

A Clinical Practice Guideline for Reducing Postoperative Delirium in Geriatric Patients

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DNP Scholarly Project

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In the United States of America, 51.4 million operations are performed each year (Centers for Disease Control and Prevention [CDC], 2015). Of those 51.4 million operations, 19.2 million are surgeries performed on geriatric patients 65 years of age and older (CDC, 2015). The most common complication of geriatric surgery is postoperative delirium (POD) (American Geriatrics Society [AGS], 2015a). The overall incidence rate varies widely and may affect anywhere between nine and eighty-seven percent of geriatric surgical patients (Whitlock, Vannucci, & Avidan, 2011).

According to the *Diagnostic and Statistical Manual* fifth edition (DSM-5), postoperative delirium (POD) is defined as a short-term disturbance in attention, awareness, and cognition after surgery (American Psychiatric Association [APA], 2013). Characteristics of POD include: inappropriate behavior and changes in emotions, disorganized thought and speech, paranoia, altered perception and attention, difficulty following directions and conversations, sleep/wake cycle changes, decreased appetite and incontinence (AGS, 2015b; Moyce, Rodseth, & Bickard, 2014). These characteristics usually present on postoperative day one or two and can persist from a few hours to several months (Brown & Purdon, 2013; Moyce et al., 2014).

Recognizing and preventing POD is important to avoid associated adverse outcomes postoperatively. Serious adverse outcomes of POD include, but are not limited to: increased hospital length-of-stay, reduced cognitive function and increased risk of dementia, loss of independence, and mortality (Bickel, Grading, Kochs, & Forstl, 2008; Robinson et al., 2009; Rudolph et al., 2010; Saczynski et al., 2012). Furthermore, delayed recognition and treatment of POD leads to mortality (AGS, 2015b). The occurrence of POD is not inevitable; approximately

one-third of cases can be prevented (Marcantonio, Flacker, Wright, & Resnick, 2001).

Preventing POD is financially beneficial as the annual cost is \$150 billion (AGS, 2015b).

Contributors to the etiology of POD include cognitive issues prior to surgery, infectious processes, metabolic disorders or derangements, various perioperative medications, hypotension and decreased cerebral perfusion, hypoxia or hypercarbia, and uncontrolled pain throughout the perioperative period (APA, 2013; Sieber, Mears, Lee, & Gottschalk, 2011). Due to its multifactorial nature, a combination of several treatment modalities is the best intervention to prevent POD (Moyce et al., 2014). A meta-analysis conducted by Moyce et al. (2014) found that the most effective methods to reduce POD rates were to perform geriatric consultations with multicomponent interventions (i.e., addressing hypoxia, anemia, urinary tract infections, malnutrition, and sleep disorders) and deliver light levels of anesthetic medications.

Postoperative delirium is a serious issue for elderly patients following anesthesia. At an urban medical center in the mid-Atlantic region an average of 21,000 surgeries are performed each year. According to the CDC (2015), 37.4% of surgeries are performed on geriatric patients. At this medical institution, this percent equates to an estimated 7,800 surgeries for geriatric patients annually. The incidence rate of POD at the medical center is unknown. Nevertheless, a quality improvement project was conducted at this medical center by introducing a guideline about POD prevention.

The purpose of this DNP scholarly project is to develop and evaluate a clinical practice guideline (CPG) at this urban medical center in the mid-Atlantic region to reduce POD in geriatric patients. The anticipated outcome of this scholarly project is that the CPG will be an effective guide for anesthesia providers (i.e., anesthesiologists and nurse anesthetists) to ultimately reduce the occurrence of POD in this urban medical center. Implementing and

providing a CPG at this institution could have a positive impact on the health of all geriatric patients requiring anesthesia. The institution will also benefit from a decrease in unnecessary expenses associated with treating POD. A CPG will also have a favorable outcome for patients by reducing the occurrence of POD, improving quality of life, and reducing morbidity and mortality.

Theoretical Framework

In order to strategically and methodically execute this scholarly project the theory of unpleasant symptoms (TOUS) will be used. This theory's central purpose is symptomatology as the true indicator of a patient's perceived health status (Lenz, Pugh, Milligan, Gift, & Frederick, 1997). The three major concepts of TOUS combine to establish the purpose of symptoms experienced by patients, factors that contribute to those symptoms, and the consequences that arise from those symptoms (Lenz et al., 1997). A hallmark of TOUS is several influencing factors and symptoms creating a multidimensional experience for the patient (Lenz et al., 1997). Furthermore, multiple symptoms felt concurrently can synergistically increase the patient's negative experience (Lenz et al., 1997). Propositions of TOUS are that symptoms are complex, intertwine, and may be vague to the patient (Lenz et al., 1997).

The phenomenon being explored is POD and can be operationalized by acknowledging that the central purpose of symptomology is important in preventing and recognizing POD. Influencing factors that contribute to POD need to be recognized to adapt perioperative management in order to prevent adverse outcomes. The three essential components of TOUS can be operationalized for patients who develop POD. The first component is to recognize the patient's POD symptom experience; keeping in mind they may be vague in presentation. The next component is to identify the factors that contributed to those symptoms, such as:

medications, type and duration of surgery, and surgical events (e.g. hypoxia and hypotension). Lastly, the final component is to understand the consequences of POD experienced symptoms, which decreases the patient's quality of life. The provider must individually address these three essential components to care for the patient's overall symptom experience.

Literature Review

The need to create a CPG based on current evidence in the literature is important to reduce POD. The literature presented in this review will address important postoperative actions the anesthesia provider should implement in the postoperative phase of surgery (Appendix A). The review will discuss interventions to prevent POD as well as strategies for early identification and treatment of POD to decrease symptom severity and duration.

The American Geriatrics Society's (2015a) twenty-three member expert panel created a well-tested clinical practice guideline from the latest research (comprised of ninety-three studies) to address POD perioperatively. The prevention of POD was categorized into pharmacologic and non-pharmacologic recommendations for providers. Pharmacologic recommendations to decrease POD in the postoperative phase of surgery included: regional anesthesia for improved pain control, non-opioid treatment of pain when possible (e.g., acetaminophen, NSAIDs, and gabapentin), avoidance of inappropriate medications (e.g., anticholinergics and drugs with anticholinergic properties, histamine-1 and histamine-2 receptor antagonists, sedative-hypnotics, meperidine, and benzodiazepines), avoidance of polypharmacy (i.e., five or more medications), and avoidance of drugs associated with serotonin syndrome. Postoperative non-pharmacologic interventions that reduced POD include: immediate application of hearing and visual aids upon wakeup, fluid and electrolyte repletion, and adequate ventilation (i.e., avoiding hypoxia and

hypercarbia). The strength of this CPG includes a large expert panel that accomplished the rigorous evidence-based review based upon the standards outlined by the Institute of Medicine. Limitations to the study are extrapolation of some studies outside the perioperative setting and restrictions in the literature search (AGS, 2015a).

The AGS (2015b) completed a systematic review to outline the best care methods for preventing POD. This review supplements the AGS's clinical practice guideline and consists of the same twenty-three member expert panel. This systematic review is based upon 101 studies. Key findings discovered were: delayed recognition and treatment of POD resulted in prolonged duration, severity, and increased mortality rates; only providers who have been trained should assess patients for POD with the validated Confusion Assessment Method (CAM) algorithm; and pharmacological and non-pharmacological interventions as previously mention in AGS (2015a) clinical practice guideline. Strengths of this systematic review included a stringent peer review process incorporating twenty-nine organizations with expertise in postoperative delirium. Limitations to the systematic review include potential conflicts of interest with eleven members of the expert panel who had various grants from third parties (AGS, 2015b).

Moyce et al. (2014) conducted a systematic review and meta-analysis to investigate the perioperative contributors to POD. After an evaluation of 1,376 studies, a total of 29 studies were selected for this systematic review and meta-analysis related to POD. Variables that were studied included: perioperative geriatric consultation vs. standard care; prophylactic haloperidol vs. placebo; donepezil vs. placebo; gabapentin vs. placebo, and bright light therapy vs. standard care. The researcher found POD protection with the interventions of geriatric consultation, bright light therapy (i.e., application of bright light after extubation for two hours and repeated daily), and prophylactic haloperidol. Strengths of this study included the adherence to the guidelines of

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), nineteen randomized controlled trials of high quality, and the researchers had no funding or competing interests, thereby limiting bias. However, the intervention of geriatric consultations was limited to orthopedic surgeries only. Additional limitations of this study were the exclusion of foreign trials and poor standardization and randomization in the pharmacological intervention studies (Moyce et al., 2014).

Siddiqi, Holt, Britton, & Holmes (2007) conducted a systematic review that included six randomized controlled trials (RCT) evaluating prevention interventions for delirium. Secondary outcome measures included duration and severity of delirium, use of psychotropic drugs, behavioral disturbance, length of admission, physical and psychological morbidity, cognitive status, institutionalization at discharge, costs of intervention, and costs of services. The researchers found geriatric consultations during the perioperative course and low dose prophylactic haloperidol reduced the incidence and severity of POD. Strengths of this systematic review included quality appraisal and data extraction of the studies was performed by two of the authors independently and had consistency with findings from other reviews. Limitations of this study included heterogeneity of the interventions between the studies that prevented the ability to perform a meta-analysis, and five of the six studies were specific to orthopedic surgery (Siddiqi et al., 2007).

Strong evidence consistently found in this literature review was the incorporation of geriatric consultation vs. usual care proved better outcomes for patients with the reduction of occurrence and severity of POD (AGS 2015a; AGS 2015b; Moyce et al., 2014; Siddiqi et al., 2007). Good evidence with limited studies found in this research was low-dose prophylactic haloperidol and bright light therapy (Moyce et al. 2014; Siddiqi et al., 2007). Finally, the AGS

recommendations in both of their publications showed strong evidence in the pharmacological and non-pharmacological techniques advised. Differences within the reviewed literature were due to study inclusions and exclusions criteria for systematic review rather than the results found. No findings between the studies contradicted each other.

Methods

The design of this quality improvement project includes the development and evaluation of a clinical practice guideline (CPG) (see Appendix B). The CPG includes techniques and recommendations for preoperative, intraoperative, and postoperative phases of anesthesia to address postoperative delirium. The setting of the CPG implementation project is at a large intercity mid-Atlantic medical center. The scholarly project is divided into three phases, each with a distinct sample. The timeline of this DNP scholarly project can be found in Appendix C.

Procedures

Phase 1.

Following the DNP project committee presentation and their approval of this scholarly project, the expert panel was recruited. Expert panel candidates were recruited in person. Prior to their acceptance as expert panel members, an explanation of the project and required commitment and support during the duration of the scholarly project was stated. The finalized expert panel was emailed the CPG with the AGREE II Tool (Appendix E) prior to the first expert panel meeting. The expert panel is the first sample consisting of one anesthesiologist and one nurse anesthetist (n=2) who evaluated the CPG with the AGREE II Tool prior to the first meeting. They submitted their completed AGREE II Tool to the Department of Anesthesiology's secretary anonymously. During the first meeting, the results of the AGREE II tool evaluation and the strengths and weaknesses of the CPG were discussed. Recommendations to edit the CPG

were considered. Afterwards, necessary revisions to the CPG were made and a second meeting was arranged to discuss and approve those revisions. At the second meeting, the CPG was finalized as well as a plan for the presentation of the CPG during anesthesia grand rounds was planned.

Phase 2.

The finalized CPG and proposed presentation was presented to the second sample, which includes the Chief Nurse Anesthetist and Chief Anesthesiologist (n=2). The chiefs did not reject the CPG and presentation; therefore, an additional meeting with the expert panel did not need to be arranged to make revisions. The chiefs accepted the CPG and presentation and was scheduled for November 17, 2016 07:00am during anesthesia grand rounds. Thus, the DNP project was able to progress to phase 3.

Phase 3.

During anesthesia grand rounds, anesthesia providers were educated with a presentation discussing the significance and background of POD, the CPG, and the purpose and anticipated outcomes of the DNP scholarly project (see Appendix D). Following the presentation, the practitioner feedback survey was administered for CPG evaluation to the anesthesia providers for voluntary completion. The anesthesia providers (n=32) are the third sample.

Data Collection and Analysis

Data was collected in phases 1 and 3. Phase 1 generated data from the AGREE II Tool responses (Appendix E) (AGREE Next Steps Consortium, 2009). Prior to the expert panel completing the AGREE II Tool, they were notified when an item was not applicable to the CPG, and a score of 1 was marked. The expert panel brought the completed AGREE II Tool to the first meeting. The panel did not identify themselves on the completed AGREE II Tool.

The AGREE II Tool (Appendix E) was created to evaluate the strength of clinical practice guidelines. The tool comprises of six domains consisting of twenty-three items. All items are scored on a 7-point Likert scale with 1 = "strongly disagree" to 7 = "strongly agree." Inter-rater reliability and validity of the tool was measured with an alpha coefficient range of 0.64 to 0.89 and face, construct, and criterion-related validities were established (Brouwers et al., 2010a; Brouwers et al., 2010b).

The AGREE II Tool data was analyzed according to the AGREE II Tool scoring instructions (Appendix G) (The AGREE Next Steps Consortium, 2009). Each of the items was calculated in their respective domain. The score of the items of each appraiser will be summed together in each domain. This calculated score for the domain was compared to the minimum and maximum possible score to obtain a percentage.

Phase 3 generated data from the Practitioner Feedback Survey (Appendix F) responses completed by the anesthesia providers. The Practitioner Feedback Survey was completed immediately after the grand rounds presentation. Anesthesia providers who completed the Practitioner Feedback Survey did so on a voluntary basis. The survey was collected anonymously and analyzed. The Department of Anesthesiology's secretary anonymously collected surveys in a box with no provider identification.

The Practitioner Feedback Survey is a tool designed to measure provider criticism for new clinical practice guidelines (Appendix F). The survey has been adapted from Brouwers, Graham, Hanna, Cameron, & Browman (2004) and consists of 23 questions with scoring on a 3-point Likert scale with "strongly agree" to "strongly disagree." Demographic data will be added to the survey. Anesthesia providers will circle if they are a nurse anesthetist or an anesthesiologist, and indicate how many years they have been practicing anesthesia. The

reliability and validity of the survey has been measured. The survey's alpha coefficient for ranged from 0.75 to 0.85 for the comparative value and quality factors, respectively, and has established criterion-related predictive validity (Brouwers, et al., 2004).

The Practitioner Feedback Survey was analyzed by calculating each items responses and the mode of the most common response was reported. In addition, the providers' responses were computed into percentages.

Human Subject Protection

A proposal of this DNP scholarly project was submitted to the University of Maryland, Baltimore's (UMB) Institutional Review Board (IRB) for a Non-Human Subjects Research (NHRS) determination. Additionally, the proposal was submitted to the IRB of the medical center where the project was conducted. Participation of the expert panel using the AGREE II Tool and the anesthesia providers who evaluated the CPG with the Practitioner Feedback Survey is completely voluntary. To protect human rights no identifiable data will be collected or used. The Department of Anesthesiology's secretary collected the Practitioner Feedback Surveys in an anonymous fashion. Surveys were then collected and had no subject identifiers. All participants were informed that their involvement was voluntary.

Results

After phase 1, the AGREE II Tool was collected and each domain was scored per the recommendations of the tool. Each domain's items per appraiser were summed to create an obtained score. The minimum possible score for each domain was subtracted by the obtained score. Then, this number was divided by the maximum possible score minus the minimum possible score. The total for each domain was converted to a percentage. The percentages for Domains 1-6 are as follows: 88.9%, 66.7%, 76.0%, 91.7%, 68.8%, and 91.7%. The average

score of all 6 domains was 80.6%. Domain 4, Clarity of Presentation, and Domain 6, Editorial Independence, were the highest scoring domains. Clarity of Presentation shows that the CPG was well structured, formatted, and worded and high Editorial Independence demonstrates that the recommendations were not overly biased with competing interests. In contrast, Domain 2, Stakeholder Involvement, was the lowest scoring domain. The Stakeholder Involvement relates to how the CPG represents the views of the target users. Tables of each domain's scores can be viewed in Appendix G. The appraisers AGREE II Tool overall assessment received a score of 91.7%. Both appraisers said that they would recommend the use of this guideline.

After completion of the presentation in phase 3, fifteen of thirty-two providers (47%, n=32) completed the Practitioner Feedback Survey. The average years of experience amongst the 15 providers were 7.7 years. Twelve of the fifteen providers indicated their professional title, 67% (n=8) were Nurse Anesthetists and 33% (n=4) were Medical Doctors.

Microsoft Excel was used to calculate the response mode of each item (2-23). In order to compute this, each of the 22 items responses were converted into a numerical score: "strongly disagree" = 1, "neither agree or disagree" = 2, "strongly agree" = 3. The Practitioner Feedback Survey responses per item number and mode of the responses are displayed in Table 1 in Appendix H. Seventy-seven percent of the item's scores mode were "strongly agree," 14% were "neither agree or disagree," and 9% were "strongly disagree."

Additionally, each of the 22 item's scores was divided into percentages. These percentages can be viewed in Table 2 in Appendix H. Of note, item 23 scored high "If this draft guideline were to be approved as a practice guideline, I would apply the recommendations to my patients." Zero percent of the providers "strongly disagreed," twenty percent "neither agreed or disagreed," and eighty percent "strongly agreed."

Discussion

The purpose of this DNP scholarly project was to develop and evaluate a clinical practice guideline (CPG) using the highest quality evidence to reduce POD in geriatric patients aged 65 and older. The anticipated outcome of this scholarly project was that the CPG would provide guidance for anesthesia providers to reduce the occurrence of POD in an urban medical center in the mid-Atlantic region. Subsequently, improving outcomes for geriatric patients undergoing procedures requiring anesthesia.

Using the highest quality evidence in the literature, the CPG was created by 2 DNP students. An appointed expert panel at the medical center evaluated the CPG using the AGREE II Tool criteria. After receiving feedback from the expert panel, revisions to the CPG were made and finalized. The finalized version of the CPG was presented to the Department of Anesthesiology with the approval from the Chiefs. After the presentation, providers voluntarily completed the Practitioner Feedback Survey. Overall the items within the survey scored high (77% of the items scored “strongly agree”), indicating the providers’ likelihood of implementing the CPG into their own practice.

Strengths of this scholarly project are that the CPG was created with the highest levels of available evidence. The expert panel included a nurse anesthetist and anesthesiologist to provide inclusiveness of both types of anesthesia providers. The AGREE II Tool and the Practitioner Feedback Survey are reputable tools with high reliability and validity to evaluate the strength of guidelines and providers’ opinions of draft guidelines. Additionally, the CPG was well rated by the expert panel according to the AGREE II Tool criteria. Lastly 80% of the providers who evaluated the CPG with the Practitioner Feedback Survey said they would apply the

recommendations in their practice. Thus, there is a strong probability the recommendations outlined in the CPG will be considered and utilized the anesthesia providers.

Limitations of this project include a low sample size of providers in the expert panel group (n=2) and the providers who completed the Practitioner Feedback Survey (n=15). In the Practitioner Feedback Survey, several of the providers omitted responses for some of the items. Therefore, modifications were made to calculate the percentages for items missing responses. Other limitations of this project include a limited quantity of available evidence.

Summary

Postoperative delirium is the most common complication following geriatric surgery. The effects of POD can be life threatening and may affect between nine and eighty-seven percent of geriatric surgical patients. Because up to 40% of POD cases can be preventable, a CPG was created to help reduce the occurrence of POD in an urban medical center. Significant findings in the literature were consulting a geriatrician for medical management of geriatric patients and avoiding medications that increase the likelihood of developing delirium. Postoperative delirium is a complex and multifactorial issue with progressing evidence. As the literature evolves, the CPG will need to be updated every two years. Following CPG updates, providers at the medical institution will need to be informed of the changes in order to keep their practice congruent with the latest guidelines.

In conclusion, the CPG was developed using the latest and highest level of evidence available. From the results of the Practitioner Feedback Survey, providers overall had positive attitudes towards the CPG and indicated their willingness to apply the recommendations into their own practice. Therefore, the CPG is a tool providers will likely use in their practice to help

reduce the occurrence of POD and the associated detrimental outcomes in the geriatric population aged 65 and older requiring anesthesia for surgery.

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Appendix A

Literature Review Table

Author, year	Study objective/ Intervention or exposures compared	Design	Sample (N)	Outcomes studied (How measured)	Results	Level and Quality Rating
American Geriatrics Society (2015a)	Create and offer a well-tested guideline as a clinical practice guideline for institutions	A 23 person expert panel created a Clinical Practice Guideline based on a published literature review	93 studies reviewed	<p>Categorized each study according to measured variables.</p> <p>Non-pharmacologic interventions:</p> <ul style="list-style-type: none"> • Education for health care providers about POD • Multicomponent non-pharmacologic POD prevention interventions: sleep enhancement, cognitive reorientation, early rehabilitation and mobility, accessibility for hearing and visually impaired, adequate oxygenation, nutrition and fluid repletion, prevention of constipation, good pain management, and proper medication use. <p>Pharmacological interventions:</p> <ul style="list-style-type: none"> • Avoid deep levels of 	<p>Interventions that reduce POD are summarized in Box 1:</p> <ul style="list-style-type: none"> • Multicomponent non-pharmacologic interventions • Continuous education programs for providers • Pain management with non-opioids • Avoidance of high risk delirium medications • Prescribe cholinesterase inhibitors to prevent and treat delirium and not use benzodiazepines for delirium with agitation and for hypoactive delirium avoid antipsychotics and benzodiazepines. • Regional anesthesia to 	1 A

				<p>anesthesia</p> <ul style="list-style-type: none"> • Regional anesthesia during surgery and postoperatively for better pain control • Five studies have shown the benefit of prophylactic antipsychotic drug administration • Should not newly prescribe cholinesterase inhibitors 	<p>improve pain control</p> <ul style="list-style-type: none"> • Antipsychotics at lowest effective dose for a short period for delirious patients • EEG monitors for anesthetic depth during anesthesia 	
American Geriatrics Society (2015b)	Prevention and Management of postoperative delirium	Systematic Review	101 studies	<ul style="list-style-type: none"> • POD risk factors • Delirium diagnosis • Delirium screening • Intraoperative measures • Medications that increase risk of POD • Pharmacologic prevention • Non-pharmacologic prevention • Evaluation • Pharmacologic treatment 	<p>Pharmacological Recommendations include:</p> <ul style="list-style-type: none"> • Regional anesthesia for improved pain control, • Non-opioids preferred for treating pain (e.g., acetaminophen, NSAIDs, and gabapentin), • Avoidance of inappropriate medications (e.g., anticholinergics and drugs with anticholinergic properties, histamine-1 and histamine-2 receptor antagonists, sedative-hypnotics, meperidine, and benzodiazepines), • Avoidance of polypharmacy (i.e., five or more medications), and • Avoidance of drugs 	1 A

					<p>associated with serotonin syndrome.</p> <p>Non-pharmacologic interventions that reduced POD include:</p> <ul style="list-style-type: none"> • Hearing and visual aids applied immediately postoperatively, • Fluid and electrolyte repletion, and • Adequate ventilation (i.e., avoiding hypoxia and hypercarbia). • Rule out other medical problems such as MI or PE may present as delirium in older adults 	
Moyce, Rodseth, & Biccard (2014)	To study perioperative interventions and their efficacy in reducing POD	A systematic review and meta-analysis	29 studies 19 studies were high quality, 10 were low quality	<p>Analyzed:</p> <ul style="list-style-type: none"> • Geriatric consultation vs. standard care; • Deep vs. light anesthesia; • General vs. regional anesthesia; • Intravenous vs. Inhalation anesthesia; • Haloperidol vs. placebo; • Donepezil vs. placebo; • Gabapentin vs. placebo; • Bright light therapy vs. standard care 	<ul style="list-style-type: none"> • Two interventions had significant results that decreased the occurrence of postoperative delirium: (1) light vs. deep anesthesia, (2) perioperative geriatric consultation vs. standard care. • Common complication in the orthopedic elderly population status post hip fracture surgeries. • Anesthetic technique may affect the occurrence of delirium. Depth of anesthesia can be recognized through 	1 A

					<p>the use of Bispectral index (BIS) monitoring.</p> <ul style="list-style-type: none"> • Postoperative use of haloperidol may protect cognition and reduce delirium. • Anticonvulsants used for chronic pain management are useful to decrease the use of opioid consumption. Additionally another study found that Gabapentin postoperatively decrease delirium rates. • Recommend not one intervention but the employment of multiple interventions can decrease the prevalence of delirium due to its multifactorial nature. • Main study results are lighter anesthesia and the use of perioperative geriatric consultations decrease delirium. 	
Siddiqi, Holt, Britton, & Holmes (2007)	Identify prevention interventions for delirium	Systematic review without a meta-analysis	Six studies with a total of 833 subjects	<ul style="list-style-type: none"> • Primary outcome measures were new onset delirium and death. • Secondary outcomes explored were duration and severity of delirium, use of psychotropic drugs, 	<ul style="list-style-type: none"> • Low dose prophylactic haloperidol may reduce the severity and duration of POD and reduce hospital stay. • Geriatric consultation vs. standard care reduces POD incidence and severity. 	1 B

				<p>behavioral disturbance, length of admission,</p> <ul style="list-style-type: none"> • Physical and psychological morbidity, cognitive status, institutionalization at discharge, costs of intervention, and costs of services. • The quality of trials were assessed with criteria from the U.S. Preventive Services Task Force 		
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Table adapted from Melnyk, & Fineout-Overholt (2011)

*Appendix B***Clinical Practice Guideline for Reducing Postoperative Delirium in Geriatric Patients****I. Overview**

- a. Purpose: To address the need for a clinical practice guideline at a mid-Atlantic urban hospital to reduce postoperative delirium in elderly surgical patients requiring anesthesia
- b. Population: Geriatric surgical patients aged 65 and older
- c. User: Anesthesia providers
- d. Background: The most common and life-threatening complication following geriatric surgery is postoperative delirium (POD) (American Geriatrics Society [AGS], 2015a). Up to forty percent of POD can be preventable (AGS, 2015a). The overall incidence rate varies widely and may affect anywhere between nine and eighty-seven percent of geriatric surgical patients (Whitlock, Vannucci, & Avidan, 2011). Clinical presentation of POD varies; consequently, more than half of the cases are misdiagnosed (AGS, 2015a). Presentation can be classified by motoric subtypes: hypoactive (e.g., withdrawn, lethargy, apathy, confusion), hyperactive (e.g., agitation, aggression, confusion, mood lability, psychotic symptoms, disruptive behaviors), mixed (e.g., both hypoactive and hyperactive symptoms), or unclassified (e.g., normal psychomotor activity) (AGS, 2015a; Saxena & Lawley, 2010). In contrast to POD, emergence agitation (EA) or emergence delirium (ED) is a temporary state of confusion and agitation, lasting approximately 30 minutes, and is seen in patients of all ages (Viswanath, Kerner, Jean, Soto, & Rosen, 2015). Conversely, postoperative cognitive dysfunction (POCD) is a persistent cognitive disorder with a longer duration than POD (Strom, Rasmussen, & Sieber, 2014).
- e. The abstracted recommendations below provide guidance on the prevention of POD in older surgical patients from the preoperative phase to 24 hours postoperatively.
- f. Rigor of Development
 - i. Search strategies: Literature was searched from PubMed, CINAHL, EBSCO, Google Scholar, and the Cochrane Library databases using the terms *postoperative delirium*, *delirium*, *anesthesia*, *surgery*, *geriatric*, *Confusion Assessment Method*, and *CAM* with the option to apply equivalent subjects selected.
 - ii. Inclusion and Exclusion Criteria: Inclusion criteria consisted of available quantitative, full text academic journal articles in English, published within the last ten years. Editorials and pilot studies were excluded.
 - iii. Strengths and Limitations: The guideline's strength is that the recommendations are from the highest levels of available evidence; systematic reviews, meta-analyses, and randomized controlled trials. Limitations include feasibility restrictions for thoroughness of the literature review and a limited quality of available evidence.
 - iv. Consensus Techniques: Consensus amongst the designated expert panel will be sought prior to introducing the guideline.
 - v. Procedure for updating the guideline: Because POD is a growing area of clinical research, regular updates of every 2 years is recommended to keep the guideline current with the latest literature.

- g. Applicability
 - i. Facilitators and barriers: the administrators and leaders will play critical roles in provider's adoption and use of guidelines. The provider's habit of managing anesthesia and the culture of the anesthesia department may be the barriers to adopt the guideline.
 - ii. Recommendation of how the guideline can be used in the clinical setting: The overall aim of these recommendations is to provide a guide of pharmacological and non-pharmacological techniques to prevent POD
 - iii. Resource implications: the leaders and expertise in the anesthesia or related department will be a valuable resource.
 - iv. Auditing Criteria: the guideline should be audited every half-year, and adjusted based on the audit and most current research.
- h. Editorial Independence: No funding body exists to influence the content of the guideline. Additionally, no competing interests of guideline development group members have been recorded and addressed.

II. Preoperative Recommendations

- a. Assess for preoperative risk factors for Delirium (AGS, 2015a; Fong et al., 2015; Oh et al., 2015; Pinho et al., 2015; Raats et al., 2016; Scholz et al., 2015)
 - i. Age > 65
 - ii. Preexisting cognitive impairment, dementia, or mental disturbance
 - iii. Severe illness or comorbidity burden
 - iv. Vision and hearing impairment
 - v. ASA classification ≥ 3
 - vi. Alcohol use, Narcotic abuse, Cigarette smoking
 - vii. Malnutrition, BMI < 20kg/m², Albumin <3.5 g/dL
 - viii. Biochemical abnormalities
 - ix. Functional impairment
 - x. Low preoperative hemoglobin (<10 g/dL)
- b. Consider prophylactic melatonin for POD prevention in high-risk patients as a supplement to traditional delirium prevention, carefully evaluating risks and benefits (Gosch & Nicholas, 2014).

III. Intraoperative Recommendations

- a. Analgesia: The anesthesia provider should administer analgesics throughout the perioperative period to ensure adequate pain management (AGS, 2015a; Moyce et al., 2014; Sieber et al., 2011). Non-opioid medications are preferred (AGS, 2015a).
- b. Medical management: The anesthesia provider must be diligent in giving appropriate antibiotics as well as avoidance of hypoxia and hypercarbia, dehydration, and electrolyte imbalances, which may contribute to delirium (Moyce et al., 2014).
- c. Low preoperative hemoglobin (< 10 g/dL) is associated with a higher risk and prolonged duration of delirium. Excessive blood loss ≥ 800 mL is associated with POD (Hasegawa et al., 2015; Raats et al., 2016; Schneider et al., 2002; Wang et al., 2004).
- d. Antipsychotics: The use of haloperidol prophylactically for the prevention of delirium is not recommended (AGS, 2015a; Moyce et al., 2014).

IV. Postoperative Recommendations

- a. Acquire geriatric consultation for medical management of patient (AGS, 2015a; AGS, 2015b; Moyce et al., 2014; Siddiqi et al., 2007).
- b. Pharmacologic recommendations to decrease POD in the postoperative phase of surgery include: (AGS, 2015a; AGS, 2015b)
 - i. When appropriate use regional anesthesia for pain management
 - ii. Non-opioids for treatment of pain are preferred (e.g., acetaminophen, NSAIDs, and gabapentin)
 - iii. Avoid inappropriate medications
 - 1. Anticholinergics and drugs with anticholinergic properties
 - a. Tricyclic antidepressants: amitriptyline, doxepin, imipramine
 - b. Antihistamines: cyproheptadine, diphenhydramine, hydroxyzine
 - c. Antimuscarinics: oxybutynin, tolterodine
 - d. Antispasmodics: hyoscyamine, scopolamine
 - e. First-generation antipsychotics: chlorpromazine, thioridazine
 - f. H₂-receptor antagonists: cimetidine, ranitidine
 - g. Skeletal muscle relaxants: cyclobenzaprine, tizanidine
 - h. Antiemetics: promethazine
 - i. Olanzapine
 - j. Paroxetine
 - 2. Sedative-hypnotics
 - a. Benzodiazepines: alprazolam, diazepam, lorazepam, midazolam
 - b. Sedative-hypnotics: zolpidem, zaleplon
 - 3. Meperidine
 - 4. Avoid medications that contribute to serotonin syndrome
 - iv. Avoid polypharmacy (i.e., starting five or more medications)
- c. Postoperative non-pharmacologic interventions that reduced POD include: (AGS, 2015a; AGS, 2015b; Moyce et al., 2014; Rudolph & Marcantonio, 2011)
 - i. Immediate application of hearing and visual aids upon emergence
 - ii. Fluid and electrolyte repletion
 - iii. Adequate ventilation (i.e., avoiding hypoxia and hypercarbia)
 - iv. Bright light therapy (i.e., application of bright light after extubation for two hours and repeated daily)
 - v. Family members at the bedside to assist with reorienting and to serve as a reassuring stimulus

V. 24-Hour Postoperative Evaluation

- a. Confusion Assessment Method to be performed during postoperative evaluation
 - i. Acute change and fluctuating course
 - 1. Evidence of an acute change in mental status from the patient's mental status prior to hospitalization, and
 - 2. Evidence that abnormal behavior fluctuates during the day (i.e., tends to come and go or increase and decrease in severity).
 - ii. Inattention
 - 1. Evidence of difficulty focusing attention, e.g., being easily distractible, or having difficulty keeping track of what is being said.
 - iii. Disorganized thinking

1. Evidence that thinking is disorganized or incoherent, such as rambling or irrelevant conversation, unclear or illogical flow of ideas, or unpredictable switching from subject to subject.
- iv. Altered level of consciousness
 1. Any evidence of any mental states other than a normal level of alertness (Altered states include vigilant or hyperalert, lethargic, drowsy or easily aroused, stuporous or difficult to arouse, coma or unarousable).
- b. Only trained providers should assess patients for POD with the validated Confusion Assessment Method (CAM) algorithm. Untrained providers may result in misdiagnosis of POD (AGS, 2015b).
- c. Delayed recognition of postoperative delirium results in increased duration and severity of POD and increased mortality rates (AGS, 2015b).
- d. Following 24 hours postoperatively, the patient should be medically managed by a geriatrician if they are exhibiting signs of POD.

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Appendix C

I. Timeline of DNP Scholarly Project

- a. Submit Proposal to committee members by April, 2016
- b. Present Proposal to committee members in May, 2016
- c. Submit Proposal to UMB's and the medical center's IRBs by May, 2016
- d. Invite expert panel members by May, 2016
- e. Send, via email, the CPG and AGREE II tool to the expert panel by August, 2016
- f. Implement project from September, 2016 to December, 2016
 - i. First expert panel meeting to discuss CPG with AGREE II Tool in September, 2016
 - ii. Second expert panel meeting to finalize CPG and review presentation for grand rounds in October, 2016
 - iii. Present CPG and have anesthesia provider's complete the Practitioner Feedback Survey during grand rounds in November, 2016
- g. Analyze, synthesize, and evaluate project data by February, 2017
- h. Submit final scholarly project manuscript to committee for review by February, 2017
- i. Present final scholarly project to committee by March, 2017

*Appendix D***Presentation Outline**

- II. Objectives
- III. Purpose
- IV. Background
 - a. Prevalence & Incidence rates
 - b. Patient presentation (signs and symptoms)
 - i. Differential diagnoses
 - c. Patient complications
 - d. Financial implications
- V. Overview of clinical practice guideline
- VI. Practitioner Feedback Survey

*Appendix E***Items of AGREE II Tool Organized by Domain*****Appendix Table. Domains of AGREE II Appraisal Instrument*****Scope and purpose**

1. The overall objective(s) of the guideline is (are) specifically described.
2. The health question(s) covered by the guideline is (are) specifically described.
3. The population (patients and public) to whom the guideline is meant to apply is specifically described.

Stakeholder involvement

4. The guideline development group includes individuals from all the relevant professional groups.
5. The views and preferences of the target population (patients, public, etc.) have been sought.
6. The target users of the guideline are clearly defined.

Rigor of development

7. Systematic methods were used to search for evidence.
8. The criteria for selecting the evidence are clearly described.
9. The strengths and limitations of the body of evidence are clearly described.
10. The methods for formulating the recommendations are clearly described.
11. The health benefits, side effects, and risks have been considered in formulating the recommendations.
12. There is an explicit link between the recommendations and the supporting evidence.
13. The guideline has been externally reviewed by experts before its publication.
14. A procedure for updating the guideline is provided.

Clarity of presentation

15. The recommendations are specific and unambiguous.
16. The different options for management of the condition or health issue are clearly presented.
17. Key recommendations are easily identifiable.

Applicability

18. The guideline describes facilitators and barriers to its application.
19. The guideline provides advice and/or tools on how the recommendations can be put into practice.
20. The potential resource implications of applying the recommendations have been considered.
21. The guideline presents monitoring and/or auditing criteria.

Editorial independence

22. The views of the funding body have not influenced the content of the guideline.
23. Competing interests of guideline development group members have been recorded and addressed.

AGREE = Appraisal of Guidelines Research and Evaluation.

Qaseem A, Snow V, Owens DK, Shekelle P, Clinical Guidelines Committee of the American College of Physicians. The Development of Clinical Practice Guidelines and Guidance Statements of the American College of Physicians: Summary of Methods. *Ann Intern Med.* 2010;153:194-199. doi: 10.7326/0003-4819-153-3-201008030-00010

Appendix F
Practitioner Feedback Survey

How many years have you been practicing? _____ **Circle one:** CRNA or MD

For each item, please check off the box that most adequately reflects your opinion.

1. Are you responsible for the care of patients for whom this draft guideline report is relevant? This may include the referral, diagnosis, treatment, or follow-up of patients.	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Unsure <input type="checkbox"/>
If you answered “No” or “Unsure”, there is no need to answer or return this questionnaire. If you answered “Yes”, please answer the questions below and return to [enter expected destination of surveys].			
	Strongly agree	Neither agree or disagree	Strongly disagree
2. The rationale for developing a guideline is clear.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. There is a need for a guideline on this topic.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. The literature search is relevant and complete (e.g., no key evidence was missed nor any included that should not have been) in this draft guideline.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. I agree with the methodology used to summarize the evidence included in this draft guideline.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. The results of the evidence described in this draft guideline are interpreted according to my understanding of the evidence.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. The draft recommendations in this report are clear.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. I agree with the draft recommendations as stated.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. The draft recommendations are suitable for the patients for whom they are intended.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. The draft recommendations are too rigid to apply to individual patients.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. When applied, the draft recommendations will produce more benefits for patients than harms.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. The draft guideline presents options that will be acceptable to patients.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. To apply the draft recommendations will require reorganization of services/care in my practice setting.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. To apply the draft guideline recommendations will be technically challenging.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. The draft guideline recommendations are too expensive to apply.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. The draft guideline recommendations are likely to be supported by a majority of my colleagues.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. If I follow the draft guideline recommendations, the expected effects on patient outcomes will be obvious.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. The draft guideline recommendations reflect a more effective approach for improving patient outcomes than is current usual practice. (If they are the same as current practice, please tick NA). NA <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. When applied, the draft guideline recommendations will result in better use of resources than current usual practice. (If they are the same as current practice, please tick NA). NA <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. I would feel comfortable if my patients received the care recommended in the draft guideline.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. This draft guideline should be approved as a practice guideline.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. If this draft guideline were to be approved as a practice guideline, I would use it in my own practice.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. If this draft guideline were to be approved as a practice guideline, I would apply the recommendations to my patients.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Adapted from: Brouwers, M.C., Graham, I.D., Hanna, S.E., Cameron, D.A., & Browman, G.P. (2004). Clinicians' assessments of practice guidelines in oncology: The CAPGO survey. *International Journal of Technology Assessment in Health Care*, 20(4), 421-6.

Appendix G
AGREE II Tool: Scoring of Each Domain

Domain 1: Scope and Purpose

	Item 1	Item 2	Item 3	Total
Appraiser 1	6	6	6	18
Appraiser 2	6	7	7	20
Total	12	13	13	38

Maximum possible score = 7(strongly agree) x 3(items) x 2(appraisers) = 42

Minimum possible score = 1(strongly disagree) x 3(items) x 2(appraisers) = 6

$$\frac{\text{Obtained score} - \text{Minimum possible score}}{\text{Maximum possible score} - \text{Minimum possible score}} = \frac{38 - 6}{42 - 6} \times 100 = \frac{32}{36} \times 100 = \mathbf{88.9\%}$$

Domain 2: Stakeholder Involvement

	Item 4	Item 5	Item 6	Total
Appraiser 1	6	6	7	19
Appraiser 2	2	2	7	11
Total	8	8	14	30

Maximum possible score = 7(strongly agree) x 3(items) x 2(appraisers) = 42

Minimum possible score = 1(strongly disagree) x 3(items) x 2(appraisers) = 6

$$\frac{\text{Obtained Score} - \text{Minimum possible score}}{\text{Maximum possible score} - \text{Minimum possible score}} = \frac{30 - 6}{42 - 6} \times 100 = \frac{24}{36} \times 100 = \mathbf{66.7\%}$$

Domain 3: Rigor of Development

	Item 7	Item 8	Item 9	Item 10	Item 11	Item 12	Item 13	Item 14	Total
Appraiser 1	6	6	6	6	7	7	6	6	50
Appraiser 2	5	6	6	5	6	3	1	7	39
Total	11	12	12	11	13	10	7	13	89

Maximum possible score = 7(strongly agree) x 8(items) x 2(appraisers) = 112

Minimum possible score = 1(strongly disagree) x 8(items) x 2(appraisers) = 16

$$\frac{\text{Obtained Score} - \text{Minimum possible score}}{\text{Maximum possible score} - \text{Minimum possible score}} = \frac{89 - 16}{112 - 16} \times 100 = \frac{73}{96} \times 100 = \mathbf{76.0\%}$$

Domain 4: Clarity of Presentation

	Item 15	Item 16	Item 17	Total
Appraiser 1	6	7	6	19
Appraiser 2	6	7	7	20
Total	12	14	13	39

Maximum possible score = 7(strongly agree) x 3(items) x 2(appraisers) = 42

Minimum possible score = 1(strongly disagree) x 3(items) x 2(appraisers) = 6

$$\frac{\text{Obtained Score} - \text{Minimum possible score}}{\text{Maximum possible score} - \text{Minimum possible score}} = \frac{39 - 6}{42 - 6} \times 100 = \frac{33}{36} \times 100 = \mathbf{91.7\%}$$

Domain 5: Applicability

	Item 18	Item 19	Item 20	Item 21	Total
Appraiser 1	6	7	6	6	25
Appraiser 2	7	1	1	7	16
Total	13	8	7	13	41

Maximum possible score = 7(strongly agree) x 4(items) x 2(appraisers) = 56

Minimum possible score = 1(strongly disagree) x 4(items) x 2(appraisers) = 8

$$\frac{\text{Obtained Score} - \text{Minimum possible score}}{\text{Maximum possible score} - \text{Minimum possible score}} = \frac{41 - 8}{56 - 8} \times 100 = \frac{33}{48} \times 100 = \mathbf{68.8\%}$$

Domain 6: Editorial Independence

	Item 22	Item 23	Total
Appraiser 1	7	6	13
Appraiser 2	6	Missing data*	-
Total	13	-	13

*Missing data – Appraiser 2 omitted from scored percentage.

Maximum possible score = 7(strongly agree) x 2(items) x 1(appraisers) = 14

Minimum possible score = 1(strongly disagree) x 2(items) x 1(appraisers) = 2

$$\frac{\text{Obtained Score} - \text{Minimum possible score}}{\text{Maximum possible score} - \text{Minimum possible score}} = \frac{13 - 2}{14 - 2} \times 100 = \frac{11}{12} \times 100 = \mathbf{91.7\%}$$

Appendix H
Practitioner Feedback Survey Results

Table 1

Provider Responses to Each Item of the Practitioner Feedback Survey

Item #	PFS 1	PFS 2	PFS 3	PFS 4	PFS 5	PFS 6	PFS 7	PFS 8	PFS 9	PFS 10	PFS 11	PFS 12	PFS 13	PFS 14	PFS 15	Mode
2	3	3	3	3	3	3	3	3		3	3	2	3	3	3	3
3	3	3	3	3	3	3	3	3		3	3	1	3	3	3	3
4	3	3	3	2	3	3	3	3	3	2	1	2	3	3	3	3
5	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3	3
6	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3	3
7	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
8	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
9	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3
10	1	1	3	2	2	2	2	1	1	2	1	2	1	1	1	1
11	3	3	3	3	3	3	3	3	3		3	2	3	2	3	3
12	3	3	3	2	3	3	3	1	3	3	3	2	3	3	3	3
13	1	2	3	2	3	2	2	1	3	2	3	1	2	3	3	2
14	1	1	3	1	2	2	2	1	2	2	1	1	2	2	2	2
15	1	2	3	1	1	2	1	2	1	1	1	1	2	2	2	1
16	3	3	3	2	3	3	1	3	2	3	3	2	2	2	3	3
17	2	2	3	2	2	3	1	3	2	3	3	2	2	3	3	2
18	3	3	3	3	3	3	3	1	3	3	3		2	3	3	3
19	3	3	3	2	2	3	1	1	3	3	3		2	3	3	3
20	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3
21	3	3	3	2	3	3	3	3	3	3	3	1	2	3	3	3
22	3	3	3	2	3	3	3	3	3	3	3	2	2	3	3	3
23	3	3	3	2	3	3	3	3	3	3	3	2	2	3	3	3

1 = Strongly Disagree
 2 = Neither Agree or Disagree
 3 = Strongly Agree
 Blank cells = no response from provider
 PFS = Practitioner Feedback Survey

Table 2

Percentage of Response per Item

Item #	Strongly Disagree (%)	Neither Agree or Disagree (%)	Strongly Agree (%)
2	0	7	93
3	7	0	93
4	7	20	73
5	0	7	93
6	0	7	93
7	0	0	100
8	0	0	100
9	0	7	93
10	53	40	7
11	0	14	86
12	7	13	80
13	20	40	40
14	40	53	7
15	53	40	7
16	7	33	60
17	7	47	47
18	7	7	86
19	14	21	64
20	0	7	93
21	7	13	80
22	0	20	80
23	0	20	80