)
30-39	5(25)
40-49	2(10)
50-59	2(10)
60+	0(0)
Degree Type	
Certificate	2(10)
Bachelors	18(90)
Masters	0(0)
Doctorate	0(0)
Years of ICU Experience	
Less than 1	9(45)
1-5	7(35)
6-10	1(5)
11-15	1(5)
16-20	0(0)
21-25	0(0)
25+	2(10)

Table 2

Self-Reported Confidence

	Strongly Disagree	Somewhat Disagree	Neither	Somewhat Agree	Strongly Agree
	n(%)	n(%)	n(%)	n(%)	n(%)
1. I feel confident receiving handoff from the anesthesia team on a post-surgical patient.	0(0)	5(24)	1(5)	10(48)	5(24)
2. Having a standardized handoff tool available would be beneficial to me.	0(0)	0(0)	2(10)	4(19)	15(71)
3. I feel confident in my airway management skills.	0(0)	2(10)	0(0)	9(43)	10(48)
4. I feel confident in the management of postoperative nausea and vomiting.	0(0)	1(5)	1(5)	9(43)	10(48)
5. I feel confident in managing postoperative cardiovascular complications (hypotension, tachycardia, hypertension).	1(5)	2(10)	0(0)	7(33)	11(52)
6. I feel confident in my neurological assessment skills and management of delirium.	0(0)	1(5)	1(5)	13(62)	6(29)
7. I feel confident in the postoperative temperature management.	0(0)	3(14)	2(10)	9(43)	7(33)
8. I am receptive to receiving information regarding post anesthesia management.	0(0)	0(0)	2(10)	2(10)	17(81)

Table 3

Independent Samples T-Tests

	Pre-Average	Pre-SD	Post-Average	Post-SD	t	df	P-value
Airway Management	4.29	0.90	4.40	0.55	-0.27	24	0.79
Postoperative Nausea & Vomiting	4.33	0.80	4.60	0.55	-0.71	24	0.49
Cardiovascular	4.19	1.17	4.4	0.55	-0.39	24	0.70
Neurological	4.14	0.73	4.2	1.3	-0.13	24	0.89
Temperature	3.95	1.02	4.40	0.55	-0.94	24	0.36

Appendix A

Pre-intervention survey

Please answer the following questions on a scale from 1-5. 1: strongly disagree, 2: disagree, 3: neither agree nor disagree, 4: agree, 5: strongly agree:

Please circle your choice below

Age (years): 20-29, 30-39, 40-49, 50-59, 60+

Degree type: Certificate, Bachelors, Masters, Doctorate

Years of ICU experience: <1, 1-5, 6-10, 11-15, 16-20, 21-25, >25

1. I feel confident receiving handoff from the anesthesia team on a post-surgical patient	1	2	3	4	5
2. Having a standardized handoff tool available would be beneficial to me	1	2	3	4	5
3. I feel confident in my airway management skills	1	2	3	4	5
4. I feel confident in the management of postoperative nausea and vomiting	1	2	3	4	5
5. I feel confident in managing postoperative cardiovascular complications (hypotension, tachycardia, hypertension)	1	2	3	4	5

6. I feel confident in my neurological assessment skills and management of delirium	1	2	3	4	5
7. I feel confident in the postoperative temperature management	1	2	3	4	5
8. I am receptive to receiving information regarding post anesthesia management.	1	2	3	4	5

Please list any other aspects of post anesthesia management you would like addressed:

Appendix B

Anesthesia Handoff Tool

1. Patient Information:

Name:

Age:

Allergies:

Vitals:

Preop Neuro Status:
Normal / Impaired (Deficits)

ASA:

Procedure:

Surgeon:

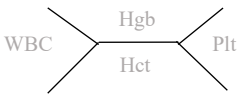
CRNA:

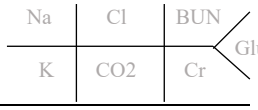
Anesthesiologist:

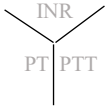
---

2. History:

3. Labs:







---

4. Airway and Lines:

O2:
Ventilator Settings:

IV:

A-line: Y / N
If yes, location:

Foley: Y / N

5. Intake and Output:

IN:
Crystalloid: Colloid: Blood products:

OUT:
Urine: Blood: Other:

---

6. Medications:

PRE-OP:
Beta blocker

Analgesia

Antibiotics

Other

INTRA-OP:
Vasoactives

Analgesia

Antibiotics

N/V

Diuretics

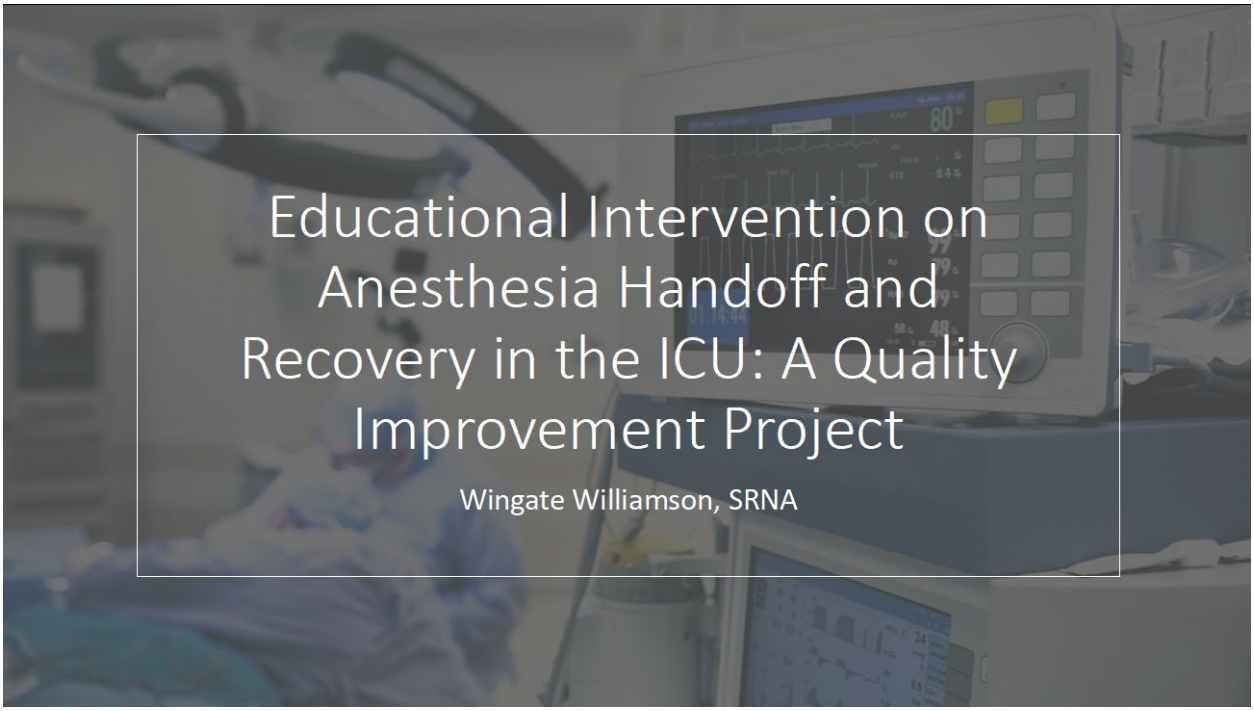
Other

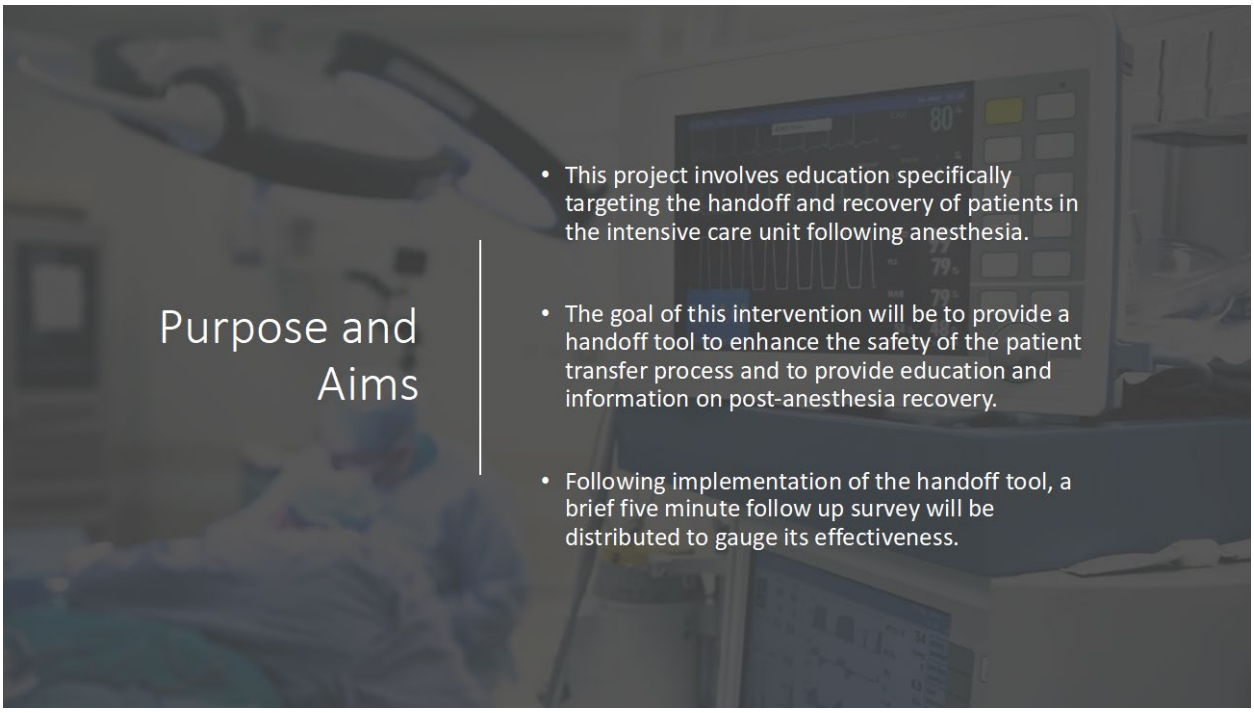
---

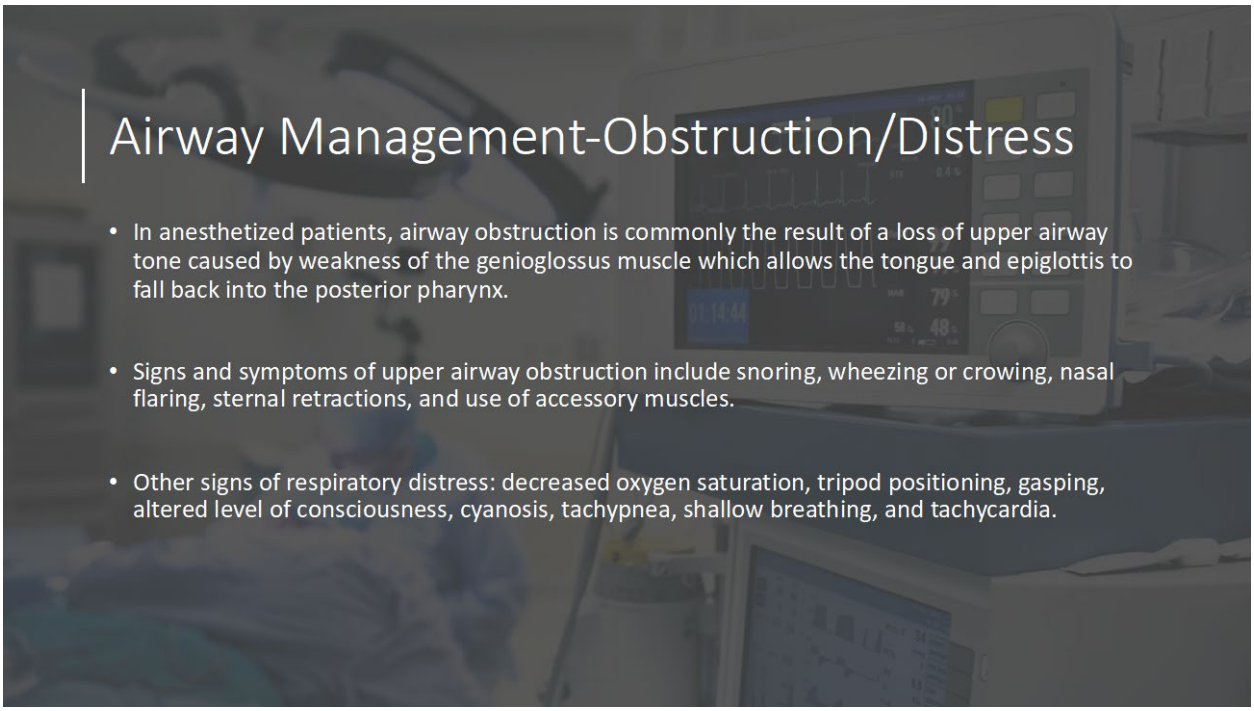
7. Post-op:

Goals/Parameters:

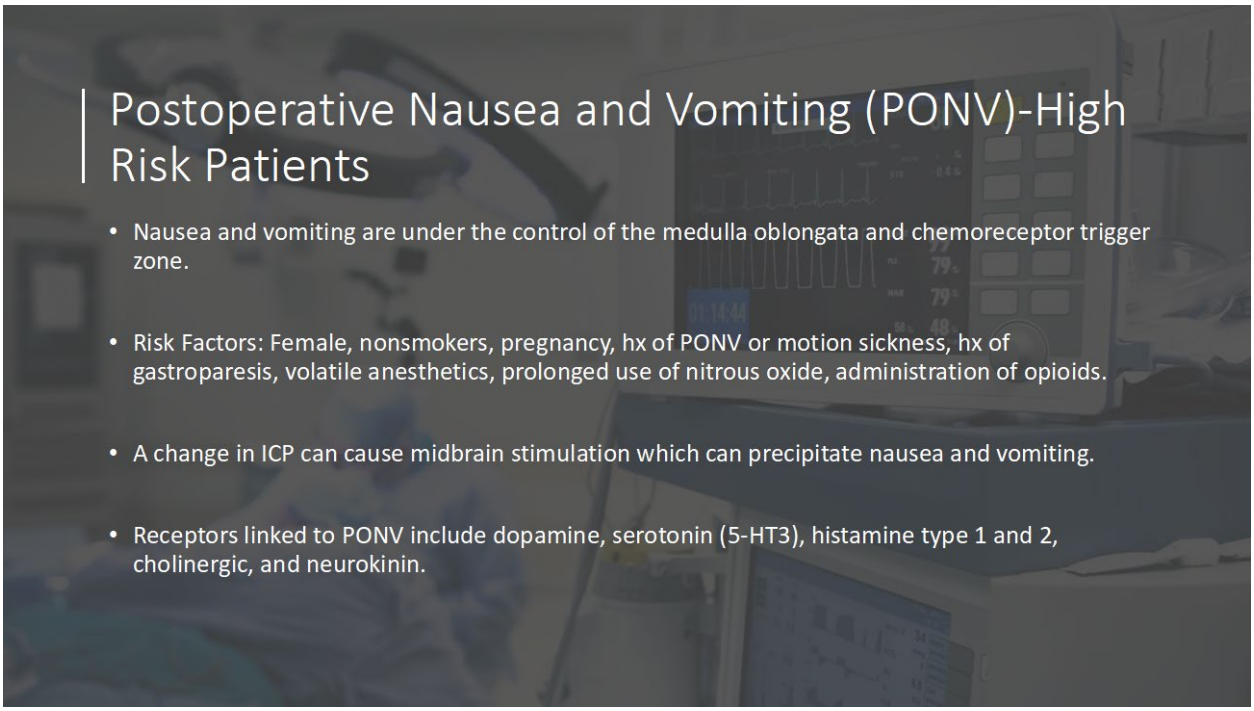
Appendix C

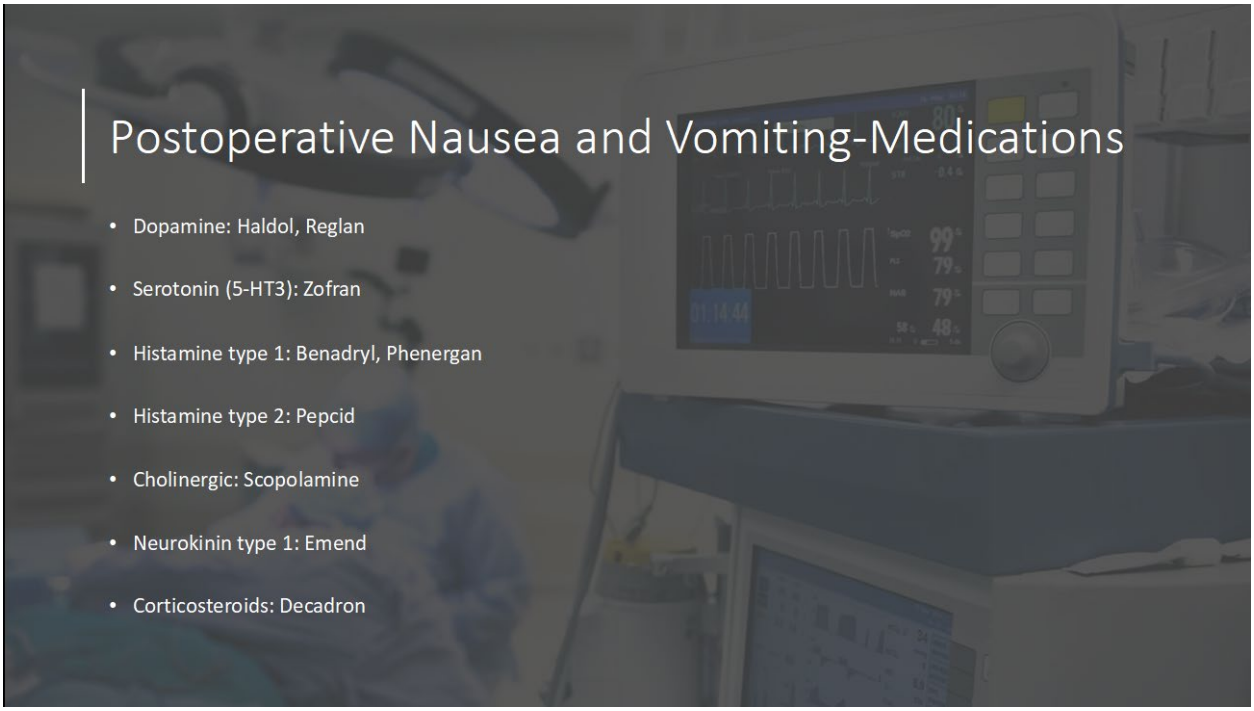

Educational Intervention on Anesthesia Handoff and Recovery in the ICU: A Quality Improvement Project
Wingate Williamson, SRNA

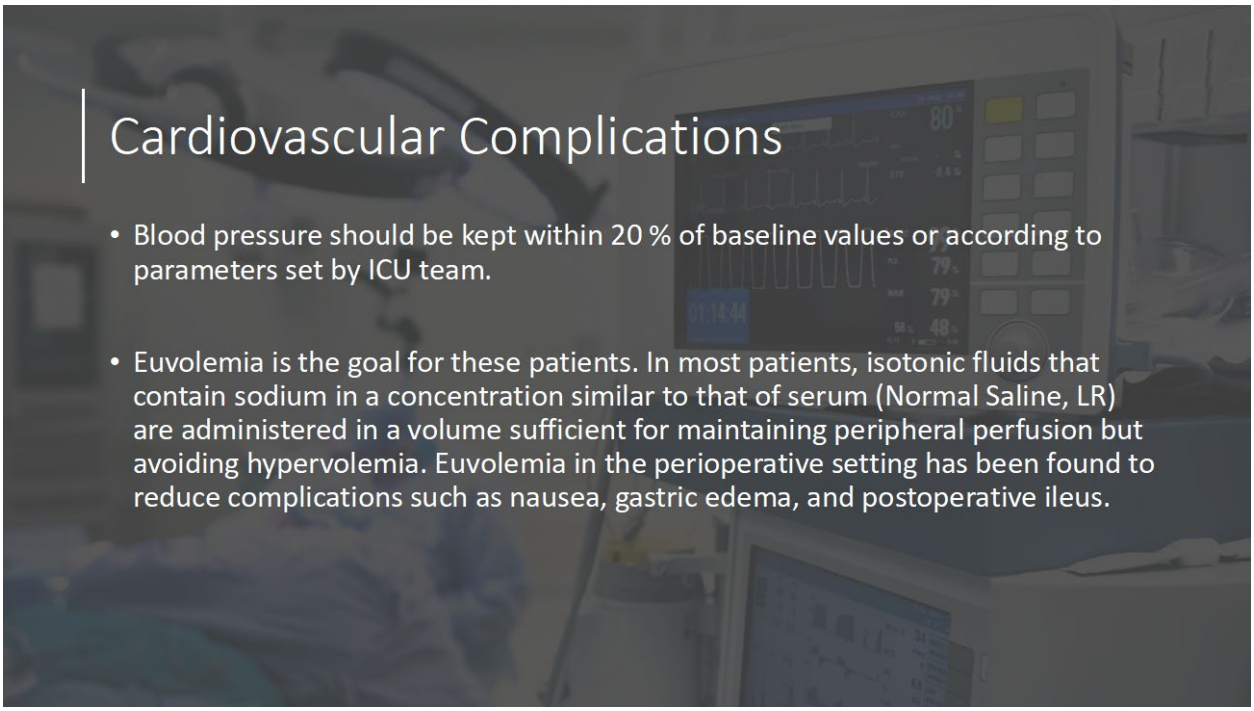

Purpose and Aims
• This project involves education specifically targeting the handoff and recovery of patients in the intensive care unit following anesthesia.
• The goal of this intervention will be to provide a handoff tool to enhance the safety of the patient transfer process and to provide education and information on post-anesthesia recovery.
• Following implementation of the handoff tool, a brief five minute follow up survey will be distributed to gauge its effectiveness.

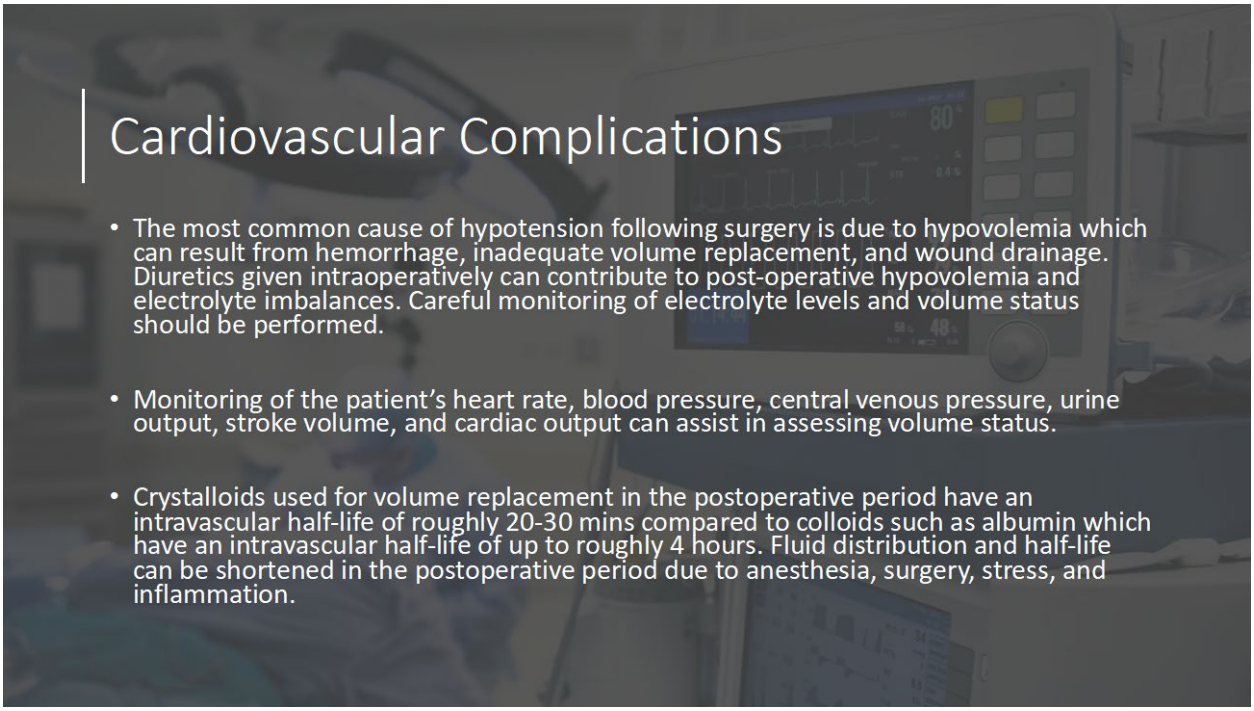

Airway Management-Obstruction/Distress
• In anesthetized patients, airway obstruction is commonly the result of a loss of upper airway tone caused by weakness of the genioglossus muscle which allows the tongue and epiglottis to fall back into the posterior pharynx.
• Signs and symptoms of upper airway obstruction include snoring, wheezing or crowing, nasal flaring, sternal retractions, and use of accessory muscles.
• Other signs of respiratory distress: decreased oxygen saturation, tripod positioning, gasping, altered level of consciousness, cyanosis, tachypnea, shallow breathing, and tachycardia.

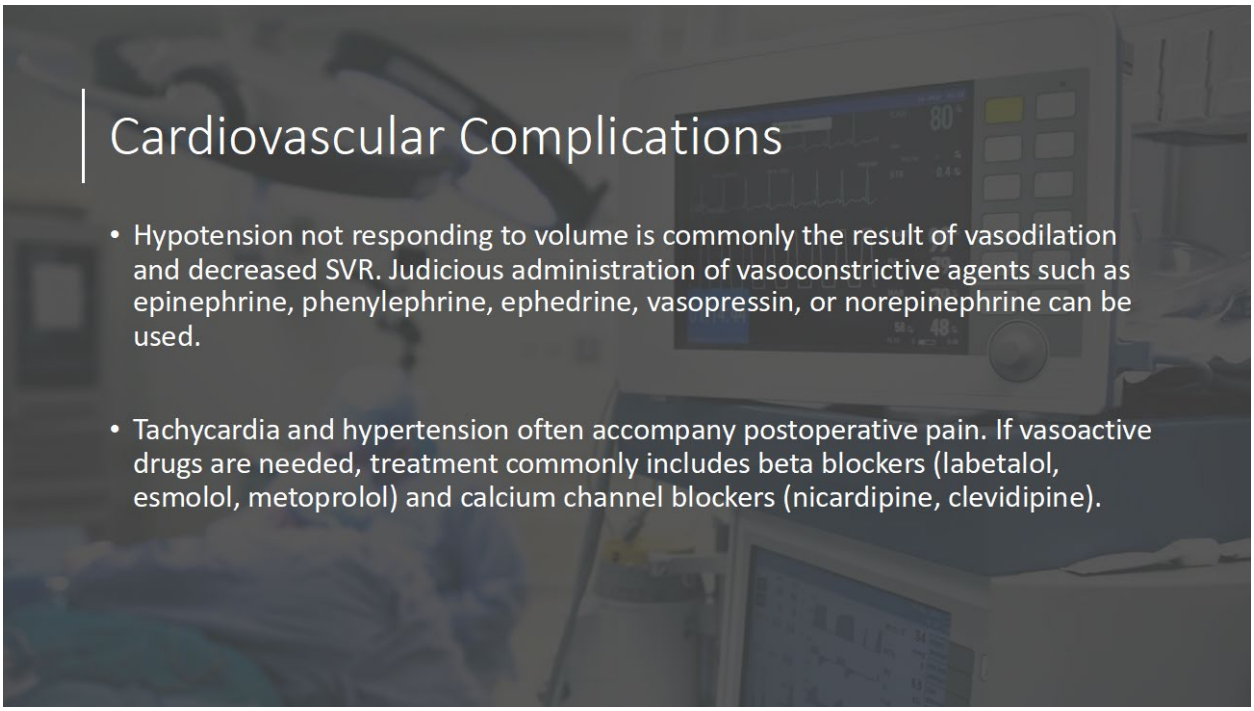

Airway Management-Video Demonstrations
• Chin Lift
• Jaw Thrust
• Oral airway insertion
• Nasal airway insertion
• One handed mask technique
• Two handed mask technique

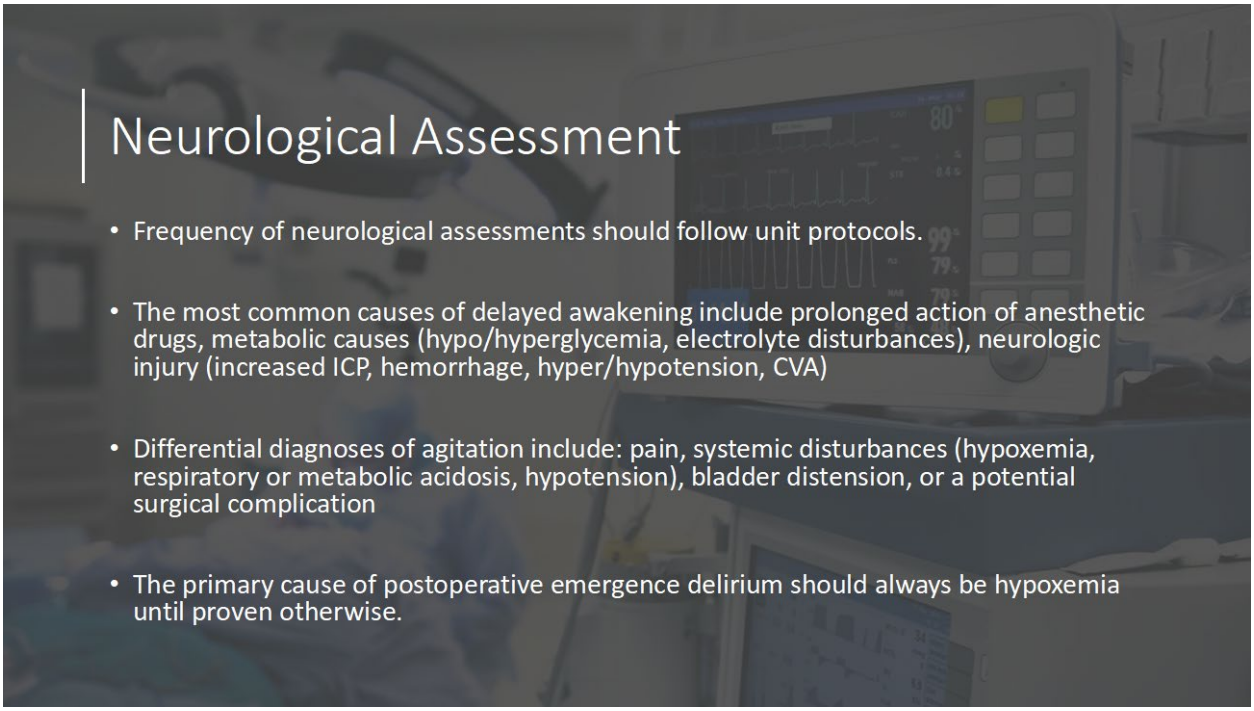

Postoperative Nausea and Vomiting (PONV)-High Risk Patients
• Nausea and vomiting are under the control of the medulla oblongata and chemoreceptor trigger zone.
• Risk Factors: Female, nonsmokers, pregnancy, hx of PONV or motion sickness, hx of gastroparesis, volatile anesthetics, prolonged use of nitrous oxide, administration of opioids.
• A change in ICP can cause midbrain stimulation which can precipitate nausea and vomiting.
• Receptors linked to PONV include dopamine, serotonin (5-HT3), histamine type 1 and 2, cholinergic, and neurokinin.


Postoperative Nausea and Vomiting-Medications
• Dopamine: Haldol, Reglan
• Serotonin (5-HT3): Zofran
• Histamine type 1: Benadryl, Phenergan
• Histamine type 2: Pepcid
• Cholinergic: Scopolamine
• Neurokinin type 1: Emend
• Corticosteroids: Decadron


Cardiovascular Complications
• Blood pressure should be kept within 20 % of baseline values or according to parameters set by ICU team.
• Euvolemia is the goal for these patients. In most patients, isotonic fluids that contain sodium in a concentration similar to that of serum (Normal Saline, LR) are administered in a volume sufficient for maintaining peripheral perfusion but avoiding hypervolemia. Euvolemia in the perioperative setting has been found to reduce complications such as nausea, gastric edema, and postoperative ileus.


Cardiovascular Complications
• The most common cause of hypotension following surgery is due to hypovolemia which can result from hemorrhage, inadequate volume replacement, and wound drainage. Diuretics given intraoperatively can contribute to post-operative hypovolemia and electrolyte imbalances. Careful monitoring of electrolyte levels and volume status should be performed.
• Monitoring of the patient's heart rate, blood pressure, central venous pressure, urine output, stroke volume, and cardiac output can assist in assessing volume status.
• Crystalloids used for volume replacement in the postoperative period have an intravascular half-life of roughly 20-30 mins compared to colloids such as albumin which have an intravascular half-life of up to roughly 4 hours. Fluid distribution and half-life can be shortened in the postoperative period due to anesthesia, surgery, stress, and inflammation.


Cardiovascular Complications
• Hypotension not responding to volume is commonly the result of vasodilation and decreased SVR. Judicious administration of vasoconstrictive agents such as epinephrine, phenylephrine, ephedrine, vasopressin, or norepinephrine can be used.
• Tachycardia and hypertension often accompany postoperative pain. If vasoactive drugs are needed, treatment commonly includes beta blockers (labetalol, esmolol, metoprolol) and calcium channel blockers (nicardipine, clevidipine).

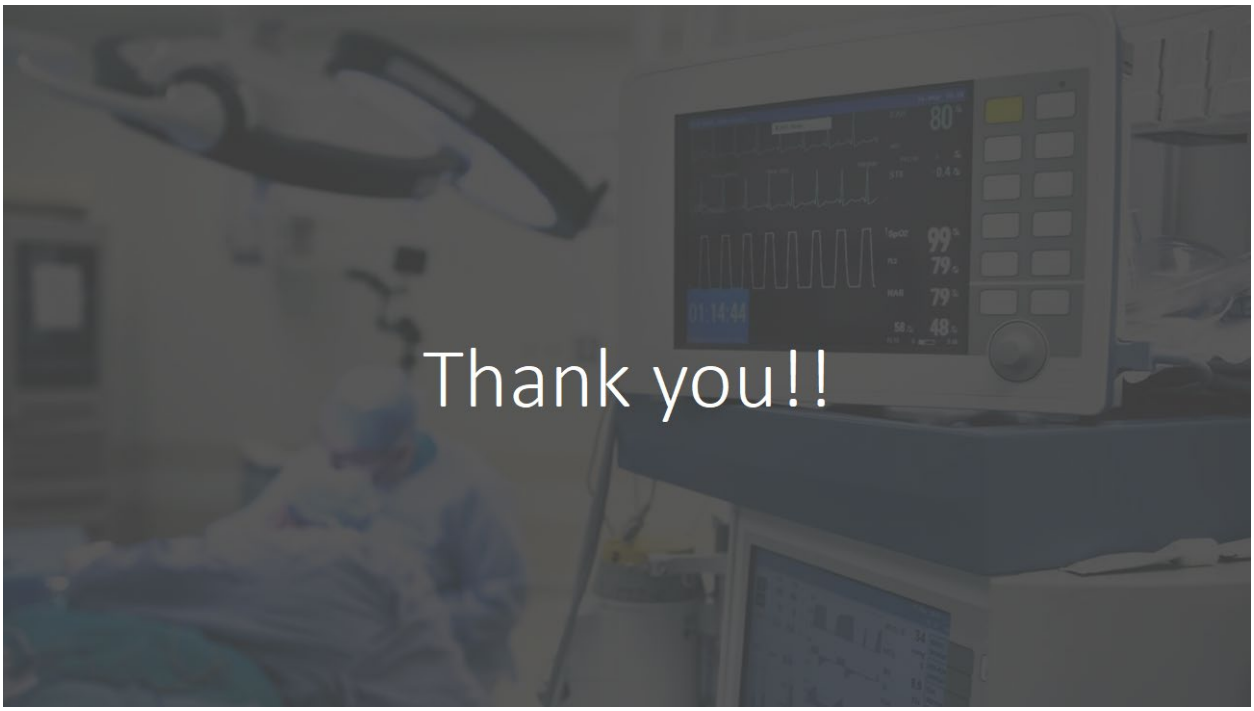

Neurological Assessment
• Frequency of neurological assessments should follow unit protocols.
• The most common causes of delayed awakening include prolonged action of anesthetic drugs, metabolic causes (hypo/hyperglycemia, electrolyte disturbances), neurologic injury (increased ICP, hemorrhage, hyper/hypotension, CVA)
• Differential diagnoses of agitation include: pain, systemic disturbances (hypoxemia, respiratory or metabolic acidosis, hypotension), bladder distension, or a potential surgical complication
• The primary cause of postoperative emergence delirium should always be hypoxemia until proven otherwise.

Hypoxemia-Oxygen Delivery Systems

- Nasal cannula: Flows 1-6 liters/min (FiO2 25-40%)
- Simple face mask: 5-10 liters/min (FiO2 40-60%)
- Non-rebreather: 10-15 liters/min (FiO2 80-95%)
- High flow nasal cannula: up to 60 liters/min (FiO2 21-100%)

Hypothermia

- Anesthetic agents can alter the hypothalamus's ability to regulate body temperature. Neuromuscular blocking drugs prevent shivering to increase body temperature.
- Hypothermia may prolong effect of anesthetic agents so neurologic assessments could be delayed.
- Hypothermia can increase the risk of myocardial ischemia, arrhythmias, bleeding, and impair wound healing.
- Postoperative shivering may increase oxygen consumption as much as fivefold, increase CO2 production, may decrease arterial oxygen saturation, and may be associated with an increased risk of ischemia.
- Methods of rewarming include forced-air warming devices, warming blankets, increasing the room temperature, and warming of IV fluids.



References

- Brooks C. (2015). Critical care nursing in acute postoperative neurosurgical patients. Critical care nursing clinics of North America, 27(1), 33–45.
- Butterworth, J.F., Mackey, D.C., Wasnick, J.D. (2018). Morgan & Mikhail's Clinical Anesthesiology. (6th Edition). McGraw-Hill Education.
- Faraj, J. H., Vegesna, A. R., Mudali, I. N., Khairay, M. A., Nissar, S., Alfarhan, M., Sabir, K., El-Imam, F., Anto, L., & Go, T. (2013). Survey and management of anaesthesia related complications in PACU. Qatar medical journal, 2012(2), 64–70.
- Feil, M., & Irick, N. A. (2016). Principles of Neuro-anesthesia in Neurosurgery for Intensive Care Unit Nurses. Critical care nursing clinics of North America, 28(1), 87–94.
- Hahn, R. G., & Lyons, G. (2016). The half-life of infusion fluids: An educational review. European journal of anaesthesiology, 33(7), 475–482.
- Higginson R., & Parry, A. (2013). Emergency airway management: Common ventilation techniques. British Journal of Nursing, 22(7), 366-371.
- Nagelhout, J. J., & Elisha, S. (2018). Nurse Anesthesia. (6th edition). Philadelphia, PA: Saunders Elsevier.
- Santafé Colomina, M., Arikan Abelló, F., Sánchez Corral, A., & Ferrer Roca, R. (2019). Optimization of the neurosurgical patient in Intensive Care. Medicina intensiva, 43(8), 489–496.

Appendix D

Post-intervention survey

Please answer the following questions on a scale from 1-5. 1: strongly disagree, 2: disagree, 3: neither agree nor disagree, 4: agree, 5: strongly agree:

1. I feel more confident receiving handoff from the anesthesia team on a post-surgical patient	1 2 3 4 5
2. The handoff tool provided will be helpful for future patient transfer of care with the anesthesia team.	1 2 3 4 5
3. I will implement the handoff tool into my future practice	1 2 3 4 5
4. I feel more confident in my airway management skills	1 2 3 4 5
5. I feel more confident in the management of postoperative nausea and vomiting	1 2 3 4 5
6. I feel more confident in managing postoperative cardiovascular complications (hypotension, tachycardia, hypertension)	1 2 3 4 5

7. I feel more confident in my neurological assessment skills and management of delirium	1 2 3 4 5
8. I feel more confident in the postoperative temperature management	1 2 3 4 5
9. The information provided in this project will be beneficial in the care of future patients following anesthesia	1 2 3 4 5

Please list additional feedback you feel pertinent to this DNP project: