

**Implementation of a Best Practice Advisory to Reduce Postoperative Delirium Rates in  
Elderly Surgical Patients**

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## **Abstract**

There is a growing proportion of elderly patients (sixty-five years and older) in the United States using a disproportionate amount of healthcare resources. The elderly population is at the highest risk for postoperative delirium which can be associated with numerous unfavorable outcomes for patients, families, and our healthcare system. There are many medications given during anesthesia care that can increase the likelihood of patients experiencing post operative delirium. This project aimed to create a tool to help remind anesthesia providers of these medications and their impact. With the implementation of the tool and education, there was a significant reduction in the amount of corticosteroid administered. This result indicates that a best practice advisory can be helpful for anesthesia providers to tailor their care to meet each patient's needs.

## **Background and Significance**

In the U.S., a growing proportion of elderly patients use a disproportionate amount of healthcare resources. Generally, this population needs more healthcare resources in the form of medications, hospital admissions, and surgical interventions. The elderly population is at the highest risk for postoperative delirium, with prevalence up to 50% (Donovan, 2020). Delirium is described by Sultan as an acute, confused state, in which a patient has reduced awareness or clarity of their surroundings, an alteration in attention, disorganized thinking, disrupted psychomotor activity and abnormal sleep and wakefulness cycles (Sultan, 2010). As anesthesia providers, it is imperative we use anesthetic techniques and medications that will optimize patients' recovery from anesthesia while avoiding medications that could contribute to delirium.

Postoperative delirium is associated with prolonged recovery, longer hospital admissions, worse outcomes and reduced functional recovery with cognitive decline (Donovan, 2020). These

factors make postoperative delirium costly and lead to poor outcomes for already fragile patients. The American Geriatric Society (AGS) Beers Criteria identifies medications that should be avoided in elderly (ages 65 and older) patients. Anesthesia providers should use the criteria to ensure they are tailoring practices to meet this population's needs. This includes avoiding administering potentially harmful medication to elderly patients. The AGS Beers Criteria is a simple reference tool for providers to verify they are administering appropriate medications (Fixen, 2019).

Implementing a best practice advisory (BPA) serves as a reminder in the electronic health record. This is helpful to anesthesia providers who administer anesthesia to numerous elderly patients daily. An automatically populating best practice advisory can improve patient outcomes by presenting important information once a particular patient population has been identified (Alagiakrishnan et al., 2019). The advisory would populate in the electronic medical record, highlighting the "Best Practice" tab in all patient charts that are age sixty-five and older. The advisory would encourage the provider to use best practices regarding postoperative delirium. This advisory would also be paired with education about best practices before implementation in the electronic medical record.

Providing education and integrating a best practice advisory into the electronic medical should encourage providers to avoid medications outlined by the AGS Beers Criteria. In turn, this should reduce postoperative delirium in elderly patients and improve outcomes.

### **Search Strategy**

A literature search of the database PubMed was conducted using the following search terms and Boolean operators; "postoperative" "delirium" "elderly". This search matched thirty-eight articles. The ten articles most relevant to the PICOT question were selected from this

search. A second search of the “CINAHL” database using the Boolean operators “delirium” “medications” and “perioperative” generated an five additional articles. Inclusion criteria included studies of surgical patients undergoing general anesthesia, ages sixty-five and older. Exclusion criteria included patients not receiving general anesthesia and those under sixty-five years old.

### **Purpose**

In the U.S. there is a growing elderly population utilizing a disproportionate volume of healthcare resources (Donovan, 2019). This cohort is prescribed more medications, require more frequent hospital admissions, and has more frequent surgical interventions. Elderly patients are at the highest risk for postoperative delirium, with prevalence up to 50% (Donovan, 2020).

Delirium is described as an acute confused state, in which a patient has reduced awareness or clarity of their surroundings, alteration in their attention, disorganized thinking, disrupted psychomotor activity, and abnormal sleep and wakefulness cycles (Sultan, 2010). Anesthesia providers should be encouraged to use anesthetic techniques and medications to optimize patients’ recovery from anesthesia and avoid medications that contribute to delirium.

Postoperative delirium is associated with prolonged recovery times, extended hospital stays, increased healthcare costs, worse outcomes, reduced functional recovery, and cognitive decline (Donovan, 2020). Implementation of specific interventions could reduce and/or prevent delirium, leading to lower costs and improved patient outcomes.

The American Geriatric Society (AGS) developed the Beers Criteria, which includes guidelines for medications to avoid in elderly patients. Anesthesia providers should apply the criteria to ensure they tailor practices to limit the administration of potentially harmful

medications. The AGS Beers Criteria is a reference tool for providers to verify they are administering appropriate medications (Fixen, 2019).

Implementing a “Best Practice” advisory in the electronic health record could capture the attention of providers who administer anesthesia daily to elderly patients. An automatically populating “Best Practice” advisory could improve patient safety, serving as a reminder of best practices in a vulnerable population (Alagiakrishnan et al., 2019). Integrating this alert into the electronic medical record would notify providers their patient is at risk for postoperative delirium. This would encourage avoidance of the drug classes outlined by the AGS Beers Criteria and reduce postoperative delirium in elderly patients.

### **Review of Current Evidence**

Many medications anesthesia providers commonly administer are linked to postoperative delirium in elderly patients. There is strong evidence to support reducing administration of these medications in delirium-prone patients. These medications are identified by The American Geriatric Society as potentially inappropriate medications for elderly patients (Fixen, 2019). Patients having two or more of the following criteria should be considered at high risk for developing postoperative delirium: age greater than sixty-five years, chronic cognitive decline or dementia, poor vision or hearing, severe illness, or the presence of infection (Burfeind, 2021). It is important to avoid the use of anticholinergics, H2 blockers, benzodiazepines, opioids, and antipsychotics when caring for these patients (Elkassabany, 2009).

Delirium prolongs hospital stays, is linked to worse outcomes, and increases mortality (Elkassabany, 2009). Delirium causes problems in the acute postoperative period and causes detrimental long-term effects. Patients may have increased hospital length of stay and may need

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a higher level of care postoperatively. Medications administered intraoperatively are an avoidable cause of delirium. Anesthesia providers should limit the administration of medications linked to causing delirium and choose medications shown to reduce the occurrence of delirium (Elkassabany, 2009; Huyan, 2019).

In contrast, Dexmedetomidine (Precedex) has been found to reduce the risk of postoperative delirium (Huyan, 2019). Precedex improves sleep quality in the postoperative period, linking it to reducing delirium. Precedex has analgesic properties, and the reduction of pain decreases the incidence of delirium (Huyan, 2019).

Delirium prevention requires multidisciplinary collaboration. The role anesthesia providers play is fundamental. Focus on medication administration intraoperatively could make a significant improvement in postoperative outcomes.

Published evidence supports using a computerized clinical alert in the electronic health record to reduce inappropriate medication administration to elderly patients (Adeola, 2018). Delirium can be prevented by reducing the administration of inappropriate medications (Donovan, 2020). Implementing an advisory would encourage providers to be more aware of the harm the medications can cause. Along with education, the advisory would serve as a reminder and could contribute to reducing postoperative delirium in the elderly.

### **Conceptual Framework/Theoretical Model**

The Johns Hopkins Practice Model was used to guide the project. The model is based on improving healthcare practice. The first step is proposing a question or issue, using evidence to improve practice, and examining if outcomes are improved after implementation (Dang &

Dearholt, 2018). Following this model, the project aimed to improve healthcare practice by focusing on postoperative delirium.

The first step in the model is inquiry, which was done by inquiring about postoperative delirium's impact on patients, families, and our healthcare system. A literature review was performed to gain current information. This led to researching best practices and finding evidence. Evidence was found for reducing the use of medications listed in the Beers Criteria. An attempt to improve practice was made by implementing a best practice advisory.

The project aimed for anesthesia providers to reduce perioperative administration of medications meeting the Beers Criteria. A best practice advisory was embedded in the electronic medical record and was intended to reduce postoperative delirium in elderly patients undergoing general anesthesia. A chart review was done before and after implementation to examine effectiveness. Based on reflection, the final step of the Johns Hopkins Model occurred after data collection. Reflection led to further inquiry about the project's limitations and what could be done to further the success of this or future projects.

## **Methods**

The project conducted was quantitative and included data from chart review performed before and after providing education and implementing a best practice advisory (BPA) in the electronic medical record, EPIC. The chief CRNA granted site approval at the selected hospital. This project was deemed exempt from both the university and site IRB. The selected hospital had a Clinical Decision Support Committee, and a request was submitted for permission to implement a BPA in EPIC. The Committee agreed to include a passive best practice alert in



EPIC electronic. The original alert can be seen in *Figure 1*; a screenshot of the implemented final alert is pictured in *Figure 2*.

The starting framework for the alert was created and included in a project implemented by SRNAs at the University of Pennsylvania. See *Figure 1* (Warner et al., 2019). The alert was then tailored to the criteria approved by the Clinical Decisions Committee at the selected hospital.

The BPA was created to be active in charts of surgical patients aged sixty-five years and older, as this population is considered “high risk” for developing postoperative delirium. The intention behind the advisory was to encourage providers to avoid administration or reduce dosage of benzodiazepines, anticholinergics, H2-receptor antagonists, corticosteroids, and antipsychotics. It was also intended to promote the use of regional anesthesia, decrease opioids with other multimodal medications, such dexmedetomidine and acetaminophen, and encourage bispectral index (BIS) use.

Before the BPA went live in EPIC, education was provided in handout form to notify CRNAs about the new alert. To engage CRNAs to read the education via the handouts, a basket of snacks with the handouts was provided in the breakroom frequented by CRNAs throughout the day. In addition, the educational materials were emailed to each CRNA. The education was available for one week before the advisory was activated. An electronic medical record review was conducted before and after implantation. Data analysis was performed to determine if the alert implementation changed medication administration by CRNAs.

The chief CRNA at the selected hospital granted permission for the project’s implementation. The chief provided the contact person for the Clinical Decision Support

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Committee, which met periodically to discuss various clinical topics. At this meeting, the idea for the project was discussed with the team. Background and significance were discussed as well as the implementation of a Best Practice alert/advisory. The team ultimately agreed that this project was significant and could improve patient care. The Committee declined to implement an active “pop-up” type of alert, for fear of alert fatigue but agreed a passive, “Best Practice Advisory” would be acceptable.

This project required minimal funding. The anticipated cost was a snack basket to encourage provider engagement, and for paper/printing of educational handouts. The project’s cost was small and could be financed by the PI. No other financial support was needed.

### **Design**

Anesthesia providers were informed of the best practice advisory via email one week before implementation. Secondly, a brief educational pamphlet and snack basket were provided in the breakroom, with flyers posted outside the anesthesia office, locker room, and near computer workstations.

The design for the best practice alert was modeled after an alert previously implemented by DNP students in Pennsylvania (See *Figure 1*) (Warner et al., 2019). The advisory’s purpose was to make the anesthesia provider aware of the patient’s risk of postoperative delirium, remind them of medications to avoid, and offer recommendations to facilitate better outcomes.

### ***Translational Framework***

The translational framework used to guide this project was Lewin’s Change Model. This model is commonly implemented for projects requiring clinical practice change to take place. The model is based on unfreezing, change, and refreezing (Hussain et al., 2018). This project

sought to follow the model in the following ways: unfreezing was performed using impactful education about the need for change and why the project was necessary. The change would then be more likely to happen following this education and to see the passive alert in patient charts. Once the practice changes happen, providers will see improved outcomes, which will enforce refreezing, meaning that the providers will have adopted and continued to use a new way of practicing.

### ***Population***

Inclusion criteria for sampled patients were those aged sixty-five or older, undergoing general anesthesia at the selected hospital. Chart review was conducted by randomly selecting 100 patient charts that met the inclusion criteria before the BPA was implemented and sampling another 100 patient charts meeting the same inclusion criteria after the BPA was in effect. Exclusion criteria included patients not undergoing general anesthesia or general anesthesia administered to patients younger than age sixty-five.

### ***Setting***

The hospital where this project was implemented was in southeast North Carolina. It has 208 acute care beds. The surgery department has ten operating rooms, two minor procedure rooms, and cystoscopy and endoscopy suites. In 2021, this hospital performed 2,952 inpatient surgeries and 6,490 outpatient surgeries. This site was selected because of the receptivity of the chief CRNA and staff to promoting education and best practice interventions. The small size of this hospital made it feasible to meet with information support and create a BPA in EPIC in a timely manner. Additionally, the hospital is associated with other hospitals in the area, including

a large, level 1 trauma hospital. The intent was to implement this project on a larger scale in the future by including other associated hospitals.

### **Project Implementation**

Implementation was contingent on permission from the Clinical Decision Support Committee. In April 2023, a meeting was conducted with the committee. At the meeting, information about the project was presented and discussed. The committee members agreed the intervention was valuable and could be implemented. It was decided that a passive best practice advisory be utilized. This would flag charts, highlighting that there was a “Best Practice Advisory” for the patient. The user would need to click the highlighted tab to view the advisory. The advisory appeared as in figure 2. (See figure 2). An informational email was sent out to all CRNAs at the facility to notify them of the coming advisory. Also, written information was distributed in the form of a physical flyer. The flyers were placed in the anesthesia breakroom, alongside a basket of snacks, to encourage providers to take notice of the information. Additional flyers were posted near workstations and in the locker room.

After the information was available for an entire week, the advisory went live in EPIC. Three weeks after advisory implementation, a chart review was conducted. Using fifty patient charts, medication administrations that met the Beers Criteria were quantified, pre- and post-implementation of the BPA. The medications quantified were narrowed to the most commonly administered medications meeting Beers Criteria and dexmedetomidine, for comparison, which was recommended to use reduce the incidence of delirium.

### **Data Analysis**

Data was collected from fifty patients that met inclusion criteria pre-intervention and fifty patients post-intervention. Data was randomly collected from the operating room schedule,

selecting patients greater than and equal to sixty-five years old from three weeks before the best practice advisory went live. Similarly, another fifty patients were selected over three-weeks after the best practice advisory was available in the electronic medical record.

The number of administrations of midazolam, diphenhydramine, dexamethasone and dexmedetomidine were tallied. A statistician was consulted on how to analyze this data best. A Chi-square test was done to determine if the results were statistically significant.

### **Results**

Four of the medications listed explicitly in the best practice advisory were examined as data. Three of the medications are from the Beers criteria, midazolam, diphenhydramine, and dexamethasone and the fourth, dexmedetomidine, was listed as an encouraged medication linked to delirium reduction.

While there was a reduction in the number of administrations of midazolam, it was not statistically significant. There was no difference in the administration of diphenhydramine. There was a significant reduction in dexamethasone. The amount of dexmedetomidine was included in the results to see if there was an increase in administration as the alert recommended using this medication as an adjunct to reduce opioids. There was a slight decrease in the number of times dexmedetomidine was administered.

Table 1.

	Preintervention administrations (out of 50)	Postintervention administrations (out of 50)	P-value
Midazolam	26	23	0.616
Diphenhydramine	4	4	1
Dexamethasone	45	14	0.004
Dexmedetomidine	10	9	0.871

### Discussion

The project's purpose was to implement a BPA and determine if it reduced the number of administrations of medications listed (midazolam, diphenhydramine, dexamethasone) known to contribute to postoperative delirium. Also, for comparison, the number of administrations of dexmedetomidine was included, which was suggested to be beneficial, to see if there was an increase in administration.

The major finding was that there was one medication that had a statistically significant reduction in administration. The medication was dexamethasone, a corticosteroid commonly given to prevent postoperative nausea and vomiting and reduce swelling.

This finding is important because it supports that a passive, best-practice advisory did lead to a practice change. This finding could be directly related to education about this commonly given drug and the reinforcement of reminders via the best practice advisory. In the clinical setting, providers may give this medication to most patients to prevent nausea. However, they may not have been aware of the risk of increasing delirium rates until viewing the education and best practice advisory.

### *Limitations*

This project has some limitations. Because the alert was passive, there was nothing the provider had to click on to acknowledge reading the alert. It is unknown if the advisory was selected to view when the provider accessed the chart. The advisory was a chart tab, highlighted if the patient met the criteria. The concern from the approval committee was that if a “pop-up” type of alert was implemented, it could contribute to alert fatigue. Therefore, the limitation was having an advisory that needed to be clicked on to view, rather than an active alert that the provider would have to see when it displayed itself upon entering the chart.

Findings of this project include results from project collaborator Danielle Lee. Lee used the same education and intervention but focused her research on other variables. She examined hospital stay length and if patients developed delirium, confusion, or disorientation in the postoperative period (Lee, 2023). Her findings were that slightly fewer patients developed delirium postoperatively, but not enough to be statistically significant. This was also true for hospital length of stay (Lee, 2023).

A possible explanation as to why there was not a reduction in midazolam and diphenhydramine could be that providers already felt that they were making the most clinically sound decisions in their medication administration and did not feel the benefit outweighed the risk. Another possible explanation is that providers do not typically administer midazolam or diphenhydramine to elderly patients, so the only significant change was seen in the administration of dexamethasone. Based on discussion with various CRNAs in clinical practice, providers may be wary of increasing the administration of Precedex for fear that elderly patients will be too obtunded in the intraoperative phase to move to the postoperative phase.

Suggestions for further research include the following. Further research could consist of exploring patient perspectives about their postoperative period and recovery. Additional research could also be performed by comparing less commonly administered medications to learn if reduction occurred. Because the medicines examined are given routinely, the repetition of use could have been a barrier to change.

### **Conclusion**

In conclusion, reducing the administration of medications known to contribute to postoperative delirium should be encouraged whenever clinically reasonable. Implementation of multimodal pain medications, such as acetaminophen and dexmedetomidine, should continue to be encouraged. The implementation of a best practice advisory led to the reduction of a commonly administered corticosteroid. With further research and greater understanding of postoperative delirium, one day it can be eliminated as a risk for all patients. In current practice, evidence should continue to drive best practices. Utilization of best practice advisories can help improve patient outcomes for postoperative delirium and much more.



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## Appendices

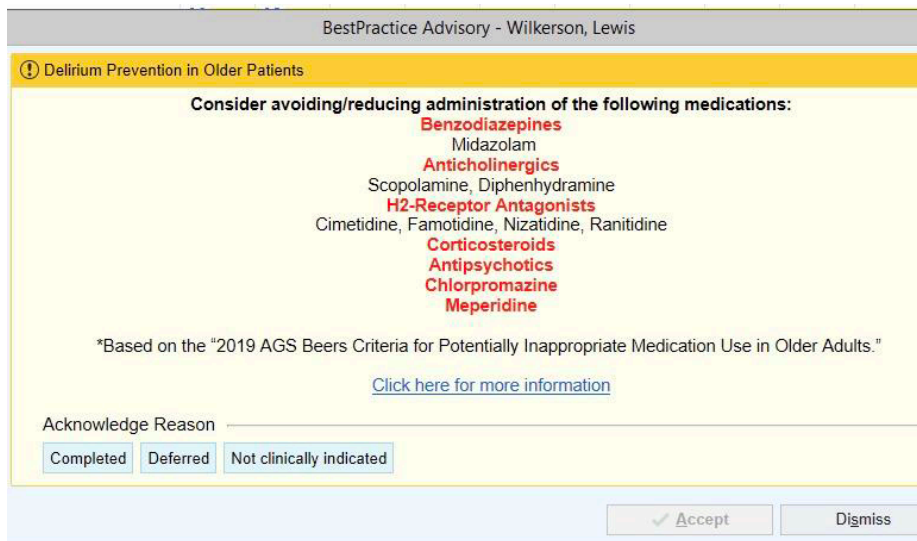


Figure 1. This is an example of a similar BPA previously implemented by SRNAs in Pennsylvania.

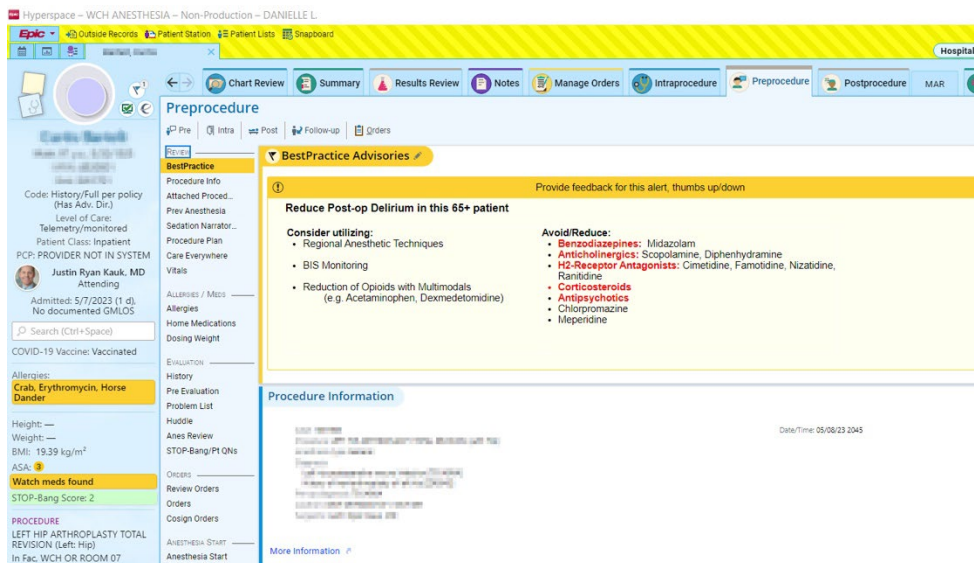


Figure 2. An example of the Best Practice Advisory implemented in the electronic medical record at the selected site.

# POSTOPERATIVE DELIRIUM BEST PRACTICE ADVISORY

## Why are we concerned about delirium?

Release in September 2023

- 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.

The screenshot shows an EMR interface with a 'Best Practice Advisories' section. A yellow alert is displayed: 'Reduce Post-op Delirium in this 66+ patient'. The alert includes a 'Consider utilizing' list (Regional Anesthetic Techniques, BIS Monitoring, Reduction of Opioids with Multimodals) and an 'Avoid/Reduce' list (Benzodiazepines, Anticholinergics, H2-Receptor Antagonists, Corticosteroids, Antipsychotics, Chlorpromazine). The patient's chart information is visible on the left, including 'Justin Ryan Kauk, MD' and 'LEFT HIP ARTI-ROPLASTY TOTAL REVISION (Left Hip)'.

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



DNP Project for Megan ~~Donnaker~~ SRNA and Danielle Lee, SRNA  
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