PREVENTION INITIATIVE FOR POSTOPERATIVE DELIRIUM

Danielle Lee BSN, RN, SRNA

A Project Report 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
2024

Approved by:

Dr. Terry Wicks	Project Team Leader
Dr. Vadim Korogoda	Project Team Co-Leader
Dr. Wanda Williams	DNP Program Director

Table of Contents

Dedication and Acknowledgments

I would like to thank God for guiding me to this profession and giving me this opportunity to care for others. I would also like to thank my husband and family for the unending support that brought me this far. I specifically would like to recognize my late grandmother who inspired me to pursue higher education to ensure I could always provide for and support myself. I would also like to thank all of the UNC-Greensboro anesthesia faculty who taught and guided me through this journey including Dr. Terry Wicks, Dr. Linda Stone, Dr. Vadim Korogoda, Dr. Stacey Schlesinger, and Dr. Chrissy Kress.

Abstract

Background: With an aging population, postoperative delirium is one of the most common anesthesia complications in those over 60, and 40% of reported cases could have been prevented. Postoperative delirium is associated with a decline in activities of daily living, increased mortality, increased nursing home placement, and increased hospital readmissions and costs. **Purpose:** The purpose of this project was to reduce delirium frequency by providing evidence-based anesthetic recommendations to anesthesia providers by using a best practice advisory flag in the electronic medical record to address the factors that have been shown to increase the risk of delirium development and can be influenced during anesthesia care**. Methods:** This project was a quantitative, cross-sectional design with retrospective data collection. Education was provided to staff using email and flyers. Baseline delirium frequency and post-implementation frequency were obtained through the use of the Epic program SlicerDicer. **Results:** The frequency of delirium before implementation of the best practice advisory was 5.6%, and the frequency after implementation was 4.5%. Although this indicates a slight reduction, this reduction was not indicated to be clinically significant. **Conclusion:** As the elderly population is rising, care should be taken to individualize their plan of care to best minimize the risk of associated complications.

Key Words: postoperative delirium, elderly, anesthesia, pain management, opioid reduction, surgical stress response, Bispectral index, multimodal pain management, deep anesthesia, confusion, altered mental status, disorientation

Background and Significance

The World Health Organization predicts by the year 2030, there will be 1 in 6 people over 60, an increase from 1 billion in 2020 to 1.4 billion (World Health Organization, 2021). This is indicative of healthcare facilities experiencing a larger amount of elderly than ever before, emphasizing the importance of anesthesia providers being proficient in managing and preventing common complications of the elderly. One common complication is postoperative delirium. Delirium has been described as an acute mental state of confusion, decreased awareness, and fluctuating orientation and attention (Cohen et al., 2019). Postoperative delirium is one of the most common anesthesia complications in those over 60, and 40% of reported cases could have been prevented (American Geriatrics Society Expert Panel on Postoperative Delirium in Older Adults, 2015). This fact alone is a reason to make a prevention initiative a priority.

Postoperative delirium has been associated with many post-surgical complications. Multiple studies have concluded postoperative delirium is associated with a decline in activities of daily living, increased mortality, increased nursing home placement, and increased hospital readmissions and costs (Flacker et al., 2000; Hensens et al., 2009). The economic burden of delirium is comparable to diseases such as diabetes and cardiovascular disease (Abdeen et al., 2021). Preventing postoperative delirium will not only reduce the frequency of physical and mental complications but reduce healthcare costs as well.

Unfortunately, preventing postoperative delirium is not simple, but the American Geriatric Society has drafted a list of recommendations to assist clinicians. This guideline includes drugs to avoid such as benzodiazepines, anticholinergics, and histamine-2 receptor antagonists. This guideline also recommends the use of an electroencephalographic monitor, utilizing regional anesthesia, reducing the use of opioids, using multimodal anesthesia, and using

nonopioid drugs for the prevention of postoperative pain (American Geriatrics Society Expert Panel on Postoperative Delirium in Older Adults, 2015). Applying these methods can reduce the incidence of postoperative delirium and hospital costs that result from it.

Purpose

This project aims to introduce an electronic notification with evidence-based anesthetic recommendations to anesthesia providers to reduce incidences of postoperative delirium. A best practice advisory will be implemented to assist in evidence-based practice education with the potential result of reducing the frequency of delirium at a full-service hospital.

Review of Current Evidence

The literature search was conducted utilizing PubMed and CINAHL databases. Over 55 articles were reviewed, and 16 were chosen based on the inclusion criteria. Inclusion criteria included clinically significant results, apparent risk factors for delirium, proven anesthetic techniques to impact the outcome of delirium, and known guidelines to reduce postoperative delirium. Articles with small sample sizes, inconclusive results, out-of-date information, or insignificant conclusions were excluded.

Keywords: postoperative delirium, risk factors for delirium, anesthetic techniques to reduce delirium, anesthetic factors that increase delirium, total intravenous anesthesia and delirium, Beers Criteria

Postoperative delirium is defined as “acute brain dysfunction” following surgery comparable to that of dementia (Oh & Park, 2019). Postoperative delirium has a multidimensional etiology linked to age, frailty, stress, pain, opioid consumption, alcohol abuse, operation time, and gender (Deiner et al., 2014; Li et al., 2021; Subramaniam et al., 2019; Wang et al., 2022). Postoperative delirium is a devastating complication for geriatric patients, leading

to higher hospital costs, a decline in daily function, increased mortality and morbidity, and an increase in hospital readmission (Abdeen et al., 2021). Postoperative delirium may be preventable in up to 40% of cases, emphasizing the need for evidence-based practice changes (American Geriatrics Society Expert Panel on Postoperative Delirium in Older Adults, 2015). In addition to identifying risk factors, specific anesthetic techniques have been shown to reduce incidences of postoperative delirium. Elements highly associated with postoperative delirium include pain, opioids, deep anesthesia, and systemic inflammatory stress responses. This project will focus on reducing risk factors to prevent incidences of postoperative delirium.

Pain

One factor increasing the risk for postoperative delirium is pain. Not only is moderate to severe pain an undesirable experience, but also puts the elderly at high risk for delirium. Regional blocks are an ideal way to reduce postoperative pain and delirium (Li et al., 2021; Wei et al., 2022). Regional anesthesia has been shown to reduce anesthetic requirements, reduce postoperative pain, and blunt the body's systemic inflammatory response to surgical stress (Li et al., 2021; Wei et al., 2022). Compared to intravenous analgesia, recipients of regional anesthesia experienced less pain postoperatively (Li et al., 2021; Wei et al., 2022). Regional techniques are preferable for elderly patients if there are no contraindications.

Multimodal postoperative pain management decreases pain and reduces delirium. Scheduled acetaminophen has been shown to reduce postoperative pain, delirium, and ICU length of stay (Subramaniam et al., 2019). These studies supported the conclusion that reducing postoperative pain can reduce delirium postoperatively (Li et al., 2021; Wei et al., 2022; Subramaniam et al., 2019).

Opioids

Minimizing opioid use has been shown to reduce the incidence of delirium. Excessive opioid administration also increases the risk of addiction, constipation, and respiratory depression (American Geriatrics Society Expert Panel on Postoperative Delirium in Older Adults, 2015). Reducing opioid administration to geriatric patients can enhance post-surgical recovery when alternative pain management strategies are implemented.

Postoperative pain and opioid administration can be reduced significantly by implementing regional anesthetic techniques (Li et al., 2021; Wei et al., 2022). With regional anesthesia techniques, pain tends to be milder and less frequent, and there is a measurable reduction in postoperative opioid requirements. Employing multimodal analgesic techniques reduce postoperative pain and opioid consumption have been shown to reduce the incidence of postoperative delirium (Hu et al., 2021; Subramaniam et al., 2019). Opioid-sparing techniques include the use of scheduled intravenous acetaminophen and dexmedetomidine in combination with total intravenous anesthesia (Hu et al., 2021; Subramaniam et al., 2019).

Stress

Surgical stress and systemic inflammation have been shown to lead to neuroinflammation and cognitive dysfunction (Wei et al., 2022; Hu et al., 2021; Ishii et al., 2016; Deiner et al., 2014; Gracie et al., 2021; Siripoonyothai & Sindhvananda, 2021). Surgical nociception provokes a systemic stress response, releasing free radicals, cortisol, norepinephrine, epinephrine, pro-inflammatory cytokine IL-6, and possibly β-amyloid proteins (Ishii et al., 2016; Hu et al., 2021; Wei et al., 2022; Deiner et al., 2014). B-amyloid proteins are released when apoptosis occurs and are associated with Alzheimer's disease (Deiner et al., 2014; Ishii et al., 2016; Hu et al., 2021; Wei et al., 2022). The stress response can be reduced by a combination of anesthetics such as

dexmedetomidine and total intravenous anesthesia (TIVA) (Hu et al., 2021). The combined anesthetic reduces circulating levels of proinflammatory cytokine IL-6, decreasing inflammation (Hu, et al., 2021; Kotekar et al., 2018). Regional anesthesia reduces pain perception and the stress response to stimuli reducing the release of tumor necrosis factor-α markers associated with inflammation and delirium (Wei et al., 2022). Importantly, elevated levels of cytokine IL-6 correlate with postoperative delirium and frailty (Gracie et al., 2021; Hu et al., 2021).

Cortisol levels are higher intraoperatively and postoperatively when volatile anesthetics are administered; volatile anesthetics are associated with increased apoptosis and β-amyloid proteins (Deiner et al., 2014; Ishii et al., 2016). Both by-products are associated with Alzheimer's disease (Deiner et al., 2014; Ishii et al., 2016). Total intravenous anesthetic techniques have been shown to promote the release of these proinflammatory enzymes. Ketamine reduces postoperative delirium due to its anti-inflammatory, anti-depressant, and neuroprotective effects (Siripoonyothai & Sindhvananda, 2021). Ketamine administration, compared to propofol, produces lower rates of delirium (Siripoonyothai & Sindhvananda, 2021). Stress produces systemic inflammation and stress responses positively correlate with developing postoperative delirium (Siripoonyothai & Sindhvananda, 2021; Deiner et al., 2014).

Deep Anesthesia

The American Geriatrics Society Expert Panel on Postoperative Delirium in Older Adults (2015) recommends limiting anesthesia exposure to reduce the incidence of postoperative delirium. An epidural-general anesthesia combination reduces exposure to sevoflurane up to 18% (Li et al., 2021). Combined anesthetic techniques reduce post-surgical pain, opioid consumption, and volatile anesthetic requirements. This significantly reduces the chances of postoperative delirium but does not eliminate the risk of delirium as it has a multifactorial etiology.

Fortunately, there are elements that can be controlled by the anesthetist to reduce the incidence of delirium.

The administration of dexmedetomidine lowers the requirements of total intravenous anesthesia, sevoflurane, and volatile agents. The depth of anesthesia influencing delirium may be limited by using a Bispectral (BIS) index monitoring device. A BIS allows anesthetists to limit the depth of a patient's anesthesia during maintenance by maintaining a BIS value between 40-60 during general anesthesia (Radtke et al., 2013). When providers avoid deep anesthesia or BIS levels below 40, the incidence of delirium can be reduced (Kim et al., 2015; Radtke et al., 2013). Anesthesia that is too deep is an independent risk factor for postoperative delirium (Kim et al., 2015; Radtke et al., 2013; American Geriatrics Society Expert Panel on Postoperative Delirium in Older Adults, 2015).

Conclusion and Implications

In conclusion, although these studies presented promising results, they also suffered from significant limitations, such as sample bias and implementation of multiple variables and interventions, making it difficult to form a causal relationship between the variables and results. The review of the literature demonstrates that the use of regional anesthesia can reduce postoperative pain, opioid consumption, and stress, all of which are associated with postoperative delirium risks (Li et al., 2021; Wei et al., 2022). Adjuncts such as intravenous acetaminophen postoperatively, and dexmedetomidine use intraoperatively combined with TIVA, have been shown to reduce opioid consumption and delirium in the postoperative period (Subramaniam et al., 2019; Hu et al., 2021). Stress and inflammation are correlated with the frequency of delirium. Use of specific anesthesia interventions such as regional anesthesia, dexmedetomidine, total intravenous anesthesia, and ketamine, the stress and inflammatory

response to surgical stimulus, and delirium can be reduced (Li et al., 2021; Wei et al., 2022; Hu et al., 2021; Deiner et al., 2014; Siripoonyothai & Sindhvananda, 2021). These studies did not produce a consensus pointing towards a simple solution but instead led to further questions regarding delirium's complex origin and development.

Methods

Evidence-Based Practice Model

The IOWA model is the most appropriate for this project. The IOWA model is a model that can be utilized as a guide for the implementation of evidence into current practice. An opportunity for improvement initiates this specific evidence-based practice model. This could be anything from a clinical problem that impacts patients to new evidence or even an imperfect policy. Once an issue is identified, there needs to be a question or purpose stated. At this point, one would determine whether or not this problem is a priority. Ideally, it should be a priority to accumulate interest and participation. A team would then be assembled to further research, evaluate, and synthesize evidence that can be employed to address the problem. With adequate evidence, the team can move on to design practice changes and determine how to execute them. Data would then be collected for further analysis to see if inferences could be made. If the evidence-based change is appropriate, there would be further plans to sustain this intervention for the long term. Finally, results can be disseminated (Iowa Model Collaborative, 2017).

The triggering issue identified was postoperative delirium experienced in patients over the age of 65 after anesthesia. The inquiry was proposed to determine whether or not identifying those patients early on in the perioperative period and implementing anesthetic practice changes would reduce postoperative delirium before discharge at the hospital selected for the project. This effort is a priority because the World Health Organization predicted that by the year 2030,

there will be around 1.4 billion people over 60 years old, which is a drastic increase (World Health Organization, 2021). Delirium is currently one of the most common postoperative complications in the elderly. Up to 40% of those reported cases could have been prevented (American Geriatrics Society Expert Panel on Postoperative Delirium in Older Adults, 2015). The proposed intervention to be an electronic health record Best Practice Advisory for those over the age of 65 undergoing general anesthesia. A method to sustain these practices changes would be developed if this is proven to reduce postoperative delirium numbers. Results could be disseminated once this is a permanent fixture at the facility.

Theoretical Framework

The conceptual framework that meets the needs of this project would be Lewin's Change Theory. This theory has three steps: unfreeze, transition, and freeze. This describes the support of change in practice rather than resistance, often found in changing current practice. The problem of preventative postoperative delirium has been established, so the anesthesia staff will need to become more aware of this current problem and the need for further change. This would be the unfreezing step. Transition is the implementation of the Best Practice Advisory with recommendations for changes to practice for those over 65 years old undergoing general anesthesia. Refreezing is continuing this practice change for further reduction in postoperative delirium frequency. Refreeze involves these changes becoming the new status quo for the facility and continuing on with the improvement of the problem.

Project Design

This DNP project is designed to be a quantitative study. The project will involve a cross-sectional design. The team will obtain retrospective observations of the population over 65 receiving general anesthesia. Data will be collected one month before the implementation of the

intervention and one month after the intervention at a community-based hospital. Then, an association can be examined between outcomes and the intervention. The intervention is a best practice advisory (Appendix A) describing recommended anesthetic practices for preventing postoperative delirium. This project was submitted to the Institutional Review Board (IRB) for approval, and the project was deemed to be a quality improvement project, and there were no direct patient interventions. The best practice advisory provided education to the anesthesia staff, and all data collected was deidentified for patient privacy.

Setting

This community-based hospital is currently the only full-service hospital in its area. Adult surgeries are performed in this setting, with a large percentage being those over the age of 65. Surgery specialties include bariatrics, ENT (Ear, Nose, and Throat), general, plastic, orthopedics, podiatry, ophthalmology, urology, and vascular. Both men and women were included in the data collection, as well as all ethnicities, as long as they are over 65. Data will be collected on anyone receiving general anesthesia who meets the age requirement. The patient population will be those over 65 years old undergoing general anesthesia. Those patients undergoing minor procedures that only require monitored anesthesia care or sedation will be excluded from this project. This facility has no current standard of practice for these patients or consistency in anesthetic practices to reduce delirium frequency.

Sampling

The sampling design is convenience sampling because those selected will be of a target population that meets said criteria at one hospital. Sampling selection criteria involve those over 65 and undergoing a general anesthetic. There is no specific recruitment since data will be

deidentified for privacy purposes as long as the previous criteria are met. The data will be obtained retrospectively using postprocedural delirium diagnostic codes from billing.

Education

A flyer was created with an example of how the best practice advisory will appear in the chart (Appendix B), which was created with the assistance of the epic/information technology team at the specific project hospital for quick reference and education to the anesthesia providers. These flyers were posted for reference in the break room, locker rooms, and bathrooms. An email with a brief outline of the project and a description of the best practice advisory was administered to the anesthesia team to make the evidence behind the advisory clear and available. Emphasis was placed on the significance of the evidence, the potential for a reduction in postoperative delirium, and the potential for a reduction in hospital costs.

Barriers to Design

A barrier encountered is staff needing to acknowledge the recommendations listed in the electronic health record. This was addressed by educating the staff on the current evidence-based recommendations from The American Geriatrics Society with an educational presentation emailed to all the anesthesia staff at the project site. As an easy reference and reminder, efforts to engage and educate staff in utilizing this resource included flyers in the bathroom, breakroom, locker room, and other meeting areas.

Collection of Data

The frequency of delirium was measured over one month directly, which was then reflected in the results and analysis. No specific tool with validity and reliability was used. Data collection was conducted via diagnostic postoperative delirium codes using deidentified data reports from billing with the assistance of the Epic Program SlicerDicer. Diagnostic codes

included delirium, unspecified disorientation, altered mental status, confusion and disorientation, and acute confusion. This allowed for patient privacy and an overall frequency of delirium data collection. The frequency of delirium was measured over one month before the intervention and one-month after the intervention. Informed consent was not required because the practice changes would be up to the individual provider. The project involved only providing recommendations and education. Any information collected was deidentified and unrelated to one patient nor will it have any identifying information. The only information would be age greater than 65 years, undergoing general anesthesia, and average length of stay.

Data Analysis

Data analysis was conducted utilizing descriptive analytics comparing the results from before to after, and the percentage or ratio of delirium observed retrospectively. The level of data will be high due to the ability to produce comparable ratios. Data analysis was conducted with guidance from a quantitative methods expert at UNCG School of Nursing. Microsoft Excel was utilized to determine a correlation between implementing the best practice advisory and reducing the frequency of delirium. A chi-square test was performed to analyze and compare the data collected before implementation and after implementation. This information was then interpreted and transcribed to determine if there was any impact of the education and implementation on delirium. A p-value of <0.05 was considered statistically significant.

Budget, Resources, and Timeline

The budget was around $100 of personal funds for possible printing and ink fees to produce educational resources for staff. The project took a little over six months due to data collection before the intervention, development of a best practice advisory flag, education of staff to reach as many staff as possible, implementation of intervention over a month, data

collection after the intervention is employed, and extensive approval processes for implementation. This project involved utilizing information technology staff, specifically those involved with Epic build to produce and design the "Best Practice Advisory" that appears in the charts of those undergoing general anesthesia at 65 or older.

The project also involved databases to collect the deidentified frequency of delirium in retrospective data. This data was then analyzed with the assistance of a statistician for analysis, presentation, and correlation to determine inferences. The team worked alongside technology support staff to develop the flag that appeared in electronic medical records. The team also obtained further education on obtaining specific data from charts to analyze the project results with assistance from information technology support staff.

Results

Using the SlicerDicer program for data measurement, 1,513 total anesthetic records were reported for patients 65 years of age and older in the pre-intervention period, and 725 (48%) were general anesthetics (Table 1) out of those 725 patients who received general anesthesia, 41 (5.6%) of those developed delirium, confusion, or disorientation (Table 1). In the month following implementation, the total number of anesthetic records in those 65 and older was 1,489, and general anesthesia was administered to 737 (49%) of those patients. After implementation, of the 737 patients who received general anesthesia, 33 (4.5%) of those patients developed delirium, confusion, or disorientation (Table 1). Although there was a slight reduction in the percentage of those who developed delirium in the postoperative period, the chi-square test indicated the values did not represent a significant change. The chi-square test resulted in a p-value of 0.352. This is interpreted as insignificant because the benchmark for clinical significance is <0.05. The average length of hospital stay was also measured in those two

timeframes. The average length of stay before implementation was around five days, and after, it was four days on average. This data was also found to be insignificant with a p-value of 0.739.

Categories	*Number of Cases*	
	Pre-Intervention	**Post-Intervention**
Total Anesthetic Records ≥65 y/o	1,513	1,489
General Anesthetic Cases ≥65 y/o	725	737
Incidences of Delirium	41	33

Table 1: Frequency of Delirium Comparison

Discussion and Clinical Implications

As recognized in the results, postoperative delirium continues to be an issue in 4-6% of patients at the project facility over the age of 65 who received general anesthesia. As previously mentioned in the literature review, up to 40% of postoperative delirium cases can be prevented (American Geriatrics Society Expert Panel on Postoperative Delirium in Older Adults, 2015). Postoperative delirium is a costly condition that can leave a lasting impact on the patients who suffer from it. Postoperative delirium can result in increased cognitive decline, increased length of hospital stay, increased morbidity and mortality, as well as increased hospital costs (Abdeen et al., 2021). Reducing this condition after anesthesia will benefit those patients by reducing the risk of the associated complications, and can also assist in hospital efficiency and reduce hospital costs.

In the cases where delirium was measured, we cannot state the causation of the delirium cases as delirium is a multifactorial condition. Factors potentially impacting the development of delirium include stress, pain, opioids, medication side effects, excessive anesthesia, etc. Anesthesia delivery by providers is complex and impacted by providers' training, environment,

and culture. Education was provided to all anesthesia providers through the use of a best practice advisory in the electronic health record. Still, it was found that practices were not specifically changed or were not changed in a significant way to reduce postoperative delirium. As stated in the results, there was a slight reduction in the percentage of postoperative delirium after general anesthesia, but after data analysis, this change was noted as clinically insignificant. Although the intervention did not prove clinical significance, there is still a benefit to individualizing one's anesthesia to benefit the patient best and improve their recovery and outcomes.

The key finding of this project is that postoperative delirium continues to be an issue and anesthesia providers are responsible for staying up to date on current evidence-based care practices. These care practices include ensuring the most effective pain management for patients, such as regional anesthesia to provide long-acting pain relief, reducing the effects of surgical stress, and reducing opioid consumption, which has complications such as respiratory depression, constipation, and risk for addiction (American Geriatrics Society Expert Panel on Postoperative Delirium in Older Adults, 2015). Reducing stress and unnecessarily deep anesthesia can also benefit patients' outcomes and recovery.

Strength, Challenges, and Limitations

Many strengths and noticeable limitations of this project influenced data collection and, therefore, the results. The strength of this project is the continuation of education and recommendations to providers on a case-by-case basis via an electronic best practice advisory that appears in the charts of patients at risk for postoperative delirium. Other strengths of this project include the project site, which regularly cares for patients over the age of 65 years. The type of data collected also allowed for a suitable sample size to provide more accurate data for analysis as opposed to a smaller sample size that may give a less accurate outlook.

Numerous challenges and limitations accompanied these strengths. Although these recommendations were provided to anesthesia staff, alert fatigue is a common problem among healthcare providers. It can lead to irritation, alert overstimulation, and alerts perceived as irrelevant, which causes the alert to become ineffective at promoting safety and education as designed (Bhakta et al., 2019). Even though the education was provided and recommendations were readily available in the chart, practitioners will practice anesthesia how they see fit. Other limitations include time restraints, unexpected staffing patterns, and the need to acknowledge the best practice advisory. After implementation, more than one month's data collection may have been needed to provide the best overall picture of the response to the best practice advisory.

This period was also a rare time when the staff was undergoing a significant transition, and many of the staff originally educated and briefed on the best practice advisory transitioned to other facilities during data collection periods. This could have significantly reduced the alert's effectiveness as some providers may not have been aware of the best practice advisory and its purpose. Other staff may have just been resistant to change. Many anesthesia provider preferences vary based on training, culture, and experience. With this being said, in my project partner's research, it was noted that there was not a statistically significant difference in the number of medications administered that have the potential side effect of postoperative delirium. It was also noted that there was not a significant increase in the medications advised to be added (i.e., dexmedetomidine) to promote a reduction in opioids either. This indicates that the recommendations were potentially ignored and not utilized as there was no clinically significant change in practice. As a result, the frequency of delirium measured was not drastically changed either.

Recommendations for Future Study

Recommendations for future projects include a lengthier collection of data that involves six months before and six months after implementation. Future projects could also focus on more educational sessions to assist with changing staff patterns. Another opportunity would be surveying the practicing CRNAs, anesthesiologists, and anesthesiology assistants on their knowledge of postoperative delirium prevention and if the education provided changed practice. More insight into the practitioners' choices could guide further improvement of the quality improvement project to meet the specific needs of the staff. Receiving open-ended feedback would also be invaluable.

Conclusion

This project aimed to reduce the frequency of delirium by providing anesthetic recommendations with a best practice advisory in the electronic medical records of patients at high risk for developing delirium postoperatively. Pain, overuse of opioids, stress, and unnecessarily deep anesthesia can all impact a patient's risk for the development of postoperative delirium. Recommendations were provided to reduce pain, opioids, stress, and too-deep anesthesia including regional anesthesia, multimodal techniques for pain management, and the use of Bispectral index monitors. The best practice advisory implemented to improve delirium and outcomes did not produce clinically significant results, potentially due to significant limitations. In conclusion, more projects need to be done to implement these practices while successfully overcoming this project's challenges and limitations. Overall, a patient's anesthetic plan should be tailored to the patient, and their risks should be considered, as it is the responsibility of anesthesia providers to minimize the adverse effects of the anesthesia provided.

References

Abdeen, A., Cooper, Z., Earp, B., Fond, T. G., Gou, R. Y., Hshieh, T. T., Inouye, S. K., Jones, R. N., Lange, J., Leslie, D. L., Marcantonio, E. R., Schmitt, E. M., & Travison, T. G. (2021). One-year medicare costs associated with delirium in older patients undergoing major elective surgery. *JAMA Surgery. 156*(5), 430-442. doi:10.1001/jamasurg.2020.7260

American Geriatrics Society Expert Panel on Postoperative Delirium in Older Adults (2015). American Geriatrics Society abstracted clinical practice guideline for postoperative delirium in older adults. *Journal of the American Geriatrics Society*, *63*(1), 142–150. https://doi.org/10.1111/jgs.13281

Bhakta, S. B., Colavecchia, A. C., Haines, L., Varkey, D., Garey, K. W. (2019). A systematic approach to optimize electronic health record medication alerts in a health system. *American Journal of Health-System Pharmacy. 76*(8), 530-536. https://doi.org/10.1093/ajhp/zxz012

Cohen, N. H., Eriksson, L. I., Fleisher, L. A., Gropper, M. A., Leslie, K., Miller, R. D., & Wiener-Kronish, J. P. (2019). *Millers Anesthesia* (9th ed., pp. 2604). Elsevier.

Deiner, S., Lin, H. M., Bodansky, D., Silverstein, J., & Sano, M. (2014). Do stress markers and anesthetic technique predict delirium in the elderly? *Dementia & Geriatric Cognitive Disorders, 38(*5/6), 366-374. https://doi-org.libproxy.uncg.edu/10.1159/000363762

Flacker, J. M., Marcantonio, E. R., Michaels, M., Resnick, N. M. (2000). Delirium is independently associated with poor functional recovery after hip fracture. *Journal of the*

American Geriatrics Society, 48(6), 618-624. https://doi.org/10.1111/j.1532 5415.2000.tb04718.x

Gracie, T. J., Caulfield-Noll, C., Wang, N. Y., & Sieber, F. E. (2021). The association of preoperative frailty and postoperative delirium: A meta-analysis. *Anesthesia and Analgesia, 133*(2), 314-323. https://doi.org/10.1213/ANE.0000000000005609

Goins, A. E., Smeltz, A., Ramm, C., Strassle, P. D., Teeter, E. G., Vavalle, J. P., & Kolarczyk, L. (2017). General anesthesia for transcatheter aortic valve replacement: Total intravenous anesthesia is associated with less delirium as compared to volatile agent technique. *Journal of Cardiothoracic and Vascular Anesthesia, 32(*4), 1570-1577. Doi: 10.1053/j.jvca.2017.12.018

Hensens, A. G., Koster, S., van der Palen, J. (2009). The long-term cognitive and functional outcomes of postoperative delirium after cardiac surgery. *The Annals of Thoracic Surgery, 87*(5), 1469-1474. https://doi.org/10.1016/j.athoracsur.2009.02.080

Hu, J., Zhu, M., Gao, Z., Zhao, S., Fen, X., Chen, J., Zhang, Y, Maze, M. (2021). Dexmedetomidine for prevention of postoperative delirium in older adults undergoing oesophagectomy with total intravenous anesthesia: A double-blind, randomised clinical trial. *European Journal of Anaesthesiology, 38*(1), S9-S17. doi: 10.1097/EJA.0000000000001382

Iowa Model Collaborative. (2017). Iowa model of evidence-based practice: Revisions and validation. *Worldviews on Evidence-Based Nursing, 14*(3), 175-182. doi:10.1111/wvn.12223

Ishii, K., Makita, T., Yamashita, H., Matsunaga, S., Akiyama, D., Toba, K., Hara, K., Sumikawa, K., & Hara, T. (2016). Total intravenous anesthesia with propofol associated with a lower rate of postoperative delirium in comparison with sevoflurane anesthesia in elderly patients. *Journal of Clinical Anesthesia, 33*, 428-431. https://doi-org.libproxy.uncg.edu/10.1016/j.clinane.2016.04.043

Li, Y. W., Li, H. J., Li, H. J., Zhao, B. J., Guo, X. Y., Feng, Y., Zuo, M. Z., Yu, Y. P., Kong, H., Zhao, Y., Huang, D., Deng, C. M., Hu, X. Y., Liu, P. F., Li, Y., An, H. Y., Zhang, H. Y., Wang, M. R., Wu, Y. F., Wang, D. X., Sessler, D. I. (2021). Delirium in older patients after combined epidural-general anesthesia or general anesthesia for major surgery: A randomized trial. *Anesthesiology*, *135(*2), 218-232. Doi: 10.1097/ALN.0000000000003834.

Kim, D. J., Kim, S. H., So, K. Y., Jung, K. T. (2015). Effects of dexmedetomidine on smooth emergence from anesthesia in elderly patients undergoing orthopaedic surgery. *BMC Anesthesiology, 15(*1), 1-11. https://doi-org.libproxy.uncg.edu/10.1186/s12871-015-0127-4

Kotekar, N., Shenkar, A., & Nagaraj, R. (2018). Postoperative cognitive dysfunction - current preventive strategies. *Clinical interventions in aging*, *13*, 2267–2273. https://doi.org/10.2147/CIA.S133896

Oh, S.T. & Park, J.Y. (2019). Postoperative delirium. *Korean Journal of Anesthesiology, 72*(1), 4-12. doi: 10.4097/kja.d.18.00073.1.

Radtke, F. M., Franck, M., Lendner, J., Kruger, S., Wernecke, K. D., & Spies, C. D. (2013). Monitoring depth of anaesthesia in a randomized trial decreases rate of postoperative delirium but not postoperative cognitive dysfunction. *British Journal of Anaesthesia*, 110(S1), i98-i105. Doi: 10.1093/bja/aet055

Siripoonyothai, S., & Sindhvananda, W. (2021). Comparison of postoperative delirium within 24 hours between ketamine and propofol infusion during cardiopulmonary bypass machine: A randomized controlled trial. *Annals of Cardiac Anaesthesia, 24*(3), 294-301. https://doi-org.libproxy.uncg.edu/10.4103/aca.ACA_85_20

Subramaniam, B., Shankar, P., Shaefi, S., et al. (2019). Effect of intravenous acetaminophen vs placebo combined with propofol or dexmedetomidine on postoperative delirium among older patients following cardiac surgery: The DEXACET randomized clinical trial. *Journal of the American Medical Association, 321*(7), 686-696. Doi:10.1001/jama.2019.0234

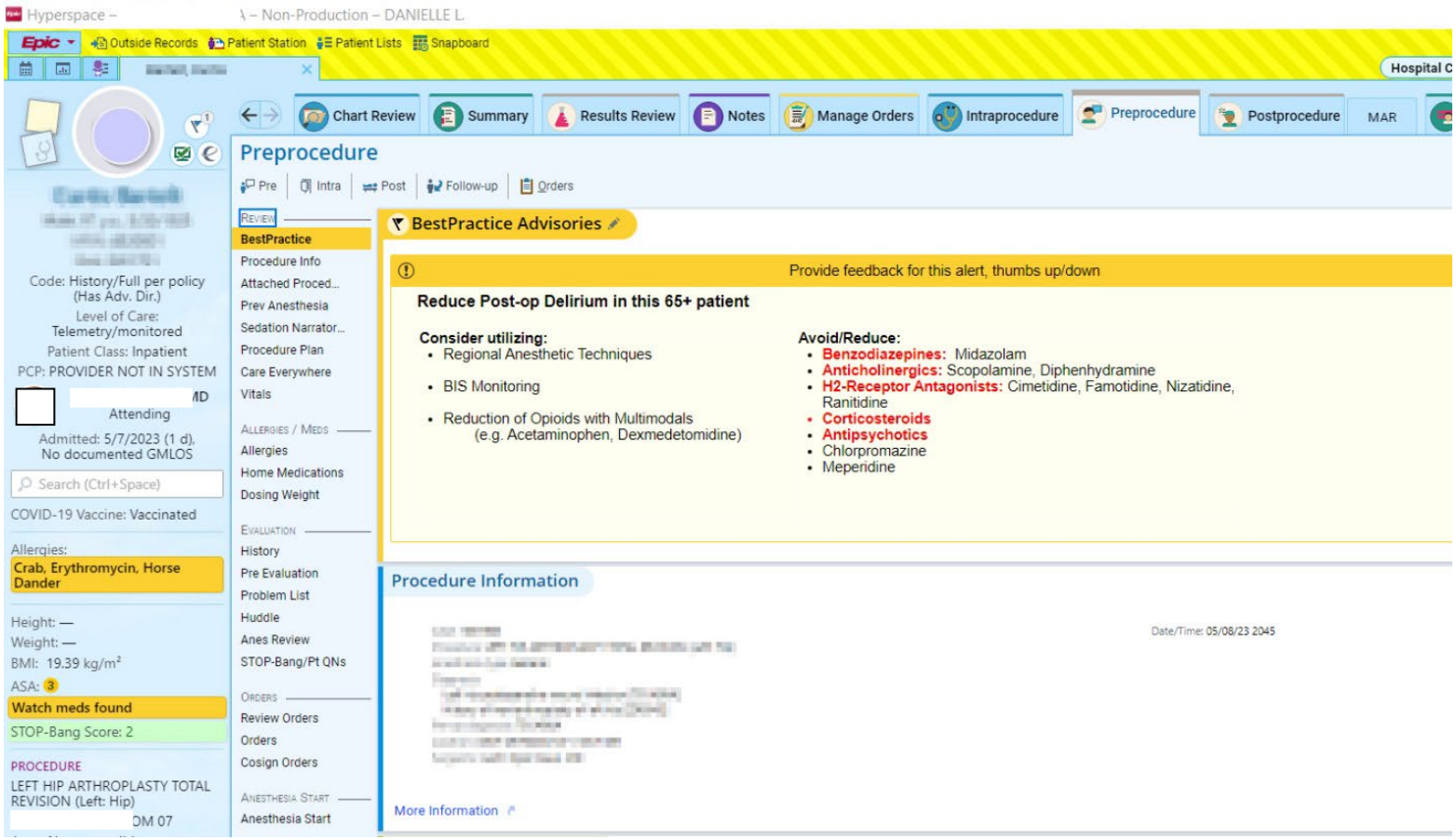
Wang, X., Yu, D., Du, Y., & Geng, J. (2022). Risk factors of delirium after gastrointestinal surgery: A meta-analysis. *Journal of Clinical Nursing*, 00, 1– 11.

https://doi-org.libproxy.uncg.edu/10.1111/jocn.16439

Wei, W., Zheng, X., Gu, Y., Fu, W., Tang, C., & Yao, Y. (2022). Effect of general anesthesia with thoracic paravertebral block on postoperative delirium in elderly patients undergoing lobectomy: A randomized-controlled trial. *BMC Anesthesiology, 22*(1), 1-10. https://doi-org.libproxy.uncg.edu/10.1186/s12871-021-01532-1

World Health Organization. (2021, October 4). *Ageing and Health.* https://www.who.int/newsroom/fact-sheets/detail/ageing-andhealth#:~:text=Every%20country%20in%20the%20world,in%202020%20to%201.4%2billion.

Appendix A


Hyperspace –
– Non-Production – DANIELLE L.
Epic
Outside Records
Patient Station
Patient Lists
Snapboard
Hospital C
Chart Review
Summary
Results Review
Notes
Manage Orders
Intraprocedure
Preprocedure
Postprocedure
MAR
Preprocedure
Pre
Intra
Post
Follow-up
Orders
Code: History/Full per policy (Has Adv. Dir.)
Level of Care: Telemetry/monitored
Patient Class: Inpatient
PCP: PROVIDER NOT IN SYSTEM
Attending
Admitted: 5/7/2023 (1 d), No documented GMLOS
Search (Ctrl+Space)
COVID-19 Vaccine: Vaccinated
Allergies:
Crab, Erythromycin, Horse Dander
Height: —
Weight: —
BMI: 19.39 kg/m²
ASA: 3
Watch meds found
STOP-Bang Score: 2
PROCEDURE
LEFT HIP ARTHROPLASTY TOTAL REVISION (Left: Hip)
REVIEW
BestPractice
Procedure Info
Attached Proced...
Prev Anesthesia
Sedation Narrator...
Procedure Plan
Care Everywhere
Vitals
ALLERGIES / MEDS
Allergies
Home Medications
Dosing Weight
EVALUATION
History
Pre Evaluation
Problem List
Huddle
Anes Review
STOP-Bang/Pt QNs
ORDERS
Review Orders
Orders
Cosign Orders
ANESTHESIA START
Anesthesia Start
BestPractice Advisories
Provide feedback for this alert, thumbs up/down
Reduce Post-op Delirium in this 65+ patient
Consider utilizing:
• Regional Anesthetic Techniques
• BIS Monitoring
• Reduction of Opioids with Multimodals (e.g. Acetaminophen, Dexmedetomidine)
Avoid/Reduce:
• Benzodiazepines: Midazolam
• Anticholinergics: Scopolamine, Diphenhydramine
• H2-Receptor Antagonists: Cimetidine, Famotidine, Nizatidine, Ranitidine
• Corticosteroids
• Antipsychotics
• Chlorpromazine
• Meperidine
Procedure Information
Date/Time: 05/08/23 2045
More Information

Appendix B

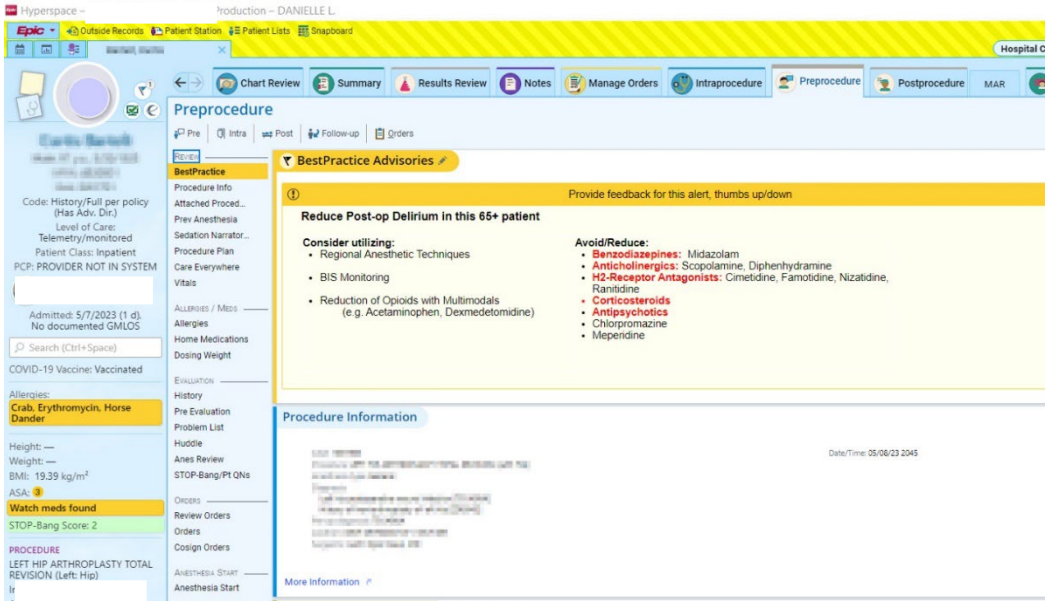
OSTOPERATIVE DELIRIUM BEST PRACTICE ADVISORY

Why are we concerned about delirium?

- The World Health Organization predicts that by the year 2030, there will be 1 in 6 people over the age of 60, which is an increase from 1 billion in 2020 to 1.4 billion.
- Postoperative delirium is one of the most common anesthesia complications in those over 60, and 40% of reported cases could have been prevented!
- Postoperative delirium is associated with prolonged recovery time, longer hospital admissions, worse outcomes, reduced functional recovery with cognitive decline, and increased hospital cost.
- Research has determined that the economic burden of delirium is comparable to diseases such as diabetes and cardiovascular disease.

Goal: Reduce the frequency of postoperative delirium related to general anesthesia administration in patients over the age of 65 by providing an educational best practice advisory alert within the EMR for anesthesia providers.

Release in September 2023



The highlighted row will indicate if your patient is at higher risk for postoperative delirium. Under the advisory, recommendations for best practice will appear.

UNC GREENSBORO
School of Nursing

DNP Project for Megan Danneker, SRNA and Danielle Lee, SRNA
If questions, feel free to email us!