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Identifying Elderly Patients at High Risk for Post-Operative Cognitive Dysfunction: A Clinical Perspective

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UNIVERSITY OF SAN DIEGO
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DOCTOR OF NURSING PRACTICE PORTFOLIO

by

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Documentation of Mastery of DNP Program Outcomes

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Kelly Ann Glas

University of San Diego Doctor of Nursing Practice Program

Author Note

This project would not have been possible without the support of Dr. Joseph Burkard, Dr. Alyssa Brzenski, and Stephanie Scott, as well as the entire team and support staff in the peri-operative services department.

Abstract

Background: The U.S. Census Bureau projects the number of Americans age 65 years and older will more than double between 2010 and 2050. The geriatric patient population will likely require the use of surgical services at a higher rate than ever before. To best care for the elderly undergoing procedures with anesthesia, it is imperative to follow the most up to date evidence to avoid post-operative complications, and more specifically post-operative cognitive dysfunction.

Purpose: The purpose of this DNP evidence-based practice project is to identify patients that are at high risk for post-operative cognitive dysfunction prior to undergoing anesthesia. Post-operative cognitive dysfunction can lead to increased lengths of stay in the hospital, discharge of patients to places other than home, and leads to unnecessary spending of the healthcare system. By identifying these patients in their pre-op visit, an "anesthesia bundle for the elderly" can be implemented intra-operatively to decrease risk for cognitive dysfunction post-operatively.

EBP Model: The "8 A's Model' will be used to guide this Evidence Based Practice project.

Evidence Based Interventions: Elderly patients that are over the age of 70 should be administered a Mini-Cog exam in their pre-op visit. If the Mini-Cog is failed, this information should be disseminated to the surgical team so the patients can be treated more appropriately intra-operatively. The evidence demonstrates that Benzodiazepines and Anticholinergic drugs specifically should be avoided in patients who are at high risk for post-operative cognitive dysfunction.

Evaluation and Results: The initial stages of this project will gather information through a chart review on current practices at a local university hospital. Charts were reviewed of elderly patients aged 70 and older that underwent anesthesia at this hospital in the past month. Per the evidence, patients with a history of alcohol abuse, depression, renal insufficiency, anemia, coronary artery disease, hypertension, and poor functional capacity should be administered a Mini-Cog exam. We will note if a Mini-Cog was done or not and note which medications the patients were on prior to undergoing anesthesia. Additionally, it will be important to know which medications were administered to patients during anesthesia, as well as how the patient did post-operatively. CAM scores conducted in the PACU will be taken from the chart. All information gathered will have no patient identifiers present.

Implications for Practice: The goal of this project is to make a practice change in this local hospital's anesthesia department to improve cognitive outcomes for the elderly post-operatively. Best practices for our growing elderly population are critical for anesthesia administration. Continuity of care between pre-op, intra-op, and post-op is imperative and can help decrease cognitive dysfunction after anesthesia for some of our most fragile patients.

Keywords: post-op cognitive dysfunction, peri-op, anesthesia, mini-cog, CAM score, benzodiazepines, anticholinergics

Abbreviations: Confusion Assessment Method (CAM), Post-Anesthesia Care Unit (PACU), Doctor of Nursing Practice (DNP)

Identifying Elderly Patients at High Risk for Post-Operative Cognitive Dysfunction: A Clinical Perspective

Introduction

The U.S. Census Bureau projects that between 2012 and 2050, the older population will grow at a rapid rate. The number of Americans aged 65 years and older will almost double in size, increasing from 43.1 million elderly adults in 2012, to over 83.7 million elderly adults by 2050 (U.S. Census Bureau, 2014). These changes will impact many facets of life in this country, including families, businesses, health policies like Social Security and Medicare, as well as the U.S. healthcare system in general (U.S. Census Bureau, 2014). The geriatric patient population will likely require the use of surgical services at a higher rate than ever before. To best care for the elderly undergoing procedures with anesthesia, it is imperative to follow the most up to date evidence to avoid post-operative complications, and more specifically post-operative cognitive dysfunction.

One of the most common post-operative complications in our elderly patients is delirium, which occurs in up to 65% of patients who undergo anesthesia and surgical operations (Decker & Peden, 2020). However, about 40% of cases of post-operative cognitive changes could have been avoided with simple steps conducted by the peri-operative services team before, during, and after undergoing anesthesia (Decker & Peden, 2020). One of the steps that healthcare teams can take to mitigate post-operative cognitive impairment is to screen patients for preexisting cognitive impairment in the days prior to procedure, and then disseminate the patient's screening results to the peri-operative team to reduce risk for cognitive dysfunction in the post-op period (Decker & Peden, 2020). One of the biggest predictors of postoperative cognitive dysfunction is

preexisting cognitive impairment, which makes it critical to identify these patients early and manage them appropriately during and after their procedures. Post-operative cognitive dysfunction is associated with poor surgical outcomes, longer stays in the hospital, mortality, postoperative functional decline, and being discharged to places other than home, like a long-term care facility or a skilled nursing facility (Chow, Esnaola, Ko, & Rosenthal, 2012). Ideally, healthcare systems should implement a 'peri-operative anesthesia bundle', which includes screening in the pre-operative period, specific medication selection intra-operatively, and a care bundle in the recovery room to decrease post-operative cognitive dysfunction.

The purpose of this evidence-based practice project was to partner with the peri-operative services department at a local hospital and review their current practices by sifting through the electronic health records of elderly patients who had recently undergone anesthesia to trend their pre-operative status, their intra-operative status, and their post-operative status. By collecting actual data from the patients that receive surgical services at this prestigious hospital system, the true numbers would be able to be compared to the national benchmark data, and recommendations and changes can be implemented to improve outcomes for our most fragile patients.

Methods

Evidence Based Practice Model

The 8 A's Evidence Based Practice (EBP) Model, which was initially created by Dr. Laurie Ecoff and Dr. Caroline Brown in 2011, was selected to guide this project. The model has most recently been updated in 2020 and provides a sequential, concise model to effortlessly implement an evidence-based change project (Ecoff & Brown, 2020).

This model was chosen as the framework for this project because it is clear and easy to implement at almost any stage of a practice change project. The eight steps of the model include assessing, asking, acquiring, appraising, applying, analyzing, adopting, and advancing (Ecoff & Brown, 2020). The seventh and eighth steps are all about "advancing and adopting" the EBP project and include the dissemination of the project results (Ecoff & Brown, 2020). This step is where one should consider taking the new practice and implementing it beyond the initial population (Ecoff & Brown, 2020).

The 8 A's model has many strengths that help bring evidence-based changes to fruition. First, the 8 A's model is easy for its users to understand and remember. This model uses simple alliteration to engage its users and to ensure no steps are forgotten. The current model further appeals to its users as it is color coded, versus the older version which is black and white, which makes it easier for users to stay on track and note which stage of a process change they are taking part in (Brown & Ecoff, 2011). Overall, the model is organized, clear cut, and concise.

While the 8 A's model is a newer model developed here in San Diego, it was developed utilizing the core fundamentals from older and more widely known change models like that of Rosswurm and Larrabee, and that of Haywood. This model can be used both in a hospital setting, as well as outside a hospital setting, which gives users the opportunity to expand their change project and to many locations.

What is most intriguing about the 8 A's model is the fact that once you hit the eighth step, the change project does not end there. It encourages the user to go one step further and disperse the results to more than just the target organization. The outcome should go beyond the initial problem that inspired the change project (Ecoff, et al., 2020).

Often, change projects start small, but if they are successful, it is important to implement the results beyond the scope of the initial change project and the 8 A's model lets users do just that in the last step. The plan for this DNP project was to initially start small with the implementation of my practice change (just one department in a local hospital), but eventually, if the project returns positive results and outcomes, the goal is to disseminate this information via a reputable medical journal in hopes of creating a practice change at a state or national level.

Literature Review and PICO Question

An extensive review of the literature was conducted prior to beginning this evidence-based practice project. The CINAHL and PubMed databases were utilized, and key words including cognitive dysfunction, post-op cognitive dysfunction, delirium, elderly, peri-op, and anesthesia were entered into the search engine to bring up relevant articles. Filters and parameters were added to fine tune the articles presented and were only to include articles in the English language and those from the year 2010 and on. Additionally, three articles were pulled from www.anesthesiologynews.com, which is a subscription-based platform. It is highly respected and the most widely read publication for the anesthesia specialty over the last 25 years.

Over 20 articles were read and reviewed for relevancy and accuracy. These journal articles were evaluated for high quality evidence using the Johns Hopkins Nursing Evidence Based Practice Model research appraisal tool. In total, 10 articles were chosen based on the quality of the content and application to this project. Ultimately, each of the articles selected were, in part, able to answer the PICO question: In the geriatric population, (adults age 70+) who are undergoing anesthesia, does establishing

and implementing a perioperative anesthesia bundle for brain health, compared to current practices, decrease amount of postoperative cognitive dysfunction and improve patient outcomes?

As a whole, the 10 articles selected all supported the fact that elderly patients are at high risk for post-operative cognitive dysfunction. The cause of post-operative cognitive dysfunction is unclear, but is likely to include age, pre-existing mild cognitive impairment, and lower education (Nathan, 2018). Additionally, risk factors such as depression, alcohol abuse, anemia, renal insufficiency, heart disease and hypertension, poor functional capacity and the use of polypharmacy or psychotropic medications can affect the likelihood of cognitive impairment as well (Chow, et al., (2012). Of all the potential causes of post-operative cognitive dysfunction, the strongest predictor is pre-existing cognitive impairment (Chow, et al., (2012). However, small changes can be implemented during the pre-op visit, intra-op procedure, and post-op recovery can greatly improve these elderly patients' outcomes.

The articles pinpoint that the use of benzodiazepine and longer-acting opioids while under anesthesia increases the risk of postoperative delirium, and those should be avoided when possible (Arora, 2014). Additionally, use of medications on the BEERS list (see Appendix K) as well as anticholinergic medication should be avoided as they are high risk medications in the elderly (Decker & Peden, 2020). Specifically, pharmaceuticals like Diphenhydramine, all Benzodiazepines, Scopalamine, Ketamine, Meperidine, Morphine, Zolpidem, and Histamine-receptor antagonists are mentioned and should be avoided when possible (Hughes, 2020). Instead, administering lower risk

medications like Acetaminophen and NSAIDs would be appropriate to minimize post-operative cognitive dysfunction (Decker & Peden, 2020).

Because preexisting cognitive impairment is the strongest predictor of post-operative cognitive dysfunction, cognitive screening using the Mini-Cog should be administered to all elderly patients age 70 and older. Documentation of Mini-Cog results in the electronic health record, as well as disseminating this information to the peri-operative team is critical in preventing post-operative cognitive dysfunction (Decker & Culley, 2021). "Documentation of cognitive status led to a decrease in the administration of high-risk medications with anticholinergic properties, such as scopolamine, meperidine and diphenhydramine, from 9.6% to 3.2%. Conversely, low-risk medications such as acetaminophen were much more commonly used in patients with documentation (68.8%) than in those with no documentation" (Decker, 2021). Additionally, patients with a documented Mini-Cog score received significantly fewer benzodiazepines and were more likely to have a cognitive impairment prevention plan in place for the post-op period than those without a Mini-Cog in their chart (Decker & Culley, 2021).

While implementing a Mini-Cog in the pre-op phase and withholding the use of high-risk medications in the intra-op phase can improve outcomes in our elderly who are undergoing anesthesia, even more can be done in the post-op phase to protect our most fragile patients. Regular screening using the Confusion Assessment Method (CAM) tool should be conducted in the recovery unit (Decker & Peden, 2020). Nursing actions become extremely essential in the post-op period. Returning the patients' most important belongings to them as soon as it is safe, like hearing aids, dentures, and glasses, can help patients get their bearings more quickly (Decker & Peden, 2020). Nurses should

encourage family, friends, and visitors to be present with the patient and do everything possible to adjust lighting and tune out background noise to protect the sleep and wake cycle (Decker & Peden, 2020). Additionally, using pharmacy alerts for high-risk medications and providing suggested alternatives can be beneficial (Decker & Peden, 2020). If impairment occurs in the post-operative phase, trying non-pharmacologic options first is preferred, only resorting to pharmacologic options if they are absolutely necessary, starting at the lowest dose and advancing slowly (Decker & Peden, 2020).

Selected Screening Tool

As mentioned previously, the consensus is that a Mini-Cog should be utilized for patients aged 70 and older during their pre-op visit. The Mini-Cog is a screening tool that is used to increase the detection of cognitive impairment in elderly adults. It consists of two components: a three-item recall test to test memory, as well as completing a simple drawing of a clock. A score of zero to two indicates probable cognitive dysfunction, and a score of three to five suggests a lower likelihood of cognitive impairment (Wanderer, 2017).

In the post-operative period, the suggested screening tool to utilize is the CAM tool. “The CAM instrument assesses the presence, severity, and fluctuation of 9 delirium features: acute onset, inattention, disorganized thinking, altered level of consciousness, disorientation, memory impairment, perceptual disturbances, psychomotor agitation or retardation, and altered sleep-wake cycle. The CAM diagnostic algorithm is based on four cardinal features of delirium: 1) acute onset and fluctuating course, 2) inattention, 3) disorganized thinking, and 4) altered level of consciousness. A diagnosis of delirium according to the CAM requires the presence of features 1, 2, and either 3 or 4. The CAM

demonstrated sensitivities from 94–100%, specificities from 90–95%, positive predictive accuracy of 91– 94%, negative predictive accuracy of 90–100%, interrater reliability ranging from .81–1.00; and convergent agreement with other mental status tests including the Mini-Mental State Examination (MMSE)" (Wei, et al., 2008).

Project Plan and Implementation Process

The development of this evidence-based practice project ultimately began with the development of a PICO question, which was followed by a thorough review of the literature. The DNP student collaborated with her campus faculty advisor to come up with an implementation process and plan. As with any change implementation project, it was important to get initial buy-in from key stakeholders at the local hospital that was identified to be where the project would take place. Because this project involves implementing changes in three different departments, it was important to identify individuals that would support this project in each area. After pitching the idea of this project to anesthesiologists, nurses, and leadership in peri-op and receiving positive feedback, the decision was made to submit for IRB approval. On December 20, 2021, the project was approved by the ACQUIRE committee at the local hospital and data collection could begin.

An excel spreadsheet was utilized to collect and store data from the chart review and 250 charts were examined on the EPIC platform from January 1, 2022 to February 20, 2022. Demographics were assessed initially, collecting data on the age, gender, and primary language spoken by the patient undergoing anesthesia. Only patients over the age of 70 were included. From there, health records were opened, and health history of these elderly patients were obtained. It was noted in the excel spreadsheet when these elderly

patients had any one of the following diagnoses added to their medical record: depression, alcohol abuse, renal insufficiency, anemia, coronary artery disease, hypertension, poor functional capacity, or taking any medications on the BEERS list. Having just one of these prior medical conditions is grounds for a Mini-Cog and avoidance of high-risk medications intra-operatively. Then, the pre-operative history and physical note from the provider was opened and skimmed to see if a Mini-Cog was administered. The medication administration record from the procedure was opened and reviewed, and administration of a benzodiazepine or an anticholinergic was documented in the excel spreadsheet. Lastly, the post-op notes from both the anesthesia team and the nursing staff in the PACU were reviewed, and the post-op course was documented in the excel spreadsheet. This included the use of a CAM score, any signs of delirium or post-op cognitive dysfunction, and the patient's length of stay.

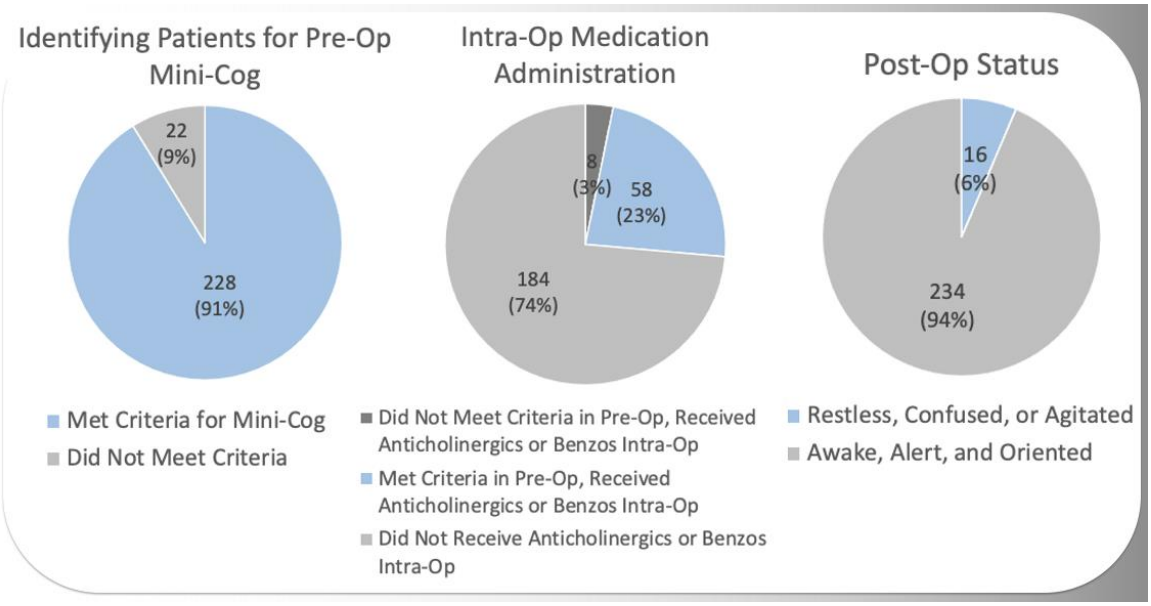
It is important to note that patients who were undergoing electroconvulsive therapy were excluded from the data set, as they come in for treatment so frequently that the data would have been skewed.

Results

After the retrospective chart review, the data was analyzed, and conclusions were drawn that were presented to the peri-operative team. Of the 250 charts reviewed, 228 of them met criteria to have a Mini-Cog prior to undergoing anesthesia (91.2%). However, zero charts actually had a Mini-Cog documented. Intraoperatively, 66 patients received medications recommended against per the literature, like a benzodiazepine or an anticholinergic. The most frequently used benzodiazepine was Midazolam. Of the 66 patients that received these drugs intra-operatively, 58 of them met criteria where they

should have been avoided based on their health history. That means that 88% of elderly patients who received a benzodiazepine or an anticholinergic intra-operatively should not have. Post-operatively, there were zero documented CAM scores to assess for delirium, which is the tool recommended by the literature. Instead, there was documentation of a RASS score in most of the charts, or the Richmond Agitation and Sedation Scale. Based on RASS assessments, 16 patients were either restless, confused or agitated when they woke up from anesthesia. Ultimately, length of stay did not seem to be affected by which drugs were used intraoperatively.

Figure 1.



Discussion

Strengths and Limitations

Looking back upon the completion of this evidence-based practice project, it is important to evaluate the strengths, limitations and possible areas for improvement. One of the main strengths of this project is the amount of literature that suggests the implementation of a Mini-Cog and the avoidance of benzodiazepines and

anticholinergics, among other medications, intra-op. The evidence gathered was very high level and each article was in congruence with the suggestions of the next article. Another one of the strengths that can be appreciated is that the use of the suggested screening tools are easy to understand, easy to interpret, and quick to implement in practice. Each screening tool should take less than 3 minutes to conduct, which should not disrupt current workflow. Lastly, it is beneficial that this evidence-based practice project is being conducted with the staff of the hospital versus trying to get patients themselves to make a change. Healthcare workers know through and through that change and quality improvement projects are a significant part of medicine. Because of this, healthcare workers are usually more open and welcoming to the idea of process improvement, which was noticed during this project and can be considered a strength of this project.

Limitations of this project included a small sample of charts and a short time frame where chart review was conducted. Due to the COVID-19 pandemic, it was difficult to get this project started at the anticipated time. The IRB committees did not meet as frequently because of the global pandemic, and approval took longer than anticipated. This ultimately led to reviewing a much smaller number of charts than what was hoped for. Additionally, while there was a surplus of information and journal articles on how to screen for post-operative cognitive dysfunction and which medications to avoid intra-op, there seemed to be a limited amount of information available that discussed recommended post-op interventions and which medications should be used instead intra-operatively.

Cost Benefit Analysis

Ultimately the potential benefit of this project greatly outweighs any of the associated costs. As stated previously, the Mini-Cog only takes three minutes to conduct and can be added as a requirement during the pre-operative history and physical that must completed within 30 days of the scheduled procedure. Adding one small step to the patient's visit would not cost anything to the hospital. Disseminating this information to the anesthesia team on the day of the procedure will also not cost anything, but can significantly benefit the patient. Intraoperatively, the anesthesia team has the freedom to make clinical judgments based on their critical thinking to determine which combination of pharmaceuticals would be best for each patient's individual case. By having the documented Mini-Cog, the anesthesia team has the knowledge to avoid administering benzodiazepines and anticholinergics when possible. Per the literature, this can lead to less post-op cognitive dysfunction and, in turn, shorter hospital stays, increased discharge to home instead of skilled nursing or long-term care facilities, and decreases in morbidity and mortality. If a day in the hospital in California typically costs an average of $3726.00, it is in the best interest of each hospital system to follow best practice and safely discharge patients as soon as possible (Fay, 2021). By preventing post-operative cognitive dysfunction in our elderly, we can do just that.

Conclusion

As clinicians, we are constantly changing and evolving our practice to keep up with the latest literature. Simply documenting a Mini-Cog in the electronic health record and verbally disseminating this information to the anesthesia team prior to putting a patient under can decrease the use of high-risk medications like benzos and anticholinergics intra operatively. In the PACU, documentation of a CAM score can help

identify delirium early, and in these patients, we can best assist them by bringing in familiarities to help them adjust post-op.

All of these tools, which can be referred to as “the peri-op anesthesia bundle” are easy changes that can be implemented at this local hospital to improve our peri-op care for our elderly patients and improve their outcomes. It is clear that while this hospital system is looked upon highly and with favor by the community, has won many awards and is MAGNET designated facility, which only 8.9% of hospitals in the United States are, the data coming from their peri-op department demonstrate there is still room for improvement.

The goal of this project is to be continued by a first-year or second-year DNP student, to implement the changes suggested in the literature. While the completion of this stage of the project was extremely important because gaps in care were identified, it is important to take this information and implement the necessary changes to improve outcomes. Our elderly patients deserve the best, and with the continued implementation of this quality improvement project, one should see increased discharges to home, decreased mortality, and decreased overall cost to the hospital.

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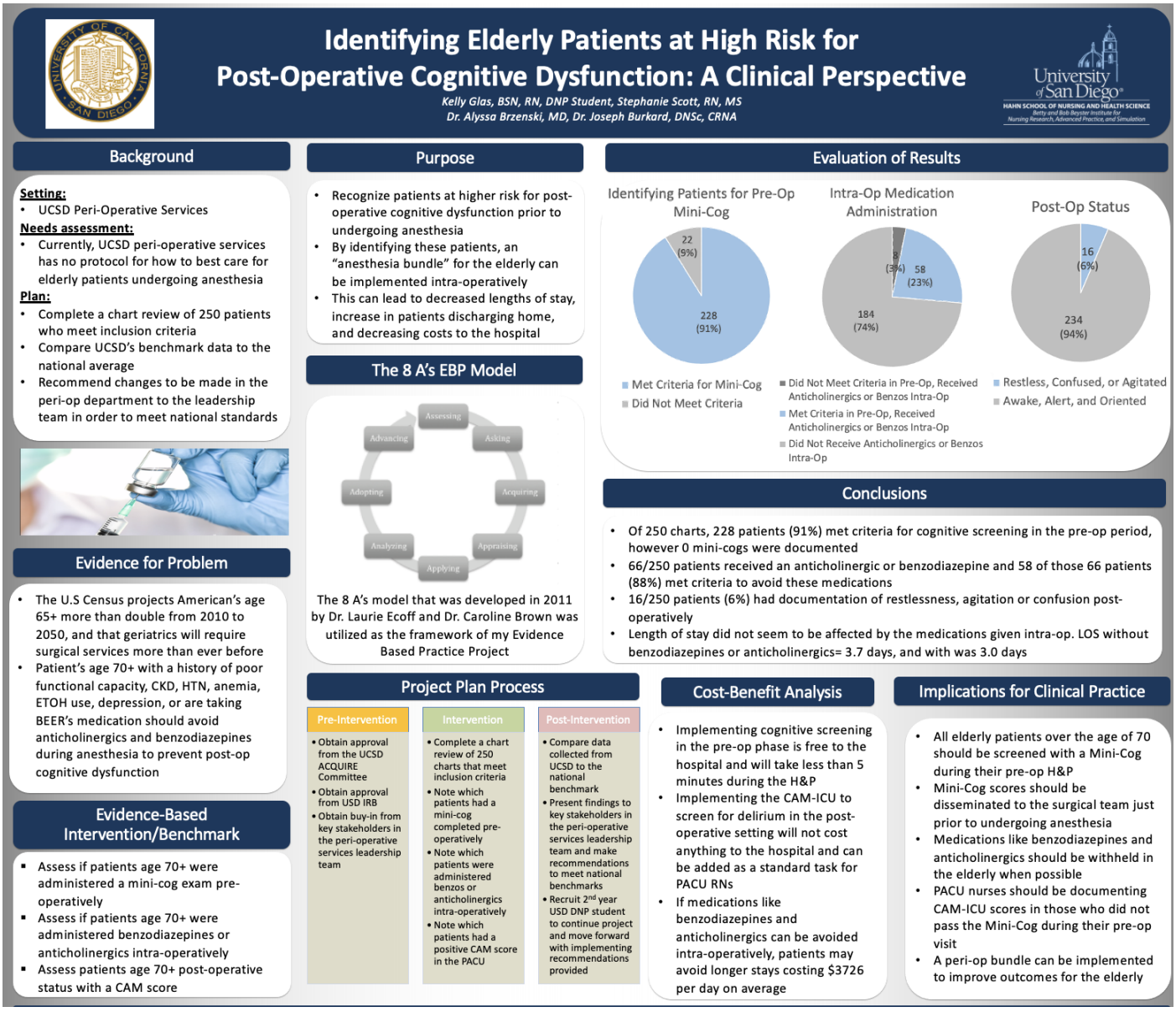
Appendix A

Poster



Appendix B

Confusion Assessment Method

CONFUSION ASSESSMENT METHOD (CAM) SHORTENED VERSION WORKSHEET

EVALUATOR: DATE:

I. ACUTE ONSET AND FLUCTUATING COURSE

a) Is there evidence of an acute change in mental status from the patient's baseline? No ____ Yes ____

b) Did the (abnormal) behavior fluctuate during the day, that is tend to come and go or increase and decrease in severity? No ____ Yes ____

II. INATTENTION

Did the patient have difficulty focusing attention, for example, being easily distractible or having difficulty keeping track of what was being said? No ____ Yes ____

BOX 1

III. DISORGANIZED THINKING

Was the patient 's thinking disorganized or incoherent, such as rambling or irrelevant conversation, unclear or illogical flow of ideas, or unpredictable switching from subject to subject? No ____ Yes ____

IV. ALTERED LEVEL OF CONSCIOUSNESS

Overall, how would you rate the patient's level of consciousness?

-- Alert (normal)

-- Vigilant (hyperalert)
-- Lethargic (drowsy, easily aroused)
-- Stupor (difficult to arouse)
-- Coma (unarousable)

Do any checks appear in this box? No ____ Yes ____

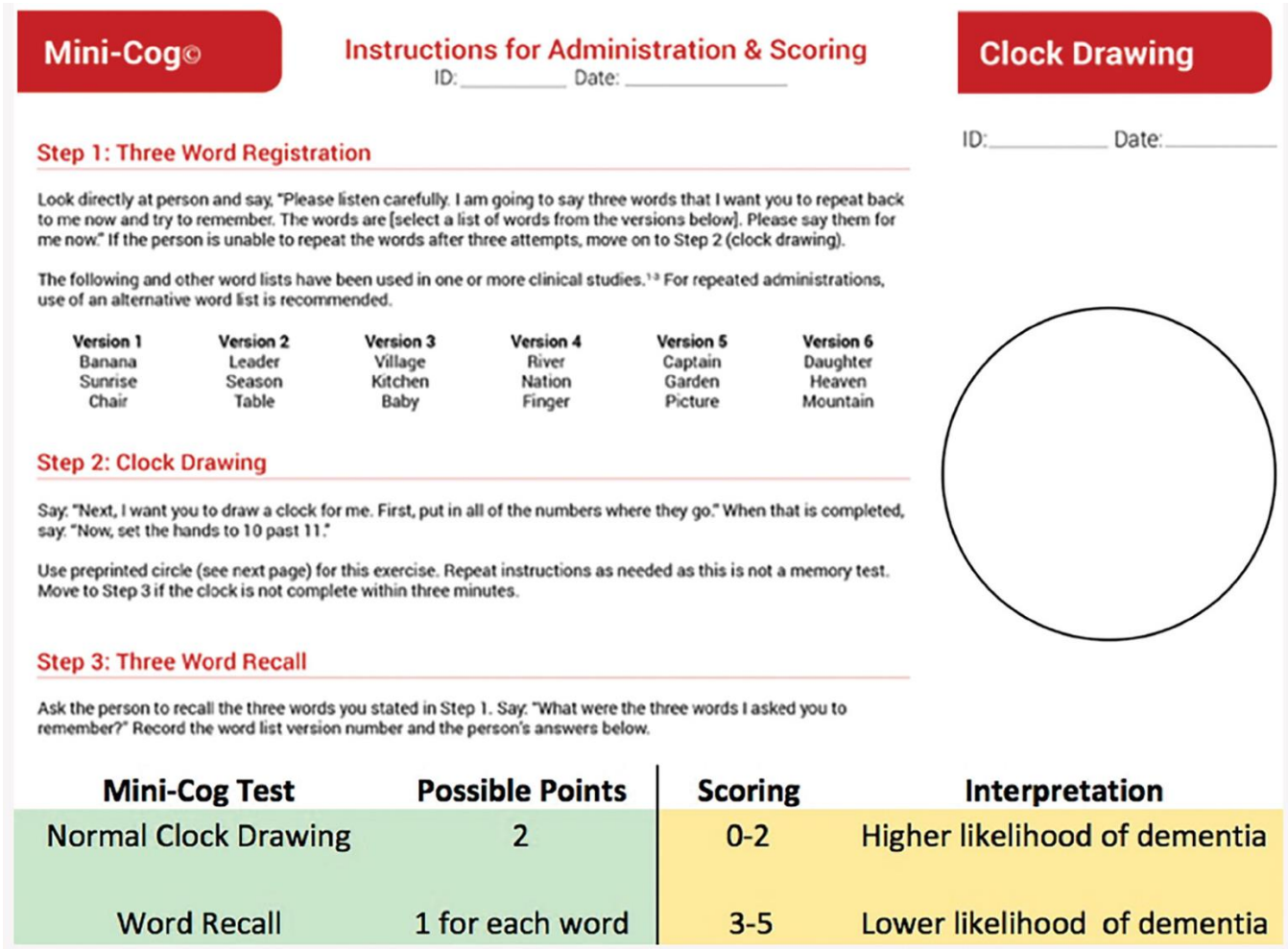
BOX 2

If all items in Box 1 are checked and at least one item in Box 2 is checked a diagnosis of delirium is suggested.

Adapted from Inouye SK et al, Clarifying Confusion: The Confusion Assessment Method. A New Method for Detection of Delirium. Ann Intern Med. 1990; 113:941-8.

Appendix C

Mini-Cog



Mini-Cog©

Instructions for Administration & Scoring

ID:_____ Date: _____

Step 1: Three Word Registration

Look directly at person and say, "Please listen carefully. I am going to say three words that I want you to repeat back to me now and try to remember. The words are [select a list of words from the versions below]. Please say them for me now." If the person is unable to repeat the words after three attempts, move on to Step 2 (clock drawing).

The following and other word lists have been used in one or more clinical studies.[1-3] For repeated administrations, use of an alternative word list is recommended.

Version 1	Version 2	Version 3	Version 4	Version 5	Version 6
Banana	Leader	Village	River	Captain	Daughter
Sunrise	Season	Kitchen	Nation	Garden	Heaven
Chair	Table	Baby	Finger	Picture	Mountain

Step 2: Clock Drawing

Say: "Next, I want you to draw a clock for me. First, put in all of the numbers where they go." When that is completed, say: "Now, set the hands to 10 past 11."

Use preprinted circle (see next page) for this exercise. Repeat instructions as needed as this is not a memory test. Move to Step 3 if the clock is not complete within three minutes.

Step 3: Three Word Recall

Ask the person to recall the three words you stated in Step 1. Say: "What were the three words I asked you to remember?" Record the word list version number and the person's answers below.

Clock Drawing

ID:_____ Date:_____

Mini-Cog Test	Possible Points	Scoring	Interpretation
Normal Clock Drawing	2	0-2	Higher likelihood of dementia
Word Recall	1 for each word	3-5	Lower likelihood of dementia

Figure 1. The Mini-Cog test. There are three steps that include a score for accuracy of "clock drawing" and "three word recall," resulting in a cumulative score that can increase the detection of cognitive impairment.

Reprinted with permission from Soo Borson, MD. See mini-cog.com for full administration instructions.

Appendix D

Richmond Agitation Sedation Scale

RASS (Richmond Agitation Sedation Scale)		
4	Combative	Overtly combative, violent, immediate danger to staff
3	Very agitated	Pulls or removes tubes or catheters; aggressive
2	Agitated	Frequent non-purposeful mvmt, fights ventilator
1	Restless	Anxious but movements not aggressive or vigorous
0	Alert and calm	
-1	Drowsy	Sustained awakening to voice (≥10sec)
-2	Light sedation	Briefly awakens with eye contact to voice (<10 sec)
-3	Moderate sedation	Movement or eye opening to voice but no eye contact
-4	Deep sedation	No response to voice but movement or eye opening to physical stimulation
-5	Cannot be aroused	No response to voice or physical stimulation

Appendix E

BEERS Medication List

2012 AGS BEERS CRITERIA FOR POTENTIALLY INAPPROPRIATE MEDICATION USE IN OLDER ADULTS[97]

Organ System/ Therapeutic Category/Drug(s)	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Anticholinergics (excludes TCAs)				
First-generation antihistamines (as single agent or as part of combination products) • Brompheniramine • Carbinoxamine • Chlorpheniramine • Clemastine • Cyproheptadine • Dexbrompheniramine • Dexchlorpheniramine • Diphenhydramine (oral) • Doxylamine • Hydroxyzine • Promethazine • Triprolidine	Highly anticholinergic; clearance reduced with advanced age, and tolerance develops when used as hypnotic; increased risk of confusion, dry mouth, constipation, and other anticholinergic effects/toxicity Use of diphenhydramine in special situations such as acute treatment of severe allergic reaction may be appropriate	Avoid	Hydroxyzine and promethazine: High All others: Moderate	Strong
Anti-Parkinson agents • Benztropine (oral) • Trihexyphenidyl	Not recommended for prevention of extrapyramidal symptoms with antipsychotics; more effective agents available for treatment of Parkinson disease	Avoid	Moderate	Strong
Antispasmodics • Belladonna alkaloids • Clidinium-chlordiazepoxide • Dicyclomine • Hyoscyamine • Propantheline • Scopolamine	Highly anticholinergic, uncertain effectiveness	Avoid except in short-term palliative care to decrease oral secretions	Moderate	Strong
Antithrombotics				
Dipyridamole, oral short-acting* (does not apply to the extended-release combination with aspirin)	May cause orthostatic hypotension; more effective alternatives available; IV form acceptable for use in cardiac stress testing	Avoid	Moderate	Strong
Ticlopidine*	Safer, effective alternatives available	Avoid	Moderate	Strong
Anti-Infective				
Nitrofurantoin	Potential for pulmonary toxicity; safer alternatives available; lack of efficacy in patients with CrCl <60 mL/min due to inadequate drug concentration in the urine	Avoid for long-term suppression; avoid in patients with CrCl <60 mL/min	Moderate	Strong

2012 AGS BEERS CRITERIA FOR POTENTIALLY INAPPROPRIATE MEDICATION USE IN OLDER ADULTS[97]

Organ System/ Therapeutic Category/Drug(s)	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Cardiovascular				
Alpha 1 blockers • Doxazosin • Prazosin • Terazosin	High risk of orthostatic hypotension; not recommended as routine treatment for hypertension; alternative agents have superior risk/benefit profile	Avoid use as an antihypertensive	Moderate	Strong
Alpha blockers, central • Clonidine • Guanabenz* • Guanfacine* • Methyldopa* • Reserpine (>0.1 mg/day)*	High risk of adverse CNS effects; may cause bradycardia and orthostatic hypotension; not recommended as routine treatment for hypertension	Avoid clonidine as a first-line antihypertensive Avoid others as listed	Low	Strong
Antiarrhythmic drugs (Class Ia, Ic, III) • Amiodarone • Dofetilide • Dronedarone • Flecainide • Ibutilide • Procainamide • Propafenone • Quinidine • Sotalol	Data suggest that rate control yields better balance of benefits and harms than rhythm control for most older adults Amiodarone is associated with multiple toxicities, including thyroid disease, pulmonary disorders, and QT interval prolongation	Avoid antiarrhythmic drugs as first-line treatment of atrial fibrillation	High	Strong
Disopyramide*	Disopyramide is a potent negative inotrope and therefore may induce heart failure in older adults; strongly anticholinergic; other antiarrhythmic drugs preferred	Avoid	Low	Strong
Dronedarone	Worse outcomes have been reported in patients taking dronedarone who have permanent atrial fibrillation or heart failure In general, rate control is preferred over rhythm control for atrial fibrillation	Avoid in patients with permanent atrial fibrillation or heart failure	Moderate	Strong
Digoxin >0.125 mg/day	In heart failure, higher dosages associated with no additional benefit and may increase risk of toxicity; decreased renal clearance may lead to increased risk of toxic effects	Avoid	Moderate	Strong
Nifedipine, immediate release*	Potential for hypotension; risk of precipitating myocardial ischemia	Avoid	High	Strong
Spironolactone >25 mg/day	In heart failure, the risk of hyperkalemia is higher in older adults if taking >25 mg/day	Avoid in patients with heart failure or with a CrCl <30 mL/min	Moderate	Strong

2012 AGS BEERS CRITERIA FOR POTENTIALLY INAPPROPRIATE MEDICATION USE IN OLDER ADULTS[97]

Organ System/ Therapeutic Category/Drug(s)	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Central Nervous System				
Tertiary TCAs, alone or in combination: • Amitriptyline • Chlordiazepoxide-amitriptyline • Clomipramine • Doxepin >6 mg/day • Imipramine • Perphenazine-amitriptyline • Trimipramine	Highly anticholinergic, sedating, and causes orthostatic hypotension; the safety profile of low-dose doxepin (≤6 mg/day) is comparable to that of placebo	Avoid	High	Strong
Antipsychotics, first- (conventional) and second- (atypical) generation (see **Table First- and Second-Generation Antipsychotics below for full list)**	Increased risk of cerebrovascular accident (stroke) and mortality in persons with dementia	Avoid use for behavioral problems of dementia unless nonpharmacologic options have failed and patient is threat to self or others	Moderate	Strong
Thioridazine Mesoridazine	Highly anticholinergic and greater risk of QT-interval prolongation	Avoid	Moderate	Strong
Barbiturates • Amobarbital* • Butabarbital* • Butalbital • Mephobarbital* • Pentobarbital* • Phenobarbital • Secobarbital*	High rate of physical dependence; tolerance to sleep benefits; greater risk of overdose at low dosages	Avoid	High	Strong
Benzodiazepines SHORT- AND INTERMEDIATE-ACTING: • Alprazolam • Estazolam • Lorazepam • Oxazepam • Temazepam • Triazolam LONG-ACTING: • Chlorazepate • Chlordiazepoxide • Chlordiazepoxide-amitriptyline • Clidinium-chlordiazepoxide • Clonazepam • Diazepam • Flurazepam • Quazepam	Older adults have increased sensitivity to benzodiazepines and decreased metabolism of long-acting agents; in general, all benzodiazepines increase risk of cognitive impairment, delirium, falls, fractures, and motor vehicle accidents in older adults May be appropriate for seizure disorders, rapid eye movement sleep disorders, benzodiazepine withdrawal, ethanol withdrawal, severe generalized anxiety disorder, periprocedural anesthesia, end-of-life care	Avoid benzodiazepines (any type) for treatment of insomnia, agitation, or delirium	High	Strong

2012 AGS BEERS CRITERIA FOR POTENTIALLY INAPPROPRIATE MEDICATION USE IN OLDER ADULTS[97]

Organ System/ Therapeutic Category/Drug(s)	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Chloral hydrate*	Tolerance occurs within 10 days and risk outweighs the benefits in light of overdose with doses only 3 times the recommended dose	Avoid	Low	Strong
Meprobamate	High rate of physical dependence; very sedating	Avoid	Moderate	Strong
Nonbenzodiazepine hypnotics • Eszopiclone • Zolpidem • Zaleplon	Benzodiazepine-receptor agonists that have adverse events similar to those of benzodiazepines in older adults (for example, delirium, falls, fractures); minimal improvement in sleep latency and duration	Avoid chronic use (>90 days)	Moderate	Strong
Ergot mesylates* Isoxsuprine*	Lack of efficacy	Avoid	High	Strong
Endocrine				
Androgens • Methyltestosterone* • Testosterone	Potential for cardiac problems and contraindicated in men with prostate cancer	Avoid unless indicated for moderate to severe hypogonadism	Moderate	Weak
Desiccated thyroid	Concerns about cardiac effects; safer alternatives available	Avoid	Low	Strong
Estrogens with or without progestins	Evidence of carcinogenic potential (breast and endometrium); lack of cardioprotective effect and cognitive protection in older women Evidence that vaginal estrogens for treatment of vaginal dryness is safe and effective in women with breast cancer, especially at dosages of estradiol <25 mcg twice weekly	Avoid oral and topical patch Topical vaginal cream: Acceptable to use low-dose intravaginal estrogen for the management of dyspareunia, lower urinary tract infections, and other vaginal symptoms	Oral and patch: High Topical: Moderate	Oral and patch: Strong Topical: Weak
Growth hormone	Impact on body composition is small and associated with edema, arthralgia, carpal tunnel syndrome, gynecomastia, impaired fasting glucose	Avoid, except as hormone replacement following pituitary gland removal	High	Strong
Insulin, sliding scale	Higher risk of hypoglycemia without improvement in hyperglycemia management regardless of care setting	Avoid	Moderate	Strong
Megestrol	Minimal effect on weight; increases risk of thrombotic events and possibly death in older adults	Avoid	Moderate	Strong
Sulfonylureas, long-duration • Chlorpropamide • Glyburide	Chlorpropamide: Prolonged half-life in older adults; can cause prolonged hypoglycemia; causes SIADH Glyburide: higher risk of severe prolonged hypoglycemia in older adults	Avoid	High	Strong

2012 AGS BEERS CRITERIA FOR POTENTIALLY INAPPROPRIATE MEDICATION USE IN OLDER ADULTS[97]

Organ System/ Therapeutic Category/Drug(s)	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Gastrointestinal				
Metoclopramide	Can cause extrapyramidal effects including tardive dyskinesia; risk may be further increased in frail older adult.	Avoid, unless for gastroparesis.	Moderate	Strong
Mineral oil, given orally	Potential for aspiration and adverse effects; safer alternatives available	Avoid	Moderate	Strong
Trimethobenzamide	One of the least effective antiemetic drugs; can cause extrapyramidal adverse effects	Avoid	Moderate	Strong
Pain Medications				
Meperidine	Not an effective oral analgesic in dosages commonly used; may cause neurotoxicity; safer alternatives available	Avoid	High	Strong
Non–COX-selective NSAIDs, oral • Aspirin >325 mg/day • Diclofenac • Diflunisal • Etodolac • Fenoprofen • Ibuprofen • Ketoprofen • Meclofenamate • Mefenamic acid • Meloxicam • Nabumetone • Naproxen • Oxaprozin • Piroxicam • Sulindac • Tolmetin	Increases risk of GI bleeding/peptic ulcer disease in high-risk groups, including those >75 years old or taking oral or parenteral corticosteroids, anticoagulants, or antiplatelet agents; use of proton pump inhibitor or misoprostol reduces but does not eliminate risk; upper GI ulcers, gross bleeding, or perforation caused by NSAIDs occur in approximately 1% of patients treated for 3–6 months, and in about 2%–4% of patients treated for 1 year; these trends continue with longer duration of use	Avoid chronic use unless other alternatives are not effective and patient can take gastroprotective agent (proton-pump inhibitor or misoprostol)	All others: Moderate	Strong
Indomethacin Ketorolac, includes parenteral	Increases risk of GI bleeding/peptic ulcer disease in high-risk groups (see above non–COX-selective NSAIDs) Of all the NSAIDs, indomethacin has most adverse effects	Avoid	Indomethacin: Moderate Ketorolac: High	Strong
Pentazocine*	Opioid analgesic that causes CNS adverse effects, including confusion and hallucinations, more commonly than other narcotic drugs; is also a mixed agonist and antagonist; safer alternatives available	Avoid	Low	Strong
Skeletal muscle relaxants • Carisoprodol • Chlorzoxazone • Cyclobenzaprine • Metaxalone • Methocarbamol • Orphenadrine	Most muscle relaxants poorly tolerated by older adults because of anticholinergic adverse effects, sedation, increased risk of fractures; effectiveness at dosages tolerated by older adults is questionable.	Avoid	Moderate	Strong

2012 AGS BEERS CRITERIA FOR POTENTIALLY INAPPROPRIATE MEDICATION USE IN OLDER ADULTS[97]

Organ System/ Therapeutic Category/Drug(s)	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation

*Infrequently used drugs

Abbreviations: ACEI, angiotensin converting-enzyme inhibitors; ARB, angiotensin receptor blockers; CNS, central nervous system; COX, cyclooxygenase; CrCl, creatinine clearance; GI, gastrointestinal; NSAIDs, nonsteroidal anti-inflammatory drugs; SIADH, syndrome of inappropriate antidiuretic hormone secretion; TCAs, tricyclic antidepressants.

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2012 AGS BEERS CRITERIA FOR POTENTIALLY INAPPROPRIATE MEDICATIONS TO BE USED WITH CAUTION IN OLDER ADULTS[97]

Drug(s)	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Aspirin for primary prevention of cardiac events	Lack of evidence of benefit versus risk in individuals ≥80 years old	Use with caution in adults ≥80 years old	Low	Weak
Dabigatran	Increased risk of bleeding compared with warfarin in adults ≥75 years old; lack of evidence for efficacy and safety in patients with CrCl <30 mL/min	Use with caution in adults ≥75 years old or if CrCl <30 mL/min	Moderate	Weak
Prasugrel	Increased risk of bleeding in older adults; risk may be offset by benefit in highest-risk older patients (for example, those with prior myocardial infarction or diabetes)	Use with caution in adults ≥75 years old	Moderate	Weak
Antipsychotics Carbamazepine Carboplatin Cisplatin Mirtazapine SNRIs SSRIs TCAs Vincristine	May exacerbate or cause SIADH or hyponatremia; need to monitor sodium level closely when starting or changing dosages in older adults due to increased risk	Use with caution	Moderate	Strong
Vasodilators	May exacerbate episodes of syncope in individuals with history of syncope	Use with caution	Moderate	Weak

Abbreviations: CrCl, creatinine clearance; SIADH, syndrome of inappropriate antidiuretic hormone secretion; SSRIs, selective serotonin reuptake inhibitors; SNRIs, serotonin–norepinephrine reuptake inhibitors; TCAs, tricyclic antidepressants.

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FIRST- AND SECOND-GENERATION ANTIPSYCHOTICS[97]	
First-Generation (Conventional) Agents	**Second-Generation (Atypical) Agents**
Chlorpromazine	Aripiprazole
Fluphenazine	Asenapine
Haloperidol	Clozapine
Loxapine	Iloperidone
Molindone	Lurasidone
Perphenazine	Olanzapine
Pimozide	Paliperidone
Promazine	Quetiapine
Thioridazine	Risperidone
Thiothixene	Ziprasidone
Trifluoperazine	
Triflupromazine	

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DRUGS WITH STRONG ANTICHOLINERGIC PROPERTIES

Antihistamines

- Brompheniramine
- Carbinoxamine
- Chlorpheniramine
- Clemastine
- Cyproheptadine
- Dimenhydrinate
- Diphenhydramine
- Hydroxyzine
- Loratadine
- Meclizine

Anti-Parkinson Agents

- Benztropine
- Trihexyphenidyl

Antidepressants

- Amitriptyline
- Amoxapine
- Clomipramine
- Desipramine
- Doxepin
- Imipramine
- Nortriptyline
- Paroxetine
- Protriptyline
- Trimipramine

Antipsychotics

- Chlorpromazine
- Clozapine
- Fluphenazine
- Loxapine
- Olanzapine
- Perphenazine
- Pimozide
- Prochlorperazine
- Promethazine
- Thioridazine
- Thiothixene
- Trifluoperazine

Antimuscarinics (Urinary Incontinence)

- Darifenacin
- Fesoterodine
- Flavoxate
- Oxybutynin
- Solifenacin
- Tolterodine
- Trospium

Antispasmodics

- Atropine products
- Belladonna alkaloids
- Dicyclomine
- Homatropine
- Hyoscyamine products
- Loperamide
- Propantheline
- Scopolamine

Skeletal Muscle Relaxants

- Carisoprodol
- Cyclobenzaprine
- Orphenadrine
- Tizanidine

The End