Actionable Patient Safety Solutions™ (APSS™):
Post-Operative Delirium in Older Adults

How to use this guide

This APSS provides evidence-based actions and resources for executives, leaders, clinicians, and performance improvement specialists. This document is intended to be used as a guide for healthcare organizations to examine their own workflows, identify practice gaps, and implement improvements. In it, you'll find:

Best Practice Summary: A high level summary of evidence-based, clinical best practices. (page 2)

Executive Summary: Executives should understand the breadth of the problem and its clinical and financial implications. (page 3)

Leadership Checklist: This section is for senior leaders to understand common patient safety problems and their implications related to post-operative delirium in older adults. Most preventable medical harm occurs due to system defects rather than individual mistakes. Leaders can use this checklist to assess whether best practices are being followed and whether action is needed in their organization around post-operative delirium in older adults. (page 4)

Clinical Workflow: This section includes more specific information about post-operative delirium in older adults across the continuum of care. Leaders should include the people doing the work in improving the work. This section outlines what should be happening on the frontline. Clinicians can use this section to inform leaders whether there are gaps and variations in current processes. This is presented as an infographic that can be used for display in a clinical area. (page 6)

Education for Patients and Family Members: This section outlines what frontline healthcare professionals should be teaching patients and family members about post-operative delirium in older adults. Clinicians can inform leaders whether there are gaps and variations in the current educational processes. (page 10)

Performance Improvement Plan: If it has been determined that there are gaps in current practice, this section can be used by organizational teams to guide them through an improvement project. (page 12)

What We Know about Post-Operative Delirium in Older Adults: This section provides additional detailed information about post-operative delirium in older adults. (page 16)

Resources: This section includes helpful links to free resources from other groups working to improve patient outcomes and safety. (page 23)

Endnotes: This section includes the conflict of interest statement, workgroup member list, and references. (page 23)

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Patient Safety
M O V E M E N T

Best Practice Summary

Prevention:
- ☐ Screen the patient for pre-existing cognitive impairment or history of cognitive impairment. Identify previous experiences of post-operative delirium.
- ☐ If any risk factors are detected upon admission, communicate appropriately with the surgical team.
- ☐ Inquire about psychotropic medications.
- ☐ Apply the standard postoperative delirium predictive tool to understand the risk of developing delirium.

Detection and Preoperative Care:
- ☐ Establish the patient's baseline of attentions, awareness, and cognition.
- ☐ Evaluate the patient's environment to ensure optimal safety and supportive orientation.
- ☐ Document all episodes of delirium and cognitive screenings and assessments into the patient's record.
- ☐ Evaluate baseline cognition and create an individualized plan of care for all patients at risk of developing delirium.
- ☐ Involve patients and family members in creating an individualized care plan for patients at risk.
- ☐ Document and report any symptoms that are identified as related to delirium.
- ☐ Manage delirium promptly as for any other acute medical condition.
  - ☐ Implement the organization's pre-determined escalated care plan, which includes
    - ☐ Appropriate treatment strategies
    - ☐ Consideration of geriatric, psychiatric or psychological referral.

Intraoperative Care:
- ☐ Avoid excessive dosing of anesthesia and continuously monitor the depth of anesthesia.
- ☐ Maintain normothermia.

Post Operative Care:
- ☐ Closely monitor the patient for any signs or symptoms of postoperative delirium.
- ☐ Employ the ABCDEF bundle (Assess, prevent and manage pain, Both spontaneous awakening trials (SAT) and spontaneous breathing trials (SBT), Choice of analgesia and sedation, Delirium: assess, prevent and manage, Early mobility and exercise, and Family engagement and empowerment)
- ☐ Optimize pain management with non-pharmacological, non-opioid pharmacological, and opioid-based pain management strategies.
- ☐ Ensure a normal sleep cycle for the patient
- ☐ Perform deliberate and frequent verbal reorientation by asking questions such as where they are, what surgery they underwent, etc).
- ☐ Promote early mobilization
- ☐ Report any incidences of delirium to the oversight committee and in relevant hospital communication.

Discharge Recovery
- ☐ Notify the patient's primary care provider if the patient experienced any episodes of postoperative delirium.
- ☐ Do not discharge patients currently experiencing post-operative delirium.
- ☐ Coordinate care for the patient as an outpatient setting (e.g., skilled nursing facility, nursing home, caregiver, etc).

Executive Summary

The Problem
Delirium in older patients following anesthesia and surgery (Postoperative Delirium (POD)) is a frequent occurrence that often goes undiagnosed. Delirium can lead to both short and long-term morbidity and mortality, including cognitive impairment. It is an immensely disturbing experience for patients and families which can lead to long-term neuropsychiatric sequelae, resulting in an increase in cost of care (American Geriatrics Society Expert Panel on Postoperative Delirium in Older Adults). Up to 65% of older post-operative patients suffer some form of delirium following a surgical procedure, especially if requiring ICU admission (Marcantonio, 2017). It is associated with serious consequences for hospitals, including (O'Regan et al., 2013; Rudolph & Marcantonio, 2011; Gleason, 2015):

- Increased rates of surgical complications, including falls and chest and wound infections
- Increased costs resulting from escalations in care, longer hospital stays, and additional medications and laboratory tests
- Increased 30-day readmissions
- Increased ratio of observed/expected mortality.

The Cost
POD adds $125 billion to the cost of healthcare in the United States and $182 billion in 18 European countries combined every year (Inouye et al., 2014; Brown et al., 2016). The increased cost of healthcare attributed to delirium has been difficult to accurately estimate, as it is a result of the direct consequences of delirium related to utilization of additional health resources including increased length of stay, admission to ICU, additional medications and increased needs for institutionalizations post acute care (Barton & DePaulo, 2008; Leslie & Inouye, 2011; Vasilevskis et al., 2018).

The Solution
Many healthcare organizations have successfully implemented and sustained improvements and reduced death and harm from postoperative delirium in older adults. This document provides a blueprint that outlines the actionable steps organizations should take to successfully reduce post-operative delirium rates and summarizes the available evidence-based practice protocols. This document is revised annually and is always available free of charge on our website.

Leadership Checklist

On a monthly basis, or more frequently if a problem exists, the executive team should review the outcomes of patients at risk for delirium. Use this checklist as a guide to determine whether current evidence-based guidelines are being followed in your organization:

Collaboration and Involvement

- ☐ Ensure there are enough staff to effectively manage necessary preventive care.
- ☐ Coordinate with relevant local medical practitioners (primary care / family medicine / general practitioners) for pre-hospital and post-discharge planning. Such planning includes assessment, optimization, implementation of appropriate referral pathways, and post-discharge medication management. See "Care Coordination" APSS for more information.
- ☐ Ensure frontline involvement in delirium improvement activities. Maintain their engagement and remove barriers to progress. Continually ensure that all staff are aware of the delirium reduction program and educated in its implementation.
- ☐ During the development of educational resources and protocols/guidelines, include a Patient Family Advisory Committee (PFAC) representative on the Delirium Workgroups/Committees. In the development of educational materials/handouts and protocols for patients and support persons, engage with the Patient, Family Advisory Committee (PFAC) to review educational materials from a patient's perspective. Incorporate patient and family stories as a powerful way to engage practitioners and transform how they perceive the issue of delirium. See "Person and Family Engagement" APSS for more information.
- ☐ Provide public education on postoperative delirium to include signs, symptoms and treatment through public awareness events and marketing platforms.

Education and Clinical Workflow

- ☐ Ensure adequate training and documentation of screening competencies and skills. Train the team on the basic features of delirium as well as the features of any tools that will be used.
- ☐ Ensure that delirium protocols are embedded into clinical workflows, whether electronic or paper.
- ☐ Eliminate barriers to making rapid changes to documentation templates and order sets. Standardize order sets and documentation templates and consider data collection and integrity. Ensure cognitive screening and delirium assessments are embedded in clinical records, whether paper or electronic, to ensure each of access in auditing for prevalence, incidence and intervention effectiveness and for monitoring the patient course during hospitalization.
- ☐ Develop a hospital-wide education program, targeted appropriately to relevant clinical areas, with the intent of increasing awareness of the importance of identifying cognitive impairment and delirium, and what strategies can be used to support and best manage such patients.
- ☐ This should incorporate local/national/international recommended best practice standards and tools where they exist.
- ☐ Consider a predictive tool that includes use of variables and assessments that are readily available in clinical practice and are feasible to administer without extensive training or

interpretation. See "Predictive Tools in the General Hospital Surgical Population" in the "What We Know" section.

- ☐ Leverage electronic medical records to trigger reminders / alerts / order-sets.
- ☐ Establish hospital resources including protocols and guidelines (listed in Appendix A) for delirium prevention and management by identifying risk factors for delirium, minimizing trigger factors and optimizing assessment and care in the perioperative environment, including high dependency units (HDUs) and intensive care units (ICUs) again drawing on any local/national or international standards or resources that may exist. Understand what related organizational policies exist and determine areas for alignment.

Implementation and Measurement

- ☐ Measure and report delirium incidence monthly. Routinely assess outcomes.
- ☐ In order to gain buy-in from hospital administration and leadership, calculate potential cost-savings based on performance gap.
- ☐ Initiate a PI (performance improvement) project. Routinely reassess to identify gaps, and ensure integration of the data collected
- ☐ Expect that when the organization starts tracking safety events, there will be an initial increase in reported events before organizational improvement work begins to reduce error rates over time. Ensure that the frontline staff and leaders understand this so they don't become demotivated to improve. Map time course for implementation with an expectation of months to years but be ready and okay to adjust the plan as needed.

Sustainment and Continuous Improvement

- ☐ Ensure that leaders have a simple process to oversee delirium improvement work while also considering how it aligns with other initiatives across the organization. Establish an Oversight Committee which oversees pre-hospital and admission screening programs, multidisciplinary care programs and perioperative assessment, prevention, and care strategies. The committee reports through safety and quality care pathways.
- ☐ Debrief on a regular basis to solicit team feedback about barriers to sustained compliance. Adjust the plan quickly and nimbly as needed. Conduct regular program auditing.
- ☐ Consider implementing fast track surgery (ERAS program) with early mobilization and discharge to prevent postoperative delirium. See "Early Mobility Management" APSS for more information.
- ☐ Hold staff accountable for providing the standard of care and reward success.

Clinical Workflow

1. PREVENTION OF DELIRIUM

- Prior to hospital admission or upon hospital admission for emergencies or day-cases, identify predisposing factors and precipitating events for delirium such as pre-existing cognitive impairment (history, memory complaint (patient or informant), screening tests), prior experience of postoperative delirium or neurocognitive decline, age, frailty, polypharmacy, cerebrovascular disease, major cavity surgery (e.g., abdominal, thoracic), emergency surgery, metabolic disturbances, history of falls, history of health injury, history of brain infection, mental subnormality, learning disabilities, asperger/autism, seizure disorder, current or past, substance abuse, current or past (American Geriatrics Society, 2015). Alert the treatment team if any of these risk factors are detected, as a delirium risk care plan may be required.
- Inquire about psychotropic medications. Conduct a pharmacological review, ideally by a geriatrician or pharmacist to identify polypharmacy, drug withdrawal risk and potential drug interactions. See "Medication Safety" APSS for more information.
- Use the organizationally-adopted predictive tool for screening for the risk of developing delirium.
- Involve the patient and carer and ensure the provision of sensory aids (glasses, hearing aids).
- Incorporate the delirium screening information into hand-off procedures. See "Hand-Off Communication" APSS for more information.
- See "Tools for Screening and Assessment" in the "What We Know" section for more information.

2. DETECTION OF DELIRIUM

- Use the organizationally-adopted validated screening tool to establish patient baseline of attention, awareness, and cognition before or during hospital admission and to monitor post-operative changes at critical points in the care continuum (post-anesthesia care unit, ward or ICU, upon discharge, and at post-discharge primary care encounter).
- Make all allied health professionals and family members aware of the patient's baseline cognitive state and empower all to report any observed changes in mental status (new onset confusion, inattention, or memory problems) or behavior (agitation, sedation) to nursing.
- If delirium is suspected or detected by any member of the care team, document and report symptoms to the medical team. Once delirium is detected, manage promptly as for any other acute medical condition. Implement the organization's

pre-determined escalated care plan, which includes appropriate treatment strategies, and consideration of the patient for geriatric, psychiatric or psychological referral. Ensure follow up plans are in place.

- Review the patient's environment to ensure it is safe, calm, and supportive for orientation.
- Regularly re-evaluate at least once per nursing shift, during each bedside encounter, and at discharge.
- Reduce the use of pharmacologic interventions or physical restraints unless the patient or staff are at risk of harm (usually from excessive agitation). See "Restraint Safety" APSS for more information.
- Enter delirium episodes into the patient's medical record, ideally in a specific section in an Electronic Medical Record and notify the managing medical team and the patient and family members.
- See "Tools for Screening and Assessment" in the "What We Know" section for more information.

3. PREOPERATIVE CARE

- Conduct steps in the "Prevention of Delirium" section prior if not yet conducted and as appropriate.
- Record cognitive screening and delirium assessment in clinical record, as aligned with the organizational standard. Consider all risk factors for delirium.
- Objectively evaluate baseline cognition with the organization's brief screening tool during preoperative evaluation in all patients over the age of 65 and in any patient with risk factors for preexisting cognitive impairment.
- Conduct a frailty assessment. Consider use of the "Clinical Frailty Score" or the organizationally-adopted assessment tool.
- Create an individualized, managed plan of care for all patients at risk and include a focus on reducing precipitating events through thorough prehabilitation.
- Inform all patients over the age of 65 of the post-operative risks of developing delirium, including confusion, inattention, and memory problems. Involve family members and loved ones where appropriate.
- Ensure that the patient, carers and/or family are engaged at all stages of care and that family members and loved ones can be involved with support for the at risk individual.
- Avoid routine premedication with benzodiazepines for at-risk patients except for patients with severe anxiety or those with chronic use.
- Elevate concerns to the receiving unit/ward if there are risk factors upon screening.
- Avoid prolonged fasting, dehydration, or metabolic disturbance.
- Use preoperative measures of cerebral perfusion as an indicator of delirium risk.

Use objective measures of cerebral perfusion and oxygenation as surrogate measures to ensure MAP target is keeping the brain perfused as intended.

- Preoperative cognitive training, as part of a preoperative optimisation program, is being investigated for possible benefits in outcome based on early data suggesting benefit.

4. INTRAOPERATIVE CARE

- Avoid excessive anesthesia dosing. Consider monitoring depth of anesthesia using pEEG including processed frontal EEG / burst suppression indices (Siddiqi et al., 2016). Monitor age-adjusted end-tidal MAC fraction. See "Anesthesia Strategies" in the "What We Know" section for more information.
- Avoid burst suppression if using EEG technologies.
- Avoid excessive drug exposure, minimize stress, and optimize pain control. Avoid relative hypotension (Berger et al, 2018).
- Maintain normothermia.
- Encourage pre-discharge screening of at-risk patients for delirium before they leave the recovery room. If positive, patients should not be discharged to the ward without having started specific interventions to modify precipitating factors for delirium.
- There is no evidence that prophylactic antipsychotic medications decrease the incidence of delirium, and in fact, may cause harm (Burry et al., 2018).

5. DETECTION OF DELIRIUM

- Monitor symptoms of postoperative delirium at least once per shift and at every bedside encounter in higher risk patients and notify nursing, due to the fluctuating course of post-operative delirium.
- Conduct daily non-pharmacologic interventions including early mobilization, noise reduction, orientation (day, time, place), reducing polypharmacy, use of hearing and visual aids and maintenance or restoration of normal sleep-wake cycles (Scottish Intercollegiate Guidelines Network, 2019).
- Maintain normal sleep cycles for the patient.
- For ICU or high dependency areas, employ the ABCDEF bundle (Assess, prevent and manage pain, Both spontaneous awakening trials (SAT) and spontaneous breathing trials (SBT), Choice of analgesia and sedation, Delirium: assess, prevent and manage, Early mobility and exercise, and Family engagement and empowerment)
- Provide adequate pain assessment and treatment. Use strategies to minimize

opioid-based analgesia. See "[Monitoring for Opioid-Induced Respiratory Depression](#)" APSS.

- Use both a sedation/agitation tool, such as the Richmond Agitation-Sedation Scale (RASS), and a delirium screening tool in the postoperative and ICU setting.
- Provide deliberate and frequent verbal reorientation (where they are, what surgery has just occurred, etc), especially during their early recovery phase from anesthesia for patients identified at-risk preoperatively.
- For ICU, consider administering dexmedetomidine, as dexmedetomidine has been shown to decrease the incidence of delirium in elderly cardiovascular surgery patients by more than 50% when administered upon admission to the ICU and continued until the next post-operative day ([Duan et al., 2018](#)). Other studies suggest that another drug (clonidine) in the same class of drugs (alpha-2 agonists) may produce similar results. ([Rubino et al., 2010](#)). Alternatively, anti-psychotics, both typical (haloperidol) and atypical (risperidone, olanzapine) have little benefit in preventing delirium ([Wu et al., 2019](#)) and should only be used in treatment if considered essential for safe care ([Burry et al., 2018](#) & [Oh et al., 2017](#)).
- Facilitate early mobilization and return to normal function ([White et al., 2019](#)). See "[Early Mobility Management](#)" APSS for more information.
- Ensure the time on the clock is visible, a window is available with natural light, and frequent verbal reminders of where the patient is and what time it is are provided.
- Conduct a POD assessment with the organizationally-adopted, validated instrument upon receiving notification of new symptoms, at least once per shift, and at discharge.
- Regularly report delirium incidence to the oversight committee and in relevant hospital communications.

6. DISCHARGE AND RECOVERY

- Conduct pre-discharge screening for postoperative delirium in all at risk patients or patients who have had an episode of POD.
- Notify the patient's primary physician if an episode of POD was detected or if baseline cognitive impairment was found.
- Include any episodes of delirium in discharge documentation.
- Do not discharge patients with a current episode of POD.
- Coordinate outpatient care according to the needs of the patient. See "[Care Coordination](#)" APSS for more information.
- Consider the patient's ability to perform the post-hospitalization recommendations based on social, cultural, and economic factors. For example, understand the patient's transportation situation to determine if they will be well-equipped to attend support groups post-discharge. See "[Social Determinants of Health](#)" APSS for more information.

Education for Patients and Family Members

The outline below illustrates all of the information that should be conveyed to the patient and family members by someone on the care team in a consistent and understandable manner.

Explain why delirium prevention strategies are important. A member of the healthcare team should elaborate on the need for post-operative delirium strategies and should provide a basic overview of post-operative family engagement strategies. Include the patient's family and/or support persons (friends and other support) in a patient's care planning preoperatively and while in the hospital to provide complete care for the patient and provide an opportunity to implement delirium prevention strategies (Mahanna-Gabrielli et al., 2019).

Indicate what to watch out for. Family members can serve as an extra pair of eyes and ears and can alert medical staff if something might be wrong. Family members should have an understanding of what to look for that may indicate postoperative delirium, such as restlessness or agitation. In order to adequately welcome patients and family members into the care team, it is not enough to explain "what" patients and family members should look for or "what" is going to happen in their care. The "what" must always be followed with a "why" to aid in genuine understanding.

Additionally, family members should know exactly when to call for help, where to go for help, and with whom they should speak. It is essential that patients and family members understand that they should not be ashamed to ask any of their questions and that many patients in similar situations often have similar questions.

Instead of employing a directive conversation style, an active, engaging conversation should take place, leaving capacity for questions and repeat-back strategies. When patients and family members understand the signs and symptoms that could be indicative of a problem, they are able to serve as an extra set of eyes in order to elevate this concern as early as possible.

For patients identified at risk in the preoperative period, provide education to the patient and support persons on postoperative delirium, potential risks and preventative measures. Informed consent should include risks of postoperative delirium based on pre-operative screening (Berger et al., 2018; Hogan et al., 2018).

Describe what can be anticipated. In addition to explaining when to call for help in the case of a potential emergency, healthcare providers should also thoroughly explain the typical treatment that can be expected before, during, and after the operation. Additionally, it is important to discuss potential postoperative delirium complications.

Clinicians should provide a high-level overview of the processes in place at their organization to ensure usage of screening for the risk of developing delirium before the operation. This demonstrates competence of the organization, will likely bolster patient and family comfort, and will provide the patient and family members with information for which to reference if they may be suspicious of a problem post-operation.

By engaging in these conversations before a problem arises, family members can be prepared in the circumstance of necessary treatment and will have an understanding of where to go to find out more information about their loved one's condition.

Explain what is expected of them during their care. By giving patients and family members a "job" while they are in the hospital, they can be immersed fully in the routine care, can hold other team members accountable, can feel more confident voicing their concerns or opinions, and can serve as an extra set of informed and vigilant eyes to optimize delirium prevention and treatment. This team involvement can also reduce their anxiety by transforming concern into proactive action.

Risk reduction strategies include inviting a carer or family member to be with the patient at risk of delirium throughout as much of the perioperative period as possible. This includes accompanying the patient to the OR holding/preparation area and being present in the post-anaesthesia care unit (recovery room) as they emerge from anaesthesia. The benefits of orientation at these times with a familiar person present may be significant.

Patients and family members can:

- Engage in conversations around current potential health conditions such as stroke, heart attack, or liver disease
- Discuss health history and personal risk factors with healthcare team before surgery
- Keep an eye out for any new or worsening mental states that might signal delirium
- Clarify any use of or avoid use of sedatives and tranquilizers
- Provide familiar objects and reassuring companionship such as family photos or having friends and family at the bedside
- Encourage physical activity
- Advocate for minimum disruptions
- Minimize sleep deprivation, overwhelming or over stimulating situations
- Help make sure vision and hearing aids are readily available.
- Participate in medication reconciliation conversations
- Update their own personal care plan with all updates
- Advocate for bedside huddles

Explore next steps. Planning for life after the hospital, whether in assisted living, returning home, or another option, should begin as early as possible between the healthcare providers and the patient and family. For patients identified with postoperative delirium, provide education to support persons regarding postoperative delirium and management of postoperative delirium, especially nonpharmacological interventions. Engage support person(s) in nonpharmacological interventions as appropriate, including bedside presence and ongoing post-discharge support.

- Describe the organization's postoperative delirium precaution standards that were followed.
  - o If any of the protocols changed due to this specific patient's circumstance, articulate that to the patient and family members.
- Have a discussion with the patient and family around end of life care and advanced directives.
  - o Make an attempt to thoroughly understand the religious or cultural nuances in any of the patient's or family members' decisions or questions.
- Ensure thorough explanation of necessary post-discharge appointments, therapies, medications, and potential complications.
  - o Assess for patient preference in time and location of follow-up appointments, if possible.
- Provide patients and family members resources, including direct contact phone numbers, to the hospital for post-discharge questions.
  - o Make sure the resources are in their own language.
- Provide thorough instructions to the patient and family members in the days leading up to discharge regarding procedures if the patient were to become delirious after operation and recovery after discharge (What you should know, 2020).

- If delirium care is required after discharge, set aside time with the patient and family member more than once to ensure their understanding and confidence.

Performance Improvement Plan

Follow this checklist if the leadership team has determined that a performance improvement project is necessary:

☐ **Gather the right project team.** Be sure to involve the right people on the team. If possible, you'll want two teams: an oversight team that is broad in scope, has 10-15 members, and includes the executive sponsor to validate outcomes, remove barriers, and facilitate spread. The actual project team consists of 5-7 representatives who are most impacted by the process. In general, the key is having the right people on the team (people impacted by the process, executive sponsors, and subject matter experts), no matter the size of the organization. Whether a discipline should be on the advisory team or the project team depends upon the needs of the organization. Patients and family members need to be involved in all improvement projects, as there are many ways they can contribute to safer care. Define what constitutes a quorum, which team members are needed to make the quorum, and who can serve as alternatives.

> **Complete this Lean Improvement Activity:**
> Conduct a SIPOC analysis to understand the current state and scope of the problem. A SIPOC is a lean improvement tool that helps leaders to carefully consider everyone who may be touched by a process, and therefore, should have input on future process design.

RECOMMENDED DELIRIUM IMPROVEMENT TEAM

All Phases
- Hospital / health system leadership
  - o Support, time, funding
- Patient and family and/or carers

Prior to Admission
- Anesthesia preoperative clinic
  - o Screening for frailty, cognitive dysfunction, nutritional status, etc; delirium prevention education
- Surgical clinics
  - o Screening for frailty, cognitive dysfunction, nutritional status, etc; delirium prevention education
- Pharmacy review of medications
- Social workers, case workers
  - o Discharge planning
- Dieticians, Physiotherapy, Occupational Therapy
  - o Preoperative optimization
- Geriatricians, palliative care providers
  - o Medical optimization, surgical decision-making and goals of care support

Perioperative
- Preoperative nursing
  - o Screening or identification of high-risk patients, keeping sensory aids accessible to patient, patient/family education
- Anesthesia providers
  - o Choice of anesthetic technique, use of appropriate monitoring, best-practice intraoperative care
- Recovery room nursing
  - o Delirium screening, appropriate medication administration, non-pharmacologic delirium prevention measures, communicating delirium risk to ward or ICU nurse, patient/family education

Postoperative
- Surgical teams, ICU teams/ Acute Care teams
  - o Ordering of diagnostic / prevention measures, appropriate medication prescribing, appropriate consultation and hand-over
  - o Assess for metabolic disturbances and infection
  - o Ensure adequate hydration
- Ward and ICU nursing
  - o Delirium screening, non-pharmacologic delirium prevention/treatment measures, patient/family education
- Physiotherapy / Occupational Therapy staff
  - o Early mobilization, discharge planning
- Pharmacists
  - o Medication review
- Dieticians
  - o Nutrition advice
- Case workers/social workers
  - o Discharge planning
- Geriatricians, palliative care providers
  - o Medical consultation, assistance with goals of care and symptom management
- Caregivers and family members of the patient
  - o Monitor and report changes in mental status, actively support early mobilization and other non-pharmacological prevention measures

Table 1: Understanding the necessary disciplines for an air embolism prevention improvement team

☐ **Understand what is currently happening and why.** Reviewing objective data and trends is a good place to start to understand the current state, and teams should spend a good amount of time analyzing data (and validating the sources), but the most important action here is to go to the point of care and observe. Even if team members work in the area daily, examining existing processes from every angle is generally an eye-opening experience. The team should ask questions of the frontline during the observations that allow them to understand each step in the process and identify the people, supplies, or other resources needed to improve patient outcomes.

Create a process map once the workflows are well understood that illustrates each step and the best practice gaps the team has identified (IHI, 2015). Brainstorm with the advisory team to understand why the gaps exist, using whichever root cause analysis tool your organization is accustomed to (IHI, 2019). Review the map with the advisory team and invite the frontline to validate accuracy.

DELIRIUM PROCESSES TO CONSIDER ASSESSING

Preoperative
- Clinical risk assessment and documentation in clinical record
- Patient and family education and engagement in monitoring and reporting delirium symptoms
- Protocols for perioperative fluid management across care settings
- Frequency and accuracy of nursing delirium assessment with validated instrument
- Medication reconciliation

Intraoperative
- Use of intraoperative brain monitoring strategies
- Avoidance of Beers criteria medications
- Avoidance of pharmacological restraints

PACU
- Screening for postoperative delirium in PACU prior to release

Postoperative
- Process for allied health staff to query patients/family members during bedside and encounters and report symptoms of delirium
- Surgical orders for increased postoperative monitoring of at-risk patients
- Appropriate referral pathways for patients with POD
- Use of nursing guidelines to minimize POD risks, e.g,, use of physical restraints, withdrawal from prescribed and illicit substances, inadequate pain management, sleep disturbances, dehydration, metabolic disturbances, electrolyte imbalances, etc.)

Table 2: Consider assessing these processes to understand where the barriers contributing to delirium may be in your organization

☐ **Prioritize the gaps to be addressed and develop an action plan.** Consider the cost effectiveness, time, potential outcomes, and realistic possibilities of each gap identified. Determine which are priorities of focus for the organization. Be sure that the advisory team supports moving forward with the project plan so they can continue to remove barriers. Design an experiment to be trialed in one small area for a short period of time and create an action plan for implementation.

The action plan should include the following:
- Assess the ability of the culture to change and adopt appropriate strategies
- Revise policies and procedures
- Redesign forms and electronic record pages
- Clarify patient and family education sources and content
- Create a plan for changing documentation forms and systems
- Develop the communication plan
- Design the education plan
- Clarify how and when people will be held accountable

TYPICAL GAPS IDENTIFIED IN DELIRIUM

- Lack of policies, procedures and protocols for prevention and management of delirium (see preceding table)
- Failures of communications among siloed providers
- Slow response to critical lab alerts
- Inadequate or incomplete handoffs
- Lack of documentation
- Lack of identifying delirium, particularly hypoactive delirium (the most common form)

- Lack of identifying cognitive impairment (particularly subtle impairment)
- Lack of resources required for sustained recovery post-discharge
- Failure to understand patient's ability to implement care plan post-discharge, considering their built environment and social determinants

Table 3: By identifying the gaps in delirium screening and assessment compliance, organizations can tailor their project improvement efforts more effectively

☐ **Evaluate outcomes, celebrate wins, and adjust the plan when necessary.** Measure both process and outcome metrics. Outcome metrics include the rates outlined in the leadership checklist. Process metrics will depend upon the workflow you are trying to improve and are generally expressed in terms of compliance with workflow changes. Compare your outcomes against other related metrics your organization is tracking.

Routinely review all metrics and trends with both the advisory and project teams and discuss what is going well and what is not. Identify barriers to completion of action plans, and adjust the plan if necessary. Once you have the desired outcomes in the trial area, consider spreading to other areas (IHI, 2006).

It is important to be nimble and move quickly to keep team momentum going, and so that people can see the results of their labor. At the same time, don't move so quickly that you don't consider the larger, organizational ramifications of a change in your plan. Be sure to have a good understanding of the other, similar improvement projects that are taking place so that your efforts are not duplicated or inefficient.

Read this paper from the Institute for Healthcare Improvement to understand how small local steps

POSTOPERATIVE DELIRIUM METRICS TO CONSIDER ASSESSING

- Fall and fall with injury
- Restraint use
- Healthcare attendant use
- Outpatient support group attendance
- Mobility levels
- Emergency versus elective patients with postoperative delirium
- Patients with postoperative delirium based on surgical specialty
- Escalation of care with a prior episode of delirium
- Post-hospitalization support group attendance
- Number of surgical patients, 65 years and older, who require readmission within 30 days of surgery who have experienced post-operative delirium in their primary care episode
- Number of surgical patients, 65 years and older, who are screened pre-operatively for cognitive impairment and/or delirium
- Number of surgical patients, 65 years and older, who are evaluated post-operatively for delirium at prescribed intervals using standardized clinical assessment tool
- Number of surgical patients, 65 years and older, with positive delirium screens who receive postoperative preventative interventions (pharmacologic and nonpharmacologic)
- Time from onset of delirium symptoms post-operatively to implementation of treatment protocols/guidelines

Table 4: Consider evaluating related metrics to better understand delirium screening and assessment presence and contributing factors. Examples of potential metrics are above.

What We Know About Postoperative Delirium in Older Adults

What is delirium?

Delirium is an acute and fluctuating disturbance in cognition, characterized by inattention, confusion and often hallucinations and/or changes in consciousness (Association, 2015). A person suffering from delirium may be restless or agitated, but alternatively may be quiet and withdrawn. It can be described as a form of "acute brain failure." Not only can delirium be distressing for the patient and loved ones, but it has been shown to be associated with poor short-term and long-term outcomes (O'Regan et al., 2013; Rudolph & Marcantonio, 2011; Gleason et al., 2015; Inouye et al., 2016).

Delirium can occur at any age, but this APSS is focusing on delirium in older (65y or more) hospitalized adults having surgery and anesthesia because it is very common in this group, especially when admission to an intensive care unit occurs.

What is the significance of Postoperative Delirium (POD)?

In healthcare:

Delirium is associated with serious clinical consequences including (O'Regan et al., 2013; Rudolph & Marcantonio, 2011; Gleason et al., 2015; Inouye et al., 2016):

- Serious behavioral disturbances that may result in physical harm to the patient or those around them.
- Interruption to acute care by disruption of infusions or failure to comply with treatment.
- Increased complications following surgery, including falls and chest and wound infections.
- Prolonged hospital length of stay.
- Increased need for higher dependency care post discharge.
- Increased risk of acute-care readmission within 30 days.
- Increased risk of intermediate and longer-term cognitive decline (Inouye et al., 2016; Saczynski et al., 2012), including dementia (Lingehall et al., 2017).
- An association with increased mortality.

By 2050, it is estimated that half of all anesthetics and surgical procedures will be provided to those aged 65 years or more. Thus, millions of individuals at high-risk of delirium and its consequences will undergo the precipitating event of surgery and anesthesia every year.

Apart from the personal impact, for hospitalized patients overall, the cost of an episode of acute care is increased 2.5 times by the occurrence of delirium, increasing the cost of healthcare in the United States by over $125 billion dollars every year (Inouye et al., 2014; Brown et al 2016). This health-care burden includes the cost of readmission to hospital within 30 days.

It is estimated that up to 40% of hospital-related episodes of delirium are preventable (Inouye et al., 2014).

Tools for Screening and Assessment

Predictive Tools in the General Hospital Surgical Population:

A number of tools with published performance data have been reviewed ([Lindroth et al., 2018](#)). Not all are designed for postoperative risk. Common features included are pre-existing cognitive impairment, age, and general health status. Factors to consider when selecting a tool for routine use in any healthcare environment include use of variables and assessments that are readily available in clinical practice and are feasible to administer without extensive training or interpretation ([Lindroth et al., 2018](#)). Examples include:

- *AWOL* ([Douglas et al., 2013](#); [Brown et al., 2017](#))
  The AWOL prediction rule was derived by assigning 1 point to each of 4 items assessed upon admission that were independently associated with the development of delirium:
  - A: **A**ge ≥ 80 years
  - W: Unable to spell "**W**orld" backward,
  - O: Dis**O**rientation to place
  - L: Higher i**L**lness severity

  Higher scores were associated with higher rates of delirium with a score of 2 or higher indicating a 5% or higher risk of delirium (ROC AUC 0.69 in the validation cohort).

  The AWOL-S variant takes surgical complexity into account ([Whitelock et al., 2020)](#).

- NSQIP-derived predictive risk in hip fracture patients ([Kim et al., 2019](#)).

  This is a 9-feature, 20 point maximum risk index for delirium following surgery for fractured neck of femur (ROC AUC 0.77):
  - preoperative delirium (8 points);
  - preoperative dementia (3 points);
  - age (0–3 points);
  - medical co-management (1 point);
  - American Society of Anesthesiologists (ASA) physical status III–V (1 point);
  - functional dependence (1 point);
  - smoking (1 point);
  - systemic inflammatory response syndrome/ sepsis/septic shock (1 point);
  - and preoperative use of mobility aid (1 point);

Screening for Cognitive Impairment

Cognitive impairment is a well-validated risk factor for developing postoperative delirium. A number of tools and resources are available. Commonly used tests such as the Mini-Mental State Examination are able to detect possible dementia but are less sensitive to milder forms of cognitive impairment. Simple tests include the Montreal Cognitive Assessment (MoCA) ([Ciesielska et al., 2016](#)), MiniCog ([Quitoriano et al., 2017](#)), IQCODE-16, and TICS ([Cook et al., 2009](#)) which are more sensitive to subtle impairment.

Tests for the Presence of Delirium

Opinions vary widely on the most appropriate screening tool for delirium in hospitalized patients, noting that patients may manifest hypoactive or hyperactive psychomotor forms. It should be noted that a screening tool is not diagnostic and needs to be sensitive rather than specific. Any tool should also be easy and quick to administer, have a high inter-rater reliability and ideally need minimal training. A patient who screens positive for delirium should have an escalated care plan including appropriate support and treatment strategies, have the managing medical team

notified, and be considered for geriatric, neuropsychiatric or psychological referral.

There are many screening tools available of varying ease of use, and sensitivity and specificity (Scottish Intercollegiate Guidelines Network, 2019). Screening tools aid risk assessment and can guide 'next steps' including clinical intervention and support and/or referral. Simple one or two questions tests such as the Single Question to Identify Delirium (SQID) are usually based on orientation to time and place (Hendry et al., 2016) and have only moderate sensitivity and specificity.

When applying tests for delirium, especially in the perioperative/ICU setting, an assessment of the state of alertness of the patient should be part of this and made using a tool such as the Richmond Agitation and Sedation Scale (RASS) (Aldecoa et al., 2017). This is because delirium can present in different psychomotor forms (ie hyperactive versus hypocative (and mixed). Some specific tests for delirium can then be applied and include:

- 4AT
  - The 4AT is a screening instrument designed for rapid (< 2 mins) initial assessment of delirium and cognitive impairment using 4 test domains. A total score of 4 or more (maximum 12) suggests delirium but is not diagnostic. Sensitivity is 86-100%; specificity is 65-82%. Any score >0 suggests possible cognitive impairment (www.the4at.com).
- 3D-CAM
  - The 3D-CAM is a derivative of the Confusion Assessment Method CAM, taking less time (under 5 mins) and requiring less operator training. Sensitivity is 66-100%; specificity is 90-99% (Marcantonio et al., 2014).
- Nu-DESC
  - The Nursing Delirium Screening Scale (Nu-DESC) is designed to be completed quickly with minimal training using nurse administration (Gaudreau et al., 2005). It comprises an observational five-item scale. Sensitivity is 32-96%; specificity is 69-92% (Scottish Intercollegiate Guidelines Network, 2019).

The gold standard for diagnosis of POD is by an appropriately qualified physician according to the DSM-5 criteria. For suitably trained experts (or research), tools that may be used include the CAM, Comprehensive Geriatric Assessment or DRS-R-98 (Delirium Rating Scale-Revised). For non-experts options include (with appropriate training): 3D-CAM; CAM-ICU (only validated in ICU).

Prediction of Delirium in ICU

There are several assessment tools that can, with variable precision, predict the development of delirium in ICU patients (including postoperative patients) from various weighted clinical features. All models have been found to have moderate to good predictive abilities. While the features in Pre-DELIRIC (recalibrated) (Table 1, left column (van den Boogaard et al., 2014)) were most accurate, the early predictive model (Table 1, center column (Wassenaar et al., 2015)) although slightly less sensitive had the benefit that it could be applied early in the ICU admission and may allow for timely preventive measures (Green et al., 2019).

Prediction of Delirium in ICU Patients (Pre-DELIRIC)	Early Prediction of Delirium in ICU Patients (Wassenaar et al [20])	Lanzhou Model
Age	Age	Age
APACHE II score	History of cognitive impairment	APACHE II score
Coma (drug-induced or otherwise)	History of alcohol abuse	Mechanical ventilation
Patient classification (medical, surgical, trauma, neurologic)	Patient classification (medical, surgical, trauma, neurologic)	Emergency surgery
Presence of infection	Mean arterial pressure at ICU admission	Coma
Metabolic acidosis[a]	Use of corticosteroids	Multiple trauma
Morphine dose	Presence of respiratory failure[b]	Metabolic acidosis[a]
Use of sedatives	Blood urea nitrogen at ICU admission	History of hypertension
Urea concentration	Emergency admission	History of delirium
Emergency admission		History of dementia
		Use of dexmedetomidine

APACHE II = Acute Physiology and Chronic Health Evaluation II score.
[a]Metabolic acidosis was defined as an arterial pH < 7.35 with bicarbonate < 24 mmol/L.
[b]Respiratory failure was defined as the need for nonelective invasive mechanical ventilation or noninvasive ventilation at admission or anticipated within the first 24 hr of ICU admission.
Variables included in the prediction of delirium in ICU patients model and the Lanzhou model are collected in the first 24 hr of ICU admission, whereas variables included in the early prediction of delirium in ICU patients model are collected at ICU admission.

Table 1. Variables included in selected predictive models of ICU delirium (Green et al., 2019)

Precipitating Factors for Postoperative Delirium

There are many factors which may precipitate delirium, especially in patients already at risk. Many are preventable, so a delirium care-plan needs to identify and manage as many of these as possible (White et al., 2019; Scottish Intercollegiate Guidelines Network, 2019).

- Pain
  - o Poorly controlled pain
  - o Sedating analgesics, especially opioids
- Disorientation
  - o An unfamiliar environment
  - o Unfamiliar people and little/no family support
  - o Lack of sensory aids, for example, glasses or hearing aids
  - o Loss of sense of time and place
- Sleep disturbance
- Sedating drugs
  - o Especially benzodiazepines
  - o Care with tramadol and gabapentinoids
- Polypharmacy
  - o Especially drugs with anticholinergic side effects
- Drug withdrawal
  - o e.g benzodiazepines, opioids, gabapentinoids
- Dehydration and metabolic disturbances
- Local Infections and Sepsis

- Indwelling catheters
  - o especially urinary catheters
- Physical restraints

Anesthesia Strategies

- **Type of anesthesia.** There is a lack of evidence to support that type of anesthesia (regional versus general) (Patel et al., 2018) has a substantial impact on the incidence of POD. This is likely due to many factors involved including the presence of multiple risk factors and the use of sedatives to decrease psychological stress for patients. There is no consistent evidence to suggest a difference exists regarding delirium outcomes to guide choice regarding the administration of total intravenous anesthesia (TIVA) versus volatile agents (Royse et al., 2011; Landoni et al., 2019) .

- **Depth of anesthesia (dose of anesthetic).** Avoiding excessively deep anesthesia by titrating anesthetic agents can be achieved clinically, or supported by processed frontal EEG-based (pEEG) neuromonitoring or age-adjusted minimum alveolar concentration for volatile agents. This has been recommended in a number of guidelines (American Geriatrics Society, 2015; Berger et al., 2018; Aldecoa et al., 2017). The use of pEEG guided anesthesia results in lower doses of anesthetic agents being administered and decreased burst-suppression activity on the EEG, and a meta-analysis suggested a benefit in its use in reducing incident delirium (MacKenzie et al., 2018; Luo & Zou, 2018). Subsequently, a large randomized controlled trial failed to confirm a benefit in this outcome - noting that the intervention was confined to volatile agents, and burst-suppression still occurred frequently in both groups (Wildes et al., 2019). Similarly, a study in patients having hip fracture repair did not find a difference in incident delirium in patients undergoing deep or light sedation (with BIS pEEG monitoring in both groups) (Sieber et al., 2018). Possible benefit in POD reduction with the use of intraoperative EEG monitoring awaits clarification by further studies comparing the specific targeting of pEEG and/or burst-suppression levels in appropriately controlled and randomized groups (Abbott & Pearse, 2019).

- **Cerebral perfusion.** Cerebral perfusion monitoring and support has a plausible physiological basis, and hypotension has been associated with increased incidence of stroke (Wijeysundera et al., 2014). A 2018 best practices statement published by the American Society of Anesthesiologists Brain Health Initiative also suggested that optimizing intraoperative cerebral perfusion may improve outcomes (Berger et al., 2018). Limited trial data suggests that avoidance of significant blood pressure excursions (either hyper- or hypo-tension) may be important (Hori et al., 2014; Hori et al., 2016; Brown et al., 2019). Near infrared spectroscopy-based (NIRS) regional cerebral perfusion monitoring may be used to provide an indirect indicator of frontal cortex perfusion. To date there are limited studies of sufficient size or quality to confirm a strong beneficial impact of NIRS on delirium or neurocognitive outcomes either during surgery (Yu et al., 2018) or in the ICU (Bendahan et al., 2018).

- **Specific Drugs.** Dexmedetomidine is a potent alpha-2 adrenoceptor agonist with sedative and analgesic properties. Dexmedetomidine given postoperatively, predominantly in the ICU, has been shown to reduce the incidence of postoperative delirium in cardiac and non-cardiac surgery patients (Duan et al., 2018). It is still uncertain that intraoperative administration on its own is of benefit, and further trials are awaited (Deiner et al., 2017; Wu et al., 2018). There is growing evidence that peri-

operative administration of an alpha-2 agonist (dexmedetomidine) may have efficacy in the prevention and treatment of post-operative delirium in ICU patients. (Wu et al., 2018; Flukiger et al., 2018). A meta-analysis (Hovaguimian et al., 2018) and a large RCT failed to demonstrate any benefit in delirium reduction in major surgery with the use of single-low dose ketamine (Avidan et al., 2017).

Technology Plan

Technology is an enabler of good clinical care. In some cases, technology is the only practical means by which some objectives can be achieved (eg EMR medication alerts or audit; online tools). In many cases recommendations for the use of technology are based on 'best practice' recommendations, awaiting further evidence (eg pEEG monitoring) and in others, possible applications of technology are listed as they are 'emerging' (eg motion tracking or regional cerebral oximetry).

Technology can support

- EMR - linkages / alerts
- On-line tools (home assessment / tablet)
- clinical assessment of cognitive impairment
- bedside diagnosis of POD
- risk minimization strategies, including:
    - o Preoperative risk assessment and postoperative diagnosis checklists
    - o Electronic medication management (with warnings)
    - o Optimizing intraoperative depth of anesthesia control including EEG-based and MAC-based anesthetic titration (best practice recommendation)
    - o Optimizing cerebral perfusion (specific evidence weak)
- Audit and review

SYSTEM OR PRACTICE	AVAILABLE TECHNOLOGY
Preoperative clinical risk assessment and screening of cognitive impairment should be performed and documented in patients > 65 years of age or at high risk of postoperative cognitive impairment	• On-line risk assessment questionnaire • On-line / tablet-based cognitive tests o For use by clinical staff and / or patients
Screening for Postoperative Delirium • Simple tests • Quick to apply • Minimal training needed • Sensitive (not necessarily specific) Diagnosis of postoperative delirium should: • Be performed by a healthcare provider trained to perform delirium assessments using accepted diagnostic tools (listed above)	• On-line / tablet-based delirium tests o For use by clinical staff

• Include assessments for hyperactive, hypoactive, and mixed subtypes (includes application of the Richmond Agitation and Sedation Scale)	

Employing brain monitoring strategies:
• Avoidance of deep anesthesia (and sedation) during surgery
• Optimize cerebral perfusion
  o Monitoring for low cerebral perfusion / oxygenation (intra-operative and ICU)
	• Titrate volatile and intravenous anesthesia using processed EEG-based technology (best practice recommendations based on limited evidence)
	• Avoidance of burst-suppression EEG which may reflect anesthesia excess
	• Optimize cerebral perfusion (best practice recommendation)
	  o specific technology eg regional Cerebral Oximetry (NIRS) (low level evidence currently)
	• Limited ICU evidence only for post-operative use

Titrate volatile anesthesia to appropriate age-adjusted minimum alveolar concentration (MAC)	• End-tidal anesthetic agent monitoring o (best practice recommendation)
Future technologies: • Activity monitoring	• Eye tracking • Motion / activity tracking
Patient management pathways and processes	Electronic Health Record (EHR / EMR) System • Documentation of delirium screening • Positive screening notification - alerts • Computerized Provider Order Entry (CPOE) • Drug-drug interaction check • Drug-allergy interaction check • Clinical Decision Support tools (CDS) • Discharge letters / communication
Audit and review	• Built into EMR system reports

Resources
For Postoperative Delirium in Older Adults Improvement:
- '60-Second Abstracts': A Novel Pre-op Method for Identifying Post-op Cognitive Delirium

For General Improvement:
- CMS: Hospital Improvement Innovation Networks
- IHI: A Framework for the Spread of Innovation
- The Joint Commission: Leaders Facilitating Change Workshop
- IHI: Quality Improvement Essentials Toolkit
- SIPOC Example and Template for Download
- SIPOC Description and Example

Endnotes

Conflicts of Interest Disclosure

The Patient Safety Movement Foundation partners with as many stakeholders as possible to focus on how to address patient safety challenges. The recommendations in the APSS are developed by workgroups that may include patient safety experts, healthcare technology professionals, hospital leaders, patient advocates, and medical technology industry volunteers. Workgroup members are required to disclose any potential conflicts of interest.

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Appendices

Appendix A

Leaders should establish hospital resources including protocols and guidelines for delirium prevention and management. The following may be appropriate and should be tailored to organizational need, context, and resources:

☐ Screening tools administered by suitably trained personnel prior to or on admission and during the postoperative period for cognitive decline and delirium

☐ Checklists for risk identification (Predisposing factors)

- ☐ Conduct discussions with patients and caregivers about the possibility of postoperative delirium, the risks associated with delirium and the importance of its prevention.
- ☐ Checklists for trigger factor minimization (Precipitating Factors)
  - ☐ emphasizing multicomponent / multidisciplinary interventions in high risk patients [4]; including surgery, geriatrics, anesthesiology, nursing, allied health practitioners and carers/family members
- ☐ Intraoperative and perioperative guidelines which use best practice and evidence-based strategies to minimize the risk of postoperative delirium
- ☐ Assessment tools for ICU and ward use for bedside (point of care) delirium screening; include awareness of hyperactive, hypoactive and mixed presentations
- ☐ Management guidelines for delirium once diagnosed, based on the diagnosis and treatment of contributing factors; including minimization of restraints or antipsychotic medications unless the patient or staff are at risk of harm.
- ☐ Discharge protocols to communicate to patients and caregivers relevant issues relating to perioperative delirium.
- ☐ Discharge protocols for primary caregivers and other providers.
- ☐ Referral pathways for psychogeriatric consultation or memory clinics if concerns are identified as appropriate