Preoperative Cognitive Testing with the Mini-Cog Test vs. the Mini-Mental State Examination for Prediction of Risk of Postoperative Delirium: An Evidence-Based Educational Module

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Abstract

Background: Postoperative delirium (POD) is the most common postoperative complication experienced by patients aged 65 and above and is considered both life-threatening and preventable. Elderly patients who present with preexisting cognitive impairment have a significantly higher risk of developing POD; however, cognitive impairment is not always recognized in the elderly patient. Research has suggested that as many as 37% of the elderly surgical population presents with undiagnosed cognitive impairment, indicating that anesthesia providers are unaware of the baseline cognitive status of a large portion of their patients. Preoperative cognitive screening of all elderly patients has been recommended as a critical first step in identifying cognitive impairment and preventing POD. While the Mini Mental State Examination (MMSE) is considered the gold standard screening tool for cognitive impairment, the Mini-Cog is a superior tool for use in the preoperative setting due to its rapid administration time and simple instructions.

Method: A literature review was conducted via the EMBASE, CINAHL, and Cochrane databases to gather evidence for the use of the Mini-Cog for the prediction of POD risk. Following a review and synthesis of the evidence, an educational module was created to explain the benefits of the use of the Mini-Cog in the preoperative setting; the instructions for administration, scoring, and interpretation; and potential interventions for use in patients who are identified as cognitively impaired. The module was distributed to 33 Certified Registered Nurse Anesthetists (CRNAs) employed at an academic medical center, along with a pretest/posttest survey. The results of the surveys were compared to determine the effectiveness of the educational module in increasing provider knowledge and enacting evidence-based practice.

Results: A total of 10 CRNAs from the target facility participated in the study. The pre- and posttests gauged participants' knowledge of preoperative cognitive testing of elderly patients using the Mini-Cog tool. The average accuracy score on the pretest was 67.5%, compared to 96.25% on the posttest, representing a statistically significant increase in accuracy following completion of the educational module ($p < 0.001$). Results on the subjective measures improved slightly, indicating an increased belief that a screening tool is necessary for accurate cognitive assessment and a slightly increased likelihood of implementing the Mini-Cog into practice.

Discussion: The educational module was successful in increasing CRNA knowledge of the prediction of POD risk using the Mini-Cog as a preoperative screening tool. CRNA beliefs about the usefulness of such a tool and the likelihood of implementing it into practice were somewhat less affected. Further research is needed to determine if this educational module can successfully influence the way CRNAs at the target facility assess the preoperative cognitive status of elderly patients presenting for surgery. Further research may also help determine if specific policy changes are needed to increase compliance with the recommended intervention.

Keywords: preanesthetic assessment, cognitive screening, delirium, older adults

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Introduction

Background

The preoperative assessment regularly includes evaluation of major organ systems including cardiovascular, respiratory, hematological, and hepatic and renal function. However, the inclusion of standardized preoperative cognitive testing has yet to become routine in many facilities despite evidence that preoperative cognitive impairment is predictive of numerous postoperative complications.[1] Preexisting cognitive impairment in elderly patients (age 65+) is associated with increased hospital length of stay, postoperative delirium, cognitive dysfunction, declining functional status, and increased hospital mortality.[1-4] These complications can have devastating effects, as patients may struggle with loss of independence and a declining ability to carry out activities of daily living.

Postoperative delirium (POD) is the most common postoperative complication experienced by elderly patients, and is considered both life-threatening and entirely preventable.[5] Numerous medical societies and organizations have identified the prevention of POD as a clinical priority, with recent guidelines released by experts in perioperative brain health recommending preoperative cognitive screening as a critical first step in reducing its incidence.[6-8] Identification of patients who present with preexisting cognitive impairment can aid anesthesia providers in modifying their choice of pharmacological agents, arranging for postoperative rehabilitation, and establishing realistic expectations with patients and family members.

Problem Identification

The presence of mild cognitive impairment in elderly patients can often be difficult to ascertain without the use of a standardized neuropsychological screening tool. While many

anesthesia providers believe they can evaluate a patient's cognitive status using basic preoperative questioning, studies have shown that the prevalence of unrecognized cognitive impairment among elderly patients presenting for elective surgery is as high as 37%.[2] This means that many providers are formulating anesthetic plans for elderly patients without an accurate understanding of their baseline cognitive status. As the number of patients aged 65 years and older continues to increase, the incorporation of a reliable preoperative cognitive assessment will become increasingly important in minimizing postoperative morbidity and mortality among this vulnerable population.

Many neuropsychological screening tools currently exist and have been validated for use in identifying cognitive impairment in elderly patients. However, a full neuropsychological testing battery can take hours to administer and many of the shorter screening tools are still too lengthy to be realistically applied in the preoperative setting. Anesthesia providers are unlikely to adopt this critical practice if the tools at their disposal have a negative effect on efficiency and operating room turnover. Thus, it is crucial for a rapid, reliable screening tool to be identified for use as a feasible preoperative cognitive screening aid.

Scope and Consequences of the Problem

The scope of this problem is immense. The number of people in the United States aged 65 years and older is predicted to grow to 77 million by the year 2034, surpassing the 76.5 million people under the age of 18.[9] As the average age of the general population increases, so too does the average age of patients undergoing surgery. This age group is vulnerable to costly and devastating postoperative complications, including POD. Recent research has demonstrated that the 1-year cost generated by patients who suffer from delirium is $44,291 per patient.[10] This cost increases to $56,474 per patient for those suffering from severe delirium. This represents a

national cost burden of $32.9 billion per year, rivaling costs generated by cardiovascular disease and diabetes. Thus, measures that aid in the prevention of POD have the potential to drastically decrease healthcare costs while significantly improving quality of life for elderly patients.

Knowledge Gaps

Presently, there exists a knowledge gap in the best practices for preventing POD in vulnerable patients. In 2021, the American Society of Anesthesiologists (ASA) launched the Perioperative Brain Health Initiative and consulted with international experts to develop a list of guidelines for reducing the overall incidence of perioperative neurocognitive disorders, including delirium.[8] These guidelines include the administration of a baseline cognitive assessment using a standard test; pre- and postoperative delirium screening to older surgical patients; development of an interdisciplinary team of healthcare professionals to implement multicomponent non-pharmacological interventions for the prevention of delirium; optimization of postoperative pain control using multimodal techniques; avoidance of antipsychotic and benzodiazepine medications for older adults who develop POD; and development of individualized discharge plans for patients who have experienced POD or who are at increased risk of postoperative neurocognitive disorders. Additional research has suggested that the use of dexmedetomidine, total intravenous anesthesia, and BIS-guided anesthesia can also result in significant reductions in rates of POD, although further research into these interventions is still needed.[11,12]

Proposal Solution

This project aimed to implement one of the interventions recommended by the ASA Brain Health Initiative, namely the routine administration of baseline cognitive screening to older adult patients undergoing surgery. The Mini Mental State Examination (MMSE) is often

considered the gold standard rapid screening tool for the detection of cognitive impairment. Recently, several studies have shown that preoperative MMSE scores are predictive of postoperative morbidity and mortality in elderly patients.[13-17] However, the MMSE can take 10-15 minutes for proper administration, making it a poor choice for the fast-paced preoperative environment. The Mini-Cog is a more rapidly administered cognitive test that has recently shown utility as a preoperative screening tool.[18-29] Thus, training perioperative staff in the administration of the Mini-Cog has the potential to assist anesthesia providers in identification of patients at risk of significant postoperative complications and to adjust their anesthetic plan accordingly.

Objective

The objective of this quality improvement project is to educate CRNAs on the administration of the Mini-Cog to elderly patients in the preoperative setting, and to elucidate the benefits of Mini-Cog administration in predicting postoperative neurocognitive complications.

PICO Question

The PICO question for this project is as follows:

Population (P): Elderly patients (60 years or older) undergoing elective surgery

Intervention (I): Preoperative administration of the Mini-Cog test

Comparison (C): Preoperative administration of the Mini Mental State Examination (MMSE)

Outcome (O): Postoperative delirium

Patient Population

The population selected for study in this project was elderly patients undergoing elective surgery. Older adults aged 60 years and above were currently the fastest-growing age group in

the world, with at least 40% of people in this demographic requiring surgery.[2] Delirium and postoperative cognitive dysfunction (POCD) are the most common postoperative complications occurring in elderly patients, with numerous long-lasting consequences that can negatively impact overall health status.[8] Recent research has shown that preoperative mild cognitive impairment can go unrecognized in up to 37% of elderly patients across all non-cardiac surgeries.[2] Declining brain health following elective surgery can have potentially devastating effects on patients and their family members and has the potential to create an enormous burden on the healthcare system as the population continues to age.

Intervention

Recently, the ASA launched a Perioperative Brain Health Initiative that recommends the inclusion of preoperative cognitive testing for establishing a baseline and for assessing the risk of postoperative neurocognitive disorders.[8] The proposed intervention for this project was the implementation of preoperative cognitive testing for all elderly (age 65+) patients using the Mini-Cog screening tool. The Mini-Cog is a rapid assessment that takes approximately 3 to 5 minutes to administer, consisting of a 3-item recall test and a clock-drawing test. This tool can detect abnormalities in immediate and short-term memory, language skills, visual-motor skills, and executive functioning. The Mini-Cog has been validated for the detection of cognitive impairment, with scores of 0 to 2 indicating that a patient is "probably impaired," while scores of 3 to 5 indicate that a patient is "probably not impaired."[30] Its short administration time and relatively simple instructions make it an ideal tool for use in the perioperative setting. Recent research has pointed to the accuracy of the Mini-Cog in predicting postoperative delirium risk, as well as numerous other complications.[7-14]

Comparison

The Mini-Cog has often been compared to another well-known cognitive screening test, the Mini Mental State Examination (MMSE). The MMSE consists of 11 questions, including basic orientation questions, a 3-word recall test, an item identification test, and an image copying test. The MMSE has also been validated for the detection of mild cognitive impairment and has similarly shown utility in accurately predicting postoperative cognitive decline.[3-6] However, the full MMSE takes approximately 10-15 minutes to administer, making it an unrealistic choice for use in the fast-paced preoperative environment. Studies have shown that the Mini-Cog has the same if not greater predictive ability for postoperative delirium in elderly patients compared to the MMSE.[22]

Outcomes

The outcomes of interest for this literature review included postoperative delirium and overall postoperative morbidity and mortality as predicted by preoperative Mini-Cog scores. As previously mentioned, preoperative cognitive impairment is associated with numerous negative health outcomes in the older adult population. Among these are increased risk of delirium, 1-year mortality, discharge to assisted care, 30-day readmission, an overall decline in independent functioning, difficulty following postoperative care instructions, and difficulty adhering to prescribed therapy.[31] Implementing preoperative cognitive testing will allow anesthesia providers to more objectively identify those patients who are at increased risk of developing these complications, allowing the opportunity to modify their anesthetic plan accordingly.

Methodology of Literature Review

Literature Search Process

A literature search was conducted using the EMBASE, CINAHL, and Cochrane Library databases, due to their focuses on scholarly articles relating to biomedical sciences and clinical medicine. The search was completed using the following Boolean search: (preoperative AND ((cognitive testing) OR (Mini-Cog)) AND ((delirium) or (cognitive dysfunction)). The search was limited to articles published between 2018 and 2024. Inclusion criteria were as follows: English language; full text; preoperative setting; patients aged 60 years and above; and systematic reviews, randomized controlled trials, or cohort studies. Exclusion criteria were non-English language, use of a cognitive screening tool other than the Mini-Cog or MMSE, and non-perioperative setting. The initial EMBASE search returned 71 articles, from which 6 were selected after comparison against the inclusion and exclusion criteria. CINAHL returned 8 articles, from which 3 articles were selected. Cochrane Library returned 117 articles, from which 4 additional articles were selected. The final 12 articles selected for review are included in the literature matrix in Appendix A.

Literature Appraisal

All articles were appraised for their level of evidence using the Johns Hopkins evidence-based practice evidence hierarchy.[32] Under this hierarchy, Level I evidence is defined as any experimental randomized controlled trial, explanatory mixed methods designs that include only Level I quantitative studies, and systematic reviews of randomized controlled trials with or without meta-analyses. Level II evidence is defined as quasi-experimental studies (which include cohort studies, time-series designs, and pretest-posttest designs), explanatory mixed methods studies that include Level II quantitative studies, and systematic reviews of a combination of

randomized controlled trials and quasi-experimental studies with or without meta-analysis. Level III evidence is defined as any nonexperimental study, systematic reviews including nonexperimental studies with or without meta-analysis, and qualitative studies or systematic reviews of qualitative studies. Level IV and V evidence consists of non-research evidence such as opinion pieces, consensus panels/position statements, case reports, and quality improvement, program, or financial evaluations.

Characteristics of the Included Studies

Kapoor et al published a systematic review and meta-analysis examining the prevalence of preoperative cognitive impairment in older surgical patients.[2] The purpose of this review was to identify how frequently elderly patients present for elective and emergency surgery with undiagnosed cognitive impairment. Their meta-analysis included randomized controlled trials and cohort studies, making it Level II evidence according to the Johns Hopkins evidence hierarchy. For this review, relevant articles published between 1946 and 2021 were identified from MEDLINE (Ovid), PubMed, Embase, Cochrane Central, Cochrane Database of Systematic Reviews, PsycINFO, and EMCare Nursing. Selected articles included studies of patients aged 60 years and older undergoing elective cardiac and non-cardiac or emergency surgery who had been assessed preoperatively for cognitive impairment using validated cognitive assessment tools. Ultimately, 48 studies were selected for inclusion in the meta-analysis with a mean patient age of 74.8 +/- 7.3 years. Twelve of the included studies used the Montreal Cognitive Assessment (MoCA) for assessing cognitive function, 9 used the Mini-Cog, 7 used full neuropsychological batteries, and 12 used a variety of methods.

Of the 48 included studies, 25 described the prevalence of unrecognized cognitive impairment in patients undergoing elective non-cardiac surgery. The pooled prevalence of

unrecognized cognitive impairment in patients presenting for elective non-cardiac surgery was 37%.[2] Nine of the studies included in the meta-analysis examined patients undergoing elective cardiac surgeries. The pooled prevalence of unrecognized cognitive impairment in this group was 26%. Nine studies examined patients undergoing emergency orthopedic and general surgery and found that the pooled prevalence of unrecognized cognitive impairment was 50%. Overall, this systematic review provides strong evidence to support that a significant proportion of elderly patients presenting for elective and emergency surgery have some degree of unrecognized cognitive impairment.

Tong et al performed a prospective cohort study of the prevalence and impact of undiagnosed mild cognitive impairment in elderly patients undergoing thoracic surgery.[3] Patients completed the Chinese version of the MoCA preoperatively and were then categorized into a normal group (MoCA $\geq$ 26) and an abnormal group (MoCA < 26). POD was then assessed using the Confusion Assessment Method (CAM) twice daily during the following 3 days. Patients were also assessed for length of stay and incidence of postoperative pulmonary complications. The incidence of mild cognitive impairment amongst patients in this sample was found to be 49.4%. The incidence of POD identified by the CAM was 22%. The abnormal group was found to have a 30.3% incidence of POD, compared to a 14.1% incidence found in the normal group. Independent risk factors for POD were found to be preoperative mild cognitive impairment, duration of surgery > 80 minutes, and segmentectomy/lobectomy resection. POD was also found to be positively associated with risk of postoperative pulmonary complications and median length of stay. The results of this study suggested that there is a significant number of elderly patients presenting for thoracic surgery who have at least a mild degree of preexisting cognitive impairment. Additionally, this study provided evidence that preexisting mild cognitive

impairment is associated with numerous negative outcomes, including POD, postoperative pulmonary complications, and increased length of stay. One limitation to this study was its lack of randomization, which places it in Level II of the Johns Hopkins evidence hierarchy.

Krishnan et al performed a retrospective analysis of 6350 elderly patients undergoing elective total knee arthroplasty to determine if preoperative cognitive impairment was associated with increased perioperative complications.[4] Patients who were identified as having preoperative cognitive impairment were propensity-score matched to patients without cognitive impairment, and then assessed for incidence of POD, functional status, nonhome discharge, 30-day mortality, infection rates, failure to wean, and reintubation. The sample included patients aged 65 and older who participated in the American College of Surgeons National Safety Quality Improvement Program (ACS-NSQIP) Geriatric Surgery Pilot Program, compiled from 25 participating clinical settings. The cognitive impairment group was found to have significantly higher rates of POD, partial or totally dependent postoperative functional status, and non-home discharge compared to the non-cognitively impaired group. These outcomes are known to be associated with increased morbidity and mortality. This study provides further evidence for the negative outcomes associated with preexisting cognitive impairment including increased POD risk, and the importance of identifying patients presenting for surgery with this often-unrecognized condition.

In a single-center retrospective study published by Yajima et al, researchers sought to determine the usefulness of the Mini-Cog screening tool in identifying cognitive impairment and predicting the risk of delirium following major urological cancer surgery.[18] Medical records for patients who underwent surgery between 2020 and 2021 and who had preoperative cognitive screening with the Mini-Cog were selected for inclusion in the analysis. A total score of < 3 indicates cognitive impairment. The presence of POD was diagnosed using the American

Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders-5* (DSM-5). Eight percent of patients were ultimately diagnosed with POD. Mini-Cog score < 3 was found to be 69.2% sensitive and 86.2% specific for POD. Multivariate analysis found that Mini-Cog score < 3, decline in independent activities of daily living, and preoperative benzodiazepine use were all independent risk factors for the development of POD. The results of this study suggest that the Mini-Cog is a useful tool for rapidly identifying patients at risk of developing postoperative complications such as POD. One limitation of this study was its use of a retrospective design, making it Level III evidence.

Chen et al performed a prospective cohort study using the Mini-Cog to predict postoperative mortality in geriatric patients undergoing elective surgery under general anesthesia.[19] Elderly patients aged 65 and older who were scheduled to undergo elective surgery between October 2015 and December 2017 were administered the Mini-Cog preoperatively. The primary endpoint was 1-year all-cause mortality. Secondary endpoints were 1-, 3-, and 6-month mortality and postoperative complications within 30 days. Of the patients sampled, 33.2% were discovered to have cognitive impairment. One-year all-cause mortality and 3-month mortality were significantly higher in the cognitive impairment group compared to the normal cognition group. Consistent with the results of other studies, these findings suggest that there is a significant number of patients presenting for elective surgery with undiagnosed cognitive impairment. Furthermore, the Mini-Cog was shown to be a useful tool for identifying these patients, and for predicting 1-year all-cause mortality and 3-month mortality. However, this study was limited by its prospective cohort design, making it Level III evidence.

Suyama et al conducted a retrospective cohort study that sought to determine the utility of the Mini-Cog in predicting risk of readmission for elderly patients undergoing transcatheter

aortic valve implantation (TAVI).[20] Patients' preoperative cognitive status was assessed using the Mini-Cog, consisting of a verbal playback test and clock drawing test (CDT). The results saw 21.2% of patients readmitted within 1 year. Frequency of cognitive impairment (Mini-Cog score < 3) was found to be significantly higher in the readmission group than in the non-readmission group. Failure of the clock drawing portion of the Mini-Cog correlated significantly with readmission. Both CDT failure and Mini-Cog scores < 3 were found to be significant independent risk factors for readmission. These results are consistent with other results indicating that the Mini-Cog is a useful screening tool for cognitive function and for prediction of postoperative complications. Further, this study provides evidence for the utility of the clock drawing test alone in determining postoperative risk in elderly patients undergoing TAVI. Again, the retrospective design is one limitation to these results.

In another retrospective cohort study, Weiss et al examined the utility of the Mini-Cog in determining risk of POD.[21] Data were collected for patients aged 70 and above who had been preoperatively screened with the Mini-Cog and who were later evaluated for POD using the 4A's test 1 hour after admission to PACU, before PACU discharge, and on post-operative day one and two. Ultimately, 21% of patients were found to have preoperative cognitive impairment with a Mini-Cog score <3, and 14.8% of patients experienced POD. Patients who were identified as having preoperative cognitive impairment were significantly more likely to experience POD compared to those without cognitive impairment. Additionally, delirium incidence and risk increased as Mini-Cog scores decreased. Mini-Cog scores were also independently associated with falls and discharge to high-dependency facilities. This study highlights the utility of the Mini-Cog for predicting rates of POD in elderly patients undergoing elective surgery and for predicting other adverse patient outcomes.

Li et al performed a retrospective cohort study with the aim of comparing the Mini-Cog to the MMSE for rapid identification of patients with mild cognitive impairment.[22] Patients were assessed using both screening tools, and scores were then compared to determine the level of agreement between them. The Mini-Cog was found to have a higher sensitivity (85.71%) for detecting mild cognitive impairment than the MMSE (64.76%), suggesting that the Mini-Cog is a superior screening tool for this purpose. These results provide evidence that the Mini-Cog is a strong choice for a rapid screening tool for the detection of undiagnosed cognitive impairment in the hospital setting, and may even be better than the MMSE, which is often considered the gold standard rapid assessment of cognitive function.

Tiwary et al conducted a prospective cohort study with the aim of determining the level of agreement in scores between the Mini-Cog administered in a preoperative clinic versus in the preoperative area on the day of surgery.[23] Additionally, this study sought to determine the ability of the Mini-Cog to identify elderly patients at risk for developing post-anesthesia care unit (PACU) delirium. Patients between the ages of 65 and 89 who presented for elective surgery with general anesthesia were administered the Mini-Cog in the preoperative clinic and again on the day of surgery. Patients were then evaluated for delirium using the CAM in PACU. Analysis of the scores between the 2 administrations revealed 64% agreement. Clinic-day Mini-Cog scores < 3 were found to be significantly associated with PACU delirium. Surgery-day Mini Cog scores < 3 were found to increase the odds of PACU delirium by a factor of 12.8. These results provide strong evidence for the use of the Mini-Cog in either the preoperative clinic or on the day of surgery for predicting patients at increased risk of PACU delirium. Use of the Mini-Cog in the preoperative clinic may increase compliance by anesthesia providers, as it reduces the risk of anesthesia delay in room turnover on the day of surgery.

Another prospective study published by Kimura et al in 2023 aimed to identify accurate predictors of POD in older patients undergoing elective spine surgery.[24] This study sampled patients aged 65 and above who presented for elective spine surgery between February 2018 and May 2019. Patients were initially assessed for their baseline severity of comorbidities using the Cumulative Illness Rating Scale (CIRS), as well as their baseline cognitive status using the Mini-Cog. Patients also had routine laboratory blood tests drawn. Following surgery, patients were then monitored for signs and symptoms of POD, with presence of delirium confirmed using the CAM. In total, 12 out of 106 patients sampled developed POD (11.3%). Low Mini-Cog score (< 3) was found to be an independent predictor of POD. Additionally, elevated blood urea nitrogen (BUN) and advanced age were separate independent predictors of POD. These results provide evidence for the use of the Mini-Cog in the preoperative setting for predicting POD in elderly patients undergoing elective spine surgery.

Yajima et al published a recent retrospective cohort study that aimed to develop a novel predictive model for postoperative delirium in geriatric patients undergoing major urological cancer surgery.[25] This study collected data on male patients between the ages of 68 and 77 who presented for urological surgery at the National Cancer Center Hospital East (NCCHE) between January 2020 and August 2021. Patients were administered a preoperative geriatric functional assessment consisting of the Geriatric 8 test, Independent Activities of Daily Living (IADL), and the Mini-Cog. Patients who subsequently developed POD were then identified, and predictive scores for each assessment were created and several independent risk factors for POD were discovered. First, Mini-Cog scores < 3 were found to independently predict subsequent development of POD. Also, disability in being responsible for one's own medications, as identified on the IADL questionnaire, was found to be an independent risk factor. Thirdly,

preoperative benzodiazepine use was found to be an independent risk factor. When these 3 factors were combined into a composite score, the model was found to be highly specific for the prediction of the development of POD. These results provide further compelling evidence for the use of the Mini-Cog as a rapid screening tool for predicting POD risk, as well as its use in larger predictive models for geriatric risk.

In a pretest-posttest design, Sherman et al sought to test the feasibility of implementing the Mini-Cog for routine cognitive screening in the preoperative assessment clinic.[26] A 10-minute training video on the administration and scoring of the Mini-Cog was developed and shown to nurse practitioners (NPs) and anesthesiology residents at Brigham and Women's Hospital. All patients aged 65 and above who presented to the preoperative clinic were then assessed using the Mini-Cog. Blinded geriatricians cross-checked the scores generated by the NPs and residents for accuracy. Ultimately, 92% accuracy of scoring was achieved between the groups. An abnormal Mini-Cog score of < 3 was detected in 3.7% of patients between 65 and 70 years of age, 27.4% of patients between 81 and 85 years of age, and overall in 10% of patients who participated. This study demonstrates the feasibility of training perioperative health care providers in the correct administration and scoring of the Mini-Cog. Thus, it is feasible to incorporate its use into the preoperative setting by providing proper training to staff and anesthesia providers.

Synthesis of the Literature

Prevalence of Unrecognized Cognitive Impairment in Elderly Surgical Patients

Cognitive impairment is a common but often unrecognized issue in elderly patients. As elucidated by the systematic review published by Kapoor et al, the prevalence is estimated at 37% of elderly patients presenting for all non-cardiac elective surgeries, and as high as 50% of

those presenting for emergency surgery.[2] Other studies included in this review have looked at the rates of undiagnosed cognitive impairment in patients presenting for specific surgery types. For example, Tong et al found a 49.4% incidence of mild cognitive impairment in elderly patients presenting for thoracic surgery,[3] whereas studies conducted by Yajima et al found between a 17% and 18% incidence in those presenting for urologic cancer surgery.[18,25] Prospective studies have reported an incidence of between 12.5% and 33.2% for patients presenting for general elective surgery[19,23]

Despite the elevated rate of cognitive impairment in the elderly surgical population, most studies reported that the number of patients who have been formally diagnosed is low. Thus, evidence suggests that elderly patients with some degree of cognitive impairment are presenting for surgery without advanced knowledge of their cognitive status. Similarly, many CRNAs are blindly caring for many cognitively impaired elderly patients without a true picture of their brain function, leaving the CRNAs unable to tailor their anesthetic plan to accommodate for these changes. These statistics highlight the need for the incorporation of a standardized, routine assessment of cognitive function for all elderly patients presenting for surgery, even those with no history of cognitive changes.

Importance of Identifying Preoperative Cognitive Impairment

Identifying patients who present for surgery with preexisting cognitive impairment is not only important for helping patients understand their own cognitive status but also for predicting numerous postoperative complications. The link between preexisting cognitive impairment and the development of postoperative delirium (POD) has been demonstrated by numerous recent studies.[3,4,18,21,23-25,28] POD has the potential to seriously reduce quality of life for patients and their families while also creating a large burden on the healthcare system. A systematic review of

the economic costs associated with delirium found that the United States can expect to spend between $6.6 billion and $82.4 billion per year on patients who experience delirium.[33] When delirium is superimposed on preexisting dementia, the cost increases 52%. These costs are mostly generated by the numerous sequelae associated with delirium, including prolonged hospital stay, accelerated functional and cognitive decline, institutionalization, and subsequent dementia diagnosis.[10] Consequently, any intervention that improves the ability to predict and mitigate the development of POD has the potential to dramatically impact patients' quality of life and overall healthcare costs.

Preexisting cognitive impairment has also been identified as a risk factor for the development of other postoperative complications, including all-cause 1-year mortality, 90-day mortality, 30-day readmission, 1-year readmission, falls, and discharge to high-dependency facilities.[19-21,31] The ability to quickly identify patients in the preoperative setting who present with preexisting undiagnosed cognitive impairment can assist providers in planning interventions that reduce the risk of these adverse outcomes.

The Mini-Cog as a Reliable Screening Tool for Preoperative Cognitive Impairment

Numerous tools are available to help clinicians identify patients with cognitive impairment, ranging from brief screening tools to full neuropsychological testing batteries. The Mini Mental State Examination (MMSE) is often touted as the gold standard for rapid assessment of cognition. The MMSE consists of 11 questions that test 5 cognitive domains, including orientation, registration, attention and calculation, recall, and language. Several studies have demonstrated the ability of the MMSE to identify cognitive impairment in a preoperative setting.[13-17] However, the MMSE takes approximately 10-15 minutes to administer, making it a poor choice for use in a fast-paced preoperative environment.

The need for a faster screening tool that is similarly accurate in predicting cognitive impairment led to a study by Li et al that directly compared the 2 tools when used in the assessment of Chinese inpatients.[22] Their results demonstrated that the Mini-Cog had higher sensitivity in the detection of mild cognitive impairment compared to the MMSE, suggesting that it may be a superior tool for this purpose. Importantly, the Mini-Cog can be performed in 2-5 minutes, making it a much more feasible option for use in a preoperative setting. Additional research by Sherman et al demonstrated the feasibility of training preoperative clinicians in the proper administration and scoring of the Mini-Cog, lending credence to its viability in this setting.[26]

Following the establishment of the Mini-Cog as a viable tool for detecting mild cognitive impairment, numerous researchers have examined the use of the Mini-Cog in the preoperative clinic or on surgery day. These studies have repeatedly established that the Mini-Cog reliably detects preexisting cognitive impairment at rates similar to those known to be present in the elderly surgical population. Additionally, Mini-Cog scores of < 3 have been repeatedly shown to be independently associated with increased risk of POD in numerous settings and for numerous surgery types.[18,19,22-25] These studies have firmly established that the Mini-Cog is a useful rapid screening tool for identifying elderly patients who are at increased risk for the development of POD. While it does not provide a formal diagnosis of cognitive impairment, the Mini-Cog does provide an accurate measure of the patient's baseline cognitive function and thus allows clinicians to make informed decisions about the type of anesthetic care they are providing.

Conclusion

The results of this literature review provide strong evidence that incorporation of the Mini-Cog into the preoperative anesthetic assessment is a feasible, reliable, low-cost intervention

that is consistent with ASA recommendations to screen all elderly patients for preexisting cognitive impairment. Mini-Cog scores of < 3 can reliably predict the development of POD in elderly patients presenting for a wide variety of elective surgeries and can give anesthesia providers a better picture of their patients' baseline cognitive status. The Mini-Cog is rapidly administered and scored and can be done so in the preoperative clinic or on surgery day with minimal interruption to workflow. This intervention is a low-risk, high-benefit first step in preventing the development of POD in the vulnerable elderly population.

Organizational Assessment

The selected site for this quality improvement project is a 600+ bed teaching hospital located in Miami Beach, Florida, with 26 operating suites servicing a wide range of surgical specialties. Their stated mission is to provide high quality health care to its diverse community, enhanced through teaching, research, charity care, and financial responsibility. As the only hospital on Miami Beach, the facility is tasked with providing medical care for the city's 80,000 residents, 17.1% of whom are over the age of 65.[34] The facility's focus on research and academia makes it an ideal site for the implementation of new evidence-based practices. Further, the large number of elderly surgical patients that present at this hospital underscore the need for specific interventions that aim to reduce adverse outcomes in this vulnerable population.

Currently, the selected facility does not require the routine administration of preoperative cognitive screening for elderly surgical patients. Each day, surgery is provided for numerous patients aged 65 and older with unknown cognitive status. While adjustments are often made to the anesthetic plan for patients with known cognitive decline, there is no protocol in place to determine the need for these adjustments for older patients without formal neurocognitive diagnoses. Given the known rates of undiagnosed cognitive impairment in elderly patients, it is

reasonable to estimate that many of the patients presenting for surgery at this facility would benefit from interventions that have been shown to reduce rates of POD and cognitive decline. However, without the use of a validated cognitive screening tool, CRNAs are unable to objectively ascertain which patients would most benefit from these interventions.

To assist the selected surgical facility in becoming compliant with the ASA's recommendations for best practices in maintaining cognitive health in the elderly, this project aimed to implement the use of routine preoperative screening for patients aged 65 and older who present for surgery. Specifically, the Mini-Cog was selected as the ideal screening tool for the fast-paced preoperative environment, due to its accuracy in identifying preoperative cognitive impairment and its rapid speed of administration.

To aid in the implementation of this quality improvement project, Jacquelyn O'Connor, DNP, CRNA was selected as a project sponsor. Dr. O'Connor is a current CRNA employed at the hospital selected for this project, and as such she has valuable insight into the day-to-day operations of the perioperative environment there. Additional key stakeholders include preoperative nurses, Student Registered Nurse Anesthetists (SRNAs), and the numerous physicians and CRNAs employed by the anesthesia group that services the target hospital. A group of these stakeholders was educated on the need for routine preoperative cognitive screening and provided instructions for the correct administration and scoring of the Mini-Cog screening tool.

The sample included 10 CRNAs currently working in the preoperative environment at the target facility. Educational materials were provided explaining the rationale for the administration of the Mini-Cog, as well as detailed instructions for its proper administration and scoring. Finally, specific interventions that have been shown to reduce POD and other adverse

outcomes were provided. This population was important to the project because of their direct access to the elderly surgical population and their ability to assist in the identification of preexisting cognitive impairment before the patient is anesthetized. Additionally, as anesthesia providers, they have access to several possible interventions to help reduce the possibility of POD and other adverse outcomes.

Goals and Outcomes (SMART Objectives)

To aid in the implementation of this quality improvement project, the following 3 SMART (Specific, Measurable, Achievable, Relevant, and Time-Bound) objectives were identified:

1. Create an educational module for anesthesia providers describing the administration and scoring of the Mini-Cog cognitive screening tool within 1 month of starting the quality improvement project.
2. Distribute the educational module to CRNAs and physician anesthesiologists working at the selected medical facility within 3 months of starting the project.
3. Evaluate the success of the educational module through comparison of pre- and post-module surveys to determine the likelihood of practice change within 6 months of starting the project.

SWOT (Strengths, Weaknesses, Opportunities, Threats) Analysis

Strengths

The chosen hospital has several strengths that made it an ideal site for the implementation of this quality improvement project. The first strength is its focus on the cognitive health of its elderly population. This hospital has identified Alzheimer's disease as one of the leading causes

of disease-related deaths among their patient population.[35] In response to this data, a Center for Alzheimer's Disease and Memory Disorders was established to aid in the study, diagnosis, prevention, and treatment of cognitive impairment. The center's goal is to provide a comprehensive approach with a focus on cognitive screening to delay progression of memory disorders from an early stage. This program provides crucial interventions for the prevention, identification, and treatment of memory disorders among the general elderly population, but it does not yet focus on interventions in the preoperative setting. The implementation of this project is likely to be well supported by stakeholders who have already demonstrated a strong interest in preserving the cognitive health of their patients.

A second strength was the facility's status as a leading research and academic institution. As a teaching hospital, this facility is dedicated to remaining up to date on the latest in evidence-based practices and research-backed interventions. The implementation of preoperative cognitive screening of elderly surgical patients has a strong basis in peer-reviewed research that has shown time and time again that this is a low-cost intervention for preventing many devastating postoperative outcomes. Stakeholders at this institution are much more likely to accept changes to established policies based on strong research, compared to non-academic institutions.

Weaknesses

There were several organizational weaknesses that must be addressed during the implementation of this project. The first weakness was the high production pressure in the operating room at this hospital, resulting in a very fast-paced preoperative environment. Anesthesia providers are often under pressure to prepare patients as quickly as possible for surgery, leaving scarce time for the implementation of additional preoperative evaluations. Unfortunately, evidence has shown that production pressure often causes anesthesia providers to

proceed to surgery without first optimizing their patients or their anesthetic plan.[36] Consequently, production pressure presents a large hurdle to overcome before this project can be successfully implemented. While the Mini-Cog was selected due to its rapid administration time, it will still require a shift in culture to be successfully adopted for routine use.

A second weakness was the large number of anesthesia providers who work at the chosen hospital. There are currently many per diem CRNAs employed at the target facility, as well as many transient anesthesia providers in the form of SRNAs and medical residents who are present at the facility for only a short number of months or years at a time. This made it difficult to distribute educational materials to the entire anesthesia staff and even more difficult to maintain the necessary cultural changes needed to make this change permanent. To surpass this issue, the current project prioritized providing education to full-time CRNAs, as this group has the largest impact on perioperative culture.

Opportunities

There is currently a large focus on brain health in the rapidly aging general population, and this trend translates nicely into the perioperative environment. The ASA's Brain Health Initiative is representative of this trend, as the focus on maintaining cognitive health among elderly surgical patients has grown dramatically in recent years. The first mission statement of the Brain Health Initiative is to promote routine preoperative screening for risk factors for perioperative neurocognitive disorders, such as delirium and postoperative cognitive decline.[37] This presents a strong opportunity for the successful implementation of the present quality improvement project, as it strongly aligned with the goals of this initiative.

Threats

The main threat to the successful implementation of this project was resistance by patients to increased preoperative screening. Patients who do not currently have any formal cognitive diagnoses may be reluctant to undergo cognitive screening, no matter how brief the evaluation. Additionally, there is some question of the responsibility of the anesthesia provider once a patient has been identified as cognitively impaired. This situation creates an ethical duty for the provider to notify the patient of this finding so that additional treatments can be pursued if the patient desires. These factors created a possible source of resistance to the project by stakeholders who may not wish to get involved in this aspect of patient care. However, this threat could be mitigated by teaching staff to adequately educate patients on the importance of preoperative cognitive screening, and by creating a protocol for the next steps once a patient has been identified as cognitively impaired.

Conceptual Underpinning and Theoretical Framework

Theoretical frameworks are utilized in nursing research to provide structure and guidance in the conceptualization of a particular phenomenon. Empirical nursing knowledge is thought to exist in a hierarchy of abstraction, with theory existing at the concrete end of the spectrum. The theory selected for this project is Health-Related Quality of Life (HRQOL), as conceptualized by Ferrans and Powers.[38]

Theory Overview

Under this theory, quality of life is defined as a sense of well-being stemming from a person's satisfaction or dissatisfaction with important areas of his or her life. The Ferrans and Powers Quality of Life (QOL) Index separates QOL into four domains, including health and functioning, socioeconomic, psychological/spiritual, and family. Included within the health and functioning domain are the patient's perceived usefulness to others, physical independence,

responsibilities, stress levels, leisure activities, travel, and discomfort/pain. The socioeconomic domain includes the patient's standard of living, financial independence, home, job, neighborhood, emotional support, education, and social network. The psychological/spiritual domain measures the patient's overall life satisfaction, happiness, goals, peace of mind, personal appearance, faith, and control over his or her own life. Finally, the family domain includes family happiness, children, spouse, and family health. Measuring health-related QOL provides an understanding of the patient's perception of a procedure, medication, or health intervention, and the impact that it had on several domains of the patient's life.

Clinical Fit and Theory Evaluation

The HRQOL theory fits with the goals of the current quality improvement project because the ultimate purpose of this project was to enhance the expected quality of life of elderly patients who present for surgery. Presumably, patients who opt for surgery are doing so with the understanding that their quality of life will increase afterwards, either through enhanced physical capability, improved sense of self, decreased pain and suffering, or better health status. Patients who suffer from delirium and cognitive decline following elective surgery are unfortunately denied this increase in quality of life and are instead faced with decreases in independence, functional status, and overall health. The use of routine preoperative cognitive screening can directly increase HRQOL by allowing anesthesia providers to identify at-risk patients and alter their anesthetic plan in ways that are known to decrease the chance of POD. When elderly patients are spared from the devastating effects of POD, they can fully benefit from the enhanced QOL that their surgery was intended to provide.

The HRQOL theory is readily operationalized via multiple indices that have been developed to measure quality of life, including the Ferrans and Powers Quality of Life Index

(QLI). In the past, this theory has been applied to the assessment of treatment for patients with cancer, spinal cord injuries, pregnancy, organ transplants, and cardiac surgery. In these instances, the theory was used to assess the way patients perceived their quality of life after undergoing treatment for their health concerns.

The Ferrans and Powers QLI has been validated as a measurement tool and can be said to describe the phenomenon of health-related quality of life with high accuracy.[39] Its conceptualization of QOL into four domains adequately captures the components that are important to individuals' quality of life. Further, this conceptualization of QOL can be readily applied to the PICO of the present quality improvement project, particularly due to the specific focus on adverse postoperative outcomes such as delirium. POD has an adverse effect on multiple domains in the Ferrans and Powers model, including physical independence, health, usefulness to others, financial independence, life satisfaction, happiness, sense of self, peace of mind, and control over one's own life. Patients who suffer from POD and other postoperative cognitive deficits would undoubtedly be identified using the Ferrans and Powers QLI tool. The primary assumptions of the theory—namely, that quality of life is composed of numerous aspects of one's overall functional status—are consistent with the theoretical framework of this quality improvement project.

Methodology of Proposal

Setting and Participants

The participants selected for this quality improvement project were CRNAs working at the chosen medical facility. This population was selected due to their ubiquitous presence in the preoperative environment, which was the main setting relevant to this project. Anesthesia providers conduct a thorough preoperative assessment on every patient in their care, and as such,

they have access to the demographic on which this project focuses: elderly surgical patients. The target sample size was 10 individual CRNAs who received the prepared education materials detailing the use of the Mini-Cog for preoperative cognitive screening of elderly patients.

Procedures

This project followed a pre-/posttest design. Prior to receiving the educational intervention, participants will take part in a survey designed to test their knowledge of the rate of preexisting cognitive impairment in the elderly population, the availability of rapid screening tools for cognition, and their current practices for reducing or preventing delirium in elderly patients (see Appendix C). The responses collected from this survey constituted the pre-intervention data.

The intervention itself consisted of an educational module (see Appendix C) designed to explain the rationale for the recommended practice change, instructions for proper administration of the Mini-Cog, information on how to interpret scores, and possible interventions that can be selected to reduce POD in patients identified as at risk. The proper administration of the Mini-Cog is important because it is a cognitive screening tool that has been validated based on standardized administration instructions. Thus, it is crucial that all anesthesia providers learn to administer and score this screening tool in the correct way so that its results can be considered valid and reliable.

A posttest survey, which tested participants on their understanding of the material they just reviewed, followed the educational module. The questions on the posttest survey were identical to the pretest survey, allowing a direct comparison between the 2 in order to gauge the efficacy of the educational module. This survey also gauged the participants' likelihood of implementing the use of the Mini-Cog into their preoperative assessment of elderly patients. The

purpose of the post-intervention data was to assess the effectiveness of the educational module in initiating a practice change among anesthesia providers.

Participant Recruitment

Recruitment of participants took place via emails sent to full time CRNAs employed at the chosen site (see Appendix B). This email contained a summary of the purpose of the quality improvement project, as well as a link to the pre-intervention survey and the educational module. The initial participant goal was 10 individual CRNAs.

Data Collection

Data were collected using Qualtrics surveys. Demographic data were collected from each participant, including age range, profession, highest educational degree, and number of years in practice.

The surveys were also used to collect all pre- and posttest data. Participants were asked about their knowledge of the prevalence of undiagnosed cognitive impairment in elderly patients presenting for surgery. They were also asked about any prior knowledge of cognitive screening tools and their utility in the preoperative setting. Finally, they were asked about their understanding of interventions for preventing POD in elderly patients. Following the educational module, they were asked these same questions so that the effectiveness of the module could be assessed. The surveys used for data collection can be found in Appendix C.

Data Analysis

Descriptive statistics were provided to summarize the overall demographic data of the sample. To analyze the differences between the pretest data and the posttest data, a paired sample *t*-test will be performed on the average accuracy scores for all objective measures. In a paired

samples *t*-test, data from a single group is collected at two separate time points and used to compare the mean difference between the two samples. The significance of the result of a paired *t*-test is determined by the *p*-value, with $p < 0.05$ typically denoting a significant difference and $p < 0.001$ denoting a highly significant difference. For the two subjective measures included in the surveys, descriptive statistics will be provided.

Data Management and Protection of Human Subjects

This quality improvement project was submitted for Institutional Review Board (IRB) approval before initiation (see Appendix B). Care was taken to protect the privacy and confidentiality of all participants. Survey results were anonymized, with no identifying information to connect responses to specific participants. Additionally, the results of the surveys were kept under a password-protected account that can only be accessed by the principal investigator and co-investigator. Data were transferred from the password-protected Qualtrics account to an offline data storage program on a private, password-protected laptop. Upon transfer, data were permanently deleted from the online Qualtrics account.

Informed consent was provided to all participants, detailing the steps of the project and the way that their information would be stored and analyzed. Participants were asked to sign the informed consent form before proceeding to the pretest survey. All collected data was used only for analysis of this quality improvement project and not for any other purpose. The provided informed consent form was listed in Appendix B.

Discussion of Anticipated Results and Implications for Advanced Practice Nursing

The results of this quality improvement project shed light on the baseline knowledge of anesthesia providers pertaining to the high prevalence of undiagnosed cognitive impairment in

the elderly surgical population. It also helped gauge the current practices of CRNAs when providing anesthetic care for patients with suspected cognitive impairment or increased risk of POD. The posttest data helped illustrate the efficacy of the educational module in teaching the importance of preoperative cognitive screening for elderly surgical patients. It also helped determine how effectively the module explained the correct administration and scoring of the Mini-Cog, and the likelihood that the sampled providers incorporated this screening tool into their practice.

This quality improvement project aimed to educate anesthesia providers on the necessity of preoperative cognitive screening for all elderly surgical patients, even those without diagnosed cognitive disorders. By increasing the rate of preoperative screening, providers were better prepared to make necessary changes to their anesthetic plan with the goal of reducing harmful postoperative cognitive disorders such as delirium. This change in practice has proven benefits in reducing the prevalence of POD, leading to enhanced quality of life for elderly patients and a reduced burden on the healthcare system.

Timeline

The timeline for complete implementation and analysis of this quality improvement project was 1 year in duration. All materials were created and finalized by the end of January 2024. The goal for IRB approval was February 2024 so that the initial stages of participant recruitment can begin soon after. Initial recruitment emails were sent the week following IRB approval. This allowed ample time for participants to receive informed consent and begin the pre-intervention survey. The goal for the collection of a sample of 10 anesthesia providers was May 2024, with data analysis beginning after this sample size is reached. Analysis and summary

of all collected data were completed by August 2024, with the final project completed by November 2024.

Results

Patient Demographics

A total of 10 anesthesia providers from the target institution participated in this quality improvement project. All participants were CRNAs (*n* = 10, 100%). Informed consent was obtained from all 10 participants prior to the pretest survey. Most participants were female (n = 6, 60%) and between 30-39 years old (*n* = 6, 60%). 3 participants were between 40-49 years old (30%), and 1 participant was between 25-29 years old (10%). Participants reported a range of ethnicities including White (*n* = 5, 50%), Hispanic/Latino (*n* = 4, 40%), and Black (*n* = 1, 10%). The majority of participants reported holding a Doctor of Nursing Practice (DNP) degree (*n* = 8, 80%), with the remainder holding a Master of Science in Nursing (MSN) (*n* = 2, 20%). Half of the participants reported having 3-5 years of experience practicing anesthesia (*n* = 5, 50%). Three participants reported 1-2 years of experience (*n* = 3, 30%). One participant each reported having 5-10 years of experience (10%) and 10-20 years of experience (10%). Table 1 provided a complete summary of participant demographics.

Table 1. Participant Demographics

Participants (*n* = 10)	**Number**	**%**
Gender		
Male	4	40%
Female	6	60%
Race/Ethnicity		
Black	1	10%
Hispanic/Latino	4	40%
White	5	50%

Age (years)		
25-29	1	10%
30-39	6	60%
40-49	3	30%
Level of Education		
MSN	2	20%
DNP	8	80%
Years of Experience		
1-2	3	30%
3-5	5	50%
5-10	1	10%
10-20	1	10%

Pretest Survey Results

The purpose of the pretest survey was to test participants' baseline knowledge on the topic of preoperative cognitive screening for prediction of delirium risk in elderly patients. The pretest consisted of 10 questions relating to information that would later be taught in the provided educational module and then retested in the posttest survey.

Preexisting cognitive impairment among elderly surgical patients is a widespread issue affecting as much as 37% of the elderly population. Most participants underestimated the true incidence of this problem as affecting only 25% of elderly surgical patients (n = 6, 60%). However, all participants were aware that delirium is the most common postoperative complication affecting older adults (n = 10, 100%), and the vast majority recognized that routine preoperative cognitive screening of all elderly patients is recommended by numerous medical organizations and societies (n = 9, 90%). One subjective measure in the pretest sought to determine how confident CRNAs are in their ability to assess a patient's baseline cognitive status without the use of a standardized objective cognitive screening tool. Half of participants reported

that they “somewhat agree” that they can accurately assess cognitive status without the use of such a tool (*n* = 5, 50%) while 2 reported that they “somewhat disagree” (20%) and 3 reported “strongly disagree” (30%).

The next set of questions in the pretest sought to determine participants’ baseline knowledge about preoperative screening tools and the correct administration and scoring of the Mini-Cog. Most participants were already aware that the MMSE is considered the gold standard rapid cognitive screening tool (*n* = 7, 70%). Only 4 participants (40%) were aware of the components of the Mini-Cog test (3-word recall and a clock drawing test), while only half of participants (*n* = 5, 50%) were aware of the cutoff score of < 3 for determining cognitive impairment, indicating that there is a need for education on the administration and scoring of this tool.

One question on the pretest tested participants’ knowledge of existing practices that have been shown to reduce POD in at-risk patients. On this question, 6 participants (60%) correctly answered that dexmedetomidine is an adjunct that is currently the subject of ongoing research for the reduction and prevention of POD. The remainder of participants incorrectly answered that this agent was either clonidine (*n* = 1, 10%) or magnesium sulfate (*n* = 3, 30%).

Finally, the pretest survey sought to determine how likely participants were to administer the Mini-Cog test to patients as part of their preoperative cognitive assessment before they had viewed the educational module. Only 1 participant (10%) reported being “extremely likely” to incorporate this tool into their preoperative assessment; 3 (30%) reported being “somewhat likely”, 2 (20%) reported being “extremely unlikely,” and 2 (20%) reported being “neither likely nor unlikely.” These results indicate a potential area for improvement in the practice of the CRNAs at the target institution.

Accuracy on the pretest was determined based on participants' answers to the 8 questions with objectively correct or incorrect answers. Average pretest accuracy among the 10 participants was 67.5%, indicating that there is significant room for increased knowledge on this topic.

Posttest Survey Results and Comparison to Pretest

Following completion of the educational module, participants were again surveyed using the same questions from the pretest to determine the efficacy of the module in increasing participants' knowledge. Tables 2 and 3 and Figure 1 summarize the results of the posttest in comparison to the pretest. Average accuracy on the 8 objective measures increased from 67.5% to 96.25% following completion of the educational module. A paired sample *t*-test determined that this difference was highly statistically significant ($t = -4.44$, $p < 0.001$), indicating that the educational module was successful in increasing CRNA knowledge.

Table 2. Pretest vs. Posttest Objective Measure Results (* denotes correct answer)

Approx. what percentage of elderly patients (65+) present for surgery with some degree of cognitive impairment?	Pretest	Posttest	Gain
8%	0	0	0
25%	6	0	-6
37%*	4	10	6
55%	0	0	0
Accuracy	40%	100%	60%
What is the MOST common postoperative complication in older adults?			
Aspiration	0	0	0
Thromboembolic events	0	0	0
Infection	0	0	0
Delirium*	10	10	0
Accuracy	100%	100%	0
Which intervention is recommended…for reduction of postoperative delirium risk in elderly patients (65+)?			
Routine preoperative screening of all elderly patients*	9	10	1
BIS monitoring for all elderly patients undergoing general anesthesia	1	0	-1
Prophylactic haloperidol for all elderly surgical patients	0	0	0
Preoperative neurology clearance for all elderly patients	0	0	
Accuracy	90%	100%	10%
Which neuropsychological screening tool is considered the gold standard for rapid assessment of cognitive status?			
Montreal Cognitive Assessment (MoCA)	3	1	-2
Weschler Adult Intelligence Scale (WAIS)	0	0	0
Mini-Mental State Examination (MMSE)*	7	9	2
Addenbrooke's Cognitive Exam-Revised (ACE-R)	0	0	0
Accuracy	70%	90%	20%
What are the two components of the Mini-Cog test?			
Three-word recall and a clock drawing test*	4	9	5
Basic orientation questions and simple math	3	1	-2
Visual puzzles and a story recall test	3	0	-3
Image copying test and a three-step direction test	0	0	0
Accuracy	40%	90%	50%
TRUE/FALSE: The Mini-Cog can be accurately administered, scored, and interpreted within 2-5 minutes.			
TRUE*	10	10	0
FALSE	0	0	0
Accuracy	100%	100%	0%
Which Mini-Cog score cutoff has been shown to be independently predictive of increased post-op delirium risk?			
< 5	1	0	-1

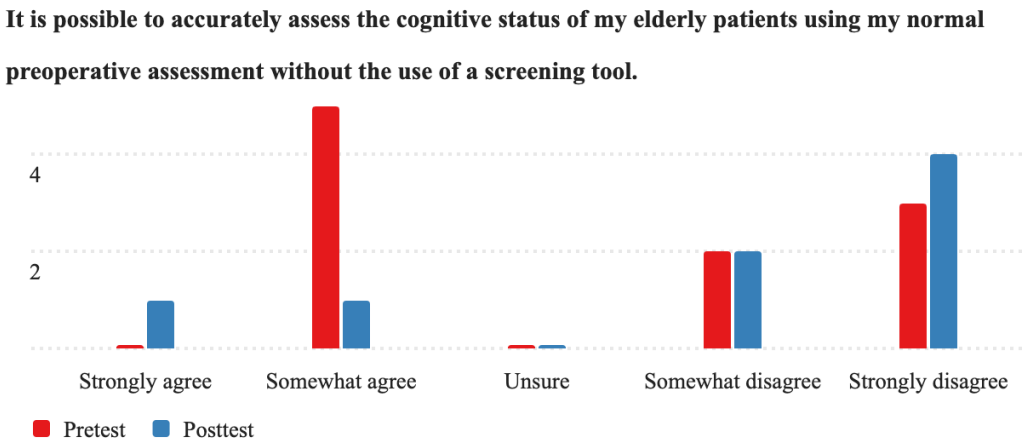
< 4	3	0	-3
< 3*	6	10	4
< 2	1	0	-1
Accuracy	60%	100%	40%
Which anesthetic adjunct is the focus of emerging research due to its potential for reducing post-operative delirium risk in elderly patients?			
Ketamine	0	0	0
Dexmedetomidine*	6	10	4
Magnesium sulfate	3	0	-3
Clonidine	1	0	-1
Accuracy	60%	100%	40%
Overall Accuracy	67.50%	96.25%	27.50%

Table 3. Paired Sample *t*-Test of Pretest vs. Posttest Scores

Values	Pretest Scores	Posttest Scores
Mean	0.675	0.9625
Variance	0.025	0.007118056
Observations	10	10
Degrees of freedom	9	
t Stat	-4.444680722	
p-value	0.000806272	

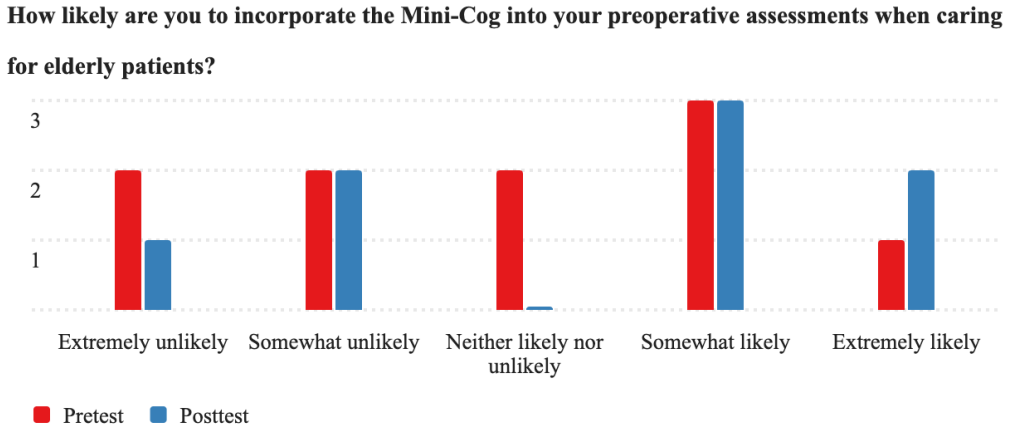
Two measures on the pre- and posttest survey were subjective measures with Likert scale responses. The first sought to determine whether CRNAs agree that it is possible to accurately assess a patient's cognitive status without the use of a standardized screening tool. Following the educational module, the number of participants who "somewhat agree" that it is possible to accurately assess their patients' cognitive status without the use of a screening tool decreased from 5 to 1, and the number of participants who somewhat or strongly disagree increased from 5 to 8. Interestingly, the number of participants who "strongly agree" increased from 0 to 1. These changes indicate that the educational module was somewhat successful in illuminating the importance of the use of a standardized cognitive screening tool when performing preoperative cognitive assessments of elderly patients. However, there is still room for improvement in convincing CRNAs of the utility of these tools.

Figure 1. Pretest vs. Posttest Responses to Subjective Measure 1



The second subjective measure sought to determine the likelihood that participants would incorporate the Mini-Cog into their preoperative assessments. In the pretest, 4 participants indicated that they were "somewhat likely" or "extremely likely" to utilize the Mini-Cog. In the posttest, this number increased to 7 participants. However, 3 participants still indicated that they were "somewhat unlikely" or "extremely unlikely" to incorporate the Mini-Cog into their practice. These results indicate that the educational module may have successfully influenced the practice of some CRNAs, but there is still potential to further increase compliance.

Figure 2. Pretest vs. Posttest CRNA Likelihood of Utilizing the Mini-Cog



Discussion

Limitations

The largest limitation affecting the results of this study was the small sample size. With only 10 participants, the ability to draw generalizable conclusions is severely limited. Additionally, the participants were all CRNAs practicing at the same facility. Thus, the external validity and reliability of the results are limited, as different results may be seen at different facilities. A larger, randomized sample of CRNAs from a wide variety of practice settings would improve the results of this project.

Implications for Practice

Baseline knowledge of the importance of preoperative cognitive screening and the correct use of the Mini-Cog was low, as indicated by a 67.5% accuracy rate on the pretest survey. Overall accuracy on the objective measures increased significantly following the completion of the educational module. This suggests that the educational module was successful in adequately educating CRNAs on the use of the Mini-Cog for preoperative cognitive screening, and the rationale behind incorporating this tool into their practice. Thus, the results of this survey suggest that a digital educational module appears to be a successful medium for disseminating information and increasing provider knowledge of evidence-based practice.

However, the results of the subjective measures indicate that there is still a need to convince CRNAs of the utility of a tool like the Mini-Cog in their preoperative assessments. While the number of CRNAs who indicated being somewhat or extremely likely to incorporate the Mini-Cog into their practice increased slightly, there is still substantial room for improvement in increasing compliance and enhancing evidence-based practice. It is unclear if this is due to complacency, perceived time restraints, or some other factor. The next steps for research into this

evidence-based intervention should focus on identifying ways to successfully implement the Mini-Cog into routine practice. This could include utilizing a preoperative assessment clinic, developing a protocol specifically for delirium prevention that includes the use of the Mini-Cog in the preoperative evaluation, and training additional staff members such as preoperative nurses in the administration and scoring of the Mini-Cog tool. These changes would likely contribute to producing a more realistic and sustainable change to practice that would greatly benefit postoperative outcomes of the elderly population.

Conclusions

Overall, the results of this quality improvement project and pretest/posttest analysis provide useful information about the efficacy of the educational module in enhancing CRNAs' knowledge of a preoperative cognitive screening tool. As indicated by the statistically significant increase in scores on the posttest survey, this method of education is effective in increasing knowledge of evidence-based practices and should continue to be utilized in this arena. Whether or not the educational module can successfully produce practice changes is yet to be seen. CRNA responses on the subjective measures indicate that they may be unlikely to believe in the need for such a tool or may be unlikely to implement its use into their daily practice. A follow-up study that examines the number of CRNAs that successfully incorporate the Mini-Cog into their preoperative assessments following completion of the educational module is warranted to determine its ability to produce meaningful changes in practice. Further research may also examine changes in institutional policy and workflow that may help improve compliance with this evidence-based intervention.

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Appendix A. Literature Matrix

Citation	Design/Method	Sample/ Setting	Major Variables	Measurement and Data Analysis	Findings	Results	Conclusions	Appraisal
Kapoor P, Chen L, Saripella A, et al. Prevalence of preoperative cognitive impairment in older surgical patients.: A systematic review and meta-analysis. *J Clin Anesth.* 2022;76:110574. doi:10.1016/j.jclinane.2021.110574	Systematic review and meta-analysis. Relevant articles from 1946 to April 2021 were identified from MEDLINE (Ovid), PubMed, Embase, Cochrane Central, Cochrane Database of Systematic Reviews, PsycINFO, and EMCare Nursing. Articles selected included studies of patients >60 years of age undergoing surgery assessed for preoperative cognitive impairment using validated cognitive assessment tools.	Patients age 60+ undergoing elective (cardiac or non-cardiac) or emergency surgeries. Included randomized controlled trials, observational studies (retro-spective and prospective cohorts), and cross-sectional studies written in English.	IV1 = surgery type DV1 = presence of diagnosed pre-operative cognitive impairment DV2 = presence of un-diagnosed pre-operative cognitive impairment	Pooled prevalence and 95% confidence intervals were calculated using a random effects DerSimonian and Laird method. I^2 statistics were used to evaluate heterogeneity. Meta-regression analysis was conducted with age, sex, BMI, study design, sample size, type of test, and country for each surgery category. *P*-value of <0.05 was considered statistically significant. Publication bias was assessed by visually inspecting funnel plots with 10 or more studies. Egger's asymmetry test and Begg and Mazumdar rank correlation tests were conducted.	Unrecognized cognitive impairment in elective non-cardiac surgeries: pooled prevalence 37.0% (95% CI = 30 to 45%, I^2 = 98%, Egger's test of asymmetry p = 0.009) Diagnosed cognitive impairment in elective non-cardiac surgeries: pooled prevalence 18% (95% CI = 9 to 33%, I^2 = 99%) Unrecognized cognitive impairment in elective cardiac surgery: pooled prevalence 26% (95% CI = 15 to 42%, I^2 = 92%) Unrecognized and diagnosed cognitive impairment in emergency surgeries: pooled prevalence 50% (95% CI = 35 to 65%, I^2 = 98%)	Preoperative cognitive impairment is common in elderly patients undergoing emergent and elective surgery. In non-cardiac surgery, the pooled prevalence of unrecognized cognitive impairment was 37%; diagnosed cognitive impairment was 18%. In cardiac surgeries, unrecognized cognitive impairment was 26%. In emergency surgeries, up to 50% of elderly patients were found to have cognitive impairment.	There is a significant number of elderly patients who undergo surgery with unrecognized preoperative cognitive impairment. Preoperative cognitive screening of elderly patients can aid in risk assessment and stratification.	Level II evidence; systematic review. Limitations included the inclusion of cohort studies, and high levels of heterogeneity due to the diversity of locations, methods, and cognitive assessment tools used. However, this review provided convincing evidence of the prevalence of undiagnosed cognitive impairment in the elderly and provides justification for the implementation of routine preoperative cognitive screening.

Citation	Design/Method	Sample/ Setting	Major Variables	Measurement and Data Analysis	Findings	Results	Conclusions	Appraisal
Tong C, Huang C, Wu J, Xu M, Cao H. The prevalence and impact of undiagnosed mild cognitive impairment in elderly patients undergoing thoracic surgery: a prospective cohort study. *J Cardiothorac Vasc Anesth.* 2020;34(9):2413-2418.	Prospective cohort study. Elderly patients completed the Chinese Montreal Cognitive Assessment (MoCA) test preoperatively and then categorized into a normal group (MoCA score ≥ 26) and an abnormal group (MoCA score < 26). Postoperative delirium was assessed using the Confusion Assessment Method (CAM) during the following 3 days postop. Patients were also assessed for length of stay and incidence of postoperative pulmonary complications (PPCs.)	Elderly patients undergoing thoracic surgery in a large tertiary medical center	IV1 = normal vs. abnormal MoCA score DV1 = postoperative delirium DV2 = postoperative pulmonary complications DV3 = hospital length of stay.	Two independent sample *t*-tests were used to compare the difference of continuous variables between patients with or without mild cognitive impairment (MCI). Kaplan-Meier estimates were used for intensive care unit (ICU) stay and length of stay (LOS). Chi-square and Fisher exact tests were used to compare categorical variables. A multivariable logistic regression model was used to evaluate risk factors found to be significantly associated with postoperative delirium (POD).	Incidence of MCI: 49.4% Incidence of postoperative delirium: 22% MCI associated with 30.3% incidence of POD compared to 14.1% incidence of POD in the normal group ($p = 0.016$) Multivariable logistic regression analysis identified MCI (OR = 2.573, 95% CI = 1.092 to 6.060, $p = 0.031$), duration of surgery >80 min (OR = 3.792, 95% CI = 1.374 to 10.461, $p = 0.010$), and segmentectomy / lobectomy resection (OR = 5.045, 95% CI = 1.063 to 23.935, $p = 0.042$) as independent risk factors for POD. POD associated with increased risk of PPCs compared to non-POD group (35.3% vs. 17.5%, $p = 0.026$) and median length of stay (4 days vs. 5 days, $p < 0.001$)	The incidence of MCI before thoracic surgery in elderly patients was higher and associated with a higher rate of POD, prolonged median LOS, and increased PPCs.	Undiagnosed preoperative cognitive impairment is present in a large number of elderly patients presenting for thoracic surgery. Preoperative cognitive impairment is a significant risk factor for postoperative delirium and pulmonary complications. Preoperative cognitive testing can help identify patients with undiagnosed cognitive impairment to aid in patient counseling, operative planning, and reducing potential risk exposure.	Level II - prospective cohort study. Limitations included the lack of randomization and blinding. Minimal harm is likely if the findings of this study are implemented. The feasibility of implementing preoperative cognitive screening will vary by institution, but overall, the use of a brief cognitive screening tool should be feasible in most settings.

Citation	Design/Method	Sample/ Setting	Major Variables	Measurement and Data Analysis	Findings	Results	Conclusions	Appraisal
Krishnan S, Brovman EY, Urman RD. Preoperative cognitive impairment as a peri-operative risk factor in patients undergoing total knee arthroplasty. *Geriatr Orthop Surg Rehabil.* 2021; 12: 21514593211004533	Retrospective cohort study. An initial cohort of 6350 patients undergoing elective total knee arthroplasty was assessed for patients with identified preoperative cognitive impairment (CI) and propensity-score matched to 104 patients without CI (non-CI group). Patients were assessed for incidence of postoperative delirium, functional status, nonhome discharge, 30-day mortality, infection rates, failure to wean, and reintubation.	Patients age 65+ were selected from the American College of Surgeons National Safety Quality Improve-ment Program (ACS-NSQIP) Geriatric Surgery Pilot Program, compiled from 25 participating clinical settings. Patients who underwent TKA and had pre-existing cognitive impairment were retrospect-ively identified and examined.	IV1 = preexisting cognitive impairment DV1 = post-operative delirium DV2 = functional status DV3 = nonhome discharge DV4 = 30 day mortality	Student *t*-test was used to compare continuous variables between the cohort with and without CI. Chi-squared tests and conditional univariable logistic regression were used to compare categorical variables. Risk adjustment was performed using propensity score matching.	The CI group had significantly higher rates of postoperative delirium (OR = 40.15, 95% CI = 5.3 to 304.13, p <0.001) compared to the non-CI group. The CI group was significantly more likely to have a partial or totally dependent post-operative functional status (OR = 4.26, 95% CI = 2.24 to 8.1, p < 0.001) compared to the non-CI group. The CI group was significantly more likely to be discharged to an area other than their own home (OR = 1.89, 95% CI = 1.07 to 3.35, p=0.029) compared to the non-CI group.	Post-operative outcomes such as delirium and reduction in functional status are predicted by pre-operative cognitive impairment. These outcomes are also associated with increased morbidity and mortality.	Early identification of patients with preoperative cognitive impairment and preemptive interventions such as multi-disciplinary care with geriatricians and/or neuro-cognitive specialists may decrease adverse outcomes for these patients.	Level II – retrospective cohort study. This study was conducted using data from the NSQIP dataset and is thus limited by its retrospective nature. However, the sample includes a large diverse group of hospitals with different practice models that submitted noncontrolled data to the NSQIP, increasing the generalizability of the findings of this study.

Citation	Design/Method	Sample/ Setting	Major Variables	Measurement and Data Analysis	Findings	Results	Conclusions	Appraisal
Yajima S, Nakanishi Y, Matsumoto S, et al. The Mini-Cog: A simple screening tool for cognitive impairment useful in predicting the risk of delirium after major urological cancer surgery. *Geriatr Gerontol Int.* 2022;22(4):319-324.	Single-center retrospective observational study. Medical records were selected for patients who underwent major urologic cancer surgery between 2020 and 2021, and who had preoperative cognitive screening with the Mini-Cog. The presence of post-operative delirium was diagnosed by attending physicians using criteria listed in the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders-5.	Patients undergoing major urologic cancer surgery, including radical cystectomy, prostatec-tomy, radical nephric-tomy, and partial nephric-tomy who received preoperative Mini Cog screening.	IV1 = Mini Cog score DV1 = post-operative delirium	Mann-Whitney U-tests were used to evaluate continuous variables, and chi-squared tests were used to evaluate categorical variables. Univariate and multivariate logistic regression analyses were used to evaluate predictive factors for the risk of postoperative delirium.	8% of patients were diagnosed with postoperative delirium, 81% of whom were male with a median age of 78 years old. Mini-Cog score <3 granted 69.2% sensitivity (95% CI = 51.5-87.0%), 86.2% specificity (95% CI = 82.3-90.1%), positive predictive value of 30.0% (95% CI = 18.4 – 41.6%), and negative predictive value of 97.1% (95% CI = 95.0-99.1%). Using multivariate analysis, a preoperative Mini Cog score <3 (OR = 12.7; 95% CI = 4.1–39.5; $p < 0.001$), IADL decline (OR = 3.0; 95% CI = 1.0–8.9; $p = 0.04$), and preoperative benzodiazepine use (OR = 8.3; 95% CI = 2.6–26.9; $p < 0.001$) were all found to be independent risk factors for postoperative delirium.	Post-operative delirium can be reliably predicted in patients undergoing major urological cancer surgery by a Mini Cog score <3, IADL decline, and preoperative benzodiazepine use.	The use of the Mini-Cog screening tool in the preoperative setting is a rapid, reliable method for predicting patients who may suffer from postoperative delirium following surgery. The Mini-Cog test is easy to administer and score, and can detect preoperative cognitive impairment in patients not previously diagnosed with dementia.	Level II evidence, retrospective observational study. Limitations included the retrospective nature of the study and the use of a single medical center. Strengths included a large sample size and large number of cognitively impaired patients. Implementation of the Mini-Cog into even the most fast-paced preoperative environments is feasible due to its ease and speed of administration and scoring. In this study, preoperative nurses successfully administered and scored the Mini-Cog assessment.

Citation	Design/Method	Sample/ Setting	Major Variables	Measurement and Data Analysis	Findings	Results	Conclusions	Appraisal
Chen D, Chen J, Yang H, et al. Mini-Cog to predict postoperative mortality in geriatric elective surgical patients under general anesthesia: a prospective cohort study. *Minerva Anestesiol.* 2019;85(11): 1193-1200. doi:10.23736/S0375-9393.19.13462-1	Prospective cohort study. Cognitive function was assessed using the Mini-Cog test, which consists of a three-item recall test of memory and a clock drawing test of executive function. A total score <3 indicates cognitive impairment. Perioperative anesthesia management was carried out using an identical protocol without premedication. The primary endpoint was one-year all-cause mortality. Secondary endpoints included 1-, 3-, and 6-month mortality, and postoperative complications within 30 days.	Elderly patients (age 65+) scheduled to receive general surgery under general anesthesia between October 2015 and December 2017 at the Department of Anesthesiology in West China Hospital in Chengdu, China.	IV1 = Mini-Cog score DV1 = one-year mortality DV2 = 1-, 3-, 6-month mortality DV3 = 30 day post-operative complications	Continuous variables were analyzed using Student's t-test. Categorical variables were analyzed using a chi-squared or Fisher's exact test. Overall survival was estimated using Kaplan-Meier curves and compared using the log-rank test. Multivariate Cox regression was used to determine the risks of one-year mortality.	The Mini-Cog detected normal cognition in 66.8% of patients, and cognitive impairment in 33.2%. One-year all-cause mortality was found to be significantly higher in the cognitive impairment group (24.0% vs. 15.0%, p = 0.009). Kaplan-Meier analysis revealed shorter overall survival in the cognitive impairment group (p = 0.005). The Cognitive impairment group also had higher 3-month mortality (7.1% vs. 2.5%, p = 0.009)	There is a high rate of undiagnosed cognitive impairment in elderly patients presenting for surgery. These patients are at increased risk of all-cause one-year mortality. This risk can be accurately predicted by Mini-Cog scores <3.	The use of the Mini-Cog in the preoperative setting can assist in predicting elderly patients that will suffer from one-year all-cause mortality. Implementation of this screening tool can allow for adjustment to anesthetic plan and planning for post-operative rehabilitation in patients who are found to have cognitive impairment.	Level II evidence, prospective cohort study. Limitations included the lack of randomization. Also, the study was not generalizable beyond elective surgery. Strengths include the large sample size. There was low risk associated with the implementation of preoperative cognitive screening using the Mini-Cog. It is a feasible and practical screening tool that provides valuable information to providers and patients regarding postoperative risk.

Citation	Design/Method	Sample/ Setting	Major Variables	Measurement and Data Analysis	Findings	Results	Conclusions	Appraisal
Suyama T, Sugihara S, Suyama R, et al. The clock-drawing test as a useful screening assessment of preoperative cognitive impairment with readmission after transcatheter aortic valve implantation. *Yonago Acta Med.* 2023;66(3):345-354.	Retrospective cohort study. Enrolled 52 patients who underwent transcatheter aortic valve implantation (TAVI) between 2019 and 2021. The measured outcome was readmission for all causes within one year of discharge. Patients had their cognitive function assessed using the Mini-Cog test, consisting of a verbal playback test and a clock drawing test (CDT).	Single-center study conducted at Matsue Red Cross Hospital in Japan. Median age was 85 years, 28.8% male.	IV1 = Mini-Cog score IV2 = Clock drawing test score DV1 = one-year re-admission	Continuous variables were assessed using a Shapiro-Wilk test, unpaired t-test for normally distributed variables, and Mann-Whitney U test for non-normally distributed variables. Categorical variables were assessed using the Fisher's exact test. The Kaplan-Meier method was used to estimate the cumulative incidence rate. A Cox proportional hazards model was used to analyze the association between cognitive impairment assessed by the Mini-Cog and the CDT and readmission after TAVI.	21.2% of patients were readmitted within 1 year. 15% of patients were found to have cognitive impairment (CI) as indicated by a Mini-Cog score <3. CI frequency was significantly higher in the readmission group than in the non-readmission group (46% vs. 7%, $p < 0.01$). The frequency of CDT failure (score of 0) was significantly higher in the readmission group than in the non-readmission group (46% vs. 12%, $p < 0.05$). CDT failure (OR = 0.172, 95% CI = 0.030-0.979, $p < 0.05$) and Mini-Cog score <3 (OR = 0.106, 95% CI = 0.016-0.701, $p < 0.05$) were found to be significant independent risk factors for readmission.	Scores <3 on the Mini-Cog test, as well as failure of the Clock Drawing Test portion of the Mini-Cog, are both predictive of one-year readmission among elderly patients undergoing TAVI.	The Mini-Cog and the CDT are 2 useful screening tools for preoperative prediction of postoperative complications in elderly patients undergoing TAVI. The CDT is even faster to perform than the Mini-Cog, and thus may be useful in settings where the Mini-Cog is not feasible.	Level II evidence, retrospective cohort study. Limitations included the retrospective nature of the study, and the inclusion of patients undergoing TAVI only. There was minimal risk involved in the implementation of a preoperative CDT or Mini-Cog screening test. The feasibility of administering the CDT is even greater than the full Mini-Cog, which is already a very easy to administer test.

Citation	Design/Method	Sample/ Setting	Major Variables	Measurement and Data Analysis	Findings	Results	Conclusions	Appraisal
Weiss Y, Zac L, Refaeli E, et al. Preoperative cognitive impairment and postoperative delirium in elderly surgical patients: a retrospective large cohort study (The CIPOD Study). *Ann Surg.* 2023;278(1): 59-64. doi:10.1097/sla.0000000000005657	Retrospective observational study. All surgical patients age 70+ were preoperatively screened with the Mini-Cog test during the preanesthetic evaluation or on the day of surgery. They were all evaluated for post-operative delirium (POD) using the 4A's test 1 hour after admission to PACU, before PACU discharge, and on post-operative day 1 and 2.	Patients 70+ years old undergoing elective noncardiac, noncranial surgery in the Tel-Aviv Medical Center between January and December 2020.	IV1 = pre-operative cognitive impairment (Mini-Cog score <3) DV1 = post-operative delirium (4AT score of 4+, new onset confusion, or positive 3-minute diagnostic confusion assess-ment) DV2 = composite of falls during hospitalization, unplanned ICU admission, discharge to high-dependency facilities, stroke, 1-year all-cause mortality	Student's *t*-test was used to analyze normally distributed continuous variables. Mann-Whitney U test was used to analyze non-normally distributed continuous variables. Categorical data were evaluated via chi squared tests or the Fisher exact test. Univariate analysis was performed to compare patients with delirium to those without POD. Multivariate analysis using logistic regression model was used to test the association between preoperative cognitive impairment and POD.	21% of patients were found to have preoperative cognitive impairment with a Mini-Cog score <3. 14.8% of patients experienced POD. Patients with preoperative CI were significantly more likely to experience POD (OR = 3.3, 95% CI = 2.3-4.7). Delirium incidence and risk increased in correlation to decreases in Mini-Cog scores. Patients with preoperative cognitive impairment were at greater risk of having the composite of postoperative complications (OR = 1.8, 95% CI = 1.2-2.5). Falls and discharge to high-dependency facilities were independently associated with cognitive impairment (OR = 2.3 and 1.7, respectively).	Mini-Cog scores were found to be predictive of postoperative delirium and several other postoperative complications, including falls and discharge to high-dependency facilities.	Preoperative administration of the Mini-Cog is a useful tool for predicting significant postoperative complications in elderly patients undergoing elective noncardiac and noncranial surgery. Incorporation of this assessment into preoperative evaluations can help anesthesia providers tailor their anesthetic and arrange for postoperative rehabilitative measures in at-risk patients.	Level II evidence, retrospective cohort study. Limitations included the use of a single tertiary medical center, and the retrospective nature of the study. The feasibility of initiating this intervention is high, with minimal risk to patients.

Citation	Design/Method	Sample/ Setting	Major Variables	Measurement and Data Analysis	Findings	Results	Conclusions	Appraisal
Tiwary N, Treggiari MM, Yanez ND, et al. Agreement between the Mini-Cog in the preoperative clinic and on the day of surgery and association with post-anesthesia care unit delirium: a cohort study of cognitive screening in older adults. *Anesth Analg.* 2021;132(4):1112-1119. doi:10.1213/ANE.0000000000005197	Prospective cohort study. Patients were administered the Mini-Cog in the preoperative clinic, and then a second version on the day of surgery. Patients were then evaluated for level of arousal in PACU using the Richmond Agitation and Sedation Scale (RASS) and for delirium using the CAM. The primary endpoint was agreement between the Mini-Cog score obtained in the clinic compared with the score obtained on surgery day. The secondary end point was PACU delirium.	Patients between the ages of 65-89 who underwent elective surgery with general anesthesia and planned post-operative hospital admission.	IV1 = Mini-Cog Score in clinic DV1 = Mini-Cog score on day of surgery DV2 = presence of delirium	Kappa statistic with ordinal weights was used to determine agreement between clinic-day and surgery-day Mini-Cog scores. Welch's t tests were performed on quantitative characteristics and chi-squared tests for categorical characteristics. Logistic regression was also used to evaluate the association between Mini-Cog scores and PACU delirium.	10 out of 80 enrolled patients were found to have cognitive impairment identified by a Mini-Cog score < 3. The mean Mini-Cog clinic-day test score was 4.18, and the mean Mini-Cog surgery-day test score was 4.03, with 64% agreement between the two ($\kappa = 0.78$, 95% CI = 0.69-0.87, $p < 0.001$). Clinic-day test scores <3 were associated with PACU delirium (odds ratio = 12.4; 95% CI = 2.8 – 55.6, $p < 0.001$). Patients with Mini-Cog surgery-day scores < 3 had 12.8 times higher odds of PACU delirium compared to patients with normal cognition.	The Mini-Cog can be reliably administered in a preoperative clinic or on the day of surgery, with a high level of agreement between the two settings. Additionally, Mini-Cog scores < 3 reliably predict PACU delirium in elderly patients undergoing elective surgery under general anesthesia.	The Mini-Cog is a feasible test for administration in either a preoperative clinic or in the preoperative area on the day of surgery. It can reliably identify patients with cognitive impairment, and can reliably predict the development of PACU delirium. Incorporation of the Mini-Cog into the preoperative assessment is a feasible intervention.	Level II evidence, prospective cohort study. This study was limited by its lack of randomization. Additionally, the study design allowed patients to receive the Mini-Cog twice, which may have affected scores on the second administration. Overall, this study provides strong evidence for the value of the Mini-Cog as a preoperative tool for predicting POD.

Citation	Design/Method	Sample/ Setting	Major Variables	Measurement and Data Analysis	Findings	Results	Conclusions	Appraisal
Sherman JB, Chatterjee A, Urman RD, et al. Implementation of routine cognitive screening in the preoperative assessment clinic. *AA Pract.* 2019;12(4):125-127.	Pretest-posttest design. A 10-minute training video was created to provide education to nurse practitioners (NPs) and anesthesia residents regarding the accurate administration and scoring of the Mini-Cog examination in a preoperative clinic setting. Blinded geriatricians then cross-checked the scores generated by the NPs and residents for accuracy. The goal of the study was to determine the feasibility of implementing the Mini-Cog in the preoperative setting.	Nurse practitioners and anesthesia residents in a preoperative clinic at Brigham and Women's Hospital between March 2, 2015 and May 30, 2015. All patients age 65+ years were asked to complete the testing.	IV1 = Mini-Cog score as determined by NP or anesthesia resident DV1 = Mini-Cog score as determined by geriatrician	Accuracy was compared between the 2 groups by assessing a sample of scores and comparing their agreement with the scores generated by geriatricians.	92% accuracy of scoring was achieved between the groups. An abnormal Mini-Cog score was detected in 3.7% of those between 65-70 years of age, 27.4% of those between 81-85 years of age, and overall in 10% of patients who participated in the study.	The Mini-Cog can be feasibly incorporate into a preoperative clinic setting following education of nurse practitioner and/or anesthesiology residents in its proper administration and scoring.	The use of the Mini-Cog screening tool is a feasible intervention that can help clinicians identify patients presenting with undiagnosed cognitive impairment. This information can assist in adjustments to the anesthetic plan and allows for planning of prophylactic measures to prevent adverse outcomes.	Level II evidence, pretest/posttest design. This study was limited by its lack of randomization. However, as this was a feasibility study, the results still provided strong evidence that the Mini-Cog can be accurately and reliably administered by anesthesia personnel following a brief training period.

Citation	Design/Method	Sample/ Setting	Major Variables	Measurement and Data Analysis	Findings	Results	Conclusions	Appraisal
Li X, Dai J, Zhao S, Liu W, Li H. Comparison of the value of Mini-Cog and MMSE screening in the rapid identification of Chinese outpatients with mild cognitive impairment. *Medicine.* 2018;97(22): e10966. doi:10.1097/md.0000000000010966	Retrospective cohort study of 229 patients with suspected mild cognitive impairment (MCI). Patients were divided into the MCI and non-MCI groups according to final evaluation by a neurologist. All subjects were assessed using the Mini Mental State Exam (MMSE) and Mini-Cog. Scores were compared to determine agreement between the 2 tests.	Patients who visited Cangzhou Central Hospital between March 2012 and April 2016 and consulted with a first-line physician at the outpatient department.	IV1 = Mini-Cog score DV1 = MMSE score	2 independent samples *t*-test was used for the comparison between the 2 groups. Chi squared test was used for the comparison of categorical data. The intraobserver and interobserver reliability of the Mini-Cog were evaluated by calculation of the intraclass coefficient (ICC).	The Mini-Cog scores in the MCI group and non-MCI group were 5.2 +/- 1.6 points and 7.5 +/- 1.7 points respectively, with a statistically significant difference ($p < 0.05$). The sensitivity of the Mini-Cog in the diagnosis of MCI was 85.71%, which was higher than the MMSE (64.76%), which was a statistically significant difference ($X^2 = 12.37$, $p < 0.05$).	The Mini-Cog shows higher sensitivity than the MMSE in the identification of mild cognitive impairment.	The MMSE is often considered the gold standard rapid assessment of cognitive function. This study shows that the Mini-Cog may actually outperform the MMSE in the identification of mild cognitive impairment. Thus, using the Mini-Cog for identification of mild cognitive impairment is a justifiable intervention.	Level II evidence, retrospective cohort study. The limitations include a small sample size and the use of a single medical center, as well as the retrospective nature of the study. Implementation of the Mini-Cog for identification of mild cognitive impairment is highly feasible, especially compared to the MMSE, which takes 10-15 minutes to administer.

Citation	Design/Method	Sample/ Setting	Major Variables	Measurement and Data Analysis	Findings	Results	Conclusions	Appraisal
Kimura A, Shiraishi Y, Sawamura H, Sugawara R, Inoue H, Takeshita K. Predictors of Postoperative Delirium in Older Patients Undergoing Elective Spine Surgery. Spine Surg *Relat Res*. 2023;7(1):13-18. doi:10.22603/ssrr.2022-0118	Prospective cohort study. Patients were assessed for their baseline severity of comorbidities using the Cumulative Illness Rating Scale (CIRS), their baseline cognitive function using the Mini-Cog test, and preoperative routine laboratory blood tests. Patients were then observed for signs and symptoms of POD. Presence of delirium was confirmed using the CAM.	Patients aged 65 and above who were scheduled for elective spine surgery between February 2018 and May 2019.	IV1 = baseline co-morbidities IV 2 = Mini-Cog score IV 3 = preoperative lab values DV 1 = POD	Patients were divided into 2 groups based on presence or absence of POD. Unpaired *t*-tests were performed for between-group comparisons. Chi-square test and Fisher's exact test were performed for proportions and the Wilcoxon rank-sum test for median values. Statistically significant variables in the univariate analyses were applied to multiple logistic regression models, and receiver operating characteristic (ROC) curves were constructed. The area under the curve was calculated for each variable to determine accuracy of each variable.	12 out of 106 patients (11.3%) developed POD. Independent predictors of POD were discovered using multiple logistic regression to be age (OR = 1.26, 95% CI = 1.08-1.47), low Mini-Cog scores (OR =0.492, 95% CI = 0.25-0.97), and a higher blood urea nitrogen (BUN) concentration (OR = 1.11, 95% CI = 1.03-1.21).	Mini-Cog scores < 3, elevated BUN, and older age are all independent predictors of POD.	The Mini-Cog can be utilized in the preoperative setting for rapid screening of mild cognitive impairment in elderly patients undergoing elective spine surgery. It can accurately predict patients with an elevated risk of developing POD, and thus, is a useful intervention for maintaining the cognitive health of elderly patients.	Level II evidence, prospective cohort study. Limitations included a smaller sample size and heterogeneity in levels of surgical stress due to varying blood loss and operative time. The study provides convincing evidence of the utility of the Mini-Cog, among other factors, for predicting POD risk. It also provides further evidence of the feasibility of this intervention in the preoperative setting.

Citation	Design/Method	Sample/ Setting	Major Variables	Measurement and Data Analysis	Findings	Results	Conclusions	Appraisal
Yajima S, Nakanishi Y, Sugimoto M, et al. A novel predictive model for postoperative delirium using multiple geriatric screening factors. *J Surg Onc.* 2023/05/01 2023;127(6):1071-1078. doi:https://doi.org/10.1002/jso.27206	Retrospective cohort study. Patients who underwent major urological cancer surgery and a preoperative geriatric functional assessment were identified for inclusion. Assessments included the Geriatric 8, Activities of Daily Living (IADL), and the Mini-Cog. Patients who later developed POD were then identified, and predictive scores for each assessment were created.	Male patients between the age of 68 and 77 who underwent major urological cancer surgery at National Cancer Center Hospital East (NCCHE) between January 2020 and August 2021.	IV1 = Mini-Cog score IV2 = Geriatric 8 score IV3 = IADL score DV1 = POD	Student's *t*-tests and Mann-Whitney U tests were performed for categorical variables. Odds ratio and 95% confidence intervals were calculated to present the risks. Multivariate logistic regression analysis was performed to identify preoperative risk factors for POD. Receiver operating characteristic (ROC) curves were constructed for factors that were significant in multivariate analyses. The AUC was calculated for each ROC curve.	Univariate and multivariate analyses revealed the following independent risk factors for development of POD: Mini-Cog score <3 (OR = 9.5, 95% CI = 4.2 – 21.4, $p < 0.001$), disability in being responsible for medication (OR = 4.1, 95% CI = 1.1 – 14.7, $p = 0.03$), and the preoperative use of benzodiazepines (OR = 6.4, 95% CI = 2.6 - 15.7, $p < 0.001$). A composite score of all 3 factors was created and found to have an AUC value of 0.819 (95% CI = 0.746 – 0.892). A total composite score of 1 (out of 3) was found to have 74.1% specificity and 84.4% sensitivity for predicting POD. A total composite score of 2 had 97.8% specificity and 28.1% sensitivity.	Mini-Cog score is independently predictive of POD. Additionally, a model consisting of the composite of Mini-Cog score, preoperative disability in medication management, and preoperative benzodiazepine use has excellent predictive power for POD in patients undergoing major urological cancer surgery.	Mini-Cog score can be used alone to predict a patient's risk of developing POD. When combined with other factors known to increase POD risk (such as benzodiazepine use and frequent medication self-administration errors), it becomes a highly specific test of POD risk. Incorporation of the Mini-Cog into a full preoperative evaluation of elderly patients is a highly beneficial practice that allows anesthesia providers to alter their anesthetic plan to reduce POD incidence.	Level II evidence, retrospective cohort study. Limitations included use of a single medical center, retrospective nature of the study, and lack of randomization. Still, the results are compelling in suggesting that Mini-Cog scores are independently predictive of POD risk and also can be used in a composite model with other known risk factors.

Appendix B: IRB Approval

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Office of Research Integrity
Research Compliance, MARC 430

MEMORANDUM

To:	Dr. Valerie Diaz
CC:	Kathryn Solomon
From:	Kourtney Wilson, MS, IRB Coordinator KMW
Date:	January 31, 2024
Protocol Title:	"Preoperative Cognitive Testing with the Mini-Cog Test vs. the Mini-Mental State Examination for Prediction of Risk of Postoperative Delirium: An Evidence-Based Educational Module"

The Florida International University Office of Research Integrity has reviewed your research study for the use of human subjects and deemed it Exempt via the **Exempt Review** process.

IRB Protocol Exemption #:	IRB-24-0028	**IRB Exemption Date:**	01/31/24
TOPAZ Reference #:	113967		

As a requirement of IRB Exemption you are required to:

1) Submit an IRB Exempt Amendment Form for all proposed additions or changes in the procedures involving human subjects. All additions and changes must be reviewed and approved prior to implementation.
2) Promptly submit an IRB Exempt Event Report Form for every serious or unusual or unanticipated adverse event, problems with the rights or welfare of the human subjects, and/or deviations from the approved protocol.
3) Submit an IRB Exempt Project Completion Report Form when the study is finished or discontinued.

Special Conditions: N/A

For further information, you may visit the IRB website at http://research.fiu.edu/irb.

KMW

Appendix C: Recruitment Email

Nicole Wertheim College of Nursing & Health Sciences

Preoperative Cognitive Testing with the Mini-Cog Test vs. the Mini-Mental State Examination for Prediction of Risk of Postoperative Delirium: An Evidence-Based Educational Module

Dear Mount Sinai Medical Center Perioperative Providers:

My name is Kathryn Solomon, and I am a student from the Anesthesiology Nursing Program Department of Nurse Anesthesiology at Florida International University. I am writing to invite you to participate in my quality improvement project. The goal of this project is to increase health care providers' awareness of the use of the Mini-Cog test for the prediction of postoperative delirium risk in elderly surgical patients. You are eligible to take part in this project because you are a part of the Mount Sinai Medical Center perioperative providers.

If you decide to participate in this project, you will be asked to complete and sign a consent form for participation. Next, you will complete a pre-test questionnaire, which is expected to take approximately 5 minutes. You will then be asked to view an approximately 15 minutes long educational presentation online. After going through the educational module, you will be asked to complete the post-test questionnaire, which is expected to take approximately 5 minutes. No compensation will be provided.

Remember, this is completely voluntary. You can choose to be in the study or not. If you'd like to participate or have any questions about the study, please email or contact me at 978-806-6672 or ksolo019@fiu.edu.

Thank you very much.

Sincerely,

Kathryn Solomon
978-806-6672
ksolo019@fiu.edu

Appendix D: Informed Consent Form

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CONSENT TO PARTICIPATE IN A QUALITY IMPROVEMENT PROJECT
Preoperative Cognitive Testing with the Mini-Cog Test vs the Mini-Mental Status Exam for Prediction of Risk of Postoperative Delirium: An Evidence-Based Educational Module

SUMMARY INFORMATION
Things you should know about this study:

- **Purpose:** Educational module to increase providers awareness of the efficacy of the Mini-Cog test for the prediction of postoperative delirium risk in elderly surgical patients.
- **Procedures**: If you choose to participate, you will be asked to complete a pretest, watch a voiceover PowerPoint, and then take a post-test.
- **Duration:** This will take about a total of 25 minutes total.
- **Risks**: There will be minimal risks involved with this project, as would be expected in any type of educational intervention, which may include mild emotional stress or mild physical discomfort from sitting on a chair for an extended period.
- **Benefits:** The main benefit to you from this research is an increase in the participant's knowledge of preoperative cognitive screening using the Mini-Cog test.
- **Alternatives:** There are no known alternatives available other than not taking part in this quality improvement project.
- **Participation:** Taking part in this quality improvement project is voluntary.

Please carefully read the entire document before consenting to participate.

NUMBER OF STUDY PARTICIPANTS:

If the participant decides to be in this study, they will be one of approximately 10 people in this research study.

PURPOSE OF THE PROJECT

The participant is being asked to be in a quality improvement project. The goal of this project is to increase providers' knowledge on the use of the Mini-Cog test as a preoperative screening tool for predicting the risk of postoperative delirium in elderly patients presenting for surgery.
If you decide to participate, you will be 1 of approximately 10 participants.

DURATION OF THE PROJECT
The participation will require about 25 minutes.

PROCEDURES
If the participant agrees to be in the project, PI will ask you to do the following things:
1. Complete an online 10-question pre-test survey delivered electronically via Qualtrics, an Online survey product for which the URL link is provided

2. Review the 15-minute educational PowerPoint delivered electronically via Qualtrics, an Online survey product for which the URL link is provided.
3. Complete the online 10-question post-test survey delivered electronically via Qualtrics, an Online survey product for which the URL link is provided.

RISKS AND/OR DISCOMFORTS
The main risk or discomfort from this research is minimal. There will be minimal risks involved with this project, as would be expected in any type of educational intervention, which may include mild emotional stress or mild physical discomfort from sitting on a chair for an extended period.

BENEFITS
The following benefits may be associated with participation in this project:
An increase in participants knowledge about the efficacy of the Mini-Cog test in predicting postoperative delirium risk, as well as the steps for administration and interpretation of this screening tool. The overall objective of the program is to increase the providers' knowledge based on the current literature.

ALTERNATIVES
There are no known alternatives available to the participant other than not taking part in this project. However, if the participant would like to receive the educational material, it will be provided to them at no cost.

CONFIDENTIALITY
The records of this project will be kept private and will be protected to the fullest extent provided by law. If, in any sort of report, PI might publish, it will not include any information that will make it possible to identify the participant. Records will be stored securely, and only the project team will have access to the records.

PARTICIPATION: Taking part in this quality improvement project is voluntary.

COMPENSATION & COSTS
There is no cost or payment to the participant for receiving the health education and/or for participating in this project.

RIGHT TO DECLINE OR WITHDRAW
The participation in this project is voluntary. The participant is free to participate in the project or withdraw the consent at any time during the project. The participant's withdrawal or lack of participation will not affect any benefits to which you are otherwise entitled. The investigator reserves the right to remove the participant without their consent at such time that they feel it is in their best interest.

RESEARCHER CONTACT INFORMATION
If you have any questions about the purpose, procedures, or any other issues relating to this research project, you may contact Kathryn Solomon at 978-806-6672 or ksolo019@fiu.edu, and Dr. Valerie Diaz at 305-348-9027 or vdiaz@fiu.edu.

IRB CONTACT INFORMATION
If the participant would like to talk with someone about their rights pertaining to being a subject in this project or about ethical issues with this project, the participant may contact the FIU Office of Research Integrity by phone at 305-348-2494 or by email at ori@fiu.edu.

PARTICIPANT AGREEMENT
I have read the information in this consent form and agree to participate in this study. I have had a chance to ask any questions I have about this study, and they have been answered for me. By clicking on the "consent to participate" button below I am providing my informed consent.

Appendix E: Pre-/Posttest Survey

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Pretest and Posttest Questionnaire:

Preoperative Cognitive Testing with the Mini-Cog Test vs. the Mini-Mental State Examination for Prediction of Risk of Postoperative Delirium: An Evidence-Based Educational Module

INTRODUCTION

The primary aim of this QI project is to increase providers awareness of the use of the Mini-Cog test as a preoperative screening tool for predicting the risk of postoperative delirium in elderly patients presenting for surgery. Please answer the question below to the best of your ability. The questions are either in multiple choice or true/false format and are meant to measure knowledge preoperative cognitive screening for prediction of postoperative delirium risk.

DEMOGRAPHIC INFORMATION

1. **Gender:**

   Male

   Female

   Other

2. **Age:**

   25-30 years

   30-40 years

   40-50 years

   50-60 years

   60+ years

3. **Race/Ethnicity (Select all that apply):**

American Indian/Alaskan Native

Asian

Black

Hispanic/Latino

Native Hawaiian/Pacific Islander

White

4. **Position/Title:**

   CRNA

   Anesthesiologist

5. **Level of Education:**

   Certificate

   Masters

   DNP

   PhD

   MD/DO

6. **How many years have you been practicing anesthesia?**

   1-2 years

   3-5 years

   5-10 years

   10-20 years

   20+ years

PRE- AND POST-MODULE QUESTIONNAIRE

1. **What percentage of elderly patients (65+) present for surgery with some degree of unrecognized cognitive impairment?**
    a. 8%
    b. 25%
    c. 37%
    d. 55%
2. **What is the MOST COMMON postoperative complication in older adults?**
    a. Aspiration
    b. Thromboembolic events
    c. Infection
    d. Delirium
3. **Which intervention is recommended by the Anesthesia Patient Safety Foundation, American College of Surgeons, American Society of Anesthesiologists, and American Geriatric Society for reduction of post-op delirium risk in elderly patients (65+)?**
    a. Routine preoperative cognitive screening for all elderly patients
    b. BIS monitoring for all elderly patients undergoing general anesthesia
    c. Prophylactic haloperidol for all eligible elderly surgical patients
    d. Preoperative neurology clearance for all elderly patients
4. **It is possible to accurately assess the cognitive status of my elderly patients using my normal preoperative assessment without the use of a screening tool.**
    a. Strongly agree

b. Somewhat agree

c. Unsure

d. Somewhat disagree

e. Strongly disagree

5. **Which neuropsychological screening tool is considered the gold standard for rapid assessment of cognitive status?**

    a. Montreal Cognitive Assessment (MoCA)

    b. Weschler Adult Intelligence Scale (WAIS)

    c. Mini-Mental State Examination (MMSE)

    d. Addenbrooke's Cognitive Exam-Revised (ACE-R)

6. **What are the two components of the Mini-Cog test?**

    a. Three-word recall and a clock drawing test

    b. Basic orientation questions and simple math

    c. Visual puzzles and a story recall test

    d. Image copying test and three-step directions test

7. **TRUE/FALSE:** The Mini-Cog can be accurately administered, scored, and interpreted within 2-5 minutes.

8. **Which Mini-Cog score cutoff has been shown to be independently predictive of increased post-op delirium risk?**

    a. < 5

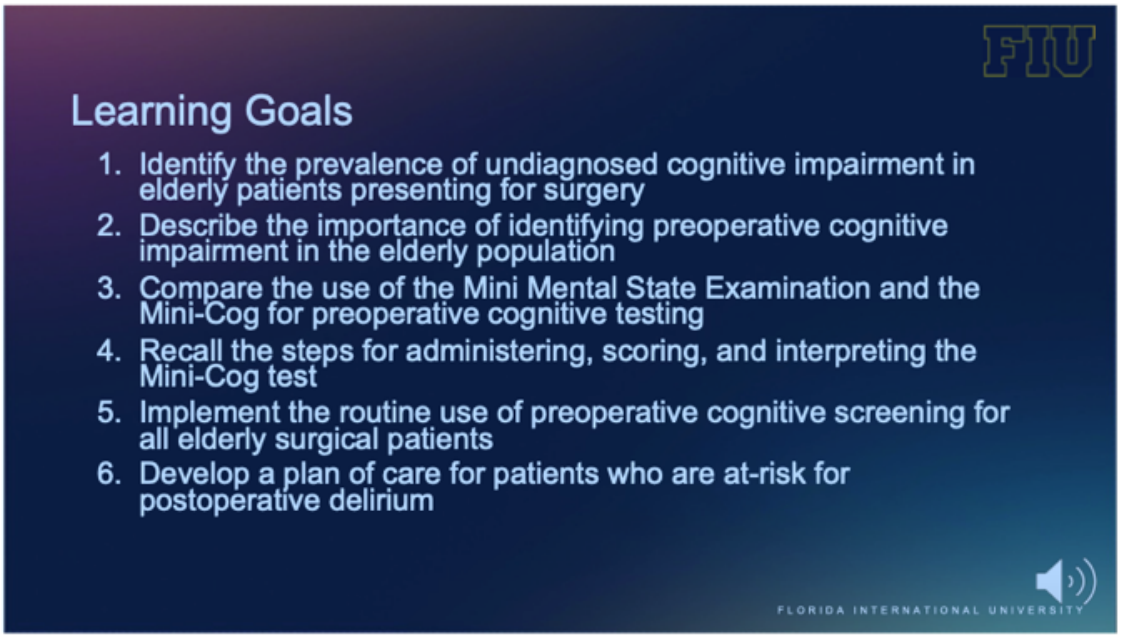
    b. < 4

    c. < 3

    d. < 2

9. **Which anesthetic adjunct is the focus of emerging research due to its potential for reducing post-operative delirium risk in elderly patients?**
    a. Ketamine
    b. Dexmedetomidine
    c. Magnesium sulfate
    d. Clonidine
10. **How likely are you to incorporate the Mini-Cog into your preoperative assessments when caring for elderly patients?**
    a. Very likely
    b. Somewhat likely
    c. Somewhat unlikely
    d. Very unlikely

Appendix F: Educational Module



Background

- Elderly patients (65+) account for ~50% of all annual surgical procedures
- **~37%** of elderly patients present for surgery with **unrecognized preoperative cognitive impairment**
- Cognitive impairment is associated with increased risk for postoperative delirium, declining functional recovery, and higher hospital morbidity/mortality
- **Postoperative Delirium (POD):** most common postoperative complication in older adults.
  - Life-threatening and preventable!

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Background

- **Perioperative brain health** has been identified as a clinical priority by numerous medical societies and organizations
- Guidelines released by these organizations recommend **preoperative cognitive screening** for all patients aged 65+

apsf Anesthesia Patient Safety Foundation

American Society of Anesthesiologists

ACS American College of Surgeons

AGS Geriatrics Healthcare Professionals — Leading Change. Improving Care for Older Adults.

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Mini-Mental State Examination (MMSE)

- **Gold standard** neuropsychological tool for rapid assessment of cognitive status
- 11-items, 10-15 minutes for administration
- Validated for use in preoperative setting
- Too lengthy to be practical in fast-paced preop environment

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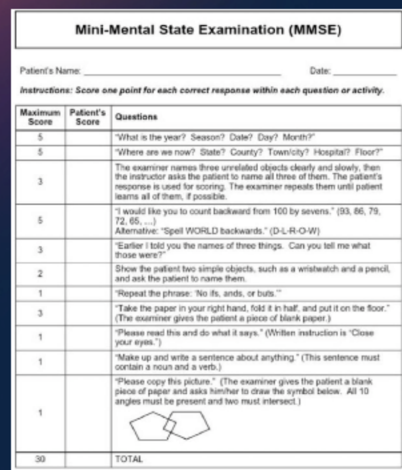

Mini-Mental State Examination (MMSE)

Patient's Name: ______ Date: ______

Instructions: Score one point for each correct response within each question or activity.

Maximum Score	Patient's Score	Questions
5		"What is the year? Season? Date? Day? Month?"
5		"Where are we now? State? County? Town/city? Hospital? Floor?"
3		The examiner names three unrelated objects clearly and slowly, then the instructor asks the patient to name all three of them. The patient's response is used for scoring. The examiner repeats them until patient learns all of them, if possible.
5		"I would like you to count backward from 100 by sevens." (93, 86, 79, 72, 65, ...) Alternative: "Spell WORLD backwards." (D-L-R-O-W)
3		"Earlier I told you the names of three things. Can you tell me what those were?"
2		Show the patient two simple objects, such as a wristwatch and a pencil, and ask the patient to name them.
1		"Repeat the phrase: 'No ifs, ands, or buts.'"
3		"Take the paper in your right hand, fold it in half, and put it on the floor." (The examiner gives the patient a piece of blank paper.)
1		"Please read this and do what it says." (Written instruction is "Close your eyes.")
1		"Make up and write a sentence about anything." (This sentence must contain a noun and a verb.)
1		"Please copy this picture." (The examiner gives the patient a blank piece of paper and asks him/her to draw the symbol below. All 10 angles must be present and two must intersect.)
30		TOTAL

Mini-Cog

- 3-items, 2-5 minutes to administer
- Higher sensitivity for mild cognitive impairment than MMSE
- **Feasibility testing**: Mini-Cog can be accurately administered and scored in a preoperative setting
- Validated Spanish version available
- **Mini-Cog scores less than 3 are independently associated with increased risk of post-op delirium**

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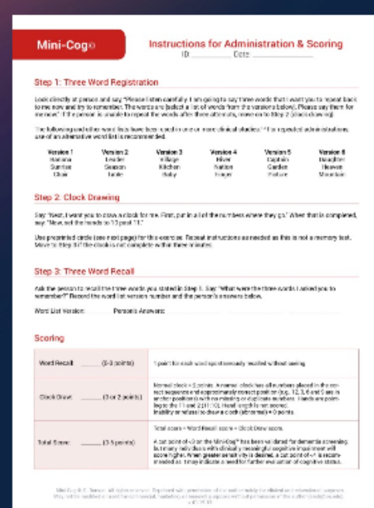

How to Administer the Mini-Cog

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

- The Mini-Cog is a standardized neuropsychological screening tool and must be administered the same way every time to maintain validity
- **Step 1:** Read the directions word-for-word to the patient, selecting one of the 6 provided word lists

Download for free from https://mini-cog.com/download-the-mini-cog-instrument/

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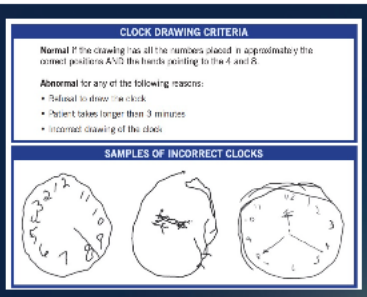
How to Administer the Mini-Cog

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 2:** Read instructions word-for-word for clock drawing task.
- Score clock based on the provided criteria.

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How to Administer the Mini-Cog

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.

Word List Version: _____ Person's Answers: _____ _____ _____

- **Step 3:** Ask patient to recall the 3 words from Step 1.

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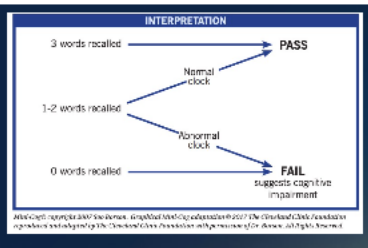
Scoring and Interpretation

Scoring

Word Recall: _____ (0-3 points)	1 point for each word spontaneously recalled without cueing.
Clock Draw: _____ (0 or 2 points)	Normal clock = 2 points. A normal clock has all numbers placed in the correct sequence and approximately correct position (e.g., 12, 3, 6 and 9 are in anchor positions) with no missing or duplicate numbers. Hands are pointing to the 11 and 2 (11:10). Hand length is not scored. Inability or refusal to draw a clock (abnormal) = 0 points.
Total Score: _____ (0-5 points)	Total score = Word Recall score + Clock Draw score. A cut point of <3 on the Mini-Cog™ has been validated for dementia screening, but many individuals with clinically meaningful cognitive impairment will score higher. When greater sensitivity is desired, a cut point of <4 is recommended as it may indicate a need for further evaluation of cognitive status.



- Mini-Cog scores < 3 are predictive of increased risk of post-op delirium.

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Recommended Interventions

- Best practices for reducing POD as recommended by the ASA Brain Health Initiative:
  1. Collaborate with multidisciplinary team (anesthesia, surgeons, RNs, pharmacists, geriatricians) to identify at-risk patients and manage those who develop POD
  2. Conduct baseline cognitive screening of all at-risk patients.
  3. Conduct delirium screening before surgery, before discharge from recovery room, and then twice daily until day 5 or discharge.
  4. Implement nonpharmacological interventions to prevent POD: early mobilization, orientation, physiotherapy, communication, promotion of sleep-wake cycles, and presence of family/friend support systems.
  5. Optimize post-op pain control using minimally-sedating, multimodal pain management.
  6. Avoid benzodiazepines and antipsychotics as first-line treatment for POD.

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Source: Swarbrick CJ, Partridge JSL. Evidence-based strategies to reduce the incidence of postoperative delirium: a narrative review. *Anaesthesia*. 2022;77(S1):92-101. doi:10.1111/anae.15607

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Take Home Points

- Many elderly patients present for surgery with unrecognized cognitive impairment, predisposing them to serious complications like post-op delirium
- Preoperative cognitive screening of **all** elderly patients is recommended by multiple medical organizations and societies
- The **Mini-Cog** has been shown to be a reliable, efficient tool for identification of cognitive impairment and prediction of POD risk
- Baseline Mini-Cog scores can help anesthesia providers select appropriate interventions for reducing POD risk in this population

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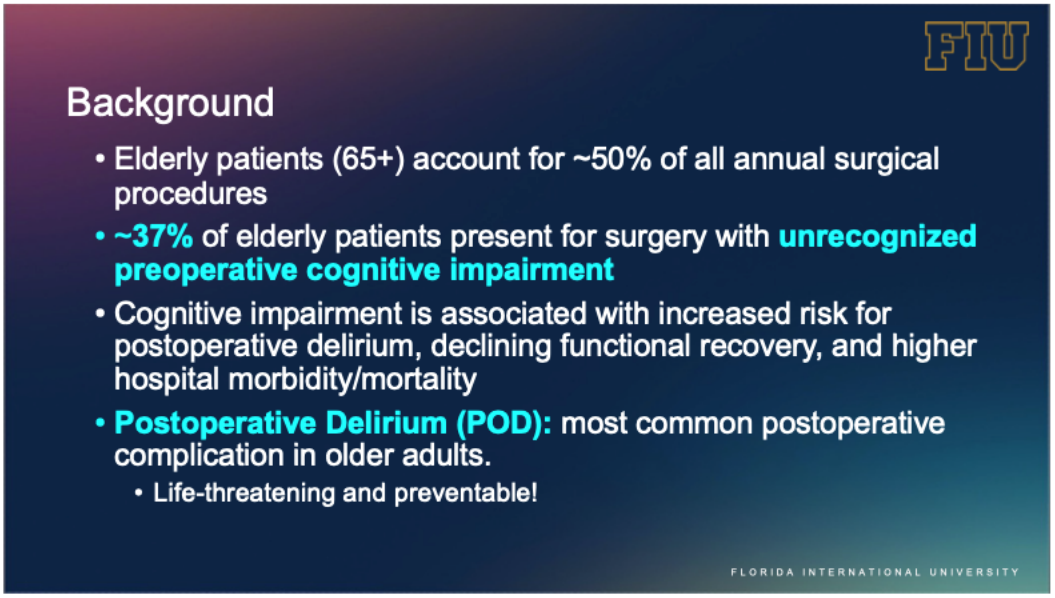
Appendix G: Dissemination PowerPoint



Background

- **Perioperative brain health** has been identified as a clinical priority by numerous medical societies and organizations
- Guidelines released by these organizations recommend **preoperative cognitive screening** for all patients aged 65+

Anesthesia Patient Safety Foundation

American Society of Anesthesiologists

American College of Surgeons

Geriatrics Healthcare Professionals — Leading Change. Improving Care for Older Adults.

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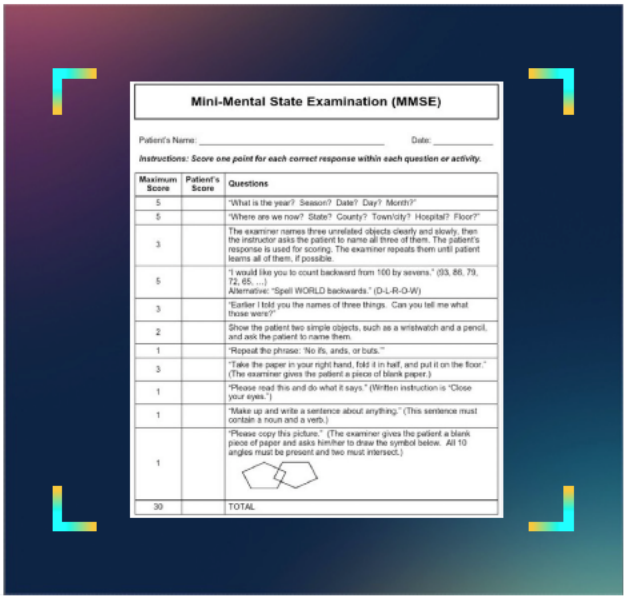
Mini-Mental State Examination (MMSE)

- **Gold standard** neuropsychological tool for rapid assessment of cognitive status
- 11-items, 10-15 minutes for administration
- Validated for use in preoperative setting
- Too lengthy to be practical in fast-paced preop environment



Mini-Mental State Examination (MMSE)

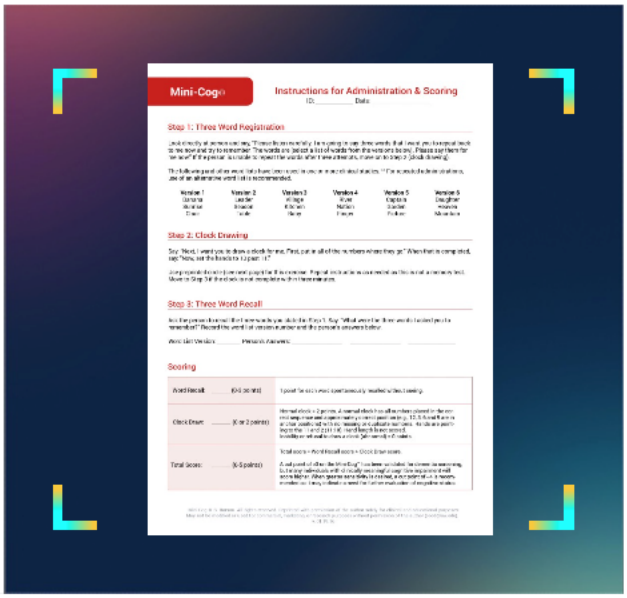
Patient's Name: _____ Date: _____

Instructions: Score one point for each correct response within each question or activity.

Maximum Score	Patient's Score	Questions
5		"What is the year? Season? Date? Day? Month?"
5		"Where are we now? State? County? Town/city? Hospital? Floor?"
3		The examiner names three unrelated objects clearly and slowly, then the instructor asks the patient to name all three of them. The patient's response is used for scoring. The examiner repeats them until patient learns all of them, if possible.
5		"I would like you to count backward from 100 by sevens." (93, 86, 79, 72, 65, ...). Alternative: "Spell WORLD backwards." (D-L-R-O-W)
3		"Earlier I told you the names of three things. Can you tell me what those were?"
2		Show the patient two simple objects, such as a wristwatch and a pencil, and ask the patient to name them.
1		"Repeat the phrase: 'No ifs, ands, or buts.'"
3		"Take the paper in your right hand, fold it in half, and put it on the floor." (The examiner gives the patient a piece of blank paper.)
1		"Please read this and do what it says." (Written instruction is "Close your eyes.")
1		"Make up and write a sentence about anything." (This sentence must contain a noun and a verb.)
1		"Please copy this picture." (The examiner gives the patient a blank piece of paper and asks him/her to draw the symbol below. All 10 angles must be present and two must intersect.)
30		TOTAL

Mini-Cog

- 3-items, 2-5 minutes to administer
- Higher sensitivity for mild cognitive impairment than MMSE
- **Feasibility testing**: Mini-Cog can be accurately administered and scored in a preoperative setting
- Validated Spanish version available
- **Mini-Cog scores less than 3 are independently associated with increased risk of post-op delirium**



PICO Question

- **Population**: Elderly surgical patients (age 65+)
- **Intervention**: Preoperative screening with the Mini-Cog
- **Comparison**: Preoperative screening with the MMSE (gold standard)
- **Outcome**: Postoperative delirium and other complications

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QI Project Purpose

- To **increase awareness** of the need for preoperative cognitive screening of all elderly patients to reduce POD risk
- To **educate** anesthesia providers on the utility of the Mini-Cog for rapid cognitive screening in the preoperative setting
- To **demonstrate** the correct administration, scoring, and interpretation of the Mini-Cog
- To **influence** changes in practice based on high quality research and evidence

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QI Methods

- Educational module created via PowerPoint containing evidence synthesized from literature review
- Pre and posttest surveys created to assess anesthesia providers' knowledge before and after completion of module
- Module and surveys consolidated via Qualtrics and disseminated to a group of practicing CRNAs
- Responses collected and statistical analysis performed on pre- and posttest data to determine efficacy of educational module

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QI Results – Objective Measures

N = 10 CRNAs

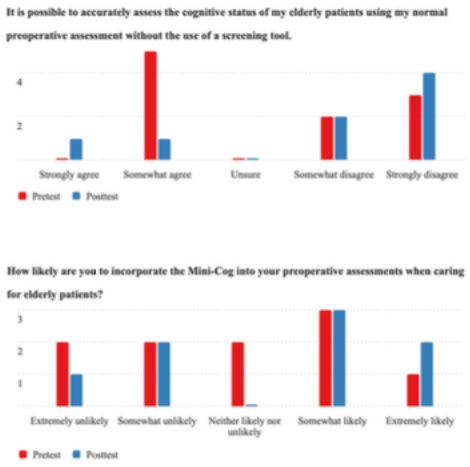
Approx. what percentage of elderly patients (65+) present for surgery with some degree of cognitive impairment?	Pretest	Posttest	Gain
8%	0	0	0
25%	6	0	-6
37%*	4	10	6
55%	0	0	0
Accuracy	40%	100%	60%
What is the MOST common postoperative complication in older adults?			
Aspiration	0	0	0
Thromboembolic events	0	0	0
Infection	0	0	0
Delirium*	10	10	0
Accuracy	100%	100%	0
Which intervention is recommended…for reduction of postoperative delirium risk in elderly patients (65+)?			
Routine preoperative screening of all elderly patients*	9	10	1
BIS monitoring for all elderly patients undergoing general anesthesia	1	0	-1
Prophylactic haloperidol for all elderly surgical patients	0	0	0
Preoperative neurology clearance for all elderly patients	0	0	
Accuracy	90%	100%	10%
Which neuropsychological screening tool is considered the gold standard for rapid assessment of cognitive status?			
Montreal Cognitive Assessment (MoCA)	3	1	-2
Weschler Adult Intelligence Scale (WAIS)	0	0	0
Mini-Mental State Examination (MMSE)*	7	9	2
Addenbrooke's Cognitive Exam-Revised (ACE-R)	0	0	0
Accuracy	70%	90%	20%

What are the two components of the Mini-Cog test?			
Three-word recall and a clock drawing test*	4	9	5
Basic orientation questions and simple math	3	1	-2
Visual puzzles and a story recall test	3	0	-3
Image copying test and a three-step direction test	0	0	0
Accuracy	40%	90%	50%
TRUE/FALSE: The Mini-Cog can be accurately administered, scored, and interpreted within 2-5 minutes.			
TRUE*	10	10	0
FALSE	0	0	0
Accuracy	100%	100%	0%
Which Mini-Cog score cutoff has been shown to be independently predictive of increased post-op delirium risk?			
< 5	1	0	-1
< 4	3	0	-3
< 3*	6	10	4
< 2	1	0	-1
Accuracy	60%	100%	40%
Which anesthetic adjunct is the focus of emerging research due to its potential for reducing post-operative delirium risk in elderly patients?			
Ketamine	0	0	0
Dexmedetomidine*	6	10	4
Magnesium sulfate	3	0	-3
Clonidine	1	0	-1
Accuracy	60%	100%	40%
Overall Accuracy	67.50%	96.25%	27.50%

QI Results – Objective Measures

	Pretest Scores	Posttest Scores
Mean	0.675	0.9625
Variance	0.025	0.007118056
Observations	10	10
Degrees of freedom	9	
t Stat	-4.444680722	
p-value	0.000806272	

QI Results – Subjective Measures



Discussion

- Completion of the educational module **significantly increased** accuracy on the objective measures as measured on the posttest survey
- Subjective measures showed a **slight increase** in CRNA likelihood of implementing the Mini-Cog into practice
  - Still room for significant improvement in compliance
  - May be due to low belief in the need for an objective tool

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Discussion

Limitations:

- Small sample size (N = 10)
- Low generalizability due to single site
- Low external reliability and validity
- May see markedly different results at facilities with different culture, workflow, and staffing

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Discussion

Implications for practice:

- The educational module is a useful tool for increasing CRNA knowledge about preoperative cognitive screening for POD prediction
- May be less useful for increasing compliance with recommended interventions and changing everyday practice

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Conclusions

- The educational module is a useful tool for enhancing CRNA knowledge of preoperative cognitive testing for POD prediction
- Further research is needed to determine methods for increasing compliance with the recommended intervention
  - **Possible barriers**: limited resources, production pressure, understaffing
- Institutional policy changes addressing these barriers are needed to enhance evidence-based practice and improve patient outcomes

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- Program director Dr. Ann Miller
- Dean of Nicole Wertheim College of Nursing and Health Sciences Dr. Jorge Valdes
- Members of the FIU DNP Nurse Anesthesiology Class of 2024
- Family and friends

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