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Evidence Grading

Literature Search

A consistent and defined literature search process is used in the development and revision of ICSI guidelines. See Appendix A for literature searches parameters and search terms. In addition to the literature searches, articles were obtained by work group members and ICSI staff. Those vetted by the work group were included in the guideline when appropriate.

Methodology

ICSI utilizes the Grading of Recommendations Assessment, Development and Evaluation (GRADE) methodology system. GRADE involves systematically evaluating the quality of evidence (high, moderate, low, very low) and developing a strength of recommendation (strong, weak). For more detailed information on GRADE, please visit http://www.gradeworkinggroup.org/. In addition, when GRADE methodology could not be applied, the work group developed consensus recommendations.

Recommendations Table

The following table is a list of evidence-based recommendations for the Perioperative Guideline based on the review of primary literature and secondary references (in instances where primary literature was not found).

Topic	Quality of Evidence	Recommendation(s)	Strength of Recommendation	Relevant Resources
Preoperative Health Screening and Assessment	Not applicable	A preoperative health screening and assessment which includes a medical history and physical examination should be completed for all patients undergoing a surgical procedure, regardless of setting (unless the procedure involves mild sedation, e.g. local/ topical anesthesia).	Consensus	*Fleisher, 2014 (Guideline); Apfelbaum, 2012 (Guideline)*
Preoperative Testing	Low	Do not routinely test all patients undergoing elective, noncardiac surgery. The need for testing should be guided by individual patient's clinical risk factors (based on medical history and physical examination) and the risk of major adverse cardiac event (morbidity or mortality) associated with the planned procedure.	Strong	*Keay, 2019 (Systematic Review); Johansson, 2013 (Systematic Review); Munro, 1997 (Systematic Review)*
Chest X-Ray	Low	Do not routinely perform chest x-rays preoperatively unless indicated by the review of medical history and physical examination.	Strong	*Johansson, 2013 (systematic review); Joo, 2005 (systematic review)*

Topic	Quality of Evidence	Recommendation(s)	Strength of Recommendation	Relevant Resources
Hemoglobin/ Hematocrit Testing	Low	Do not routinely test for hemoglobin preoperatively in healthy or asymptomatic patients. Testing for preoperative hemoglobin level should be considered in: 1. Patients with a history of anemia or history suggesting recent blood loss or anemia AND the planned procedure may lead to significant blood loss or physiologic stress. 2. Patients with prior or planned anticoagulation (expert consensus). An individual patient plan should be established for management of hemoglobin levels between primary care provider doing the preoperative health screening and assessment and surgeon performing the procedure (expert consensus). It is imperative for primary care provider ordering hemoglobin tests to communicate the results to the surgeon; conversely, the surgeon should communicate to the primary care provider if the procedure could potentially cause significant blood loss.	Strong	*Fowler, 2015 (meta-analysis); Johansson, 2013 (systematic review); Munro, 1997 (systematic review)*
Potassium/ Sodium Testing	Low	Do not routinely test for potassium or sodium level preoperatively in healthy or asymptomatic patients unless indicated. Testing may be indicated in: 1. patients who are on diuretic therapy, 2. patients with kidney disease (stage 3 or greater), 3. patients on potassium replacement therapy, 4. patients undergoing bowel preparation.	Strong	*Johansson, 2013 (systematic review); Wahr, 1999 (case-control study); Munro, 1997 (systematic review)*

Topic	Quality of Evidence	Recommendation(s)	Strength of Recommendation	Relevant Resources
Hemostasis (Coagulation) Testing	Low	Do not routinely perform coagulation tests before surgery unless indicated. Indications for testing may include the following: 1. Patients with potential bleeding problem, 2. Patients with a known history of anticoagulation abnormalities, 3. Patients with recent history suggesting the potential for anticoagulation problems, 4. Patients who are currently taking anticoagulant therapy, and 5. Patients who may need postoperative anticoagulation (where a baseline may be needed).	Strong	*Johansson, 2013 (systematic review); Munro, 1997 (systematic review)*
Glucose Testing in Non-Diabetic Patients	Not Applicable	Consider glucose testing in patients with risk factors for diabetes (as defined by USPSTF recommendations), or if a primary care provider feels that diagnosis of diabetes would alter the plan for surgery.	Consensus	*USPSTF, 2015 (Guideline)*

Topic	Quality of Evidence	Recommendation(s)	Strength of Recommendation	Relevant Resources
Sleep Apnea	Not applicable	1. Clinicians should use a validated standardized screening tool to screen patients for suspected sleep apnea (risk factors or patient reporting problems) or sleep apnea symptoms and communicate to surgical team. Major risk factors for sleep apnea include: obesity, increased neck size (> 37 cm in men, >35 cm in women), craniofacial abnormalities, older age and male sex. 2. Clinicians should remind patients who have been formally diagnosed with obstructive sleep apnea and have an oral appliance or continuous positive airway pressure equipment to bring their appliance or equipment with them on the operative day for use during the recovery from anesthesia or sedation. 3. Patients with suspected sleep apnea in the perioperative period should have a follow up evaluation typically in concert with the patient's primary provider, and/or referral to sleep center. 4. Patients with known sleep apnea or suspected sleep apnea at a preoperative evaluation should have this communicated to the surgical and anesthesiology team and the patient made aware this may increase the surgical risk.	Consensus	*Chung, 2016 (Guideline); Gross, 2014 (Guideline)*
Nicotine Cessation	Low	Smoking cessation intervention (brief or intensive) should be undertaken before elective surgery.	Strong	*Bayfield, 2018 (Meta-Analysis); Nolan, 2017 (Observational study); Nolan, 2015 (Systematic Review); Thomsen, 2014 (Systematic Review)*

Topic	Quality of Evidence	Recommendation(s)	Strength of Recommendation	Relevant Resources
HbA1c Testing in Patients with Diabetes during Preoperative Clinic Visit	Not applicable	Consider obtaining a preoperative HbA1c, if not done in the past three months, on patients with known diabetes during preoperative clinic visit. Establish a plan for management of diabetes prior to surgery. The decision to proceed with surgery or postpone surgery based on preoperative HbA1c should be based on individual patient centered factors such as urgency of planned surgery, overall mortality/morbidity risks, risks of perioperative infections, concerns for postoperative glucose control, and patient compliance.	Consensus	*ADA-Diabetes Care in the Hospital, 2019 (Guideline); van den Boom, 2018 (observational study); NICE, 2016 (Guideline); Yang, 2016 (observational study); Gustafsson, 2009 (observational study)*
Intraoperative and Postoperative Glycemic Control Targets for Patients with Diabetes	Low	Consider a glycemic target range between 140-180 mg/dL for surgical patients with diagnosed diabetes during the intraoperative and postoperative periods. Additional considerations: 1. For patients with diabetes with glucose levels naturally <140, do not treat to 140. 2. Ensure patient's risk for hypoglycemia is considered if necessary to treat for glycemic targets lower than 140.	Weak	*Nair, 2016 (observational study); Sathya, 2013 (meta-analysis); Buchleitner, 2012 (systematic review); Gandhi, 2007 (randomized controlled trial); Ata, 2010 (observational study); Ramos, 2008 (observational study)*

The ICSI Work Group did not review primary literature and instead reviewed the recommendations from the relevant societies on the following topics (see specific section for the recommendations and ICSI work group's decision on endorsement):

- Cardiovascular Diseases
- Cardiovascular Medications
- Preoperative Fasting
- Prevention of Endocarditis
- Insulin Therapy Regimens in Diabetes Mellitus

Foreword

Introduction

This version of Perioperative Guideline has been enhanced to include a new section on Perioperative Opioid Management which was developed by a separate sub group and reviewed by the Perioperative Guideline work group.

The Perioperative Guideline addresses and includes recommendations on the following topics:

Section 1: General Preoperative Management

1. Preoperative Health Screening and Assessment
2. Preoperative Testing (Electrocardiogram, Chest X-Ray, Hemoglobin/Hematocrit, Potassium/Sodium, Creatinine, Pregnancy, Hemostasis and Glucose in Non-Diabetics)
3. Obstructive Sleep Apnea
4. Nicotine Cessation
5. Preparation for Surgery

Section 2: Perioperative Management of Select Conditions

6. Cardiovascular Disease and Medications: Review of Select Recommendations from American College of Cardiology/American Heart Association Guidelines
7. Prevention of Endocarditis: Endorsement of Recommendations from American College of Cardiology and American Heart Association Guidelines
8. Anticoagulants/Antithrombotics
9. Diabetes Mellitus

Section 3: Opioid Management

10. Preoperative
11. Intraoperative
12. Postoperative

Scope and Target Population

- Adults (aged 18 years and older) undergoing elective surgery.

Aims

1. Increase the percentage of surgical patients undergoing elective surgery who have preoperative health screening and assessment by a primary care provider.
2. Increase the percentage of surgical patients undergoing elective surgery and are smokers who have smoking addressed prior to surgery.
3. Increase the percentage of surgical patients undergoing elective surgery who have risk factors for obstructive sleep apnea (OSA) who are screened for OSA prior to surgery.
4. Increase the percentage of surgical patients undergoing elective surgery who have education on preoperative hair removal, bathing, fasting and oral hygiene prior to surgery.

Implementation Recommendation Highlights

Prior to implementation, it is important to consider current organizational infrastructure that address the following:

- System and process design
- Training and education
- Culture and the need to shift values, beliefs and behaviors of the organization
- Develop a reliable, standardized system to obtain complete preoperative basic health assessments and appropriate preoperative testing to eliminate unwarranted variation.
- Establish a reliable mechanism to communicate completed preoperative basic health assessments, associated test results to surgical team prior to procedure.
- Develop a comprehensive patient-centered approach to education and appropriate procedure preparation.
- Establish a mechanism for surgical team to communicate pertinent post-surgery information to primary care to help guide postoperative assessment and management.

Related ICSI Scientific Documents

- Pain; Assessment, Non-Opioid Treatment Approaches and Opioid Management

Definitions

Clinician – All health care professionals whose practice is based on interaction with and/or treatment of a patient.

Annotations

1. General Preoperative Management

Preoperative Health Screening and Assessment

Consensus Recommendation
A preoperative health screening and assessment which includes a medical history and physical examination should be completed for all patients undergoing a surgical procedure, regardless of setting (unless the procedure involves mild sedation, e.g. local/topical anesthesia).
Benefit: Obtains current information on patient's medical status to asses for medical indications that could potentially lead to adverse perioperative outcomes and thus mitigate for that risk. **Harm:** None **Benefit-Harms Assessment:** Preoperative health screening and assessment is key to obtaining patient's current medical status to help clinicians determine if patient is at risk of adverse perioperative outcomes and to mitigate that risk.
Relevant Resources: *Fleisher, 2014 (Guideline); Apfelbaum, 2012 (Guideline)*

Preoperative health screening and assessment should be performed before all surgical procedures unless the procedure involves mild sedation or a local/topical anesthesia. The goal is to identify and manage medical conditions that may impact perioperative morbidity and mortality.

Preoperative health screening and assessment should include a review of medical history and physical examination. Additional testing, including laboratory, electrocardiogram (ECG) and further cardiopulmonary evaluation should be based on medical history and physical exam and in consideration of surgical procedure risk for adverse cardiac event (see Preoperative Testing section for details).

Specifically, medical history and physical examination should include: (by the expert consensus of the ICSI Work Group)

- **Medical history**

  Indication for surgical procedure

  Allergies and adverse reactions to medications (specify reaction type)

  Anesthesia related complications or adverse events (personal & family history)

  History of a difficult airway or intubation

  Medical history and active medical problems

  Surgical history

  Current medications (prescription, over-the-counter medications, herbal and dietary supplements)

  Implantable devices (cardiac devices, spinal stimulator, pain pumps etc.)

Focused review of issues pertinent to the planned anesthesia and procedure:

- Current status of pertinent known medical issues
- Cardiac status
- Pulmonary status
- Functional status (the ability to perform at four or more METs)
- Hemostasis status (personal or family history of abnormal bleeding) & history/at risk for anemia
- Pregnancy status
- Smoking, alcohol history and illicit drugs
- Risk factors for development of surgical site infection (e.g., smoking, diabetes, obesity, malnutrition, chronic skin disease)
- Risk factors for development of venous thromboembolism. Venous thromboembolism is a common and potentially fatal perioperative complication. All surgical patients should undergo risk assessment for the development of VTE and have appropriate measures taken to prevent both clotting and bleeding in the perioperative period.
- Chronic pain and/or chronic opioid use; plan for post-operative pain management
- Discharge plan following surgery that includes social supports
- Need for assistive devices following surgery, e.g. walker, hospital bed.

• **Physical examination**

Weight, height and body mass index

Vital signs – blood pressure, pulse (rate and regularity), respiratory rate

Cardiovascular exam

Pulmonary exam

Other exams pertinent to surgical procedure and planned anesthesia such as:

- Skin exam for signs of infection
- Neurologic exam
- Musculoskeletal
- Airway exam (dentition, prior abnormality, history)

Primary Care Provider Communication with the Surgical Team

The primary care provider should provide pertinent information to the anesthesiologist and surgeon on results of preoperative health screening and assessment in advance of anticipated day of scheduled procedure for all patients undergoing elective surgery. The report should include a comprehensive assessment, any adjunctive evaluation or specific recommendations. The ICSI work group acknowledges that regulatory agencies may have their own requirements for documentation of completion and timing of provision of information.

In instances that a review of the current history and focused physical examination is required on the day of surgery prior to the procedure, it may be done by the provider performing the procedure.

Perioperative Medication Management and Pharmacist Involvement

The primary care provider should ensure medication reconciliation. Navigating the topic of medications to stop or continue in the perioperative period can be complicated, especially as new medications come to market frequently. Working with a pharmacist to help develop and implement perioperative plans regarding medication management (medications to stop or continue) can be beneficial. The pharmacist can also perform medication reconciliation, guide medications decisions, and oversee medication dispensing.

Preoperative Testing

Recommendation	Quality of Evidence
Do not routinely test all patients undergoing elective, noncardiac surgery. **The need for testing should be guided by individual patient's clinical risk factors (based on medical history and physical examination) and the risk of major adverse cardiac event (morbidity or mortality) associated with the planned procedure.**	Quality of Evidence: Low Strength of Recommendation: Strong
Benefit: • Ensures only tests of value for patients who need it are performed. • Decreases unnecessary perioperative costs for both patients and the health care system. **Harm:** • A possibility of missing an important diagnosis. **Benefit-Harms Assessment:** Given the low likelihood that routine testing of healthy, asymptomatic patients will uncover issues that might lead to adverse outcomes during perioperative period, only those patients who would benefit from additional testing should undergo it.	
Relevant Resources: *Keay, 2019 (Systematic Review); Johansson, 2013 (Systematic Review); Munro, 1997 (Systematic Review)*	

A 1997 systematic review of case series studies found no evidence to support routine preoperative tests (chest x-ray, electrocardiogram, hemostasis, blood counts, hemoglobin, potassium, creatinine, glucose and urine testing for pregnancy) in healthy or asymptomatic adults. Very few patients went on to have a change in management of the condition prior to surgery (*Munro, 1997*).

A systematic review of three randomized trials and 98 cohort studies found no evidence that preoperative testing is beneficial in healthy adults undergoing non-cardiac surgery (*Johansson, 2013*)

Large studies have found no evidence to support routine testing in low risk surgeries such as cataract surgery. A systematic review of three randomized controlled trials including 21,531 cataract surgery patients found routine preoperative medical testing did not reduce the risk of intraoperative or postoperative ocular adverse events when compared to selective or no testing (*Keay, 2019*).

The need for preoperative testing should be guided by perioperative screening and assessment of clinical risk factors based on patient's pertinent medical history and physical exam and in consideration of risk of major adverse cardiac event (morbidity or mortality) associated with the planned procedure. Consultation with the surgeon or proceduralist may be necessary to clarify relative procedural risk for the planned procedure.

To help stratify surgical procedure risk, American College of Cardiology (ACC)/American Heart Association (AHA) estimates the combined surgical and patient characteristics predict a risk of a major adverse cardiac event (MACE) of death or myocardial infarction of <1% in low risk surgeries Procedures with a risk of MACE of >=1% are considered elevated risk (*Fleisher, 2014*).

There is some evidence that older age may be a factor in increasing the risk of adverse cardiac event during surgery depending on the type of surgery. An analysis of 2,853 procedures found inpatient mortality rate for high risk procedures in patients 65 years and older was doubled the rate than that of patients younger than 65 years (*Schwarze, 2015*).

To guide perioperative mortality risk determination, the 2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery recommends the use of a validated risk prediction tool to predict the risk of perioperative major adverse cardiac event in patients undergoing noncardiac surgery (*Fleisher, 2014*). Risk calculators may include Revised Cardiac Risk Index (RCRI), American College of Surgeons National Surgical Quality Improvement Program (NSQIP) Myocardial Infarction and Cardiac Arrest (MICA), and American College of Surgeons NSQIP Surgical Risk Calculator (*Fleisher, 2014*).

Electrocardiogram

Cardiac arrhythmias and conduction disturbances are common findings in the perioperative period, however limited evidence does not support routine testing in healthy or asymptomatic individuals. A 1997 systematic review of case series studies in healthy and asymptomatic adults found routine preoperative electrocardiograms were abnormal in 4.6-31.7% of cases (with the proportion of abnormal tests rising with age and worsening physical status) and led to a change of management in 0-2.2% of patients with unknown effect on patient outcomes (*Munro, 1997*). A literature search by the ICSI Work Group did not find any new studies on relationship of preoperative electrocardiogram testing and perioperative mortality and morbidity outcomes.

The ICSI work group AGREES with the 2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery (*Fleisher, 2014*) recommendation on preoperative electrocardiogram (ECG):

- Routine electrocardiogram is not useful for asymptomatic patients undergoing low-risk surgical procedures.
- Electrocardiogram is reasonable in patients with known coronary heart disease, significant arrhythmia, peripheral arterial disease, or other structural heart disease, except for those undergoing low-risk surgery.

Chest X-Ray

Recommendation	Quality of Evidence
Do not routinely perform chest x-rays preoperatively unless indicated by the review of medical history and physical examination.	Quality of Evidence: Low Strength of Recommendation: Strong
Benefit: • Ensures only tests of value for patients who need it are performed. • Decreases unnecessary perioperative costs for both patients and the health care system. **Harm:** • A possibility of missing an important diagnosis. **Benefit-Harms Assessment:** Given the low likelihood that routine testing of healthy, asymptomatic patients will uncover issues that might lead to adverse outcomes during perioperative period, only those patients who would benefit from additional testing should undergo it.	
Relevant Resources: *Johansson, 2013 (systematic review); Joo, 2005 (systematic review)*	

Preoperatively, chest x-rays can help assess status for known chronic medical conditions or to detect previously undiagnosed diseases such as chronic obstructive pulmonary disease (COPD), heart failure, tuberculosis and lung cancer (*NICE, 2016*).

The evidence does not indicate routine use of chest x-rays in healthy or asymptomatic adults. A 2005 systematic review of 14 studies found a highly variable rate of abnormalities (most common ones were cardiomegaly and chronic obstructive pulmonary disease) found on x-rays. The rate of abnormalities varied from 4-47% and increased with age. Few of these patients had a change in preoperative management. The rate of postoperative pulmonary complications was similar between patients who had preoperative chest x-ray vs. those who did not (*Joo, 2005*). Similarly, a 2013 systematic review of two cohort studies found no significant association between abnormal chest x-ray tests and postoperative pulmonary complications in healthy patients undergoing elective, non-cardiac surgery (*Johansson, 2013*).

Hemoglobin/Hematocrit Testing

Recommendation	Quality of Evidence
Do not routinely test for hemoglobin preoperatively in healthy or asymptomatic patients. **Testing for preoperative hemoglobin level should be considered in:** **1. Patients with a history of anemia or history suggesting recent blood loss or anemia AND the planned procedure may lead to significant blood loss or physiologic stress.** **2. Patients with prior or planned anticoagulation (expert consensus).** **An individual patient plan should be established for management of hemoglobin levels between primary care provider doing the preoperative health screening and assessment and surgeon performing the procedure (expert consensus).** **It is imperative for primary care provider ordering hemoglobin tests to communicate the results to the surgeon; conversely, the surgeon should communicate to the primary care provider if the procedure could potentially cause significant blood loss.**	Quality of Evidence: Low Strength of Recommendation: Strong
Benefit: • Ensures only tests of value for patients who need it are performed. • Decreases unnecessary perioperative costs for both patients and the health care system. **Harm:** • A possibility of missing an important diagnosis. **Benefit-Harms Assessment:** Given the low likelihood that routine testing of healthy, asymptomatic patients will uncover issues that might lead to adverse outcomes during perioperative period, only those patients who would benefit from additional testing should undergo it.	
Relevant Resources: *Fowler, 2015 (meta-analysis); Johansson, 2013 (systematic review); Munro, 1997 (systematic review)*	

One purpose of the routine preoperative measurement of hemoglobin is to detect anemia as anemia may impact general anesthesia or patient may be at risk of significant blood loss during procedure.

The evidence does not indicate routine use of hemoglobin tests in healthy or asymptomatic adults. However, the evidence suggests that it should be considered in patients who have anemia or had a recent blood loss and are at risk for significant blood loss during surgery. The ICSI work group consensus is that patients with prior or planned anticoagulation should also have their hemoglobin levels tested.

The evidence is insufficient to recommend an optimal preoperative hemoglobin levels that would avoid perioperative complications. The optimal preoperative hemoglobin level (that provides a reserve for unexpected blood loss or cardiorespiratory stress) varies by patient and by type of procedure. The ICSI work group consensus is that primary care provider and surgeon should work together to establish an individual patient plan for management of hemoglobin levels prior to surgery. It is imperative for primary care provider ordering hemoglobin tests to communicate the results to the surgeon; conversely, the surgeon should communicate to the primary care provider if the procedure could potentially cause significant blood loss.

A 1997 systematic review of case series studies in healthy and asymptomatic adults found that routine

preoperative hemoglobin testing level was lower than 10-10.5 g/dl in up to 5% of patients, but rarely lower than 9 g/dl with change of preoperative management in only 0.1% to 2.7% of patients (*Munro, 1997*).

A 2013 systematic review of 35 cohort studies and four case-control studies found a strong correlation between low hemoglobin levels and the risk for perioperative and postoperative blood transfusions in patients with pre-existing conditions or signs of anemia during clinical examination and in medical history (*Johansson, 2013*). A 2015 meta-analysis of 24 observational studies including 371,594 patients with anemia found that anemia was associated with increased mortality, acute kidney injury, infection and increased incidence of red cell transfusion in anemic patients undergoing non-cardiac or cardiac surgeries. In cardiac surgery, anemia was associated with increased risk for stroke but not myocardial infarction (*Fowler, 2015*).

Potassium/Sodium Testing

Recommendation	Quality of Evidence
Do not routinely test for potassium or sodium level preoperatively in healthy or asymptomatic patients unless indicated. **Testing may be indicated in:** **1. patients who are on diuretic therapy,** **2. patients with kidney disease (stage 3 or greater),** **3. patients on potassium replacement therapy,** **4. patients undergoing bowel preparation.**	Quality of Evidence: Low Strength of Recommendation: Strong
Benefit: • Ensures only tests of value for patients who need it are performed. • Decreases unnecessary perioperative costs for both patients and the health care system. **Harm:** • A possibility of missing an important diagnosis. **Benefit-Harms Assessment:** Given the low likelihood that routine testing of healthy, asymptomatic patients will uncover issues that might lead to adverse outcomes during perioperative period, only those patients who would benefit from additional testing should undergo it.	
Relevant Resources: *Johansson, 2013 (systematic review); Wahr, 1999 (case-control study); Munro, 1997 (systematic review)*	

Testing for serum potassium level is important in patients with conditions that may lead to significant hypokalemia or dialysis dependence (e.g. patients taking non-potassium sparing diuretics such as hydrochlorothiazide). Hypokalemia increases the risk of dysrhythmia and makes treatment of dysrhythmias difficult in patients undergoing general anesthesia. Hyperkalemia may also lead to delays or cancellations of elective surgeries due to potential for cardiac arrhythmias.

The evidence does not indicate routine use of potassium tests in healthy or asymptomatic adults undergoing elective surgery. However, the evidence suggests that potassium testing may be indicated in patients with conditions or medical history that put them at risk for cardiac arrhythmia or are undergoing cardiac surgery.

A 1997 systematic review of case series studies in healthy and asymptomatic adults found that in routine preoperative tests of serum biochemistry, abnormal levels of sodium or potassium are found in up to 1.4% of patients which rarely led to a change in preoperative management (*Munro, 1997*). A 2013 systematic review of five cohort studies found that elevated and low sodium values correlated positively with 30-day mortality in one study in veterans with ASA physical status of one, two or three undergoing elective surgery; however, the other Four studies included the review found no significant relationship between electrolyte

tests on perioperative complications for patients undergoing elective procedures (*Johansson, 2013*). A 1999 case-control study of 2,402 patients undergoing elective coronary artery bypass grafting found significantly increased risk for serious perioperative arrhythmia, intraoperative arrhythmia and postoperative atrial fibrillation/flutter as well as increased need for CPR in patients with serum potassium level less than 3.5 mmol/L (*Wahr, 1999*).

Renal Function (Creatinine) Testing

Recommendation	Quality of Evidence
Do not routinely test for creatinine levels in healthy or asymptomatic patients unless indicated. **Testing may be indicated in patients with known kidney disease, or patients with a comorbid condition (e.g. diabetes, hypertension) that carries increased risk of acute kidney injury or kidney disease.**	Quality of Evidence: Low Strength of Recommendation: Strong
Benefit: • Ensures only tests of value for patients who need it are performed. • Decreases unnecessary perioperative costs for both patients and the health care system. **Harm:** • A possibility of missing an important diagnosis. **Benefit-Harms Assessment:** Given the low likelihood that routine testing of healthy, asymptomatic patients will uncover issues that might lead to adverse outcomes during perioperative period, only those patients who would benefit from additional testing should undergo it.	
Relevant Resources: *Kork, 2015 (observational study), Johansson, 2013 (systematic review)*	

Acute kidney injury is one of the leading causes for postoperative organ failure with an estimated incidence of approximately 1% in noncardiac surgery patients (*Kork, 2015*).

The evidence does not indicate routine use of creatinine tests in healthy or asymptomatic adults undergoing elective surgery. However, the evidence suggests that creatinine testing may be indicated in patients with known kidney disease, or patients who are planning to undergo procedures with increased risk of acute kidney injury. A baseline creatinine level should be established in these patients. It is the consensus of the ICSI work group to test potassium levels within 30 days of the planned procedure. If the values are expected to change or patient has an acute condition, the levels may be redone closer to the day of the procedure.

A 2013 systematic review of 23 cohort studies on renal tests (creatinine and others) found a positive correlation between pathological renal function tests and the occurrence of complications in 11 studies of patients with known pre-existing renal disease (the remaining studies either did not provide data or there was no significant relationship) (*Johansson, 2013*). A 2015 study of 37,345 non-cardiac surgery and 2,024 cardiac surgery patients found that patients with acute kidney injury had a five-fold higher mortality risk and a five-days longer hospital length of stay. The study also found that even minor creatinine increases (change in creatinine from 25 to 49% above baseline but < 0.3 mg/dl) not meeting criteria for AKI were associated with a two-fold increased risk of death and two days longer hospital length of stay in all patients. In patients undergoing noncardiac surgery, minor creatinine increases were associated with a five-fold risk of death and a three-day longer hospital length of stay (*Kork, 2015*).

Pregnancy Testing

Consensus Recommendation
Do not routinely conduct urine tests for pregnancy. However, women of childbearing age should be asked if there is a possibility they might be pregnant. **Pregnancy testing is indicated in:** **1. women planning to undergo surgeries involving the uterus (hysterectomy, myomectomy, for example),** **2. uterine cavity (dilation and curettage, endometrial ablation, for example), or** **3. surgery that impact blood flow to the uterus (endovascular surgeries that disrupt aortic blood flow, procedures involving the uterine arteries, for example).**
Benefit: • Ensures only tests of value for patients who need it are performed. • Decreases unnecessary perioperative costs for both patients and the health care system. **Harm:** • A possibility of missing a potential pregnancy. **Benefit-Harms Assessment:** Given the low likelihood that routine pregnancy testing of all female patients will uncover a potential pregnancy and insufficient evidence on harms of anesthesia in pregnant patients, patients should be asked if there is a possibility they are pregnant and further test those where there is an indication. Shared-decision-making discussions can help guide decisions whether to test.
Relevant Resources: *ACOG, 2019 (Joint Statement with ASA); ASA, 2016 (Statement); NICE, 2016 (Guideline); Apfelbaum, 2012 (Guideline)*

Elective surgery in pregnant women is generally avoided unless absolutely necessary due to the concerns with anesthetic teratogenicity and miscarriage during procedure (*NICE, 2016*). The evidence, however, is unclear on the harm of anesthesia to pregnant women and fetus during surgery.

Literature shows the overall frequency of an incidentally found positive preoperative pregnancy test ranges from 0.34% to 2.4% (*Maher, 2012*). The American Society of Anesthesiologists (ASA) Task Force on Preanesthesia Evaluation literature review found insufficient evidence on harmful effects of anesthesia on early pregnancy (*Apfelbaum, 2012*).

The ICSI work group consensus is to not routinely conduct urine test for pregnancy. However, women of childbearing age should be asked if there is a possibility they might be pregnant. Pregnancy testing is indicated in women planning to undergo surgeries involving the uterus (hysterectomy, myomectomy, for example), uterine cavity (dilation and curettage, endometrial ablation, for example), or that impact blood flow to the uterus (endovascular surgeries that disrupt aortic blood flow, procedures involving the uterine arteries).

Shared-decision-making approach can be used to inform women of the relative risks and benefits of undergoing the planned surgery and anesthesia while pregnant and to determine if pregnancy testing is desired by the patient. The decisions to test should be guided by the following information:

- No currently used anesthetic agents have been shown to have any teratogenic effects in humans when using standard concentrations at any gestational age. (*ACOG, 2017*)
- Current scientific information is not sufficient to determine whether anesthesia causes harmful effects during pregnancy. (*ASA, 2016*)
- Current scientific information is not sufficient to determine whether pre-natal exposure to maternal anesthetics causes adverse neurodevelopmental effects. (*ASA, 2016*)

Hemostasis (Coagulation) Testing

Recommendation	Quality of Evidence
Do not routinely perform coagulation tests before surgery unless indicated. **Indications for testing may include the following:** **1. Patients with potential bleeding problem,** **2. Patients with a known history of anticoagulation abnormalities,** **3. Patients with recent history suggesting the potential for anticoagulation problems,** **4. Patients who are currently taking anticoagulant therapy, and** **5. Patients who may need postoperative anticoagulation (where a baseline may be needed).**	Quality of Evidence: Low Strength of Recommendation: Strong
Benefit: • Ensures only tests of value for patients who need it are performed. • Decreases unnecessary perioperative costs for both patients and the health care system. **Harm:** • A possibility of missing an important diagnosis. **Benefit-Harms Assessment:** Given the low likelihood that routine testing of healthy, asymptomatic patients will uncover issues that might lead to adverse outcomes during perioperative period, only those patients who would benefit from additional testing should undergo it.	
Relevant Resources: *Johansson, 2013 (systematic review); Munro, 1997 (systematic review)*	

In the preoperative setting, hemostasis tests (e.g. prothrombin time, activated partial thromboplastin time, platelet count) are used to establish a baseline for the patient and may be used to plan the use of blood products and blood salvage techniques in the perioperative period (*NICE, 2016*).

The evidence does not indicate routine use of hemostasis tests in healthy or asymptomatic adults undergoing elective surgery. However, the evidence suggests that hemostasis testing may be indicated in patients with a potential bleeding problem, patients with a known history of anticoagulation abnormalities, patients with recent history suggesting the potential for anticoagulation problems, patients who are currently taking anticoagulant therapy, and patients who may need postoperative anticoagulation (where a baseline may be needed).

A 1997 systematic review of case series studies in healthy and asymptomatic adults found abnormalities of bleeding time, prothrombin time and partial thromboplastin time in up to 3.8%, 4.8% and 15.6% of routine preoperative tests, respectively which rarely lead to change in the clinical management (*Munro, 1997*). A 2013 systematic review of nine cohort studies found one study that showed a correlation between an abnormal platelet count and an abnormal international normalized ratio test and the outcomes in adverse events or morbidity in patients undergoing elective abdominal surgery. Another study in the review found a correlation between an abnormal prothrombin time and an abnormal platelet count and mortality in patients undergoing miscellaneous surgeries. Both of these studies included patients with pre-existing conditions or were older adults. The remaining studies in the review did not find valid evidence suggesting that routine preoperative hemostasis testing would lead to a change in clinical management or outcome in asymptomatic patients (*Johansson, 2013*).

Glucose Testing in Non-Diabetic Patients

There is little evidence around screening for diabetes during the preoperative clinic visit.

The review of evidence shows no clear evidence to determine if diabetes screening in asymptomatic patients should be done preoperatively. A prospective study of 120 patients without known diabetes who underwent major colorectal surgery found that patients with a preoperative HbA1c level over 6.0% had higher mean postoperative glucose and C-reactive protein levels and postsurgical complications than patients with a normal HbA1c level (*Gustafsson, 2009*). A 1997 systematic review of case series studies found abnormal levels of glucose in up to 5.2% of healthy or asymptomatic patients undergoing elective surgery. These findings rarely led to change in clinical management (*Munro, 1997*). A 2015 systematic review of 22 cohort and case-controlled studies found no data to support routine preoperative testing for blood glucose or HbA1c in otherwise healthy adult patients undergoing elective noncardiac surgery (*Bock, 2015*).

Given the scarcity of evidence on preoperative HbA1c and postoperative outcomes, the 2016 NICE guidelines recommend against routinely offering HbA1c testing before surgery to people without diagnosed diabetes.

The U.S. Preventive Services Task Force (USPSTF) recommends screening for abnormal blood glucose as part of cardiovascular risk assessment in patients aged 40-70 years without obvious diabetes symptoms who are overweight/obese and seen in primary care settings. According to USPSTF, persons who have a family history of diabetes, have a history of gestational diabetes or polycystic ovarian syndrome, or are members of certain racial/ethnic groups (that is, African Americans, American Indians or Alaskan Natives, Asian Americans, Hispanics or Latinos, or Native Hawaiians or Pacific Islanders) may be at increased risk for diabetes at a younger age or at a lower body mass index. Clinicians should consider screening earlier in persons with one or more of these characteristics (*USPSTF, 2015*).

Given the available information, the consensus of the ICSI Work Group on glucose testing in non-diabetic patients during preoperative clinic visit is following: Consider glucose testing in patients with risk factors for diabetes (as defined by USPSTF recommendation above), or if a primary care provider feels that diagnosis of diabetes would alter the plan for surgery.

Sleep Apnea

Consensus Recommendation
1. Clinicians should use a validated standardized screening tool to screen patients for suspected sleep apnea (risk factors or patient reporting problems) or sleep apnea symptoms and communicate to surgical team. Major risk factors for sleep apnea include: obesity, increased neck size (> 37 cm in men, >35 cm in women), craniofacial abnormalities, older age and male sex. **2. Clinicians should remind patients who have been formally diagnosed with obstructive sleep apnea and have an oral appliance or continuous positive airway pressure equipment to bring their appliance or equipment with them on the operative day for use during the recovery from anesthesia or sedation.** **3. Patients with suspected sleep apnea in the perioperative period should have a follow up evaluation typically in concert with the patient's primary provider, and/or referral to sleep center.** **4. Patients with known sleep apnea or suspected sleep apnea at a preoperative evaluation should have this communicated to the surgical and anesthesiology team and the patient made aware this may increase the surgical risk.**
Benefit: Targeted screening and identification of at risk patients can direct therapy which may prevent common complications associated with perioperative sleep apnea. **Harm:** False positive screening may lead to unnecessary testing or surgical delay in some patients. **Benefit-Harms Assessment:** The potential to treat the myriad and serious harms associated with untreated perioperative sleep apnea outweigh the rare harms associated with additional testing.
Relevant Resources: *Chung, 2016 (Guideline); Gross, 2014 (Guideline)*

Obstructive sleep apnea has been identified as a perioperative risk factor with increased risks of pulmonary complications, desaturations and has been linked to post-operative cardiovascular events though its effect on perioperative mortality is less clear (*Chung, 2016*). Thus, sleep apnea should be considered during the preoperative evaluation. Validated OSA screening tools in adult surgical patients include the STOP-Bang, P-SAP, Berlin, and ASA checklist (*Chung, 2016*).

Some adult patients may not have a diagnosis of obstructive sleep apnea confirmed by polysomnography studies but are presumed to have obstructive sleep apnea based on the preoperative history and physical examination. Quick and inexpensive surrogates for polysomnography studies are not new and have several variants. Patients who score high on these indices may need to be treated in the perioperative period as though they have a formal diagnosis of obstructive sleep apnea. This information should be communicated to the surgeon and anesthesiologist before the patient undergoes any procedure involving general anesthesia, monitored anesthesia care, conscious sedation or the administration of narcotics (*Chung, 2016*). At this point evidence does not support delaying surgery to have polysomnography for formal diagnosis (*Chung, 2016*). However, it may be reasonable to delay surgery in certain situations such as patients undergoing surgery with a very high rate of OSA like bariatric surgery or where other pulmonary comorbidities are suspected, like obesity hypoventilation syndrome or severe pulmonary hypertension (*Chung, 2016*). Patients with known sleep apnea or suspected sleep apnea at a preoperative evaluation should have this communicated to the surgical and anesthesiology team and the patient made aware this may increase the surgical risk. In patients with suspected sleep apnea in the perioperative period, follow up evaluation is recommended in concert with the patient's primary provider and/or referral to sleep center.

Use of PAP for patients with known OSA may reduce postoperative complications (*Chung, 2016*). Adult patients with a diagnosis of obstructive sleep apnea often have oral appliances or continuous positive airway pressure equipment and should be reminded to bring those appliances or equipment on the operative day, for use during the recovery from anesthesia or sedation. Additionally, expert recommendations suggest monitoring patients with known or high risk for OSA until they are no longer at risk of perioperative respiratory depression, though research supporting this practice is minimal (*Gross, 2014*).

Nicotine Cessation

Recommendation	Quality of Evidence
Smoking cessation intervention (brief or intensive) should be undertaken before elective surgery.	Quality of Evidence: Low Strength of Recommendation: Strong
Benefit: Smoking cessation may reduce post-surgical complication with the best evidence suggesting reduced surgical site infections and pulmonary complications. Additionally, the long-term benefit of smoking cessation is substantial. **Harm:** Increased patient visits and patient cost when undertaking intensive smoking cessation. **Benefit-Harms Assessment:** The potential benefits of smoking cessation with postsurgical complications and long-term health outcomes outweigh minimal harms.	
Relevant Resources: *Bayfield, 2018 (Meta-Analysis); Nolan, 2017 (Observational study); Nolan, 2015 (Systematic Review); Thomsen, 2014 (Systematic Review)*	

Although smoking cessation should always be encouraged, research suggests that intensive rather than brief interventions are more effective. A systematic review found that brief interventions reduce the number of patients smoking by the day of surgery, but have not consistently shown to decrease postoperative complications, nor is there any long-term reduction in smoking rates (*Thomsen, 2014*). Intensive smoking cessation interventions (multisession face-to-face counselling) started greater than four weeks prior to surgery demonstrated efficacy at reducing smoking by the day of surgery, decreased postoperative wound and overall complications and showed a significant reduction in smoking at 12 months (*Thomsen, 2014*).

An observational study of smokers undergoing elective surgery found that smoking cessation started the day of surgery has been linked to lower post-operative surgical site infections (*Nolan, 2017*). A meta-analysis showed cardiac surgical patients who are current smokers at the time of surgery found no increased 30-day mortality risk compared with ex-smokers, although they are at significantly increased risk of postoperative pulmonary complications (*Bayfield, 2018*). Despite the limited data, this work group agrees that patients should be strongly encouraged at all times to abstain from nicotine any time before surgery.

Data regarding nicotine replacement therapy (NRT) is extremely limited and there is no convincing research suggesting NRT is harmful. A systematic review of the topic notes that when NRT is used to help with smoking cessation, there is a reduction in perioperative complications (*Nolan, 2015*). In sum, if patients are using nicotine replacement therapy prior to surgery, this should be continued preoperatively.

Preparation for Surgery

Patient Preparation and Education

When providing patient education about their procedure, adequate attention to patients' reading level, potential visual impairments (provide large print materials) and other potential learning barriers is a critical component for preparing them for surgery. The use of Teach-Back is researched based literacy intervention that promotes adherence and patient safety to patient education.

The components of patient education should include the following:

- Patients and families should be educated on how to manage postoperative pain, when to resume activities of daily living and how to manage other risk factors such as diabetes, incontinence and impaired immune status/response.
- Patients should be educated and informed of fasting requirements sufficiently in advance of the procedure.
- Patients will be educated on medications that are prescribed at discharge. Medication reconciliation will be completed and a current medication list sent home with the patient.
- All patients should be educated on the signs and symptoms of surgical site infection.
- Patients and families should be provided emergency contact numbers and instructions on whom to call.
- The nurse must confirm that discharge instructions have been explained, and patients and family should verbalize understanding. Because patients may forget verbal instructions, written instructions should be provided.
- When necessary, the nurse should verify that the patient will have care assistance for at least 24 hours.
- Patient and families should be educated on the importance of good hand hygiene in the prevention of infection. Patients and families managing wound dressings should wash their hands (either soap and water or waterless hand gels) before and after every contact. Hand gels appear to be as effective as washing with soap.
- Patients and families should be instructed on proper incision and provide wound care recommendations.

Preoperative Showering/Bathing, Hair Removal and Oral Hygiene

To prevent surgical site infections, patients should be advised to shower/bathe before arriving for their surgical procedure, however, there is no evidence that specific wash products with antiseptic solution were more beneficial than other wash products or soap without antiseptic. The evidence also did not find that hair removal was beneficial in preventing surgical site infection. If hair removal is necessary, hair clipping was found to be more effective in preventing surgical site infection compared to shaving or depilatory cream. Evidence indicates benefit of perioperative oral hygiene on the reduction of postoperative respiratory airway infections. Each facility should establish specific guidelines for their patient population and the specific procedures being performed.

Preoperative Bathing. A 2017 systematic review of eight studies involving 10,655 patients undergoing clean surgeries found soap without antiseptic had the lowest rate of surgical site infection (5.1%) compared to chlorhexidine bathing (7.1%) or placebo solution (9.1%). There were no significant reductions in the infection rates in the comparison between patients who had preoperative bathing with 4% chlorhexidine versus placebo solution as well as no difference was observed when comparing chlorhexidine bathing with soap (*Franco, 2017*). A 2015 systematic review of seven randomized trials involving 10,157 patients undergoing invasive surgical procedures found no clear evidence of benefit for preoperative showering or bathing with chlorhexidine over other wash products, to reduce surgical site infection (*Webster, 2015*).

Hair Removal. A 2017 meta-analysis of 14 trials involving 7,278 patients found no significant differences between shaving, clipping, no hair removal and depilatory cream in the frequency of surgical site infections. The evidence suggests that when it is necessary to remove hair, clipping is more effective in reducing surgical site infections than shaving or depilatory cream (*Shi, 2017*). A 2015 meta-analysis of 19 trials found no benefit of depilation to prevent surgical site infection, and the higher risk of surgical site infection when shaving is used for depilation vs clipping, chemical depilation or no depilation. The risk of surgical site infection seemed to be similar with both chemical depilation and clipping (*Lefebvre, 2015*).

Oral hygiene. A 2016 systematic review of six trials and quasi-trials found systematic perioperative oral hygiene reduces postoperative nosocomial, lower respiratory tract infections and surgical site infections but not urinary tract infections (*Pedersen, 2016*). Systematic perioperative oral hygiene involves mechanical removal of dental biofilm or plaques and/or systematic use of mouth rinse performed by patients themselves or by health care staff (such as nurses).

Preoperative Fasting Recommendations (Clear Liquids, Solids and Non-Human Milk)

The ICSI work group agrees with American Society of Anesthesiologists (ASA) recommendations on preoperative fasting for healthy patients undergoing elective procedures: (*ASA, 2017*)

- Clear liquids
  - Clear liquids may be ingested for up to 2 h before procedures requiring general anesthesia, regional anesthesia, or procedural sedation and analgesia. These liquids should not include alcohol.
- Solids and Nonhuman Milk
  - A light meal or nonhuman milk may be ingested for up to 6 h before elective procedures requiring general anesthesia, regional anesthesia, or procedural sedation and analgesia.
    - Additional fasting time (e.g., eight or more hours) may be needed in cases of patient intake of fried foods, fatty foods, or meat.

The ASA guideline recommendations are further supported by a systematic review of 19 guidelines which found strong and consistent evidence exists for the minimization of perioperative fasting, for a two-hour preoperative fast after clear fluids, and for early recommencement of oral food and fluid intake postoperatively. (*Lambert, 2016*)

2. Perioperative Management of Select Conditions

Cardiovascular Considerations

Cardiovascular Diseases

The ICSI work group agrees with the select ACC/AHA disease-specific perioperative recommendations in the table below. The select recommendations are from the 2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery (*Fleisher, 2014*) and the 2016 ACC/AHA Guideline Focused Update on Duration of Dual Antiplatelet Therapy in Patients with Coronary Artery Disease (*Levine, 2016*).

Coronary Artery Disease	Patients with known or clinic risk for coronary artery disease should be evaluated according to the ACC/AHA perioperative risk assessment protocol. (Based on ACC/AHA 2014 Guideline)
	Elective noncardiac surgery should be delayed at least 60 days after myocardial infarction in the absence of coronary intervention. (Based on ACC/AHA 2014 Guideline)
	Revascularization before noncardiac surgery is recommended in circumstances in which revascularization is indicated according to existing clinical practice guidelines. (ACC/AHA 2014 Guideline Recommendation)
	It is not recommended that routine coronary revascularization be performed before noncardiac surgery exclusively to reduce perioperative cardiac events. (ACC/AHA 2014 Guideline Recommendation)
	Elective noncardiac surgery should not be performed within 14 days of balloon angioplasty in patients in whom aspirin will need to be discontinued perioperatively. (ACC/AHA 2014 Guideline Recommendation)
	Elective noncardiac surgery should be delayed 30 days after BMS implantation and optimally six months after DES implantation. (ACC/AHA 2016 Guideline recommendation)
	In patients treated with DAPT after coronary stent implantation who must undergo surgical procedures that mandate the discontinuation of P2Y12 inhibitor therapy, it is recommended that aspirin be continued if possible and the P2Y12 platelet receptor inhibitor be restarted as soon as possible after surgery. (ACC/AHA 2016 Guideline recommendation)
	Elective noncardiac surgery after DES implantation in patients for whom P2Y12 inhibitor therapy will need to be discontinued may be considered after three months if the risk of further delay of surgery is greater than the expected risk of stent thrombosis. (ACC/AHA 2016 Guideline recommendation)
	Elective noncardiac surgery should not be performed within 30 days after BMS implantation or within three months after DES implantation in patients in whom DAPT will need to be discontinued perioperatively. (ACC/AHA 2016 Guideline recommendation)
	When noncardiac surgery is required in patients currently taking a P2Y12 inhibitor, a consensus decision among treating clinicians as to the relative risks of surgery and discontinuation or continuation of antiplatelet therapy can be useful. (ACC/AHA 2016 Guideline recommendation)

LV Function Assessment	It is reasonable for patients with dyspnea of unknown origin to undergo preoperative evaluation of LV function. (ACC/AHA 2014 Guideline Recommendation)
	It is reasonable for patients with heart failure with worsening dyspnea or other change in clinical status to undergo preoperative evaluation of LV function. (ACC/AHA 2014 Guideline Recommendation)
	Reassessment of LV function in clinically stable patients with previously documented LV dysfunction may be considered if there has been no assessment within a year. (ACC/AHA 2014 Guideline Recommendation)
	Routine preoperative evaluation of LV function is not recommended. (ACC/AHA 2014 Guideline Recommendation)
Cardiomyopathy	There is little information on the preoperative evaluation of patients with specific non-ischemic cardiomyopathies before non-cardiac surgery. Preoperative recommendations must be based on a thorough understanding of the pathophysiology of the cardiomyopathy, assessment and management of the underlying process, and overall management of the heart failure. (ACC/AHA 2014 Guideline Statement)
Valvular Heart Disease	It is recommended that patients with clinically suspected moderate or greater degrees of valvular stenosis or regurgitation undergo preoperative echocardiography if there has been either 1) no prior echocardiography within one year or 2) a significant change in clinical status or physical examination since last evaluation. (ACC/AHA 2014 Guideline Recommendation)
	For adults who meet standard indications for valvular intervention (replacement and repair) on the basis of symptoms and severity of stenosis or regurgitation, valvular intervention before elective noncardiac surgery is effective in reducing perioperative risk. (ACC/AHA 2014 Guideline Recommendation)
Arrhythmias/ Conduction Abnormalities	Before elective surgery in a patient with a cardiac implantable electronic device (CIED), the surgical/procedure team and clinician following the CIED should communicate in advance to plan perioperative management of the CIED. (ACC/AHA 2014 Guideline Recommendation)

Cardiovascular Medications

The ICSI work group reviewed with the ACC/AHA medications-specific perioperative recommendations in the table below. The select recommendations are from the 2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery (*Fleisher, 2014*) and the 2016 ACC/AHA Guideline Focused Update on Duration of Dual Antiplatelet Therapy in Patients with Coronary Artery Disease (*Levine, 2016*).

Beta Blockers Therapy: ICSI Work Group AGREES with the following ACC/AHA Recommendations.

ACC/AHA Recommendation	ICSI Work Group Comment
Beta blockers should be continued in patients undergoing surgery who have been on beta blockers chronically. (ACC/AHA 2014 Guideline Recommendation)	Agree
It is reasonable for the management of beta blockers after surgery to be guided by clinical circumstances, independent of when the agent was started. (ACC/AHA 2014 Guideline Recommendation)	Agree
Beta-blocker therapy should not be started on the day of surgery. (ACC/AHA 2014 Guideline Recommendation)	Agree

Beta Blockers Therapy: ICSI Work Group DISAGREES with the following ACC/AHA Recommendations.

ACC/AHA Recommendation	ICSI Work Group Comment
In patients with intermediate- or high-risk myocardial ischemia noted in preoperative risk stratification tests, it may be reasonable to begin perioperative beta blockers. (ACC/AHA 2014 Guideline Recommendation)	**Disagree** (due to findings from the 2018 Cochrane systematic review of increased risk of all-cause mortality and increased risk in stroke rate in non-cardiac surgery). In the 2014 ACC/AHA Guidelines, it was acknowledged that beginning beta blockers ≤1 day before surgery is at a minimum ineffective and may in fact be harmful, and that decision to begin beta blockers should be influenced by whether a patient is at risk for stroke and whether the patient has other relative contraindications (Fleisher, 2014). More recent findings from a 2018 Cochrane systematic review (Blessberger, 2018) demonstrated an association of beta-blockers with increased all-cause mortality in **non-cardiac** surgery. According to the authors of the review: (Blessberger, 2018) • Data from low risk of bias trials further suggests an increase in stroke rate with the use of beta-blockers. • As the overall quality of evidence is still low to moderate, more evidence is needed before a definitive conclusion can be drawn. • The substantial reduction in supraventricular arrhythmias and AMI in **non-cardiac** setting seems to be offset by the potential increase in mortality and stroke.
In patients with three or more RCRI risk factors (e.g., diabetes mellitus, HF, CAD, renal insufficiency, cerebrovascular accident), it may be reasonable to begin beta blockers before surgery. (ACC/AHA 2014 Guideline Recommendation)	
In patients with a compelling long-term indication for betablocker therapy but no other RCRI risk factors, initiating beta blockers in the perioperative setting as an approach to reduce perioperative risk is of uncertain benefit. (ACC/AHA 2014 Guideline Recommendation)	
In patients in whom beta-blocker therapy is initiated, it may be reasonable to begin perioperative beta blockers long enough in advance to assess safety and tolerability, preferably more than one day before surgery. (ACC/AHA 2014 Guideline Recommendation)	

A 2018 systematic review and meta-analysis of 88 randomized controlled trials (53 trials in cardiac surgery and 35 trials in non-cardiac surgery) on influence of beta blockers on perioperative adverse events had the following findings regarding **non-cardiac** surgery outcomes: (the overall quality of evidence was low to moderate) (*Blessberger, 2018*)

- Beta-blockers significantly increased the risk of all-cause mortality (number needed to treat for an additional harmful outcome NNTH 167), hypotension (NNTH 16), bradycardia (NNTH 21).
- Beta-blockers use had a potential increase in the risk of cerebrovascular events when all studies were analyzed, however, when only the studies with low risk of bias were analyzed, the risk was significantly increased (NNTH 265).
- Beta-blockers significantly reduced the risk of AMI (NNTB 76), myocardial ischemia (NNTB 9) and supraventricular arrhythmias (NNTB 112).
- No clear evidence of an effect on ventricular arrhythmias, congestive heart failure and length of hospital stay.

ACE Inhibitors and ARB Therapy

ACC/AHA Recommendation	ICSI Work Group Comment
Continuation of angiotensin-converting enzyme (ACE) inhibitors or angiotensin-receptor blockers (ARBs) perioperatively is reasonable. (ACC/AHA 2014 Guideline Recommendation)	Agree with qualification Recent evidence suggests the risk for intraoperative hypotension morbidity is significantly higher if continued the morning of surgery with unclear effect on mortality and morbidity. The consensus of the ICSI work group is for anesthetists to be cautious about the risk for intraoperative hypotension in patients chronically receiving ACEIs/ARBs and are on it the day of surgery, and should know how to treat it effectively. The risks and benefits of continuing these medications should be weighed against patient's risk factors.
If ACE inhibitors or ARBs are held before surgery, it is reasonable to restart as soon as clinically feasible postoperatively. (ACC/AHA 2014 Guideline Recommendation)	

ACEI/ARB medications reduce the activity of the renin–angiotensin–aldosterone system, ultimately decreasing peripheral vascular tone and increasing perfusion (*Fleisher, 2014*). Patients who use these medications are prone to developing side effects like hypotension and even refractory hypotension during anesthesia use, and whether ACEIs/ARBs should be continued or discontinued perioperatively in such patients remains debatable.

Though the 2014 ACC/AHA guideline recommends ACEI and ARB medications can be taken perioperatively, more recent evidence shows the risk for intraoperative hypotension morbidity is significantly higher if continued the morning of surgery with unclear effect on mortality and morbidity. The consensus of the ICSI work group is for anesthetists to be cautious about the risk for intraoperative hypotension in patients chronically receiving ACEIs/ARBs and are on it the day of surgery, and should know how to treat it effectively. The risks and benefits of continuing these medications should be weighed against patient's risk factors.

A 2018 systematic review and meta-analysis of 13 studies reporting on the incidences of intraoperative hypotension between patients who continued receiving ACEIs/ARBs and those who did not on the day of their surgical procedure found that hypotension during anesthesia was more likely to develop in patients who continued to take ACEIs/ARBs when compared to those who did not. However, no significant differences between these groups of patients were found with regards to postoperative complications including ST-T abnormalities, myocardial injury, myocardial infarction, stroke, major adverse cardiac events, acute kidney injury, or death (*Ling, 2018*).

Another 2018 systematic review and meta-analysis of nine studies (five RCTs and four cohort studies) with a total of 6,022 patients on chronic ACEI/ARB therapy before noncardiac surgery found that while withholding ACEI/ARB therapy on the morning of surgery was associated with significantly less intraoperative hypotension, withholding ACEI/ ARB therapy was not associated with a difference in the mortality risk or risk of major adverse cardiac event vs. those who continued these medications on the morning of surgery (*Hollmann, 2018*).

Calcium Channel Blocker Therapy

ACC/AHA Recommendation	ICSI Work Group Comment
No specific recommendation.	A 2003 systematic review of 11 studies with 1,007 patients found calcium channel blockers significantly reduced ischemia and supraventricular tachyarrhythmia in the setting of noncardiac surgery (Wijeysundera, 2003). While ACC/AHA guidelines do not provide specific recommendations, it is the consensus of the ICSI work group that it may be reasonable to continue calcium channel blocker therapy perioperatively.

Diuretic Therapy

ACC/AHA Recommendation	ICSI Work Group Comment
No specific recommendation.	Thiazide and loop diuretic medications are commonly prescribed for treatment of hypertension as well as congestive heart failure. While ACC/AHA guidelines do not provide specific recommendations, it is the consensus of the ICSI work group diuretic therapy should be held on the morning of surgery in most cases. Continuing diuretic therapy on the morning of surgery may be reasonable for patients with congestive heart failure.

Alpha-2 Agonists

ACC/AHA Recommendation	ICSI Work Group Comment
Alpha-2 agonists for prevention of cardiac events are not recommended in patients who are undergoing noncardiac surgery. (ACC/AHA 2014 Guideline Recommendation)	Agree

Statins

ACC/AHA Recommendation	ICSI Work Group Comment
Statins should be continued in patients currently taking statins and scheduled for noncardiac surgery. (ACC/AHA 2014 Guideline Recommendation)	Agree
Perioperative initiation of statin use is reasonable in patients undergoing vascular surgery. (ACC/AHA 2014 Guideline Recommendation)	
Perioperative initiation of statins may be considered in patients with clinical indications according to GDMT who are undergoing elevated-risk procedures. (ACC/AHA 2014 Guideline Recommendation)	

Antiplatelet Therapy

ACC/AHA Recommendation	ICSI Work Group Comment
In patients undergoing urgent noncardiac surgery during the first four to six weeks after BMS or DES implantation, DAPT should be continued unless the relative risk of bleeding outweighs the benefit of the prevention of stent thrombosis. (ACC/AHA 2014 Guideline Recommendation)	Agree
In patients who have received coronary stents and must undergo surgical procedures that mandate the discontinuation of P2Y12 platelet receptor–inhibitor therapy, it is recommended that aspirin be continued if possible and the P2Y12 platelet receptor–inhibitor be restarted as soon as possible after surgery. (ACC/AHA 2016 Guideline Recommendation)	
When noncardiac surgery is required in patients currently taking a P2Y12 inhibitor, a consensus decision among treating clinicians as to the relative risks of surgery and discontinuation or continuation of antiplatelet therapy can be useful. (ACC/AHA 2016 Guideline recommendation)	
In patients undergoing nonemergency/nonurgent noncardiac surgery who have not had previous coronary stenting, it may be reasonable to continue aspirin when the risk of potential increased cardiac events outweighs the risk of increased bleeding. (ACC/AHA 2014 Guideline Recommendation)	
Initiation or continuation of aspirin is not beneficial in patients undergoing elective noncardiac noncarotid surgery who have not had previous coronary stenting, unless the risk of ischemic events outweighs the risk of surgical bleeding. (ACC/AHA 2014 Guideline Recommendation)	

Prevention of Endocarditis

The ICSI work group did not find any new literature regarding antibiotic prophylaxis for prevention of endocarditis and agrees with the recommendations from the following guidelines:

- The 2007 American Heart Association (AHA) Guideline on Prevention of Infective Endocarditis (*Wilson, 2007*)
- The 2017 American Heart Association (AHA)/American College of Cardiology (ACC) Focused Update of the 2017 AHA/ACC Guideline for the Management of Patients with Valvular Heart Disease (*Nishimura, 2017*)

Summary of Recommendations:

1. **Increased Lifetime Risk of Acquisition of Infective Endocarditis**
   The 2007 AHA Guideline on Prevention of Infective Endocarditis (IE) does not recommend IE prophylaxis based solely on an increased lifetime risk of acquisition of IE (*Wilson, 2007*).

2. **Dental Procedures**
   Both the 2007 AHA Guideline on Prevention of Infective Endocarditis and the 2017 AHA/ACC Focused Update of the 2017 AHA/ACC Guideline for the Management of Patients with Valvular Heart Disease recommend IE prophylaxis for certain cardiac conditions* associated with the highest risk of adverse outcome from endocarditis for patients undergoing dental procedures (*Nishimura, 2017; Wilson, 2007*).

   *Specifically, prophylaxis against IE is reasonable before dental procedures that involve manipulation of gingival tissue, manipulation of the periapical region of teeth, or perforation of the oral mucosa in patients with the following:

   1. Prosthetic cardiac valves, including transcatheter implanted prostheses and homografts.
   2. Prosthetic material used for cardiac valve repair, such as annuloplasty rings and chords.
   3. Previous IE.
   4. Unrepaired cyanotic congenital heart disease or repaired congenital heart disease, with residual shunts or valvular regurgitation at the site of or adjacent to the site of a prosthetic patch or prosthetic device.
   5. Cardiac transplant with valve regurgitation due to a structurally abnormal valve.

3. **Gastrointestinal/Genitourinary Procedures**
   Both guidelines found no evidence for infective endocarditis prophylaxis in gastrointestinal procedures or genitourinary procedures, absent known active infection.

4. **Respiratory Tract/Infected Skin/Skin Structure/Musculoskeletal Tissue**
   The 2007 AHA guideline found antibiotic prophylaxis to be reasonable for procedures on respiratory tract or infected skin, skin structure, or musculoskeletal tissue only for patients with underlying cardiac conditions (listed above) associated with the highest risk of adverse outcome from IE.

5. **Invasive Procedures**
   The 2007 AHA guideline stated that it did not find published data that demonstrate convincingly that the administration of prophylactic antibiotics prevents IE associated with bacteremia from an invasive procedure. However, the possibility that there may be an exceedingly small number of cases of IE that could be prevented by prophylactic antibiotics in patients who undergo an invasive procedure could not be excluded. Such therapy should be restricted to those patients with the highest risk of adverse outcome and who would derive the greatest benefit from prevention of IE.

For information on prophylaxis on infective endocarditis, refer to resources such as the Sanford Guide for Antimicrobial Therapy or Micromedex.

Anticoagulants/Antithrombotics

The evidence on anticoagulant bridging and reversal tends to be specific to individual procedure and clinical indication. The ICSI work group consensus is to take into consideration the following for perioperative management of anticoagulants/antithrombotics to potentially prevent or reduce risk of adverse events:

Preoperative:

As part of the pre-operative assessment, patients taking any medication that can affect hemostasis or may require anti-thrombotic therapy post-op should undergo the following workup:

- Estimate thrombotic risk and bleed risk (in consultation with the surgeon) in order to determine whether or not chronic therapy should be interrupted, or to determine choice of new anti-thrombotic therapy postoperatively (at surgeon discretion)
    - Timing of interruption of anti-thrombotic therapy can differ greatly among agents that affect hemostasis (e.g., NSAID vs vitamin K antagonist vs DOAC vs antiplatelet, etc.)
- Determine whether or not patient requires bridging therapy if anticoagulation is interrupted
- Determine a tentative plan for anti-thrombotic initiation or resumption post-operatively
- Perioperative anticoagulation plan should be developed in conjunction with surgeon

Intraoperative (Day of Surgery):

- Surgery may be delayed or cancelled if perioperative plan is not in place for patients taking certain anticoagulant medications (reversal of anticoagulants would be necessary in the setting of urgent/emergent procedures)
- Risk of epidural hematoma is increased with epidural placement/removal and concurrent use of some types of anticoagulation therapy. Ensure anesthesia team is aware of anticoagulation plan
- Assess risk for development of perioperative VTE; weigh risk vs benefit of mechanical vs pharmacologic VTE prophylaxis

Postoperative:

- Communicate with anesthesia team regarding anticoagulation management in the setting of neuraxial (epidural, spinal, paravertebral) anesthesia and analgesia
- Implement post-operative anticoagulation plan as appropriate
- Provide patient education surrounding anticoagulation management

Diabetes Mellitus

HbA1c Testing in Patients with Diabetes during Preoperative Clinic Visit

Consensus Recommendation
Consider obtaining a preoperative HbA1c, if not done in the past three months, on patients with known diabetes during preoperative clinic visit. **Establish a plan for management of diabetes prior to surgery. The decision to proceed with surgery or postpone surgery based on preoperative HbA1c should be based on individual patient centered factors such as urgency of planned surgery, overall mortality/morbidity risks, risks of perioperative infections, concerns for postoperative glucose control, and patient compliance.**
Benefit: HbA1c and especially glucose levels affect patient's outcomes during surgery. It is beneficial to test preoperatively to understand the baseline and provide this information to surgeons. This would help surgeons guide and individualize their decision-making regarding whether to go ahead or delay surgery based on this information in conjunction with other risk factors. **Harm:** The evidence is not established on optimal way to test for hyperglycemia during preoperative phase in surgical patients. The patient may undergo multiple tests which increases patient visits and cost. **Benefit-Harms Assessment:** Potential to prevent harm to patients by testing (using either HbA1c or glucose values) is greater than the harms of increased visits and cost, therefore, testing should be pursued.
Relevant Resources: *ADA-Diabetes Care in the Hospital, 2019 (Guideline); van den Boom, 2018 (observational study); NICE, 2016 (Guideline); Yang, 2016 (observational study); Gustafsson, 2009 (observational study)*

Intraoperative and Postoperative Glycemic Control Targets for Patients with Diabetes

Recommendation	Quality of Evidence
Consider a glycemic target range between 140-180 mg/dL for surgical patients with diagnosed diabetes during the intraoperative and postoperative periods. **Additional considerations:** **1. For patients with diabetes with glucose levels naturally <140, do not treat to 140.** **2. Ensure patient's risk for hypoglycemia is considered if necessary to treat for glycemic targets lower than 140.**	Quality of Evidence: Low Strength of Recommendation: Weak
Benefit: Elevated post-operative glucose has been associated with several adverse outcomes including wound infection, pneumonia, sepsis, and cardiovascular events **Harm:** Individual patients may need different targets, depending on their medical comorbidities. **Benefit-Harms Assessment:** While it is critical to always individualize targets to each patient, we believe that 140-180 mg/dL reflects a reasonable target range that avoids the potential for hypoglycemia but also will mitigate adverse post-operative outcomes related to glycemic control.	
Relevant Resources: *Nair, 2016 (observational study); Sathya, 2013 (meta-analysis); Buchleitner, 2012 (systematic review); Gandhi, 2007 (randomized controlled trial); Ata, 2010 (observational study); Ramos, 2008 (observational study)*	

Preoperative Testing during Clinic Visit

In the preoperative setting, the HbA1C may be used to alter diabetes management, with the aim of reducing postoperative morbidity and mortality. However, there is uncertainty regarding the optimal timing of the test in individuals known to have diabetes (*NICE, 2016*).

Studies have shown a positive association between preoperative HbA1c and postoperative glucose levels (*Yang, 2016; Gustafsson, 2009*). Evidence on how HbA1c directly affects outcomes such as mortality is less clear.

A retrospective analysis of 6,684 noncardiac and 6,393 cardiac surgeries in patients with diabetes found that although A1c was positively associated with perioperative glucose, it was not associated with increased 30-day mortality after controlling for glucose. Perioperative glucose predicted 30-day mortality, linearly in noncardiac and nonlinearly in cardiac procedures (*van den Boom, 2018*). However, there have been a few low quality retrospective studies that found an association between poorly controlled HbA1c (>7%) and postoperative complications such as infections and mortality (*NICE, 2016*).

While not specific to perioperative patients, the ADA recommendation on patients admitted to the hospital is to perform an HbA1c on all patients with diabetes or hyperglycemia (blood glucose >140 mg/dL) admitted to the hospital if not performed in the prior three months. Specific to patients undergoing surgery, the 2016 NICE guideline recommends that people with diabetes who are being referred for surgical consultation from primary care should have their most recent HbA1c test results included in their referral information and to offer HbA1c testing to people with diabetes having surgery if they have not been tested in the last three months (*NICE, 2016*).

The consensus of the ICSI work group is to consider obtaining a preoperative HbA1c, if not done in the past three months, on patients with known diabetes during preoperative clinic visit.

Establish a plan for management of diabetes prior to surgery. The decision to proceed with surgery or postpone surgery based on preoperative HbA1c should be based on individual patient centered factors such as urgency of planned surgery, overall mortality/morbidity risks, risks of perioperative infections, concerns for postoperative glucose control, and patient compliance.

Intraoperative and Postoperative Glycemic Control

The consensus of the ICSI work group is to consider a glycemic target range between 140-180 mg/dL for surgical patients with diagnosed diabetes during the intraoperative and postoperative periods. Additionally, given the complexities and wide variety of methodologies employed to achieve glycemic control, individual patient evaluation and instruction are required prior to surgery to avoid extremes in glucose levels. Therefore, the following additional considerations should be taken: 1) For patients with diabetes with glucose levels naturally <140, do not treat to 140, and 2) Ensure patient's risk for hypoglycemia is considered if necessary to treat for glycemic targets lower than 140.

Hyperglycemia in the perioperative period is associated with several adverse outcomes including wound infection, pneumonia, sepsis, and cardiovascular events (*Kwon, 2013*). In evaluating glucose control, there is evidence that evaluates the perioperative period as a whole while other evidence specifically looks at the intraoperative and postoperative periods, respectively. The lack of robust, high-quality evidence, including inconsistently defined populations and varied methodology, make it challenging to understand if intraoperative glycemic goals should be different than postoperative glycemic goals.

Perioperative Period in General

The evidence shows that although an optimal target glucose range remains unknown for patients with diabetes, there is general consensus that adequate glycemic control, without hypoglycemia and excessive hyperglycemia, results in better surgical outcome.

- A 2013 meta-analysis of six randomized trials and cohort studies found that in patients with diabetes, a moderate peri-operative glycemic target (150-200mg/dl) is associated with reduction in postoperative mortality and stroke compared with a liberal target (>200mg/dl), whereas no significant additional benefit was found with more strict glycemic control (<150mg/dl) (*Sathya, 2013*).
- A 2012 systematic review of 12 randomized trials looking at perioperative glucose management in diabetic patients undergoing surgery found no significant difference in infectious complications, renal failure, cardiovascular events, and all-cause mortality between intensive glucose control and conventional glucose control groups (as defined by individual authors). It found that intensive glycemic control was associated with an increased risk of hypoglycemic episodes (*Buchleitner, 2012*).

Intraoperative period

Intraoperative hyperglycemia has been found to be associated with adverse surgical outcomes, but the benefits of intensive glucose control during this period are uncertain (*Simha, 2019*). A cohort study of adult surgery patients (both diabetic and non-diabetic) who required intraoperative glucose management found that a higher intraoperative glucose level is associated with a higher postoperative glucose level. Initiating insulin infusion when intraoperative glucose level exceeds 140 mg/dL to prevent hyperglycemia is associated with lower postoperative glucose levels and fewer incidences of postoperative hyperglycemia, however, patient- and procedure-specific variable interactions also play a role and may impact the relationship between intraoperative and postoperative glucose levels (*Nair, 2016*). Specific to glucose control ranges, a 2007 randomized trial of intensive insulin infusion therapy to maintain blood glucose in the normal range of 80

to 100 mg/dL in patients with and without diabetes undergoing cardiac surgery was not found to favorably influence postoperative complications and may be associated with greater harm (*Gandhi, 2007*).

Postoperative period

A retrospective study of 995 patients (with and without diabetes) who had undergone general and vascular surgery that evaluated the association of perioperative hyperglycemia and postoperative infections found that postoperative hyperglycemia increased the risk of infections by 30% with every 40-point increase from normoglycemia (<110 mg/dL). Longer hospitalization for patients with postoperative hyperglycemia from 110 to 200 mg/dL and >200 mg/dL (Ramos, 2008). Furthermore, a retrospective medical record review of 2,090 general and vascular surgery patients with and without diabetes found that postoperative hyperglycemia may be the most important risk factor for surgical site infections (*Ata, 2010*).

Medications

Oral Hypoglycemics

This ICSI Work Group agrees with the American Society of Anesthesia (ASA) recommendations on perioperative management of oral hypoglycemics with qualifications. These recommendations are from Perioperative Hyperglycemia Management: An Update (*Duggan, 2017*).

Oral Medication Use the Day Before and the Day of Surgery

Of note, ASA gives two separate recommendations for the day of surgery. The first recommendation applies to patients with reduced post-operative oral intake OR extensive surgery with anticipated hemodynamic changes and/or fluid shifts. We believe this will apply to a majority of surgeries. The second recommendation is if normal intake is anticipated the same day AND it is a minimally invasive surgery.

Secretagogues:

1. Day Before Surgery: TAKE
2. Day of Surgery if Reduced Post-Operative Oral Intake OR Extensive Surgery with anticipated HD changes and/or fluid shifts: HOLD
3. Day of Surgery if Normal Oral Intake Anticipated Same Day AND Minimally Invasive Surgery: HOLD

SGLT-2 Inhibitors:

1. Day Before Surgery: HOLD
2. Day of Surgery if Reduced Post-Operative Oral Intake OR Extensive Surgery with anticipated HD changes and/or fluid shifts: HOLD
3. Day of Surgery if Normal Oral Intake Anticipated Same Day AND Minimally Invasive Surgery: HOLD

Thiazolidinediones

1. Day Before Surgery: TAKE
2. Day of Surgery if Reduced Post-Operative Oral Intake OR Extensive Surgery with anticipated HD changes and/or fluid shifts: HOLD
3. Day of Surgery if Normal Oral Intake Anticipated Same Day AND Minimally Invasive Surgery: TAKE

Metformin

1. Day Before Surgery: TAKE (HOLD if patient having a procedure with IV contrast dye administration, particularly in those with GFR<45 milliliters/minute)
2. Day of Surgery if Reduced Post-Operative Oral Intake OR Extensive Surgery with anticipated HD changes and/or fluid shifts: HOLD
3. Day of Surgery if Normal Oral Intake Anticipated Same Day AND Minimally Invasive Surgery: TAKE (HOLD if patient having a procedure with IV contrast dye administration, particularly in those with GFR<45 milliliters/minute)

DPP-4 Inhibitors

1. Day Before Surgery: TAKE
2. Day of Surgery if Reduced Post-Operative Oral Intake OR Extensive Surgery with anticipated HD changes and/or fluid shifts: TAKE
3. Day of Surgery if Normal Oral Intake Anticipated Same Day AND Minimally Invasive Surgery: TAKE

Insulin Therapy

For surgical patients with type 2 diabetes managed at home by diet, oral hypoglycemics or very low dose insulin (less than or equal to 0.4 units/kg), in-hospital management with a basal-bolus regimen has been shown to be more effective than supplemental correction sliding-scale insulin alone. A randomized trial of 211 patients with type 2 diabetes undergoing general surgery found basal-bolus treatment with glargine once daily plus glulisine before meals improved glycemic control and reduced hospital complications compared with sliding scale insulin (*Umpierrez, 2011*). An observational study of 150 diabetic patients using a once daily evening insulin glargine regimen found that the percent of normal insulin dose given the evening before surgery directly impacts perioperative glucose levels. More specifically, patients taking 60%-87% of their usual dose the evening before surgery were likely to arrive in target blood glucose range with decreased risk for hypoglycemia with the optimal dose around 75% of normal dose (*Demma, 2017*). Both studies looked at the perioperative period.

This ICSI Work Group agrees with the American Society of Anesthesia (ASA) recommendations on how to adjust insulin regimens the day prior and the day of surgery for patients on insulin at home prior to surgery. These recommendations are from Perioperative Hyperglycemia Management: An Update (*Duggan, 2017*).

Day before surgery insulin regimens

Glargine or Detemir

- Normal Diet until Midnight (includes those permitted clear liquids until two hours prior to surgery): Usual dose for AM dose; 80% of Usual dose for PM dose.
- Bowel Prep (and/or clear liquids only 12-24 hours prior to surgery): Usual dose for AM dose; 80% of Usual dose for PM dose.

NPH or 70/30 insulin

- Normal Diet until Midnight (includes those permitted clear liquids until two hours prior to surgery): 80% of usual dose for AM dose; 80% of usual dose for PM dose.
- Bowel Prep (and/or clear liquids only 12-24 hours prior to surgery): 80% of usual dose for AM dose; 80% of usual dose for PM dose.

Lispro, aspart, glulisine, regular

- Normal Diet until Midnight (includes those permitted clear liquids until two hours prior to surgery): usual dose for AM dose; usual dose for PM dose.
- Bowel Prep (and/or clear liquids only 12-24 hours prior to surgery): usual dose for AM dose; usual dose for PM dose.

Non-Insulin Injectables

- Normal Diet until Midnight (includes those permitted clear liquids until two hours prior to surgery): Usual dose for AM dose; Usual dose for PM dose.
- Bowel Prep (and/or clear liquids only 12-24 hours prior to surgery): Hold when starting clear liquid diet/bowel prep for AM dose; Hold when starting clear liquid diet/bowel prep for PM dose.

Day of surgery insulin regimens

Glargine or Detemir

- 80% of usual dose if patient uses twice daily basal therapy

NPH or 70/30 insulin

- 50% of usual dose if BG 120mg/dL*; Hold for BG < 120mg/dL

BG=Blood Glucose

*6.6 mmol/L

Lispro, aspart, glulisine, regular: Hold

Non-insulin injectables: Hold

3. Opioid Management

Introduction

A 2015 national survey by U.S. Department of Health and Human Services found that estimated 91.8 million (37.8%) of U.S. adults used prescription opioids; 11.5 million (4.7%) misused them; and 1.9 million (0.8%) had an opioid use disorder. Among adults with prescription opioid use, 12.5% reported misuse; of these, 16.7% reported a prescription opioid use disorder. The most common reported reason for misuse was to relieve physical pain (63.4% of respondents) (*Han, 2017*).

These statistics emphasize a need to improve evidence-based pain management and approach to opioid prescribing. Improving and disseminating evidence-based practices on perioperative opioid management is an important step in combatting the opioid crisis.

Scope

The ICSI Perioperative Opioid Management guideline addresses the entire continuum of perioperative opioid management (preoperative, intraoperative and postoperative) for patients aged 18 years and older undergoing elective surgery.

The guideline is divided into following sections:

Preoperative:

1. Preoperative Engagement and Education
2. Preoperative General Risk Assessment
3. Preoperative Considerations: Opioid Naïve Patients and Patients on Opioids Preoperatively (including Chronic Opioid Use)

Intraoperative:

4. Intraoperative Considerations: Pre-incision and Post-Incision

Postoperative:

5. Postoperative Opioid Management and Prescribing: General Considerations
6. Postoperative Opioid Prescribing and Management: Opioid Naïve Patients and Patients on Opioids Preoperatively (including Chronic Opioid Use)
7. Additional Information: Naloxone, Opioids Storage and Disposal, Opioids and Driving

Perioperative Considerations for Patients with Opioid Use Disorder (OUD)

Preoperative

Preoperative Engagement and Education

Patient Engagement and Education

Post-operative pain control is an important outcome, however pain control with opioids needs to be weighed against the medical risks of opioids. It is important to educate patients about pain and opioids before the procedure. Common misconceptions that overestimate the risk of adverse effects and addiction should be dispelled. The information should include anticipated healing time based on the procedure, consistent messaging that the pain is normal and an expected part of the recovery process and information on options for opioid safe use and disposal. (*Apfelbaum, 2012*) (see the postoperative section).

Setting Realistic Goals and Expectations

Understanding the expectations of the patient in regard to his or her treatment plan and care goals are critical to establishing clear goals for surgery and to manage expectations for surgical outcomes. Unrealistic goals jeopardize the patient's participation in the care plan and could lead to disengagement. Consistent message related to the goal of improving function vs. treating a pain score are important. Complete elimination of pain is often unrealistic, but setting functional goals regardless of pain level is reasonable and prudent.

Care goals should be determined by the patient within a shared decision-making process with their primary care provider who is performing the preoperative health screening and assessment. The patient's role in creating a plan is essential. The perioperative care team should allocate appropriate time for understanding the patient's preferences and to develop a mutually accepted plan of care or treatment. A shared-decision-making conversation allows the patient to have a clear understanding of their individual risk profile, the risks and benefits associated with the surgical interventions, and an exploration of their values and goals. Additionally, within this process, patients should be well aware of the recommended guidelines for opioid prescribing in regard to duration and dosage.

Care Plan

In order to determine which treatment choices are most appropriate for a patient with pain, the clinician and patient need to consider the following questions when creating a care plan:

1. What is the severity of pain, and how does it affect quality of life and functional status? Use a functional assessment tool to help with assessment.
2. What is the diagnosis and mechanism of the pain?
3. Are there physical and/or behavioral comorbidities that will affect recovery?
4. What are the goals of treatment as determined by the patient and family?
5. What therapy options are available to the patient?
6. What is the patient's capacity to follow a treatment plan, and what will be the burden to the patient or family to follow that plan?
7. What are misconceptions do the patient or family have related to the use of opioids?
8. What are other barriers (financial, housing, employment, lifestyle, transportation, support network and other social determinants) that might interfere with successful treatment?

Provider Education

The provider charged with preoperative health screening and assessment should be aware of the following to help optimize the management of perioperative pain in their patients:

- Have a standard approach or checklist to assess for risk of adverse events (including risk for chronic opioid use) in patients for whom opioids are considered for pain control perioperatively.
- Awareness of the alternative non-opioid modalities for the treatment of perioperative pain.
- A multidisciplinary team that includes primary care provider, pain management specialist and surgical team should be created prior to surgery for patients with complex needs, such as patients with chronic pain, long-term opioid use, or opioid use disorder. This approach incorporates biopsychosocial effects on the medical condition (*Gatchel, 2014; Gatchel, 2007*) and has shown to reduce pain severity, improve mood, overall quality of life for patients with chronic pain. (*Oslund, 2009; Gatchel, 2007; Gatchel, 2006*).

Primary care providers, surgeons, and pain specialists should remain current on postoperative opioid prescribing literature and guidelines. The MN Health Collaborative has established standards for postoperative opioid prescribing (see Call to Action). Each patient is unique, and there is growing evidence that using a procedure-specific, patient-centered approach to the use of postoperative opioids provides optimal pain control, reduces unused opioids in the community, and maintains patient satisfaction. Research shows that a one-size-fits-all approach creates a risk for over- or -under prescribing and does not sufficiently curtail the quantity of opioids given postoperatively. (*Bicket, 2017; Osmundson, 2017*). Studies have found that more than up to 80% (depending on the study) of patients report unused opioids and 42-71% (depending on the study) of pills dispensed went unused after surgery (*Feinberg, 2018; Tan, 2018; Batemen, 2017; Bates, 2011; Bicket, 2017; Osmundson, 2017*)

Health care systems can support this by providing data regarding opioid prescribing practices for postoperative pain to promote transparency to understand patients' postoperative opioid needs.

Finally, continuous communication regarding opioids is needed among primary care provider, surgeon, hospitalist, and pain specialist. As the pharmacology around MAT and opioid is complex and continues to

evolve, working with a pharmacist to develop and implement protocols surrounding management of opioid medications can be beneficial. They can also perform medication reconciliation, guide medications decisions, and oversee medication dispensing.

Preoperative General Risk Assessment

In recent years, many medical effects of initiating opioids in opioid naïve patients have been described that warrant consideration prior to an elective surgery. The dose of opioids prescribed postoperatively during the inpatient stay clusters with many undesirable outcomes: longer hospital stays, increased readmission rate, increase mortality rate, increased chance of health care facility disposition, and increased total cost of care (*Shafi, 2018*). The opioid dose likely does not cause all of these unwanted outcomes, but may contribute to them. It is reasonable from this association (in light of the other information in this document) to conclude that excessive opioid dosing postoperative may lead to worse outcomes.

Risk Assessment & Intervention

Prior to surgery, patients should have an individualized assessment of their opioid risk. This will more realistically counsel the patient, may guide choice of opioids, and may improve the outcome of the surgery. The OPERATED is a tool for evaluating patient risks, developing a plan, and providing patient education in the preoperative and post-operative periods. **Consider using the OPERATED for elderly patients, patients with renal or pulmonary compromise, patients with serious psychiatric diagnoses including substance use disorders, and for any patient wishing to understand opioid-related risks.**

Opioid Problems (OUD, OD, COAT)

Psychiatric Comorbidities

Elimination of Drug

Respiratory Compromise

Adverse Reactions, Expected

Trouble Medications

Early Mobility and falls

Delirium

Opioid Use Disorder, Overdose & Ongoing Opioid Use Without Addiction

What is the risk that the patient develops a new opioid use disorder (addiction) after the surgery?

Opioid use disorder (OUD) is often not recognized, diagnosed and charted in a timely manner. OUD carries great morbidity and mortality but also has effective treatments (*Pierce, 2016; Volkow, 2014*). It is therefore challenging to discuss OUD with patients. Counseling patients on possible outcomes of opioid prescriptions requires that the provider him or herself review the diagnostic criteria of OUD (*Hasin, 2013*). OUD is also a challenging outcome to study. A recent study attempted to measure OUD in opioid naïve patients exposed to opioids after surgery. The incidence of OUD was 0.2% postoperatively. The most important risk for OUD was duration of opioids: with each additional week of opioids, the risk of OUD increased 20% (*Brat, 2018*). Preexisting substance use and mental health disorders also increased the risk of OUD. A timely discontinuation of postoperative opioids is the most likely way to mitigate risk of OUD.

Standard risk tools such as the Opioid Risk Tool are used to predict opioid misuse, but poorly predict OUD (*Klimas, 2019; Volkow, 2016*) Risk assessment tools should not be used to determine the indication or dose of opioids; these tools inform the intensity of monitoring required. Risk tools may also facilitate shared decision-making with the patient. Note that the prevalence of OUD in the community is 1%, and it is often

not disclosed or recognized in the preoperative visit. (*Han, 2017*) Thus a postoperative diagnosis of OUD may have predated the surgery. Timely recognition of OUD will improve surgical outcomes. The TAPS tool for diagnosis of opioid use disorder may help recognize opioid use disorder in an outpatient setting (*Mcneely, 2016*).

How do I predict if my patient will overdose from opioids?

Past overdose is powerful predictor of future overdoses. Many patients who are hospitalized with a nonfatal overdose resume opioids, and this puts them at elevated risk of fatal overdose and increased all-cause mortality (*Olfson, 2018; Larochelle, 2016*). A new screening tool to predict opioid overdose may prove useful: The Risk Index for Overdose or Serious Opioid-induced Respiratory Depression, or RIOSORD, accounts for medical and psychiatric comorbidities and prescription characteristics to generate a risk score that predicts chance of overdose (*Zedler, 2018*). This risk can be incorporated into the preoperative assessment with prescription recommendations to avoid adding further risk. An additional safeguard is provision of a naloxone rescue kit to the patient with instruction, however state law governing naloxone prescription varies. Several strategies can be used to mitigate the risk of overdose, and must be weighed again appropriate treatment of pain (*Babu, 2019*)

How do I prepare my patients with an established diagnosis of opioid use disorder for surgery?

Patients with opioid use disorder (OUD) can successfully undergo surgery. Patients with OUD have a wide spectrum of clinical stability: they may be stable and in long term remission, possibly on medication, or may be unstable and actively using intravenous drugs. This difference will clearly affect surgical outcomes. It is important first to ascertain if the patient is in treatment. Obtain a release of information and contact the treatment provider. Medications are an important component of recovery in OUD and should be carefully managed in the perioperative period, as reviewed elsewhere in this document (*Alford, 2006*). Consider obtaining a urine drug screen, or reviewing the urine drug screen record with the addiction provider. It is critical to assess for recent IV drug use in OUD patients in the preoperative interview. Active IV drug use may require the surgery to be postponed. A focused addiction consultation may help assess the preoperative risk of drug use, and may help direct the postoperative use of opioid analgesic.

What is the patient's risk of continuing on opioids long-term after a surgery?

Do not prescribe opioids unless clearly indicated based on the surgery. Opioid naïve patients who receive opioid prescriptions after a cataract removal remain on opioids one year later 7% of the time, 490% above baseline (*Alam, 2012*). Healthy adolescents prescribed opioids for minor procedures, such as dental extractions, have a 30% increased relative risk of misusing opioids (*Miech, 2015*). The presence of unused opioids in the home is itself a risk factor for someone in the household using opioids illicitly (*Seamans, 2018*). Most patients have unused opioids after surgery (*Bedard, 2018; Bates, 2011*). Therefore, in any instance were opioids are not routinely needed after a surgery, they should not be prescribed.

Postoperative short-term prescriptions may lead to chronic opioid use in patients who were opioid naive prior to the surgery. These patients do not meet criteria for opioid addiction. The likelihood of chronic opioid use after an acute pain episode is linearly dose-dependent on the opioid exposure (*Shah, 2017*). The opioid exposure that predicts chronic use is the sum of the total opioids in the course of acute pain treatment (called total morphine milligram equivalent [MME]). Mental health comorbidities increase the risk of ongoing opioid use: depression and anxiety, use of antidepressants and benzodiazepines, substance use disorders, tobacco use. Average rates of ongoing opioid use after surgery is 6% at three months after the surgery and 1.5% one year after the surgery (*Brummett 2017; Sun, 2016; Carroll, 2012*). Sun et al, 2016 article provides relative risks associated with ongoing opioid use that can be used to individualize an assessment, and incorporated in the preoperative evaluation (e.g. the relative risk for ongoing opioid use is 1.8 for patients also prescribed benzodiazepine) (*Sun, 2016*).

Psychiatric Comorbidities

Patients with mental health disorders deserve full proper analgesia. They will need clearer expectations set on dosing and more careful monitoring. "As needed" opioids may reduce the total opioid taken in the typical patient, but can create a confusing dynamic for patients with mental health disorders. More clear and specific directions should be provided.

Patients with anxiety may wish to receive opioids in anticipation of feared pain. They may have had bad experiences with pain control in the past, prompting them to overestimate their pain. Anxious patients should have clear reassurance that their providers are their ally managing postoperative pain. They should be educated of the normal expected course of pain. Anxious patients may feel anxiolytic relief from opioids. This is normal and unavoidable. However, providers should be carefully coach anxious patents.

More serious mental health disorders pose a higher risk when initiating opioids (*Davis, 2017; Volkow, 2016*). Patients with post-traumatic stress disorder or patients with adverse childhood experiences are very high risk for opioid misuse and addiction. Patients with eating disorders and obsessive-compulsive disorders are similarly high risk, but less studied.

Behavioral health status of the patient should be thoroughly vetted and screening tools can be used as an aid. If conditions are under poor control, therapies should be initiated prior to surgery if possible.

Elimination and Drug Interactions

Renal impairment is the most important limiting factor when choosing an opioid. Most opioids are cleared at least in part by the kidneys. In anyone other than young healthy patients, providers should have a recent measurement of renal function before prescribing an opioid. If the glomerular filtration rate is less than 60, consult a pharmacist before deciding on an opioid. (*Dean, 2004*)

Respiratory Compromise (and Immunocompromise)

Opioids suppress dyspnea, decrease ventilation, relax the muscles of the upper airway and reduce the gag reflex, and therefore cause a number of respiratory effects important in the perioperative period. Opioids in an opioid naïve patient will worsen sleep apnea, hypoventilation syndromes and oxygenation in any patient already predisposed to these issues (*Mador, 2014*). Unrecognized obstructive sleep apnea increases the risk of death and heart failure after noncardiac surgeries, possible related to opioid exposure (*Chan, 2019*). Observation in the postoperative period may reveal apneic episodes in patients without an established sleep apnea diagnosis. Initiating opioids in an opioid naïve patient with COPD doubles the mortality from pulmonary causes (*Levine, 2017; Vozoris, 2016*). Opioids are associated with an increased risk of pneumonia, including invasive pneumococcal disease, and opioid prescriptions are overrepresented in deaths from pneumonia. (*Wiese, 2018; Hall, 2017*) The cause of the increase in pneumonia is not known but may be due to immunosuppression or aspiration (*Wiese 2019*). The effect of opioids on other causes of respiratory compromise—heart failure or asthma—are uncertain, but it can be surmised that if the patient is clinically stable, the patient can tolerate opioids. For patients hospitalized after a surgery, they can easily be observed for respiratory complications. However, outpatient surgeries for opioid naïve patients with a respiratory illness may require educating the patient and family, and provision of a naloxone kit. It should be emphasized that the relative risks of respiratory events due to postoperative opioids may be large, but the absolute risk remains small.

Adverse Reactions, Expected

Urinary retention is a common and underestimated adverse effect of opioids, especially given the risk of urinary tract infection postoperatively, and the importance of minimizing unneeded urinary catheters. Patients with preexisting urinary retention may particularly struggle.

Opioid-induced constipation results from decreased bowel motility and decreased mucosal secretions. Colace or fiber is not adequate treatment or prevention of opioid induced constipation. Senna may help situate the bowel but is often not sufficient if the stool is dry. Polyethylene glycol is a good agent to treat opioid induced constipation. Patients will often become nauseated when receiving opioids. This can be easily diagnosed and treated with traditional antiemetics as long as the provider is aware.

Patients will often develop pruritis on opioids. Antihistamines may reduce the pruritus but some antihistamines have an anticholinergic effect which may interact with the sedating effect of the opioids. Consider loratadine or cetirizine or fexofenadine before agents such as diphenhydramine.

It is important to distinguish true allergic reaction vs adverse reaction when choosing opioid therapy for patients. If a true, IgE mediated allergic reaction (hives, anaphylaxis) is documented, patients often tolerate opioid therapy from a different structural class. Expected adverse reactions to opioids are common and can be managed with a variety of medications.

Trouble Medications: Tramadol, Meperidine, Methadone, Codeine, Long Acting Opioids and Benzodiazepines

Tramadol, tapentadol and meperidine lower seizure threshold (*Manninen, 1997*). This epileptogenic effect is exaggerated in renal failure and for those with preexisting seizure disorder. In such patients these medications should be avoided. Postoperatively, Tramadol carries an increased risk of ongoing opioid use compared to other opioids (*Thiels, 2019*). There is a black box warning against use of tramadol in children under twelve years of age and against use in breastfeeding women (https://www.fda.gov/drugs/drug-safety-and-availability/fda-drug-safety-communication-fda-restricts-use-prescription-codeine-pain-and-cough-medicines-and). Meperidine increases the risk of serotonin syndrome.

Many opioids prolong the QT interval, and in some instances, arrhythmias result. QT prolongation is multifactorial, typically resulting from other medications, electrolyte abnormalities, and bradycardia, and individual susceptibility. For patient with a long QT interval, consult with a pharmacist before initiating opioids to avoid exacerbating the risk. Methadone in particular is problematic in prolonging QT interval.

The Food and Drug Administration has issued a black box warning against using codeine in children of any age after surgery, specifically after tonsillectomy and/or adenoidectomy and against use in breastfeeding women (https://www.fda.gov/drugs/drug-safety-and-availability/fda-drug-safety-communication-fda-restricts-use-prescription-codeine-pain-and-cough-medicines-and). This is due to fact that many people are ultra-rapid metabolizers of codeine, leading to the rapid buildup of the active metabolite, and there for unexpected respiratory suppression. This effect this not unique to children: any patient may have respiratory suppression from codeine from this mechanism.

Long-acting opioids should not be initiated for acute pain. Even in chronic pain, long acting opioids are associated with increased mortality, including increased cardiovascular and pulmonary mortality (*Ray, 2016*). The CDC has warned against use of methadone for pain due to its pharmacologic variability (*Faul, 2017; Dowell, 2016*).

Benzodiazepines add risk of overdose, addiction, and ongoing use, and should be used sparingly and cautiously in combination with opioids in the postoperative period (*Hozack, 2019*).

Early Mobility and Falls

Opioids are associated with a 4.5-fold increase risk of falls and double the mortality in elderly patient compared to NSAIDs (*Solomon, 2010*). The highest risk opioid to cause falls is codeine; the lowest risk opioid to cause falls is tramadol. The first two weeks after initiating opioids is the highest risk (*O'Neil, 2012; Miller, 2011; Buckeridge, 2010*). While opioids are necessary, early mobilization is also critical. For hospitalized patients, a physical therapist should be able to assess safety, and should do so aware of the

relationship of the assessment to the most recent opioid dose: the patient's safety assessment my change after they have taken an opioid. For outpatient surgeries careful explanation of the risk of falls is important, and planning to minimize fall risk could help.

Delirium

Delirium is a possible outcome after any surgery and is usually multifactorial. Postoperative delirium occurs in 16-35% of patients (*Leung, 2009; Morrison, 2003*). Pain itself causes delirium; patients receiving very low doses of opioids after hip replacement are at significant increased risk of delirium. Yet opioids themselves also contribute to delirium (*Swart, 2017; Clegg, 2010; Morrison, 2003*). Meperidine is and tramadol may be more associated with postoperative delirium than other opioids, whereas fentanyl and hydromorphone are less associated (*Swart, 2017*). One possible explanation for tramadol and meperidine's higher risk and fentanyl and hydromorphone's lower risk is that the former medications are not safe in renal impairment while the latter medications are. To further minimize the risk of delirium, polypharmacy and excessive sedation should be avoided, particularly by not starting benzodiazepines or using anticholinergic antihistamines (*Clegg, 2010*). Medical causes of delirium should be ruled out. Postoperative delirium will never be completely eliminated. But by treating pain prudently, while minimizing unneeded opioids, avoiding benzodiazepines and anticholinergic medications, the risk and severity of postoperative delirium may be diminished.

Preoperative Considerations: Opioid Naïve Patients and Patients on Opioids Preoperatively

Preoperative Opioid Use (including Chronic Preoperative Opioid Use) and Surgical Outcomes

Preoperative Opioid Use (General)

When looking at evidence on the postoperative outcomes of patients on perioperative opioids, the definition of preoperative opioid use varied across studies. The definitions ranged from any opioid use document for any reason in the medical record prior to surgery to more specific timeframes defined by each study. Because of this broad definition of perioperative opioid use, it is hard to draw definitive conclusions. Additionally, there is variation among studies on inclusion into analysis of medical and mental health comorbidities (mood, anxiety), personality disorders, trauma and substance use disorders comorbidities (some studies looked at impact of this and others did not). However, in general, the literature shows that compared to opioid naïve, patients with preoperative opioid use (even after controlling for certain medical and mental health comorbidities in studies that included it) have worse postoperative outcomes such as patient-reported physical and mental health outcomes including pain and function scores, higher likelihood of long-term opioid use, increased discharges to rehabilitation facility instead of home, length of stay, readmission rates, higher rates of surgical site infections, and revisions. In general, the literature comprises mostly of patients undergoing orthopedic surgeries, particularly primary total joint arthroplasty (e.g. knee and hip).

A systematic review and meta-analysis found that patients with preoperative opioid use had worse postoperative patient-reported outcomes regarding their pain and function when compared to those with no preoperative opioid use. All studies in the review reported that opioid users had worse preoperative mental health when compared to opioid-naïve patients. (*Goplen, 2019*). Findings from large single studies (>1,000 patients per study) show increased rates of postoperative complications (e.g. infections), length of stay, discharges to rehabilitation, readmissions, and surgical revisions among those with preoperative opioid use. One study showed that those taking opioids preoperatively were more likely to become chronic opioid users postoperatively compared to opioid-naïve (*Blevins Peratikos, 2019; Bell, 2018; Politzer, 2018; Zarling, 2017*). Findings from studies with <1,000 patients show preoperative opioid use was the largest independent predictor of increased postoperative opioid use and worse physical and mental health outcomes compared to opioid naïve (*Bonner, 2019; Berglund, 2018; Rozell, 2017*).

Studies of other types of orthopedic surgery (spine, lumber fusion and cervical fusion) followed similar outcomes as did studies of abdominal surgery (*Cron, 2017; Faour, 2017; Tye, 2017; Waljee, 2017; Issa, 2014; Lee, 2014*).

Chronic Preoperative Opioid Use

There were some studies that specifically looked at outcomes for patients with preoperative chronic opioid use (although there were differences among studies on definitions of chronic opioid use). The total body of literature is smaller compared to general preoperative opioid use. Evidence shows that patients who are chronic opioid users preoperatively have worse postoperative outcomes compared to patients who are not chronic opioid users or are opioid naïve prior to surgery. Patients with medical and mental health comorbidities (mood, anxiety) were more likely to be chronic opioid users preoperatively. However, there was variation across the studies on which comorbidities were included.

Large studies (>1,000 patients per single study) show an association between preoperative chronic opioid use and higher likelihood of long-term opioid use postoperatively, increased risk of complications (e.g. wounds, infections and constipation), ED visits, and revision surgery (*Kalakoti, 2019; Jain, 2018a; Jain, 2018b*). Findings from studies with <1,000 patients show longer length of stay, continued and persistent chronic opioid use postoperatively, and higher MED consumption compared to non-chronic opioid users and non-opioid users (*Kim, 2019; Kim, 2018; Cheah, 2017; Zarling, 2016*).

As with general preoperative opioid use, the definitions of chronic opioid use varied across studies. None of the studies included patients who have opioid addiction. In general, the literature comprises mostly of patients undergoing orthopedic surgeries, particularly, total knee, shoulder arthroplasty, cervical spine fusion, and lumbar spine fusion).

Preoperative Tapering

While the evidence overwhelmingly shows worse patient outcomes postoperatively for patients who are either on opioids preoperatively or chronic opioid users, there is less evidence showing whether tapering or weaning prior to surgery helps improve surgical outcomes. However, small body of evidence that is available (summarized below) shows that postoperative outcomes (reduced risk of adverse events, reduced likelihood of revision surgery, reduced MEDs and improved pain scores and patient reported scores on physical and mental health outcomes) in weaned patients are comparable to the outcomes for opioid naïve patients. None of the available studies identified potential harms from stopping opioids or tapering.

One large study of 58,082 total knee, hip arthroplasty and posterior lumbar fusion showed that with >6 months of continuous use before surgery and stopping opioids three months before surgery (study assumption was that these two periods would mimic weaning period) seemed to reduce the risk of pain related ED visits, readmissions, infections and revision surgery within one year. The largest impact was observed in patients undergoing hip surgery and lumbar fusion (*Jain, 2019*). A study of 41 patients who regularly used opioids and successfully weaned (defined as weaning their morphine equivalent dose by 50%) prior to a total knee or hip arthroplasty had greater improvements in both disease-specific and generic measures of health outcomes (but no difference in mental health outcomes) than patients who did not wean, with outcomes similar to patients who were opioid naïve. (*Nguyen, 2016*). In this study, the weaning protocol included any of the following: self-wean, referral to pain management to help wean, or weaning under the supervision of patient's primary care provider (*Nguyen, 2016*). A case series report of six spine surgery patients who were preoperative opioid users and underwent preoperative opioid reduction program for an average of 6-8 weeks found a decrease in daily MED, and decrease in pain score in all five patients, but one who had a surgery related complication. All patients had improvements in mental health outcomes such as depression, anxiety and fatigue. Satisfaction with participation in social roles, sleep disturbances, and physical functioning improved in most patients (*Hassamal, 2016*). The weaning protocol included individualized opioid taper regimens tailored to each patient with the goal of tapering the opioid dose by at least 10% per

week; addition of psychotropic medications as needed to treat co-morbid psychiatric disorders; attempts were made to reduce benzodiazepines and other sedative medications; Physical therapy (PT), occupational therapy (OT), as well as pain-focused cognitive behavioral therapy (CBT), were also part of the program (Hassamal, 2016).

ICSI Work Group Recommendation: Preoperative Opioid Use (including Chronic Preoperative Opioid Use)

Given the lack of uniformity in the literature on the standard definitions of preoperative or chronic opioid use and lack of more expansive literature looking at efficacy and/or harms of weaning/tapering prior to surgery, **the ICSI Perioperative Opioid Management Work Group consensus is to take an individualized approach for weaning or tapering in patients who are on opioids preoperatively.** A decision on whether to wean or taper preoperatively needs to be made well in advance of surgery. However, if a significant medical concern about opioid use is recognized closer to the surgery date which could be made safe with a taper, the surgeon, patient, and team should discuss whether delaying the surgery in order to treat the underlying condition is appropriate.

The individualized approach should take into consideration the following:

- individual patient risk factors for adverse events of continued opioid use post-surgery,
- individual patient risk factors for adverse events due stopping or tapering opioids prior to surgery,
- shared-decision-making discussions between providers and patients on the risks of continued opioid use preoperatively, which include patient education on postoperative pain expectations,
- multidisciplinary approach that focuses on opioid management and communication between primary care providers and surgical team both preoperatively and postoperatively,
- follow-up and support for patients managing pain and changes to their medication regimens.

Messaging (if Appropriate to Type of Surgery) on Postoperative Pain Control with Opioids

Following preoperative messaging to patients on postoperative pain control may be helpful:

- Some patients may not need opioids to manage pain after surgery. Some studies show that ibuprofen and acetaminophen can be more effective for pain than opioids (*Daniels, 2019; Carrier, 2018*)
- Pain after surgery, even with medications, will be present and will improve after time.
- In patients on opioids preoperatively, discuss different medication requirements for postoperative pain control due to their chronic opioid use.

Intraoperative

Intraoperative Considerations: Pre-incision and Post-Incision

The provider who is performing the preoperative assessment on risks of adverse events of opioid use perioperatively should work closely with anesthesiology staff to establish a plan of care for opioid management during intraoperative phase. The plan of care should optimize peri-procedural regional analgesia/anesthesia techniques to reduce the need for opioid use postoperatively where possible. Additionally, the plan should emphasize use of multimodal analgesia (e.g., NSAIDs and acetaminophen) when possible. This approach provides superior pain relief and decreases the need for supplemental opioid use compared to unimodal analgesia approach which in turn means that patients may only require non-pharmacologic modalities postoperatively (*Apfelbaum, 2012*).

This table provides a summary of intraoperative approaches prior to incision vs. post-incision during the surgical procedure. It is based on the American Society of Anesthesiologists Task Force on Acute Pain Management Practice Guidelines for Acute Pain Management in the Perioperative Setting (*Apfelbaum, 2012*).

Pre-Incision Medications & Techniques	Post-Incision Medications & Techniques
Acetaminophen* NSAIDs (COX-2 inhibitor) Gabapentinoids (gabapentin, pregabalin) Regional anesthesia • Neuraxial blockade - Continuous epidural analgesia Single injection spinal opiates - Paravertebral • Peripheral nerve blockade (single injection or continuous) - Upper extremity • Interscalene block • Suprascapular nerve block • Supraclavicular block • Infraclavicular block • Axillary block - Lower extremity • Lumbar plexus / fascia iliaca block • Femoral nerve block • Distal femoral triangle block • Adductor canal block • Sciatic nerve block • Popliteal (sciatic) nerve block • Selective tibial nerve block • Ankle block • IPACK blcok • Truncal / fascial plane blockade (single injection or continuous) - Erector Spinae Plane (ESP) block - PECS I, II blocks - Serratus plane block - TAP block - Rectus Sheath block - Quadratus Lumborum block	Acetaminophen* NSAIDS (ketorolac, ibuprofen) Dexamethasone Regional / local anesthesia • See pre-incision regional techniques • Surgeon-administered incision infiltration • Surgeon-administered fascial plane blocks Lidocaine, bolus plus infusion Ketamine, bolus plus infusion Dexmedetomidine, bolus plus infusion Magnesium infusion

*A note on acetaminophen: There is some early evidence showing positive preventive effect of acetaminophen given within one hour of anesthesia vs. post-incision; however, more evidence is needed to draw definitive conclusions. A 2015 systematic review and meta-analysis of seven randomized controlled trials with 544 patients aged 16 years and older including all types of surgeries looked at the relationship between acetaminophen as preventive analgesia and postoperative outcomes. Acetaminophen given preventively (defined as within one hour before induction of anesthesia) was compared to acetaminophen given after incision (any time between post-incision and within 30 minutes from the end of surgery). The review found a reduction in 24-hour opioid consumption, lower pain scores at one hour and two hours, and a lower incidence of postoperative vomiting in the preventive acetaminophen group (*Doleman, 2015*).

Postoperative

Postoperative Opioid Management and Prescribing: General Considerations

Multimodal Management

In general, multimodal pain management strategies that include use of medications from multiple therapeutic classes prioritizing non-opioid medications before administering opioid medications should be used whenever appropriate. These include: a scheduled regimen of NSAIDs, COXIBs, or acetaminophen, when appropriate and regional blockade with local anesthetics, when appropriate. These modalities may reduce pain enough to save opioids for extreme or break-through pain.

Opioid pain management techniques should be carefully planned considering individual patient factors such as age, prior exposure, mental status, and pain management history. Co-administering adjunct medications may reduce the opioid dose. Consistent messages from staff and providers related to pain management and opioid use is essential to help the patient and family understand their discharge regimen. For instance, avoid scheduled opioids or telling the patient to "stay ahead of the pain". Instead, communicate that when the patient states he or she is in pain, if it is time, they will receive medication that will take effect very quickly.

The Role of Surgical Team

Before discharge, know the patient's pre-existing health conditions that increase the risk of opioid use (see General Risk Assessment). Additionally, patients should have a functional assessment at the time they are under the influence of an opioid to determine safety, discharge equipment, and transportation, etc. This will help inform the family of patient needs, and may influence the quantity or directions for discharge opioid medications. This should be done by the surgical team.

The postoperative management of pain should also be done by the surgical team. That includes opioid refills (the surgeon knows much more about expected degree of pain and duration of pain expectations than the primary care provider). If pain seems to be longer than expected or more opioids are used than expected the patient should be re-evaluated prior to a refill being given. Finally, if the patient is not responsive to the pain management plan, the primary care clinician should engage in a further exploration of co-morbidities.

Prescription Monitoring Program (PMP)

PMP should be checked preoperatively during the preoperative exam. If not done, the surgical team should consider querying the PMP as it provides information about the patient's exposure to opioids and other controlled substances, as well as whether patients receive opioids from other prescribers. A PMP query may affect clinician decision-making on postoperative opioid prescribing. In a study looking at opioid prescribing behavior before and after a PMP query, a high proportion of prescribing decisions was changed in light of the information the PMP query provided, both decreasing and increasing the total opioid prescribed (*Gugelmann, 2011*). It is important to note that PMPs use is governed by different states' laws and not every source of opioids may be captured. It is helpful to document the results of the PMP in the medical record, both to demonstrate the physician's diligence in decision-making, and to capture outside information in the medical chart for future review.

Clear Opioid Prescription Instructions and General Messaging for Patients

All opioid prescriptions should include clear prescription instructions and information on safe disposal, restrictions for driving/ use of equipment and health risks of opioids. Patients generally do not understand "PRN" instructions. Create instructions for your patients that include how and when to decrease dose and increase the interval between doses as their pain subsides. The most common mistake is that patients take their opioids "as the doctor told them to", without really hearing that they should not take it if they don't need it.

If patients are prescribed opioids at discharge, the following are general messages for the patient:

- Don't take opioids because you think you may need them. You don't need to take an opioid pre-emptively to "stay ahead of the pain".
- Don't expect to treat your pain to a pain scale of zero (on a 0-10 scale), some pain is normal. Instead, treat to your function and ability to rehabilitate vs. your pain score.
- Take non-opioid medications as directed on a scheduled basis to control pain.
- Oral opioids work relatively quickly (15-20 minutes) and can be used effectively to manage break-through or severe pain.
- Don't be afraid to take opioids if you need them.
- Strongly recommend use of a laxative with an opioid.

Postoperative Opioid Prescribing and Management: Opioid Naïve and Patients and Patients on Opioids Preoperatively (including Chronic Opioid Use)

At the time of discharge, each patient should be considered individually when determining their home pain management. Again, the goal is improved function and controlling pain. Providers should review the preoperative history and physical to understand the patient's history with pain management and medications. It is important to understand from the patient and family what the goals are and the postoperative arrangements to support those goals.

There is growing literature looking at patterns of opioid use within the facility to determine the amount needed on discharge, if any at all (*Hill, 2018; Mark, 2018*). Due to more public information available about opioids, some patients are refusing an opioid prescription following a procedure. This should stimulate a shared decision-making dialogue to answer any misconceptions the patient or family may have about opioids. The patient's wishes should be respected and documented in the record to provide guidance should the patient change their mind.

If Opioids are Prescribed at Discharge: Considerations for All Patients

It is the consensus of this work group the postoperative opioid prescribing plan for all patients should include the following:

- Prescribed opioid doses should be individualized based on the risk of adverse events to each patient due to opioid use.
  - Refer to the MN Health Collaborative Call to Action on community standards for opioid prescribing based on the type of surgery.
- Avoid long-acting opioids.
  - Initiation of long-acting opioids can harm the patient by increasing the risk of overdose or death (*Ray, 2016; Miller, 2015; Dhalla, 2009*).
- Patients should be given the following information:
  - Expectations on length of time they would be on opioids for surgical related pain
  - Risks of the medications including overdose and death for themselves, other person/child, or pet, specifically if taken with alcohol or illegal drugs
  - Safe storage of the medications, preferably in a lock box and safe disposal instructions

- Information on opioids and driving
- Clinicians should consider offering high risk surgical patients and/or their close contacts (family/friends/caretaker) a naloxone kit.

Specific to patients on chronic opioids preoperatively:

- Preoperatively, the patient and care team should be educated that any new higher dosing of opioids for post-op pain is not the new normal. The objective is to treat surgical related pain, not chronic pain.
- The surgical team should manage tapering of any increased amount of opioids (over preoperative dose) related to the surgery.
- Patients may not need their preoperative opioid dose after surgical healing, particularly if the surgery was done to help improve the issue for which opioids were initially prescribed.
- The primary care team should evaluate continued need for opioids beyond surgical healing and offer taper of preoperative dose as appropriate. Refer to the MN Health Collaborative Guide on Tapering.

Additional Information: Naloxone, Opioids Storage and Disposal, Opioids and Driving

Naloxone

According to the CDC: (*CDC, 2018*)

- Naloxone is a medication that can reverse the sedating effects of opioids.
- Serious side effects from naloxone use are rare, but benefits during an overdose far exceed the negative risks.

According to the 2017 ICSI Pain Guideline: (*Hooten, 2017*)

- Naloxone is available in most states without a prescription and can be administered intra-nasally, intramuscularly or subcutaneously by a layperson.
- Patients who are prescribed naloxone should be directed to free online or community training courses.
- The reversal effect of naloxone may not outlast the sedating effect of many opioids, so it is recommended to activate the emergency services whenever it is used.

Opioids Storage and Disposal

According to the 2017 ICSI Pain Guideline: (*Hooten, 2017*)

- Proper storage and disposal of opioids can reduce diversion, accidental misuse and overdose.
- All patients should be instructed to store their opioids in a location, ideally locked, that is unreachable by family or house guests.
- Patients should be instructed to dispose of their unused medications promptly at the end of a pain episode.

Disposal Options

There are several options for properly disposing of unused opioid medications. According to FDA guidance, medication take-back options are the preferred way of disposal. Additionally, the U.S. Drug Enforcement Agency periodically hosts prescription take-back events at temporary collection sites.

There are authorized collection sites in the community, which often include local law enforcement facilities, retail pharmacies and hospital or clinic pharmacies that collect and dispose of unused medications. The FDA information is available at: https://www.fda.gov/drugs/resourcesforyou/consumers/buyingusingmedicinesafely/ensuringsafeuseofmedicine/safedisposalofmedicines/ucm186187.htm. The following website can be utilized to locate the nearest collection site https://apps2.deadiversion.usdoj.gov/pubdispsearch/spring/main?execution=e1s1. If no takeback programs are available, pharmaceutical disposal bags with activated charcoal can be purchased for at-home disposal. The FDA and DEA allow for opioids to be flushed down the toilet, but this method is not endorsed by the EPA.

Opioids and Driving

According to the ICSI Pain Guideline 2017: (*Hooten, 2017*)

- The sedating effects of opioids may impair one's ability to operate a motor vehicle or carry out tasks that require wakefulness and reaction time (i.e. parenting). Therefore, it is important to warn patients about the risk to themselves and others while performing potentially dangerous tasks while on opioids.
- Non-tolerant opioid users will likely experience greater impairment. Alcohol and other CNS depressants may increase these effects and should be avoided while a patient is on opioid medications. When a patient has developed tolerance to the sedating effects of opioids, studies have shown patients can safely operate a motor vehicle. Determining when the patient has developed enough tolerance is a judgment call and prescribers should err on the side of caution.
- There may also be legal implications for patients who drive while taking opioids, which can vary state to state. Local law may vary on what meets the definition of "driving under the influence" of a controlled substance, and prescribers should understand and follow local laws.

Perioperative Considerations for Patients with Opioid Use Disorder (OUD)

Perioperative Considerations: Patients with Opioid Use Disorder (OUD) who are on Medication-Assisted Therapy (MAT)

Three agents are currently used for MAT in OUD:

1. Methadone: A synthetic, long acting opioid, approved for treatment of OUD in 1972. Doses generally range from 60-120mg and is only available for treatment of OUD via Opioid Treatment Program (OTP).
2. Buprenorphine: A partial mu agonist, kappa antagonist and is long acting. It was approved for office-based treatment of OUD in 2002 and requires DATA 2000 Waiver.
3. Naltrexone: Opioid antagonist by blocking opioid effects with a 28-day extended release formulation. Also Available in p.o. formulation, but this has not been shown to be effective for Opioid Use Disorder

General Preoperative Considerations

Preoperative patient education for patients who are currently on any of these agents should include expectations:

- Expectations of pain from surgery
- Risk of opioid relapse
- Risk of overdose of using an agent and naloxone training
- Buprenorphine specific: include education on when and how to decrease buprenorphine
- Naltrexone specific: include education on when to restart naltrexone

In general, preoperative management plan for patients with OUD on MAT should include:

- Maximize non-pharmacological and non-opioid pharmacology if pharmacologic options are used postoperatively (*Quinlan*)
- Avoid use of opioids preoperatively for chronic pain, ok for use in acute pain (expert consensus)
- Give patients REASSURANCE regarding pain expectations. Discuss previous experiences and utilize shared-decision-making in discussions regarding decisions for opioids for pain management.
- Consider preoperative consult with addiction medicine,
- Naloxone should be available postoperatively.
- Always discuss preoperatively the postoperative opioid management plans with opioid prescriber and/or surgeon.

General Postoperative Considerations

In general, postoperative management plan for patients with OUD on MAT should maximize non-pharmacological and non-opioid pharmacology if pharmacologic options are used postoperatively. (*Quinlan*)

Postoperative patient education for patients who are currently on any of these agents should include:

- Expectations regarding postoperative pain
- Risk of opioid relapse
- Discussion of storage/disposal/lock box
- Naloxone training
- Risk management rules: High frequency visits, pill counts, PMP checking, UDS, etc
- Specific to patients on buprenorphine: Identify triggers/cravings, when to re start or increase buprenorphine back to pre-operative doses.
- Specific to patients on naltrexone: Restart after the opioid taper, cannot be on both opioids and naltrexone at the same time

Postoperative management of specific risks of adverse events related to postoperative opioid prescribing at discharge regardless of which MAT agent they are on include:

- High frequency visits: closely monitor use of post-operative opioid
- Support person manages postoperative opioids
- Monitor UDS for drug/alcohol use
- No early refills
- No replacement of lost prescriptions
- Prescription only with visit
- Pill counts
- Verify availability of naloxone at home

Methadone

Preoperative Management

- Verify patient's outpatient methadone dose with their OTP
- Verify availability of naloxone in hospital/at home
- Daily dose is NOT adequate to treat acute pain
  - Think of methadone as their basal needs (like insulin) and short acting opioids as their acute needs. The basal needs are not going to cover acute pain; therefore they will need some opioids to treat acute pain, on top of the methadone dose.
- Patients with OUD are more likely to exhibit hypersensitivity symptoms and high tolerance (*Jamison et al. 2000, Barry 2009, Mehta, 2006*)
- Relapse risk is high and worse with inadequate pain control (*Ti, 2015, Voon 2018*)
- Avoid partial agonists (butorphanol, buprenorphine). Giving a partial agonist with a full agonist (methadone) has the potential to displace the full agonist and cause precipitated withdrawal.

Postoperative Management

- Continue base dose methadone throughout entire perioperative period (*Harrison, 2018*)
- Discuss postoperative opioid management plans with support person or OTP
- High frequency visits/prescriptions
  - Closely monitor use of post-operative opioid use
- Taper postoperative opioids in similar time frame than for opioid naïve patients
- Methadone clinic communication
  - Let them know that the patient will undergo a procedure and that the hospital will administer methadone until discharge, and potential discharge date
  - If patient is not hospitalized or in a TCU, they will need to get their methadone from the OTP, the OTP will decide if the patient is eligible for take home doses

Buprenorphine

Preoperative Management

In general, the preferred method is to either continue patient's current dose of buprenorphine or continue a lowered dose prior to surgery (*Harrison, 2018, Quaye, 2018*).

1. Continuing current dose buprenorphine **(Preferred Method)**
   - Overdose risk is low unless there is relapse.
   - Relapse risk is low, unless there is inadequate pain relief (*Ti, 2015, Voon, 2018*).
   - Inadequate pain relief – buprenorphine blocks mu opioid receptors, with high potency and affinity. It may be difficult to treat pain with opioids, prepare to use more potent or higher dose opioids to overcome the blockade.

2. Continue lowered dose buprenorphine **(Preferred Method)**

- Overdose risk is low unless there is relapse.
- A lower dose of buprenorphine generally infers a higher risk of relapse. A lower dose of buprenorphine will cause more cravings. The dose is adjusted/increased to decrease cravings, so a lower dose would create more cravings. Most patients can tolerate a short period of time on lower dose, but if this is combined with poorly treated pain, the risk of relapse increases (*Ti, 2015, Voon, 2018*)
- Decreasing the dose of buprenorphine will open up some of the receptors for the full agonists to occupy, allowing pain relief, but you have to find a balance between full and partial agonists, titrated to pain symptoms.

Continuing current dose versus lowering dose

The decision of whether to continue the current dose of Buprenorphine versus decreasing the dose of Buprenorphine should be a shared decision between the provider and the patient, taking into account dose, previous patient experiences, and relapse risk.

- Specific recommendations can be found in Quaye et al, as below:
  - If the patient is on over 16 mg they recommend to decrease the dose to 16 mg until the day before the surgery and 8 mg the day of the surgery
  - If the patient is on 8-16 mg they recommend continuing the home dose until the day before the surgery and decreasing to 8 mg the day of the surgery
  - If the patient is on less than 8 mg they recommend continuing the home dose throughout the perioperative period

3. Discontinuation of buprenorphine **(Not Preferred Method)**

- Overdose risk is high (*Mattick 2014, Larochelle 2018, Russolillo, A 2018; Expert Consensus, ASAM Guidelines*)
- Relapse risk is very high. Because the patient is no longer on buprenorphine, they have no blockade of their mu receptors and thus can feel the full effects of all opioids.
- Re-induction on buprenorphine necessary. After the patient has tapered off opioids the patient should be started back on their buprenorphine as soon as possible.
- Discontinuing makes all opioid receptors are available, but given the high affinity of buprenorphine for the opioids receptor, the equivalent dose of morphine is generally considered somewhere between 30 and 75mg for each mg of buprenorphine, so they have an extremely high tolerance.

Postoperative Management

1. If continued current dose buprenorphine:

- Use higher potency opioids
- Taper post-operative opioids in similar time frame as for opioid naïve
- Consider split dose or decreasing buprenorphine dose for inadequate pain

2. If continued lowered dose buprenorphine:

- Use higher potency opioids
- Taper post-operative opioids in similar time frame as for opioid naïve

- Consider split dose or decreasing buprenorphine dose for inadequate pain
- If cravings or use occurs, increase buprenorphine back to preoperative (home) dose

3. If discontinued buprenorphine:

- Will likely need higher potency opioids as still has high tolerance
- Speed taper, especially if cravings or use
- Restart buprenorphine if cravings or use and decide if need more post-op opioids or split dose buprenorphine

**An Example of Buprenorphine Perioperative Management Plan: Base plan on expected pain and dose*

Low pain level	**Moderate-Severe pain level + <8mg Buprenorphine**	**Moderate- Severe pain level + 9mg-15mg Buprenorphine**	**Moderate- Severe pain level + >16mg Buprenorphine**
Continue current dose buprenorphine Consider buprenorphine dividing dose TID Consider very short-term post-op opioids	Continue current dose buprenorphine Consider buprenorphine dividing dose TID Post-op opioids - Length same as opioid naïve - Need higher potency opioid	Consider tapering buprenorphine to 8mg over 1-4 weeks Consider buprenorphine dividing dose TID Discuss relapse risk with patient→ if high, continue current dose and use higher potency or higher dose opioids post-op Post op opioids - Length same as opioid naïve - Need higher potency opioid	Taper to 16mg over 1-4 weeks, then to 8 over 1-4 weeks prior to surgery Discuss relapse risk with patient→ if high, continue current dose and use higher potency or higher dose opioids post-op, ideally get to 16mg or less Consider buprenorphine dividing dose TID Post-op opioids - Length same as opioid naïve - Need higher potency opioid

Naltrexone IM/PO

Preoperative Management

1. Planned procedures: Able to discontinue IM naltrexone >4 weeks prior to surgery (72h for PO)

- Risk of overdose is high because of loss of tolerance
    - o Do not restart naltrexone until off all post-operative opioids
- For patients OUD not on MAT there is high risk of relapse, loss of tolerance off all opioids (*Mattick 2014, Larochelle 2018, Russolillo, A 2018*)
- Risk of inadequate pain relief is high, and patients with OUD, often have hypersensitivity (*Jamison et al. 2000, Barry 2009, Mehta, 2006*)

2. Unplanned procedures: Unable to discontinue naltrexone

- Risk of overdose is high, especially with inadequate pain relief; patient may try to overcome blockade with illicit opioids (*Vickers, 2006, Kunoe, 2010*)

- Relapse risk is higher with inadequate pain relief, especially if injection falls during the postoperative period while still on postop opioids (*Vickers, 2006, Ti, 2015, Voon, 2018*)
- Inadequate pain relief, may need higher dose/potency of postop opioids to overcome blockade (*Vickers, 2006*)

Postoperative Management

1. For planned procedures where naltrexone was discontinued:
    - Opioid taper: The taper off post-operative opioids is dependent upon the patient's cravings, risk of use. If you suspect drug use or confirm it with UDS, restart MAT. **Can restart naltrexone or consider buprenorphine**
    - Restart naltrexone (IM, PO)
        - Restart after the opioid taper, cannot be on both opioids and naltrexone at the same time
2. For unplanned procedures where naltrexone was NOT discontinued:
    - Opioid taper: If the patient's injection is still "active" (i.e. within the four weeks), they are likely going to require higher potency opioids to overcome the blockade
        - You need to know when the injection "runs out," (i.e. 28-30 days from last dose, as the blockade then wears off too and the doses/potencies may then be too high)
    - Restart naltrexone
        - Restart after the opioid taper, cannot be on both opioids and naltrexone at the same time
        - IM-Must be off opioids for 7-10 days (When opioid taper complete)
        - PO- Must be off opioids for 7-10 days (When opioid taper complete)

Patients with Opioid Use Disorder not on MAT/Ongoing Opioid Use

Patients with Opioid Use Disorder currently using opioids should not undergo a procedure unless it is urgent or emergent. Treatment of the substance use disorder should take priority. Once the patient is on medication assisted therapy the procedure can take place.

If a procedure is urgent or emergent every effort should be made to start medication assistant therapy before the procedure takes place. An addiction or pain consultation is recommended.

If that is not possible, the management plan should include maximizing non-pharmacological intervention, maximizing non-opioid pharmacology, and addiction or pain consultation as soon as possible to initiate medication assistant therapy after the procedure. Opioid management of the acute pain will likely still be required, but should be monitored carefully.

Quality Improvement Support:

The intent of this section is to provide resources, strategies and measurement to help close the gap between current clinical practice and the recommendations set forth in the guideline.

Measurement is one of the key components of quality improvement. It evaluates the impact of clinical evidence-based recommendations on current clinical practice, and can assure that new practices are being implemented. The measures are recommended by each guideline workgroup and confirmed through consensus. ICSI's Committee for Evidence-Based Practice provides oversight and final approval for the measures as part of the guideline revision process.

As part of the process, local and national resources for measures are searched and relevant measures are included if aligned with the workgroup recommendations. These resources include: National Quality Forum (NQF), Joint Commission, National Committee for Quality Assurance (NCQA), MN Community Measurement (MNCM), CMS MACRA-MIPS measures and resources specific to the guideline topic.

ICSI work groups focus on quality improvement measures, not measures for accountability. Our goal is to help organization understand how closely practice mirrors guideline recommendations and monitor this over time as quality improvement changes are implemented.

Types of measures included are measures of process, experience, and outcomes; each measure is labeled accordingly. Measurement data should be tracked and compared over time to help gain insight into effectiveness of interventions. Measurement definitions and data collection frequency need to be consistent to ensure validity of data comparisons over time.

The subdivisions of this section are:

- Aims and Measures
- Implementation Recommendations
- Implementation Tools and Resources

Aims and Measures

1. Increase the percentage of surgical patients undergoing elective surgery who have preoperative health screening and assessment by a primary care provider.

   Measure for accomplishing this aim:

   a. Percent of patients undergoing elective surgery who have preoperative health screening and assessment by a primary care provider.

2. Increase the percentage of surgical patients undergoing elective surgery and are smokers who have smoking addressed prior to surgery.

   Measures for accomplishing this aim:

   a. The percentage of current smokers who abstain from cigarettes prior to anesthesia on the day of elective surgery or procedure. (ASA) (MACRA-MIPS)

3. Increase the percentage of surgical patients undergoing elective surgery who have risk factors for obstructive sleep apnea (OSA) who are screened for OSA prior to surgery.

   Measures for accomplishing this aim:

   a. Percentage of surgical patients undergoing elective surgery with risk factors for OSA who are screened for OSA prior to surgery.

4. Increase the percentage of surgical patients undergoing elective surgery who have education on preoperative hair removal, bathing, fasting and oral hygiene prior to surgery.

   Measure for accomplishing this aim:

   a. Percentage of patients with education on preoperative hair removal, bathing, fasting and oral hygiene prior to surgery.

Implementation Recommendations

Prior to implementation, it is important to consider current organizational infrastructure that address the following:

- System and process design
- Training and education
- Culture and the need to shift values, beliefs and behaviors of the organization
- Develop a reliable, standardized system to obtain complete preoperative basic health assessments and appropriate preoperative testing to eliminate unwarranted variation.
- Establish a reliable mechanism to communicate completed preoperative basic health assessments, associated test results to surgical team prior to procedure.
- Develop a comprehensive patient-centered approach to education and appropriate procedure preparation.
- Establish a mechanism for surgical team to communicate pertinent post-surgery information to primary care to help guide postoperative assessment and management.

Implementation Tools and Resources

Because an extensive revision was done on the clinical content of this guideline, the work group was not able to complete an in-depth search of additional tools and resources.

The subdivisions of this section are:

- References
- Appendix

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Appendix A: ICSI Shared Decision-Making Model

The technical aspects of Shared Decision-Making are widely discussed and understood.

- **Decisional conflict** occurs when a patient is presented with options where no single option satisfies all the patient's objectives, where there is an inherent difficulty in making a decision, or where external influencers act to make the choice more difficult.
- **Decision support** clarifies the decision that needs to be made, clarifies the patient's values and preferences, provides facts and probabilities, guides the deliberation and communication and monitors the progress.
- **Decision aids** are evidence-based tools that outline the benefits, harms, probabilities and scientific uncertainties of specific health care options available to the patient.

However, before decision support and decision aids can be most advantageously utilized, a Collaborative Conversation™ should be undertaken between the provider and the patient to provide a supportive framework for Shared Decision-Making.

Collaborative Conversation™

A collaborative approach toward decision-making is a fundamental tenet of Shared Decision-Making (SDM). The Collaborative Conversation™ is an inter-professional approach that nurtures relationships, enhances patients' knowledge, skills and confidence as vital participants in their health, and encourages them to manage their health care.

Within a Collaborative Conversation™ , the perspective is that both the patient and the provider play key roles in the decision-making process. The patient knows which course of action is most consistent with his/her values and preferences, and the provider contributes knowledge of medical evidence and best practices. Use of Collaborative Conversation™ elements and tools is even more necessary to support patient, care provider and team relationships when patients and families are dealing with high stakes or highly charged issues, such as diagnosis of a life-limiting illness.

The overall framework for the Collaborative Conversation™ approach is to create an environment in which the patient, family and care team work collaboratively to reach and carry out a decision that is consistent with the patient's values and preferences. A rote script or a completed form or checklist does not constitute this approach. Rather it is a set of skills employed appropriately for the specific situation. These skills need to be used artfully to address all aspects involved in making a decision: cognitive, affective, social and spiritual.

Key communication skills help build the Collaborative Conversation™ approach. These skills include many elements, but in this appendix only the questioning skills will be described. (For complete instruction, see O'Connor, Jacobsen "Decisional Conflict: Supporting People Experiencing Uncertainty about Options Affecting Their Health" [2007], and Bunn H, O'Connor AM, Jacobsen MJ "Analyzing decision support and related communication" [1998, 2003].)

1. **Listening skills:**

   Encourage patient to talk by providing prompts to continue such as "*go on, and then?, uh huh,"* or by repeating the last thing a person said, "*It's confusing*."

Paraphrase content of messages shared by patient to promote exploration, clarify content and to communicate that the person's unique perspective has been heard. The provider should use his/her own words rather than just parroting what he/she heard.

Reflection of feelings usually can be done effectively once trust has been established. Until the provider feels that trust has been established, short reflections at the same level of intensity expressed by the patient without omitting any of the message's meaning are appropriate. Reflection in this manner communicates that the provider understands the patient's feelings and may work as a catalyst for further problem solving. For example, the provider identifies what the person is feeling and responds back in his/her own words like this: *"So, you're unsure which choice is the best for you."*

Summarize the person's key comments and reflect them back to the patient. The provider should condense several key comments made by the patient and provide a summary of the situation. This assists the patient in gaining a broader understanding of the situations rather than getting mired down in the details. The most effective times to do this are midway through and at the end of the conversation. An example of this is, *"You and your family have read the information together, discussed the pros and cons, but are having a hard time making a decision because of the risks."*

Perception checks ensure that the provider accurately understands a patient or family member, and may be used as a summary or reflection. They are used to verify that the provider is interpreting the message correctly. The provider can say *"So you are saying that you're not ready to make a decision at this time. Am I understanding you correctly?"*

2. **Questioning Skills**

Open and closed questions are both used, with the emphasis on open questions. Open questions ask for clarification or elaboration and cannot have a yes or no answer. An example would be *"What else would influence you to choose this?"* Closed questions are appropriate if specific information is required such as *"Does your daughter support your decision?"*

Other skills such as summarizing, paraphrasing and reflection of feeling can be used in the questioning process so that the patient doesn't feel pressured by questions.

Verbal tracking, referring back to a topic the patient mentioned earlier, is an important foundational skill (Ivey & Bradford-Ivey). An example of this is the provider saying, *"You mentioned earlier…"*

3. **Information-Giving Skills**

Providing information and **providing feedback** are two methods of information giving. The distinction between providing information and giving advice is important. Information giving allows a provider to supplement the patient's knowledge and helps to keep the conversation patient centered. Giving advice, on the other hand, takes the attention away from the patient's unique goals and values, and places it on those of the provider.

Providing information can be sharing facts or responding to questions. An example is *"If we look at the evidence, the risk is…"* Providing feedback gives the patient the provider's view of the patient's reaction. For instance, the provider can say, *"You seem to understand the facts and value your daughter's advice."*

Additional Communication Components

Other elements that can impact the effectiveness of a Collaborative Conversation™ include:

- Eye contact
- Body language consistent with message
- Respect

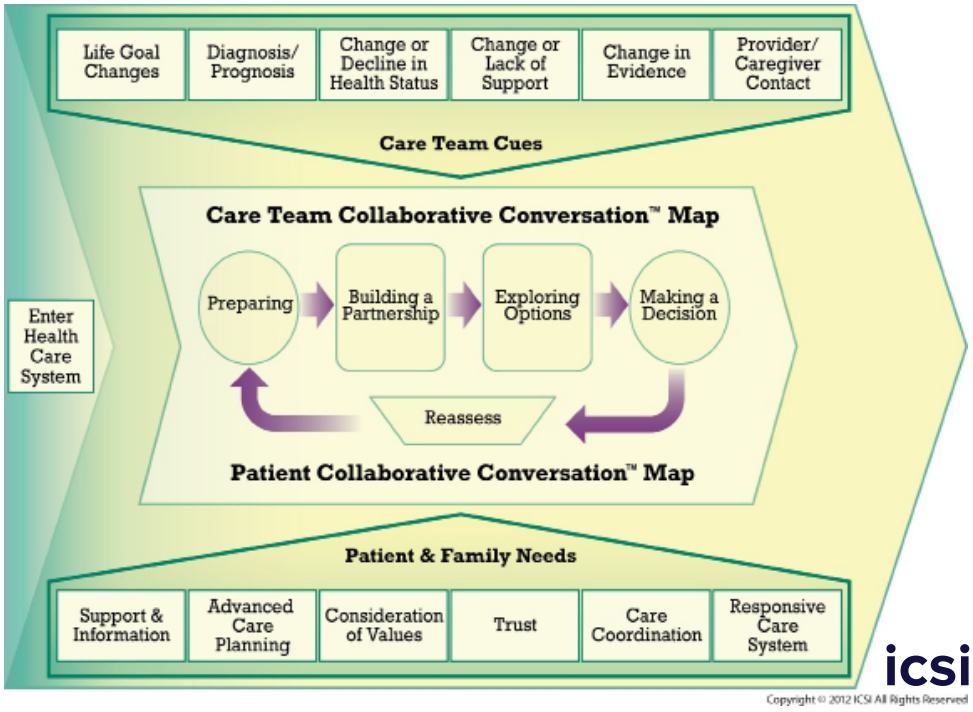
- Empathy
- Partnerships

Self-examination by the provider involved in the Collaborative Conversation™ can be instructive. Some questions to ask oneself include:

- Do I have a clear understanding of the likely outcomes?
- Do I fully understand the patient's values?
- Have I framed the options in comprehensible ways?
- Have I helped the decision-makers recognize that preferences may change over time?
- Am I willing and able to assist the patient in reaching a decision based on his/her values, even when his/her values and ultimate decision may differ from my values and decisions in similar circumstances?

When to Initiate a Collaborative Conversation™

A Collaborative Conversation™ can support decisions that vary widely in complexity. It can range from a straightforward discussion concerning routine immunizations to the morass of navigating care for a life-limiting illness. Table 1 represents one health care event. This event can be simple like a 12 year-old coming to the clinic for routine immunizations, or something much more complex like an individual receiving a diagnosis of congestive heart failure. In either case, the event is the catalyst that starts the process represented in this table. There are cues for providers and patient needs that exert influence on this process. They are described below. The heart of the process is the Collaborative Conversation™. The time the patient spends within this health care event will vary according to the decision complexity and the patient's readiness to make a decision.



Regardless of the decision complexity there are cues applicable to all situations that indicate an opportune time for a Collaborative Conversation™. These cues can occur singularly or in conjunction with other cues.

Cues for the Care Team to Initiate a Collaborative Conversation™

- **Life goal changes:** Patient's priorities change related to things the patient values such as activities, relationships, possessions, goals and hopes, or things that contribute to the patient's emotional and spiritual well-being.
- **Diagnosis/prognosis changes:** Additional diagnoses, improved or worsening prognosis.
- **Change or decline in health status:** Improving or worsening symptoms, change in performance status or psychological distress.
- **Change or lack of support:** Increase or decrease in caregiver support, change in caregiver, or caregiver status, change in financial standing, difference between patient and family wishes.
- **Change in medical evidence or interpretation of medical evidence:** Providers can clarify the change and help the patient understand its impact.
- **Provider/caregiver contact:** Each contact between the provider/caregiver and the patient presents an opportunity to reaffirm with the patient that his/her care plan and the care the patient is receiving are consistent with his/her values.

Patients and families have a role to play as decision-making partners, as well. The needs and influencers brought to the process by patients and families impact the decision-making process. These are described below.

Patient and Family Needs within a Collaborative Conversation™

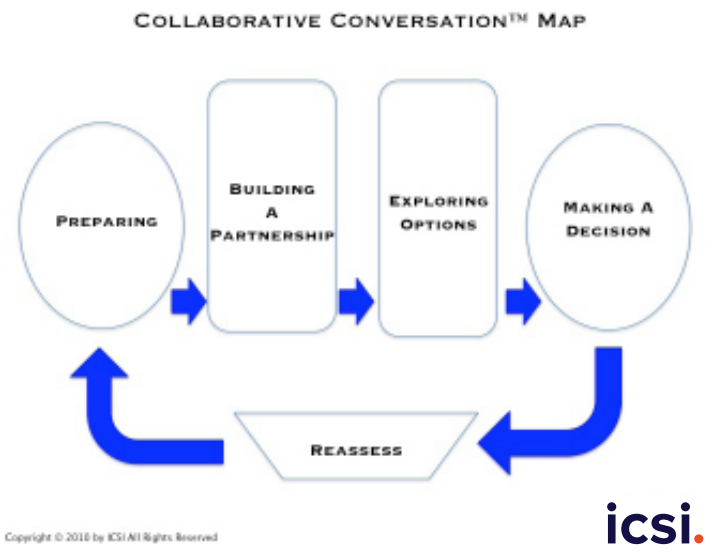
- **Request for support and information:** Decisional conflict is indicated by, among other things, the patient verbalizing uncertainty or concern about undesired outcomes, expressing concern about choice consistency with personal values and/or exhibiting behavior such as wavering, delay, preoccupation, distress or tension. Generational and cultural influencers may act to inhibit the patient from actively participating in care discussions, often patients need to be given "permission" to participate as partners in making decisions about his/her care.

  Support resources may include health care professionals, family, friends, support groups, clergy and social workers. When the patient expresses a need for information regarding options and his/her potential outcomes, the patient should understand the key facts about options, risks and benefits, and have realistic expectations. The method and pace with which this information is provided to the patient should be appropriate for the patient's capacity at that moment.

- **Advance Care Planning:** With the diagnosis of a life-limiting illness, conversations around advance care planning open up. This is an opportune time to expand the scope of the conversation to other types of decisions that will need to be made as a consequence of the diagnosis.
- **Consideration of Values:** The personal importance a patient assigns potential outcomes must be respected. If the patient is unclear how to prioritize the preferences, value clarification can be achieved through a Collaborative Conversation™ and by the use of decision aids that detail the benefits and harms of potential outcomes in terms the patient can understand.
- **Trust:** The patient must feel confident that his/her preferences will be communicated and respected by all caregivers.
- **Care Coordination:** Should the patient require care coordination, this is an opportune time to discuss the other types of care-related decisions that need to be made. These decisions will most likely need to be revisited often. Furthermore, the care delivery system must be able to provide coordinated care throughout the continuum of care.

- **Responsive Care System:** The care system needs to support the components of patient- and family-centered care so the patient's values and preferences are incorporated into the care he/she receives throughout the care continuum.

The Collaborative Conversation™ Map is the heart of this process. The Collaborative Conversation™ Map can be used as a stand-alone tool that is equally applicable to providers and patients as shown in Table 2. Providers use the map as a clinical workflow. It helps get the Shared Decision-Making process initiated and provides navigation for the process. Care teams can used the Collaborative Conversation™ to document team best practices and to formalize a common lexicon. Organizations can build fields from the Collaborative Conversation™ Map in electronic medical records to encourage process normalization. Patients use the map to prepare for decision-making, to help guide them through the process and to share critical information with their loved ones.



Evaluating the Decision Quality

Adapted from O'Connor, Jacobsen "Decisional Conflict: Supporting People Experiencing Uncertainty about Options Affecting Their Health" [2007].

When the patient and family understand the key facts about the condition and his/her options, a good decision can be made. Additionally, the patient should have realistic expectations about the probable benefits and harms. A good indicator of the decision quality is whether or not the patient follows through with his/her chosen option. There may be implications of the decision on patient's emotional state such as regret or blame, and there may be utilization consequences.

Decision quality can be determined by the extent to which the patient's chosen option best matches his/her values and preferences as revealed through the Collaborative Conversation™ process.

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ICSI has long had a policy of transparency in declaring potential conflicting and competing interests of all individuals who participate in the development, revision and approval of ICSI guidelines and protocols.

In 2010, the ICSI Conflict of Interest Review Committee was established by the Board of Directors to review all disclosures and make recommendations to the board when steps should be taken to mitigate potential conflicts of interest, including recommendations regarding removal of work group members. This committee has adopted the Institute of Medicine Conflict of Interest standards as outlined in the report, Clinical Practice Guidelines We Can Trust (2011).

Where there are work group members with identified potential conflicts, these are disclosed and discussed at the initial work group meeting. These members are expected to recuse themselves from related discussions or authorship of related recommendations, as directed by the Conflict of Interest committee or requested by the work group.

The complete ICSI policy regarding Conflicts of Interest is available at http://bit.ly/ICSICOI.

Funding Source

The Institute for Clinical Systems Improvement provided the funding for this protocol revision. ICSI is a not-for-profit, quality improvement organization based in Bloomington, Minnesota. ICSI's work is funded by the annual dues of the member medical groups. Individuals on the work group are not paid by ICSI but are supported by their medical group for this work.

ICSI facilitates and coordinates the guideline development and revision process. ICSI members review and provide feedback but do not have editorial control over the work group. All recommendations are based on the work group's independent evaluation of the evidence.

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All ICSI documents are available for review during the revision process by ICSI members. In addition, all members commit to reviewing specific documents each year. This comprehensive review provides information to the work group for such issues as content update, improving clarity of recommendations, implementation suggestions and more.

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The next scheduled revision will occur within 24 months.

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Document History

In 2005-2007, ICSI hospital members championed patient safety activities aimed at advancing efficient surgical process flow and creating safe and reliable practices that reduced the number of adverse events in surgery. In collaboration with its members, ICSI developed standardized surgical protocols for safe site marking, the reduction of surgical site infection and retained foreign objects. This work resulted in the creation of three specific safety protocols:

Safe Site Protocol for All Invasive, High-Risk or Surgical Procedures; Prevention of Unintentionally Retained Foreign Objects in Surgery; and *Prevention of Surgical Site Infection*.

In 2007-2008, ICSI facilitated a Reliability Centered Surgical Care Redesign Collaborative, which provided a collaborative learning environment for participants to become knowledgeable in reliability theory and principles. This collaborative provided an opportunity for participants to share their learnings as they worked to implement these and other surgical related protocols.

Recognizing that these surgical processes are part of the comprehensive perioperative experience, these three distinct protocols were merged in 2008 to create one comprehensive Perioperative consistent with the requirements established by The Joint Commission National Patient Safety Goals.

In 2013-2014, the Preoperative guideline and Perioperative protocol were merged into one document.

The 2019 revision included the following updates:

- The guideline name changed from Perioperative Protocol to Perioperative Guideline.
- A new section on perioperative opioid management has been added. It was developed by a separate sub group and reviewed by the Perioperative Guideline work group.
- Since an extensive revision was done on the clinical content of this guideline, the work group members recruited for this revision were primarily from content areas related to recommendations addressed in this revision. Work Group members were not recruited to review and update the Surgical Care Protocol (Human Factors) section, thus that section was not addressed in this version.

ICSI Document Development and Revision Process

Overview

Since 1993, the Institute for Clinical Systems Improvement (ICSI) has developed more than 60 evidence-based health care documents that support best practices for the prevention, diagnosis, treatment or management of a given symptom, disease or condition for patients.

Audience and Intended Use

The information contained in this ICSI Health Care Guideline is intended primarily for health professionals and other expert audiences.

This ICSI Health Care Guideline should not be construed as medical advice or medical opinion related to any specific facts or circumstances. Patients and families are urged to consult a health care professional regarding their own situation and any specific medical questions they may have. In addition, they should seek assistance from a health care professional in interpreting this ICSI Health Care Guideline and applying it in their individual case.

This ICSI Health Care Guideline is designed to assist clinicians by providing an analytical framework for the evaluation and treatment of patients, and is not intended either to replace a clinician's judgment or to establish a guideline for all patients with a particular condition.

Document Development and Revision Process

The development process is based on a number of long-proven approaches and is continually being revised based on changing community standards. The ICSI staff, in consultation with the work group and a medical librarian, conduct a literature search to identify systematic reviews, randomized clinical trials, meta-analysis, other protocols, regulatory statements and other pertinent literature. This literature is evaluated based on the GRADE methodology by work group members. When needed, an outside methodologist is consulted.

The work group uses this information to develop or revise clinical flows and algorithms, write recommendations, and identify gaps in the literature. The work group gives consideration to the importance of many issues as they develop the protocol. These considerations include the systems of care in our community and how resources vary, the balance between benefits and harms of interventions, patient and community values, the autonomy of clinicians and patients and more. All decisions made by the work group are done using a consensus process.

ICSI's members review each guideline as part of the revision process. They provide comment on the scientific content, recommendations, implementation strategies and barriers to implementation. This feedback is used by and responded to by the work group as part of their revision work. Final review and approval of the guideline is done by ICSI's Committee on Evidence-Based Practice. This committee is made up of practicing clinicians and nurses, drawn from ICSI member medical groups.

Implementation Recommendations and Measures

These are provided to assist medical groups and others to implement the recommendations in the protocols. Where possible, implementation strategies are included that have been formally evaluated and tested. Measures are included that may be used for quality improvement as well as for outcome reporting. When available, regulatory or publicly reported measures are included.

Document Revision Cycle

Scientific documents are revised every 2-5 years as indicated by changes in clinical practice and literature. ICSI staff monitors major peer-reviewed journals every month for the guidelines for which they are responsible. Work group members are also asked to provide any pertinent literature through check-ins with the work group midcycle and annually to determine if there have been changes in the evidence significant enough to warrant document revision earlier than scheduled. This process complements the exhaustive literature search that is done on the subject prior to development of the first version of a guideline.