



# OPTIMAL PERIOPERATIVE MANAGEMENT OF THE GERIATRIC PATIENT:

## Best Practices Guideline from ACS NSQIP®/American Geriatrics Society



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# **Optimal Perioperative Management of the Geriatric Patient: A Best Practices Guideline from the ACS NSQIP/American Geriatrics Society**

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## **Abstract**

The older adult population (>65 years) is growing at a rapid rate, and a significant percentage of older adults undergo surgical procedures. This population has a unique set of needs owing to the effects of aging, some of which make them particularly prone to postoperative complications and a prolonged recovery. The purpose of this document is to review the literature, consolidate current guidelines, and provide a set of expert recommendations to help practicing surgeons, anesthesiologists, and allied health care professionals manage older adults during the perioperative period. This guide is not a substitute for clinical judgment and experience.

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## Introduction

### From Preoperative Assessment to Perioperative Management

Adults age 65 and older (“older adults”) are the fastest growing segment of the United States population, and their number is expected to double to 89 million people between 2010 and 2050.<sup>1</sup> Based on these evolving demographics, it is expected that there will be a concurrent rise in the demand for a variety of surgical services, including vascular surgery (with a projected growth of 31 percent) and general surgery (with a projected growth of 18 percent).<sup>2</sup>

Older adult surgical patients often require a different level of care than younger patients during the perioperative period. They are prone to developing postoperative complications, functional decline, loss of independence, and other untoward outcomes. In order to provide optimal care for the older surgical patient, a thorough assessment of the individual’s health status is essential. Though the goal should be a tailored, comprehensive geriatric evaluation at a designated preoperative appointment, this goal may not always be possible in the context of a busy surgical practice.<sup>3</sup> Therefore, the American College of Surgeons (ACS) partnered with the American Geriatrics Society (AGS) and the John A. Hartford Foundation in 2012 to develop the *American College of Surgeons National Surgical Quality Improvement Program (NSQIP)/American Geriatrics Society (AGS) Best Practices Guidelines: Optimal Preoperative Assessment of the Geriatric Surgical Patient*. This resource defined nine assessment categories corresponding to cognitive/behavioral disorders, cardiac evaluation, pulmonary evaluation, functional/performance status, frailty, nutritional status, medication management, patient counseling, and preoperative testing.

This document provides guidance on managing the older adult in the perioperative period. It is organized into sections corresponding to the immediate preoperative period, the intraoperative period, and the postoperative period. Building upon domains of geriatric care and proposed geriatric competencies established by prior work, these guidelines are designed to provide a framework for thinking about the complex issues around perioperative care in this patient population.<sup>4,5</sup> We address each section by compiling current evidence and best practices, as well as expert opinion. Similar to the Preoperative Assessment guidelines, this work is designed to help clinicians. It is not a substitute for clinical judgment and experience.

## Table of Contents

INTRODUCTION.....	iii
TABLE OF CONTENTS.....	iv
SECTION I. IMMEDIATE PREOPERATIVE MANAGEMENT.....	1
IMMEDIATE PREOPERATIVE MANAGEMENT CHECKLIST.....	2
A. PATIENT GOALS, PREFERENCES, AND ADVANCE DIRECTIVES.....	3
B. PREOPERATIVE FASTING.....	5
C. ANTIBIOTIC PROPHYLAXIS AND VENOUS THROMBOEMBOLISM PREVENTION.....	6
D. MEDICATION MANAGEMENT.....	7
SECTION II. INTRAOPERATIVE MANAGEMENT.....	8
INTRAOPERATIVE MANAGEMENT CHECKLIST.....	9
A. ANESTHESIA IN THE OLDER ADULT.....	10
B. PERIOPERATIVE ANALGESIA IN THE OLDER ADULT.....	12
C. PERIOPERATIVE NAUSEA AND VOMITING.....	14
D. PATIENT SAFETY.....	16
E. INTRAOPERATIVE STRATEGIES TO PREVENT POSTOPERATIVE COMPLICATIONS AND HYPOTHERMIA.....	17
F. FLUID MANAGEMENT AND TARGETING PHYSIOLOGIC PARAMETERS.....	18
SECTION III. POSTOPERATIVE MANAGEMENT.....	19
POSTOPERATIVE ROUNDING CHECKLIST.....	20
A. POSTOPERATIVE DELIRIUM.....	21
B. PULMONARY COMPLICATION PREVENTION.....	25
C. FALL RISK ASSESSMENT AND PREVENTION.....	26
D. NUTRITION IN THE POSTOPERATIVE PERIOD.....	28
E. URINARY TRACT INFECTION PREVENTION.....	30
F. FUNCTIONAL DECLINE.....	32
G. PRESSURE ULCER PREVENTION AND TREATMENT.....	34
SECTION IV. CARE TRANSITIONS.....	36
APPENDICES.....	38
APPENDIX I. ADVANCE DIRECTIVE POSITION STATEMENTS.....	39
APPENDIX II. OLDER ADULT PATIENT GROUPS AT HIGH RISK FOR VTE.....	40
APPENDIX III. SUGGESTED DOSE ADJUSTMENTS FOR ANESTHETIC MEDICATIONS IN OLDER PATIENTS.....	41
APPENDIX IV. PERIOPERATIVE RISK FACTORS FOR DELIRIUM.....	42
APPENDIX V. THE CAM-ICU.....	43
APPENDIX VI. MORSE FALL SCALE.....	44
APPENDIX VII. FOUR GERIATRIC MODELS OF CARE.....	45
APPENDIX VIII. THE BRADEN SCALE FOR ASSESSING PRESSURE ULCER RISK.....	46
APPENDIX IX. CARE TRANSITIONS MODELS.....	48
EXPERT PANEL.....	50
REFERENCES.....	54

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## SECTION I. Immediate Preoperative Management

The health care team, patient, and his or her family/caregivers should ensure that patient goals and treatment preferences are understood before deciding on a treatment plan. Ideally, this step occurs at a preoperative clinic appointment.

In the immediate preoperative period the patient's goals and treatment preferences should be confirmed and documented. Also during this time, fasting recommendations should be followed, appropriate prophylactic medications should be given, and medications lists should be reviewed for nonessential and inappropriate medications.<sup>6</sup>

The health care team can also take this opportunity to begin proactive, postoperative planning, especially with regard to analgesia strategies and minimization of opioids, prevention of functional decline and delirium, early multispecialty consultation where indicated, early involvement of allied health staff such as physical or occupational therapy, and anticipating home health needs at discharge.

## Immediate Preoperative Management Checklist

- ☐ Confirm and document patient goals and treatment preferences, including advance directives
- ☐ Confirm and document patient's health care proxy or surrogate decision-maker
- ☐ In patients with existing advance directives, discuss new risks associated with the surgical procedure and an approach for potentially life-threatening problems consistent with the patient's values and preferences ("required reconsideration")
- ☐ Consider shortened fluid fast (clear liquids up to two hours before anesthesia)
- ☐ Adhere to existing best practices regarding antibiotic and venous thromboembolism prophylaxis
- ☐ Ensure nonessential medications have been stopped and essential medications have been taken

## A. Patient Goals, Preferences, and Advance Directives

A 2010 study showed that almost half of patients over the age of 60 required decisions about treatment in the final days of life. Although 70 percent of these patients lacked decision-making capacity, 68 percent of them had advanced directives, and the majority received care in accordance with their wishes.<sup>7</sup> This fact underscores the importance of having such information understood and documented. That said, few patients undergoing high risk surgical procedures have advanced directives in place, and the literature would suggest that surgeons do not routinely discuss these issues preoperatively.<sup>8,9</sup>

Personal goals and treatment preferences should be addressed in the outpatient setting prior to surgery. Additionally, patients who may be near the end of life could benefit from early palliative care consultation.<sup>10</sup>

All surgeons should have an understanding of their patients' wishes regarding medical care at the end of life. In the immediate preoperative area, patient goals and treatment preferences should be confirmed and documented by a health care provider (surgeon and/or anesthesiologist). Patients should be strongly encouraged to designate a health care proxy, and this information should be documented.

1. The health care team (including the surgeon and anesthesiologist) should ensure that they discuss personal goals and treatment preferences prior to surgery, including specific outcomes that may be important to older adults, such as postoperative functional decline, loss of independence, and skilled care burden.
2. The health care team (including the surgeon and/or anesthesiologist) should ensure that older adult patients undergoing surgery have an advance directive and a designated health care proxy (or surrogate decision-maker). This information should be documented in the patient's medical record.

TYPES OF ADVANCE DIRECTIVES <sup>†</sup>	
<b>Living will</b>	Specifies medical treatments—including cardiopulmonary resuscitation (CPR), mechanical ventilation, enteral feeding, dialysis, and antibiotics—that the patient would or would not want used to prolong their life, as well as other decisions regarding pain management or organ/tissue/body donation
<b>Durable power of attorney</b>	A person (with or without alternatives) named to make decisions on behalf of the patient if they are unable to do so
<b>Do not resuscitate (DNR) order</b>	Specific medical order instructing providers not to perform CPR if the patient's heart activity or breathing ceases
<b>Do not intubate (DNI) order</b>	Specific medical order instructing providers not to intubate the patient and/or place him or her on mechanical ventilation
<sup>†</sup> See <a href="http://www.lifecaredirectives.com">www.lifecaredirectives.com</a>	

3. Whenever possible, the health care team should consider early (postoperative) palliative care consultation in older adult patients with poor prognoses undergoing surgery, especially those not expected to survive more than six months postoperatively.

### ***Suspending DNRs in patients with existing advance directives***

The ACS position statement on Advance Directives by Patients, “‘Do Not Resuscitate’ in the Operating Room,” dictates that the best policy regarding patients who have existing DNR orders is that of “**required reconsideration.**”<sup>11</sup> This means that the new risks, benefits, and alternatives of the surgical procedure should be considered and discussed with the patient, and an approach to life-threatening problems that may arise that is consistent with patient values and preferences be clarified.

Routinely setting aside such patient preferences is not appropriate. Several other professional organizations, including the American Society of Anesthesiologists and the Association of Perioperative Registered Nurses, have provided relevant guidelines on this topic.<sup>12-14</sup>

See **Appendix I** for a summary of relevant professional society statements.

4. The health care team (including the surgeon and anesthesiologist) should use a structured approach that is consistent with established best practices (for example, as defined by relevant professional societies) and local norms when caring for patients with existing advance directives that may limit resuscitative procedures. Any clarifications and modifications made to the advance directive should take into account exceptions to the order and include a plan for reinstating the order when the patient has recovered from anesthesia.



## B. Preoperative Fasting

Preoperative fasting is defined as a prescribed period of time before a procedure requiring general anesthesia or sedation during which time patients are not allowed the oral intake of liquids or solids. Historically, this period began the night before an elective procedure, but there is increasing agreement regarding the benefit of limiting extended periods (greater than four to six hours) of preoperative fasting.<sup>15</sup> A recent review of the topic demonstrated there was not a significant association between a shortened (two to three hours) clear fluid fast (versus milk or juice with pulp) and subsequent postoperative complications, including delirium.<sup>16,17</sup>

At present, the American Society of Anesthesiologists 2011 practice guidelines on preoperative fasting represent the most widely-used reference for appropriate preoperative fasting practices. These guidelines do not specifically address preoperative fasting in elderly patients; however, the recommendations below draw primarily from these existing guidelines.

1. In adults undergoing nonemergent surgical procedures, fasting from the intake of clear liquids at least two hours before elective procedures requiring general anesthesia, regional anesthesia, or sedation/analgesia is recommended.

Examples of clear liquids include water, fruit juices without pulp, carbonated beverages, clear tea, and black coffee.

2. In adults undergoing nonemergent surgical procedures, fasting from the intake of a light meal and/or nonhuman milk six hours or more before elective procedures requiring general anesthesia, regional anesthesia, or sedation/analgesia is recommended.

Examples of a light meal include toast, cereal, soup, or apple sauce.

3. Additional fasting (eight hours or more) may be required depending on the amount and type of food ingested. Fried, fatty foods, or meat may prolong gastric emptying. Finally, these guidelines may not apply to patients with comorbidities or diseases (for example, diabetes, hiatal hernia) that affect gastric emptying or fluid volumes.

## C. Antibiotic Prophylaxis and Venous Thromboembolism Prevention

### Antibiotic prophylaxis

The relationship between appropriately dosed preoperative antibiotics and reduced risk of surgical site infections (SSIs) is well-established. Studies have also suggested a mortality benefit at 60 days for older patients who receive preoperative antibiotics within at least two hours of incision.<sup>18,19</sup> Older patients may have compromised renal function and, as such, may require particular attention to dosing.

The risk of SSI is highly dependent on the type of surgery.<sup>20</sup> Procedures at particularly high risk of infection include abdominal operations, operations requiring bowel anastomosis, contaminated or dirty procedures, procedures for cancer, and prolonged, complex, or emergent procedures.<sup>21-23</sup>

The Society for Healthcare Epidemiology of America/Surgical Infection Society/American Society of Health-System Pharmacists/Infectious Diseases Society of America clinical practice guidelines apply to older adults.<sup>24</sup>

- Preoperative antibiotics should be given based on procedure, risk factors, and the hospital's unique pathogen profile within 60 minutes before surgical incision.

### Venous thromboembolism prophylaxis

Older age confers additional risk for venous thromboembolism (VTE). It is important that older adult patients undergo VTE risk stratification, which may involve the use of a scoring tool.<sup>25,26</sup>

The most recent American College of Chest Physicians (ACCP) guidelines and ACS NSQIP Best Practices Guidelines for the Prevention and Treatment of Venous Thromboembolism provide comprehensive direction.

See **Appendix II** for several older adult patient groups at particular high risk for VTE.

- Older adult patients should be stratified for VTE and bleeding risk with a structured approach, based on available methods and local institutional norms, and a plan, including dosage and duration, should be determined based on the patient's risk profile.

#### RISK FACTORS FOR VTE<sup>27,28</sup>

##### Hypercoagulability

Congenital hypercoagulability  
Cancer  
Cancer therapy  
History of VTE  
Inflammatory bowel disease  
Oral contraceptives  
Polycythemia  
Pregnancy  
Smoking  
Thrombocytosis

##### Venous Stasis

Congestive heart failure  
Immobility  
Increasing age  
Obesity  
Varicose veins  
Venous compression/obstruction

##### Endothelial Injury

Recent surgery  
Severe infection  
Trauma

## D. Medication Management

The *ACS/AGS Best Practices Guidelines for the Optimal Preoperative Assessment of the Geriatric Surgical Patient* provide guidance on how to approach medication management in the preoperative period.<sup>29</sup> Generally, this means that the patient's complete medication list, including over the counter medications, supplements, vitamins, and herbal agents, should be reviewed and documented.

Nonessential medications should be stopped in the days leading up to surgery. Medications with withdrawal potential or that are medically indicated during the perioperative period (for example, cardiac medications) should be continued. Ideally, a plan regarding the discontinuation or continuation for each of the patient's chronic medications has already been implemented prior to the arrival to the holding area.<sup>29</sup>

- In the immediate preoperative period, providers should repeat their review of the patient's medications and confirm that recommendations regarding management have been implemented, including:
  1. Discontinuation of nonessential medications.  
  
General considerations may include:
    - a. The potential for withdrawal
    - b. The progression of disease with interruption of drug therapy
    - c. The potential for interactions with anesthetic agents
  2. Continuation of essential medications.
  3. Planning for the resumption of all other baseline outpatient medications in the postoperative period with consideration for minimizing polypharmacy risk.

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## Section II. Intraoperative Management

Most intraoperative changes in physiologic parameters have minimal impact on long-term outcomes, though they have potential to result in harm for certain patients or in certain contexts. Aging is associated with numerous physiologic changes that affect pharmacokinetics and are important to consider during the intraoperative period.

In addition, many intraoperative considerations that are important for any patient population are particularly important in the elderly, owing to their decreased ability to compensate for physiologic stress.

In this section, we discuss regional anesthesia in the older adult, both for reducing adverse outcomes and improving postoperative pain control; approaches to perioperative analgesia; postoperative nausea and vomiting risk stratification and prevention; patient safety in the operating room; perioperative hypothermia; and fluid management.

## Intraoperative Management Checklist

- ☐ Anesthetic approach
  - Consideration of regional techniques to avoid postoperative complications and improve pain control
- ☐ Perioperative analgesic plan
  - Directed pain history
  - Multi-modal or opioid-sparing techniques
  - Consideration of regional techniques
- ☐ Postoperative nausea risk stratification and prevention strategies
- ☐ Patient safety
  - Strategies to pressure ulcers and avoid nerve damage
- ☐ Prevention of postoperative pulmonary complications and hypothermia
- ☐ Fluid management and physiologic management
  - Appropriate use of intravenous fluids
  - Appropriate hemodynamic management
  - Continuation of indicated cardiac medications

## A. Anesthesia in the Older Adult

Anesthetic medications have broad physiologic effects, potentially causing changes in systemic vascular resistance, cardiac preload, baroreceptor responses, lung mechanics and oxygen diffusion, neurotransmitter function, and blood flow to end-organs. Aging has wide-ranging effects on cardiovascular, pulmonary, and organ-specific physiology, as well as aspects of body composition, such as total body water and adipose tissue mass. All of these factors may affect drug pharmacokinetics and pharmacodynamics. In this context, many of the effects of anesthetic agents can be exaggerated, and adjustments to medication dosages may be warranted in older adults (see **Appendix III**).<sup>30-32</sup>

Essential to addressing the complex interaction of aging physiology and anesthetic pharmacology is meticulous monitoring and close collaboration between the surgery and anesthesia teams throughout the perioperative period. As with any patient, the appropriate anesthetic plan should take into account the type of procedure, as well as its duration and requirements.

- I. There is insufficient evidence to recommend a single “best” anesthetic plan for all older adults. The following physiologic changes should be considered when deciding on an anesthetic plan that is appropriate for each individual patient.

ALTERATIONS TO PHYSIOLOGY AND CLINICAL IMPLICATIONS FOR ANESTHESIA		
	Physiologic Alterations	Clinical Implications
Cardiovascular <sup>31,33</sup>	<ul style="list-style-type: none"> <li>• Decreased sympathetic response</li> <li>• Decreased venous compliance</li> <li>• Decrease in preload</li> <li>• Baroreceptor response impaired</li> <li>• Cardiac diastolic dysfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Labile blood pressure</li> <li>• Susceptibility to hypotension</li> <li>• Susceptibility to volume overload</li> <li>• Exaggerated decline in cardiac function with inadequate cardiac filling</li> </ul>
Pulmonary <sup>34</sup>	<ul style="list-style-type: none"> <li>• Increased pulmonary arterial pressures</li> <li>• Decreased response to hypoxia and hypercarbia</li> <li>• Decreased muscle mass and lung elasticity</li> <li>• Decreased cough reflex and esophageal motility</li> </ul>	<ul style="list-style-type: none"> <li>• Increased A-a gradient</li> <li>• Susceptibility to hypercarbia and hypoxemia</li> <li>• Susceptibility to residual anesthetic effects</li> <li>• Increased work of breathing</li> <li>• Increased dead space ventilation</li> <li>• Aspiration risk</li> </ul>
Nervous System	<ul style="list-style-type: none"> <li>• Decreased neurotransmitters</li> </ul>	<ul style="list-style-type: none"> <li>• Increased risk of postoperative delirium and cognitive dysfunction</li> </ul>
Endocrine System	<ul style="list-style-type: none"> <li>• Impaired glucose tolerance</li> </ul>	<ul style="list-style-type: none"> <li>• Increased intra-op hyperglycemia</li> </ul>
Hepatic/Renal System	<ul style="list-style-type: none"> <li>• Altered drug metabolism</li> <li>• Decreased renal mass</li> </ul>	<ul style="list-style-type: none"> <li>• Decreased drug clearance</li> <li>• Susceptible to acute kidney injury</li> </ul>
Thermoregulation	<ul style="list-style-type: none"> <li>• Decreased muscle mass</li> <li>• Decreased vascular reactivity</li> </ul>	<ul style="list-style-type: none"> <li>• Increased risk of hypothermia</li> </ul>

### ***The role of regional techniques for anesthesia in the older adult***

Regional anesthesia refers to nerve blockade with local anesthetic medications. Regional techniques that block nerves within the central nervous system are termed “neuraxial” blocks and involve injection of local anesthetic into either the epidural or subarachnoid (“spinal anesthesia”) space. Other regional techniques may block individual nerves or groups of nerves within the peripheral nervous system, such as the femoral nerve or the brachial plexus.

Regional techniques may be used as a primary anesthetic modality (typically combined with intravenous sedation) for surgical anesthesia or may be combined with general anesthesia as an adjunctive modality to enhance intraoperative and postoperative pain relief (see Section II.B).

#### **2. Definitive evidence does not exist establishing the superiority of regional anesthesia compared with general anesthesia when used as a primary modality for surgical anesthesia in older adults.**

Although a recent Cochrane review suggests there may be benefits to selecting regional versus general anesthesia as a primary anesthetic modality in certain patient groups (see the following table), this issue remains controversial due to the quality of the studies and the lack of consideration of the risks of neuraxial blockade in many of the studies.<sup>35-42</sup> The overall approach to the determination of the planned primary anesthetic technique for surgery in older adults should occur in a multidisciplinary fashion, involving the surgeon, anesthesiologist, and, whenever possible, the geriatrician.<sup>43</sup>

<b>ROLE OF REGIONAL ANESTHETIC TECHNIQUES FOR ANESTHESIA IN OLDER ADULTS: SELECTED EXAMPLES<sup>39,43-55</sup></b>		
<b>Scenario</b>	<b>Recommendation</b>	<b>Potential benefits of regional anesthesia</b>
Repair of hip fracture	In appropriate patients undergoing surgery for hip fractures, patients should be offered regional anesthesia <i>or</i> general anesthesia after discussing the risks and benefits	<ul style="list-style-type: none"> <li>• Reduced 30-day mortality</li> <li>• Reduced requirement of sedatives</li> <li>• Absence of airway instrumentation</li> <li>• Decreased risk of thrombosis and blood loss</li> <li>• Reduced postoperative confusion</li> </ul>
Elective hip and knee arthroplasty	In appropriate patients undergoing elective joint replacements, regional anesthesia should be considered after discussing the risks and benefits	<ul style="list-style-type: none"> <li>• Reduced mortality</li> <li>• Better pain scores</li> <li>• Reduced sedation frequency</li> <li>• Reduced use of critical care</li> <li>• Reduced systemic infection</li> <li>• Increased urinary retention</li> <li>• Increased pruritus</li> <li>• Increased frequency of low BP</li> </ul>
Lower limb revascularization	In appropriate patients undergoing lower limb revascularization, regional anesthesia should be considered after discussing the risks and benefits	<ul style="list-style-type: none"> <li>• Reduced risk of pneumonia</li> </ul>

## B. Perioperative Analgesia in the Older Adult

There are numerous techniques and approaches to analgesia, including intravenous opioids, oral opioids, nonopioid analgesics, regional techniques (such as neuraxial blockade and peripheral nerve blocks), and alternative methods (for example, acupuncture, music therapy, massage, cryotherapy).

Older adults (>65 years) in particular are sensitive to opioid analgesics, and use of medications beyond the minimum doses needed to achieve adequate analgesia should be avoided. Opioids can lead to complications such as cognitive dysfunction or delirium; in addition, older adults are at higher risk for hemodynamic and respiratory impairments associated with opioid analgesics.<sup>56-58</sup>

In this section, we focus on multimodal approaches to pain control in general, as well as the role of regional techniques for analgesia for several procedures commonly performed in older adults. The ASA provides practice guidelines on acute pain management in the perioperative period, from which some of these recommendations are drawn.<sup>59</sup>

1. Anesthesiologists offering perioperative analgesia services should provide, in collaboration with other health care professionals as appropriate, ongoing education and training to ensure that hospital personnel are knowledgeable and skilled with regard to the effective and safe use of the available treatment options within the institution.
2. Every older adult patient should receive a directed pain history and physical examination.
3. An appropriate analgesic plan should be developed in every older adult patient prior to an operation. This plan should be multimodal in nature and accomplish the following:
  - Be appropriately titrated for the increased sensitivity and altered physiology of the older adult.
  - Include a prophylactic pharmacologic bowel regimen such as a stool softener (for example, docusate) and stimulant laxative (for example, stool softener, bisacodyl) when appropriate.<sup>55,60</sup>
    - ◇ Oral mineral oil should be avoided (Beers criteria)
  - Avoid potentially inappropriate medications as defined by the American Geriatrics Society Beers criteria.  
**Common analgesics and anxiolytics to avoid include:**
    - ◇ Barbiturates
    - ◇ Benzodiazepines
    - ◇ Nonbenzodiazepine hypnotics (eszopiclone, zolpidem, zaleplon)
    - ◇ Pentazocine
    - ◇ Meperidine
    - ◇ Skeletal muscle relaxants (carisoprodol, chlorzoxazone, metaxalone, methocarbamol, orphenadrine)
    - ◇ Non-Cox NSAIDs
  - Use opioid-sparing techniques, which may include preoperative, intraoperative, and/or scheduled postoperative acetaminophen or the addition of regional techniques such as neuraxial blockade or peripheral nerve blocks (see the following table).



### ***The role of regional techniques for analgesia in the older adult***

Regional techniques can be added to the perioperative plan as a way to improve pain control, avoid opioids, and improve satisfaction and outcomes. Many epidural anesthetics include low doses of local anesthetic agents, which can result in sympathetic blockade. The effects of such a blockade can be exaggerated in the elderly.<sup>31,61,62</sup>

4. When added to general anesthesia and compared with systemic opioid-based pain relief, regional techniques in select patients can reduce pain, sedation frequency, duration of tracheal intubation and mechanical ventilation, time to return of gastrointestinal function, risk of perioperative myocardial infarction, and overall risk of perioperative cardiovascular complications.<sup>39,44-47</sup>

Peripheral nerve blocks can be useful in many older adult patients, particularly those undergoing orthopaedic procedures, though there is controversy over the relative benefit of single injection vs continuous nerve block. Generally speaking, these blocks can result in better pain scores, reduced sedation frequency, and reduced usage of opioid medications when compared with systemic opioids.

#### **ROLE OF REGIONAL TECHNIQUES IN MULTIMODAL POSTOPERATIVE ANALGESIA IN OLDER ADULT PATIENT GROUPS: SELECTED EXAMPLES<sup>44-49,51,63-65</sup>**

Scenario	Recommendation	Potential benefits of regional anesthesia
Abdominal surgery, including open abdominal aortic aneurysm repair	<ul style="list-style-type: none"> <li>In appropriate patients undergoing major abdominal surgery, the addition of an epidural with local anesthetic may be considered</li> </ul>	<p>When compared with systemic opioid therapy:</p> <ul style="list-style-type: none"> <li>Quicker return to of bowel function</li> <li>Reduced duration of tracheal intubation/mechanical ventilation</li> <li>Reduced cardiac complications, respiratory failure, GI complications, renal failure</li> <li>Improved pain scores</li> </ul>
Repair of hip fracture	<ul style="list-style-type: none"> <li>Preoperative or postoperative nerve blocks (via femoral nerve or iliac blockade) should be considered for all patients undergoing hip fracture surgery</li> </ul>	<ul style="list-style-type: none"> <li>Decreased hospital length of stay</li> <li>Improved pain scores</li> <li>Reduced sedation frequency</li> </ul>
Thoracotomy	<ul style="list-style-type: none"> <li>In appropriate patients undergoing thoracotomy, the addition of thoracic epidural anesthesia should be considered</li> <li>The role of paravertebral blocks in this patient group is not clear</li> </ul>	<p>When compared with systemic opioid therapy:</p> <ul style="list-style-type: none"> <li>Better pain scores</li> <li>Increased incidence of hypotension</li> </ul>
Elective hip and knee arthroplasty	<ul style="list-style-type: none"> <li>Regional analgesic techniques should be considered in all older adult patients undergoing joint arthroplasty procedures without contraindications</li> </ul>	<ul style="list-style-type: none"> <li>Reduced opioid usage</li> <li>Improved pain scores</li> </ul>

## C. Perioperative Nausea and Vomiting

Nausea and vomiting is among the most common complications in the immediate postoperative period. It is an important patient fear entering a surgical procedure and can result in poor patient satisfaction, prolonged time in the postanesthesia care unit, and unplanned hospital admission in surgical outpatients.<sup>66,67</sup>

Important in its prevention and management in older adults is appropriate risk stratification, implementation of prevention strategies, and avoidance of medications typically used in this setting (for example, scopolamine) that may precipitate confusion and postoperative delirium. These recommendations arise mainly from a recent update to guidelines published by the Society for Ambulatory Anesthesiology.<sup>68</sup>

1. The risk factors for postoperative nausea and vomiting should be assessed in all older adult patients undergoing a surgical procedure.

There are several tools available that can assist with objective assessment of risk, including the Apfel and Koivuranta tools.<sup>69, 70, 71, 72</sup>

<b>RISK FACTORS FOR PONV<sup>68,71,73</sup></b>
<b>Patient-specific</b>
Female gender
Nonsmoking status
History of PONV or motion sickness
Younger age (age<50 years)
<b>Anesthetic- and surgery-related</b>
Use of volatile anesthetics and nitrous oxide
General versus regional anesthesia
Use of intraoperative and postoperative opioids
Longer duration of surgery

2. Older adults at moderate or high risk for PONV should receive prophylactic interventions and risk mitigation strategies based on their baseline risk factors per guidelines and local norms.
3. The health care team should be aware of those medications used for PONV prophylaxis and treatment that are on the American Geriatrics Society updated Beers criteria for potentially inappropriate medication use in older adults and carefully weigh their potential benefits and risks.<sup>58</sup>

**SUMMARY OF MEDICATIONS COMMONLY USED FOR PONV  
PROPHYLAXIS AND TREATMENT IN ADULTS<sup>58,68</sup>**

Drug	Beers criteria recommendation	Caution
5-HT <sub>3</sub> receptor antagonists (for example, ondansetron)	Use as alternative	Serotonin syndrome QT prolongation
Corticosteroids (for prophylaxis)	Avoid in older adults with or at high risk for delirium	May induce or worsen delirium
Transdermal scopolamine (for prophylaxis)	Avoid unless no other alternatives	Strong anticholinergic properties (increased risk for delirium/cognitive impairment)  Can worsen constipation
Metoclopramide	Avoid, unless for gastroparesis	Risk of extrapyramidal effects may be increased in frail older adults
Low-dose promethazine	Avoid	Anticholinergic (increased risk for delirium/cognitive impairment)  Increased risk of constipation
Prochlorperazine	Avoid	Anticholinergic  (increased risk for delirium/cognitive impairment)
PONV, postoperative nausea and vomiting		

## D. Patient Safety

Patient safety is an important consideration in the operating room. With regard to older adults, the risk of peripheral nerve damage and pressure injuries from malpositioning is increased by skin atrophy and decreased skin integrity. A national study found the prevalence of intraoperative ulceration to be 8.5 percent.<sup>74</sup>

- Measures should be taken to ensure proper positioning and padding of bony prominences of elderly patients undergoing elective or nonelective surgery to maintain skin integrity and limit pressure on peripheral nerves.

### POSSIBLE INTRAOPERATIVE RISK FACTORS FOR PRESSURE ULCERS<sup>74-83</sup>

- Cardiopulmonary bypass
- Hypothermia
- Intraoperative transfusion
- Longer case length
- Longer periods of intraoperative hypotension
- Low intraoperative diastolic blood pressure
- Patient positioning
- Severe illness (higher ASA class, comorbidity burden)
- Vasopressor use

## E. Intraoperative Strategies to Prevent Postoperative Complications and Hypothermia

### ***Prevention of Postoperative Pulmonary Complications***

The other patient safety concern during the intraoperative period has to do with aspiration and pulmonary complications. Retrospective work has suggested that though this is a rare event, perioperative pulmonary aspiration can potentially lead to significant morbidity.<sup>84,85</sup> In addition to following fasting recommendations (see I.B), there are several strategies in the operating room that should be considered.

- The health care team should implement intraoperative strategies to prevent aspiration and pulmonary complications.

#### **INTRAOPERATIVE STRATEGIES TO PREVENT PULMONARY COMPLICATIONS<sup>33,86,87</sup>**

- Epidural use whenever possible
- Avoid intermediate-(for example, cisatracurium, rocuronium, vecuronium) and long-acting neuromuscular blocking agents (i.e., pancuronium) where possible
- When neuromuscular blockade is used, ensure adequate recovery of neuromuscular function prior to extubation
- Use of laparoscopic approaches whenever possible, especially during bariatric surgery

### ***Intraoperative Hypothermia***

Perioperative hypothermia is defined as a temperature of less than 36.0°C. Almost all anesthetics can inhibit thermoregulatory function, both centrally and via direct vasodilatory action, which is exacerbated by the cold operating room environment. Although hypothermia is a concern in any patient during the intraoperative period, the elderly in particular are predisposed to hypothermia due to altered thermoregulation from decreased muscle mass, metabolic rate, and vascular reactivity.<sup>82,83</sup>

Hypothermia is associated with adverse events in the surgical patient, including surgical site infections, cardiac events, coagulopathy leading to surgical bleeding, and increased oxygen consumption due to shivering.<sup>82,83,88-92</sup>

1. Core temperature should be monitored in surgeries lasting more than 30 minutes.
2. Patient warming with forced air warmers and/or warmed IV fluids should be used in older patients who are undergoing procedures longer than 30 minutes to avoid hypothermia.

## F. Fluid Management and Targeting Physiologic Parameters

Appropriate use of intravenous fluids to prevent adverse effects associated with decreased physiologic reserve is important when caring for the geriatric surgical patient. Several studies have suggested that certain groups of patients stand to benefit from specific fluid management protocols (restrictive vs. liberal intravenous fluids) and strategies based on optimizing physiologic parameters (“goal-directed therapy”).

Generally speaking, more restrictive or goal-directed strategies should be preferred over fixed-volume strategies, which can cause fluid overload.<sup>93-95</sup> However, there is no consensus on the proper definition of a restrictive strategy or the optimal monitoring method.

A 2012 Cochrane review included 31 studies and over five thousand participants. Though not limited to older adult patients, the authors found that the use of fluids and/or vasoactive medications to achieve defined targets significantly increased global blood flow, but did not improve mortality. The review did however note that such approaches may reduce perioperative complications and length of stay. The overall quality of evidence was moderate to low.<sup>96</sup> More recently, a 2014 randomized trial suggested that a cardiac output-guided hemodynamic therapy algorithm did not have an effect on postoperative outcomes, but inclusion of the data in an updated meta-analysis indicated a reduced complication rate.<sup>97</sup>

Unfortunately, this literature does not allow for broad best practices statement regarding intraoperative fluid management beyond the avoidance of fixed-volume strategies. The reasons for this are numerous and include: heterogeneous patient populations and operations, variable monitoring methods, and no standardized definitions of what constitutes “restrictive” vs. “liberal” fluid administration or “goal-directed therapy” across studies.

1. In general, the administration of intravenous fluids should take into account the combined effects of aging, anesthetics, analgesics, and anxiolytics on physiology.
2. There is insufficient evidence to support a best practices statement for or against specific fluid management strategies or interventions designed to optimize physiologic parameters (“goal-directed therapy”) in the older adult.

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## Section III. Postoperative Management

This section focuses on several postoperative complications particularly common in geriatric patients, including delirium, pulmonary complications, falls, undernutrition, urinary tract infection (UTI), pressure ulcers, and functional decline.

Many of these age-related postoperative complications share common risk factors. Several multicomponent interventions designed to address them have been developed and implemented with success. Generally, these address the education of health care providers in core geriatric principles, risk factors, patient and family choices and treatment goals, the incorporation of evidence-based interventions and interdisciplinary communication, and discharge planning/transitional care.<sup>98</sup> The principles underlying these multicomponent interventions are summarized in Section III.F, and several widely-known care models are described in Appendix VI.

In order to help facilitate comprehensive evaluation of geriatric patients following surgery, we have provided a postoperative “rounding” checklist. This checklist incorporates assessments that should be performed daily as well as associated prevention strategies.

## Postoperative Rounding Checklist

Daily Evaluation For	Prevention/Management Strategies
<input type="checkbox"/> Delirium/cognitive impairment	<ul style="list-style-type: none"> <li>• Pain control</li> <li>• Optimize physical environment (for example, sleep hygiene, sleep protocol, minimize tethers, encourage family at bedside)</li> <li>• Vision and hearing aids accessible</li> <li>• Remove catheters</li> <li>• Monitor for substance withdrawal syndromes</li> <li>• Minimize psychoactive medications</li> <li>• Avoid potentially inappropriate medications (for example, Beers criteria medications)</li> </ul>
<input type="checkbox"/> Perioperative acute pain*	<ul style="list-style-type: none"> <li>• Ongoing education regarding safe and effective use of institutional treatment options</li> <li>• Directed pain history</li> <li>• Multimodal, individualized pain control</li> <li>• Vigilant dose titration</li> </ul>
<input type="checkbox"/> Pulmonary complications	<ul style="list-style-type: none"> <li>• Chest physiotherapy and incentive spirometry</li> <li>• Early mobilization/ambulation</li> <li>• Aspiration precautions</li> </ul>
<input type="checkbox"/> Fall risk	<ul style="list-style-type: none"> <li>• Universal fall precautions</li> <li>• Vision and hearing aids accessible</li> <li>• Scheduled toileting</li> <li>• Appropriate treatment of delirium</li> <li>• Early mobilization/ambulation</li> <li>• Early physical/occupational therapy if indicated</li> <li>• Assistive walking devices</li> </ul>
<input type="checkbox"/> Ability to maintain adequate nutrition	<ul style="list-style-type: none"> <li>• Resume diet as early as feasible</li> <li>• Dentures made available</li> <li>• Supplementation if indicated</li> </ul>
<input type="checkbox"/> UTI prevention	<ul style="list-style-type: none"> <li>• Daily documentation of Foley catheter indication</li> <li>• Catheter care bundles, hand hygiene, barrier precautions</li> </ul>
<input type="checkbox"/> Functional decline	<ul style="list-style-type: none"> <li>• Care models and pathways</li> <li>• Structural: uncluttered hallways, large clocks and calendars</li> <li>• Multidisciplinary rounds</li> <li>• Early mobilization and/or PT/OT</li> <li>• Family participation</li> <li>• Nutritional support</li> <li>• Minimize patient tethers</li> </ul>
<input type="checkbox"/> Pressure ulcers	<ul style="list-style-type: none"> <li>• Reduce/minimize pressure, friction, humidity, shear force</li> <li>• Maintain adequate nutrition</li> <li>• Wound care</li> </ul>
*See Section II.B in these guidelines and the ASA Practice Guidelines for Acute Pain Management in the Perioperative Setting. <sup>59</sup>	



## A. Postoperative Delirium

Delirium is perhaps the most significant age-related postoperative complication. It is characterized by an acute decline in cognitive function and attention, with evidence from the history that this is due to physiologic derangement, a medication, or multi-factorial.<sup>99</sup> Importantly, delirium is distinct from chronic cognitive decline and dementia. The diagnosis of dementia in the preoperative period is important for risk stratification and for its implications in diagnosing delirium postoperatively.

### **Identification of high-risk patients**

- Health care professionals caring for surgical patients should perform an assessment of delirium risk factors, including age > 65 years, chronic cognitive decline or dementia, poor vision or hearing, severe illness (for example, ICU admission), and presence of infection.

Depending on the patient population in question, the prevalence of postoperative delirium ranges from 9-44 percent, with the highest rates observed after high-risk procedures, such as cardiac surgery, vascular surgery, and hip fracture surgery. Delirium is associated with worse surgical outcomes, longer hospital length of stay, functional decline, higher rates of institutionalization, higher mortality, and higher costs and resource utilization.<sup>100-110</sup>

It is important to recognize the distinct but highly interrelated concepts of baseline delirium risk factors and precipitating factors, which contribute to the development of delirium in a cumulative way.<sup>105</sup> During the postoperative period, surgery acts as a physiologic stressor, the intensity of which is determined by the extent of the operation.<sup>111</sup> A table of perioperative markers of risk for delirium, many of which are interrelated, is provided in **Appendix IV**.

### **Postoperative screening and diagnosis**

Current evidence regarding routine delirium screening in all patients is conflicting.<sup>113-115</sup> The benefits of routine postoperative screening for delirium in all older adult patients include early detection and treatment; however, routine screening could also result in misdiagnosis, inappropriate treatment, and increased costs. That said, in appropriate settings, such as in a high risk population or a specialized unit, the health care team may choose to institute screening using a validated instrument.

Evaluation of a patient who is suspected to have delirium requires an accurate clinical history, objective testing and behavioral observation. There are three distinct motor subtypes of delirium: hypoactive delirium, which presents with lack of awareness and decreased motor activity; hyperactive delirium, which occurs when a patient is combative or agitated; and a mixed subtype.<sup>116-118</sup>

In order for delirium to be diagnosed, at risk patients or patients with suspected cognitive impairment should undergo an assessment confirming the following: disturbance of consciousness, a change in cognition, acute onset, and evidence from the history that this is due to physiologic derangement (for example, hypoxia, hypoglycemia, electrolyte abnormality, acid base abnormality), an intoxicant, medications, or more than one cause.<sup>118</sup>

Several validated tools are currently available to evaluate for and diagnose delirium.<sup>116,102-111</sup> One of the most widely used instruments, known as the Confusion Assessment Method (CAM), is highlighted here;<sup>119</sup> a related tool (the CAM-ICU), specifically designed to be used in nonverbal, mechanically ventilated patients, is provided in **Appendix V**.<sup>120-122</sup>

1. The health care team may consider instituting daily postoperative delirium screening of all older adult patients using a validated screening instrument (for example, CAM-short form) in order to initiate optimal delirium treatment as early as possible.
2. All adult ICU patients and those identified as high risk (see above) should be regularly assessed for delirium by an appropriate health care team member using a validated instrument such as the CAM-ICU or Intensive Care Delirium Screening Checklist.
3. The health care team should perform a physical examination and begin managing postoperative delirium based on positive screening and/or findings.

DIAGNOSING DELIRIUM: THE CONFUSION ASSESSMENT METHOD – SHORT FORM		
Feature	Question	Answer Required
Acute onset and fluctuating course	Is there evidence of an acute change in mental status from baseline, and if so, did it tend to come and go or increase and decrease in severity?	'Yes' answer
Inattention	Did the patient have difficulty focusing attention?	'Yes' answer
Disorganized thinking	Was the patient's thinking disorganized or incoherent?	'Yes' answer
Altered level of consciousness	What is the patient's level of consciousness? (alert, vigilant, lethargic, stupor, or coma)	Any answer other than alert
Scoring: Suggestion of diagnosis requires the presence of (1) and (2) and either (3) or (4)		
Adapted from Inouye SK, van Dyck CH, Alessi CA, et al, Clarifying confusion: the confusion assessment method. A new method for detection of delirium. <i>Ann Intern Med</i> 1990;113(12):941-8.		

4. The health care team should evaluate all postoperative patients who develop delirium for possible precipitating conditions. These include:
  - a. Uncontrolled pain
  - b. Hypoxia
  - c. Pneumonia
  - d. Infection (wound, indwelling catheter and blood stream, urinary tract, sepsis)
  - e. Electrolyte abnormalities
  - f. Urinary retention
  - g. Fecal impaction
  - h. Medications
  - i. Hypoglycemia

### **Prevention and treatment**

Up to 30 to 40 percent of cases of delirium are preventable.<sup>123</sup> Consequently, the best treatment for delirium is prevention. Should delirium develop however, the first step in management is to investigate for possible causes.

There are several nonpharmacologic and pharmacologic interventions that are commonly used when delirium occurs (for example, reorientation, environmental modifications, antipsychotic agents), each of which treat the symptoms of delirium with varying levels of success.<sup>108</sup>

A recent comprehensive review of the relevant literature on the evaluation and treatment of postoperative delirium was conducted by a multidisciplinary panel.<sup>99</sup> This review focused on nonpharmacologic and pharmacologic interventions that should be implemented perioperatively for delirium prevention and treatment.<sup>124</sup>

5. Health care professionals should implement strategies for the prevention of postoperative delirium in older adults.

### **DELIRIUM PREVENTION STRATEGIES<sup>99,108</sup>**

- Education targeted to health care professionals about delirium
- Multicomponent, multidisciplinary nonpharmacologic interventions which may include:
  - Daily physical activity
  - Cognitive reorientation
  - Bedside presence of a family member whenever possible
  - Sleep enhancement (for example, nonpharmacologic sleep protocol and sleep hygiene)
  - Early mobility and/or physical rehabilitation
  - Adaptations for visual and hearing impairment
  - Nutrition and fluid repletion
  - Pain management
  - Appropriate medication usage
  - Adequate oxygenation
  - Prevention of constipation
  - Minimization of patient tethers whenever possible (for example, Foley catheters, periodic removal of sequential compression devices, EKG cords)

Adapted from Clinical Practice Guidelines for Postoperative Delirium in Older Adults, *J Am Geriatr Soc*, 2014.

6. After addressing underlying causes, health care professionals should treat older adults with postoperative delirium with multicomponent nonpharmacologic interventions and reserve pharmacologic interventions only for patients who pose substantial harm to themselves or others with agitated, hyperactive delirium behaviors.

### TREATING DELIRIUM<sup>99,108</sup>

Patient	First Line Therapy	
All delirious elderly patients	Multicomponent nonpharmacologic interventions	<ol style="list-style-type: none"> <li>1. Frequent reorientation with voice, calendars and clocks</li> <li>2. Calm environment</li> <li>3. Eliminating restraint use</li> <li>4. Familiar objects in the room</li> <li>5. Ensuring use of assistive devices (glasses, hearing aids)</li> </ol>
	Second Line Therapy	
Agitated, delirious elderly patients threatening substantial harm to self and/or others, if behavioral measures have failed or are not feasible	Antipsychotic medications at lowest effective dose	<ol style="list-style-type: none"> <li>1. Haloperidol starting at 0.5-1 mg PO/IM/IV (IV route not recommended due to increased risk of prolonged QT interval) Reevaluate in 15 min-1 hr and double dose if ineffective Increased risk of prolonged QT interval when dose exceeds 35 mg per day</li> <li>2. The following can also be used: <ol style="list-style-type: none"> <li>a. Risperidone</li> <li>b. Olanzapine</li> <li>c. Quetiapine</li> <li>d. Ziprasidone</li> </ol> </li> </ol>

Adapted from Clinical Practice Guidelines for Postoperative Delirium in Older Adults, *J Am Geriatr Soc*, 2014.

## B. Pulmonary Complication Prevention

Older adult patients are at risk for postoperative pulmonary complications, including atelectasis, hospital-acquired pneumonia, and acute respiratory failure. These kinds of complications increase the risk of long-term mortality following surgery.<sup>125,126</sup> Additionally, older age may be an independent predictor of postoperative pneumonia, after adjustment for comorbidity burden.<sup>127</sup>

In addition to interventions designed to optimize pulmonary status during the preoperative and intraoperative period such as inspiratory muscle training, minimally invasive surgical approach, and smoking cessation, which may be particularly difficult in older patients due to the duration of behavior, there are several postoperative strategies that can be used to prevent pulmonary complications in the older patient.<sup>127-129</sup>

- Health care professional should implement postoperative strategies for the prevention of pulmonary complications in the older adult.

### POSTOPERATIVE STRATEGIES TO PREVENT PULMONARY COMPLICATIONS<sup>86,130</sup>

- Aspiration precautions:
  - Bedside evaluation of any patient with symptoms, signs or history of dysphagia (see Section III.D)
  - Instrumental swallow evaluation in select patients
    - Potential indications: signs/symptoms inconsistent with examination, nutritional or pulmonary compromise with possible dysphagic-related etiology, concern for safety and efficiency of swallowing, high risk diagnosis (for example, neurologic or gastrointestinal pathology), change in swallow function suspected)
  - Head of bed elevation at all times with repositioning
  - Getting out of bed for all meals when possible
  - Sitting upright while eating and for 1 hour after completing
- Use of incentive spirometer and chest physical therapy
- Use of deep breathing exercises
- Epidural analgesia

Partially adapted from ACS NSQIP Best Practices Guidelines: Prevention of Postoperative Pulmonary Complications

## C. Fall Risk Assessment and Prevention

Falls are an important public health problem in the older adult: it is estimated that approximately 30 percent of people over 65 years of age in the community fall every year.<sup>131</sup> National Quality Forum Safe Practice 33 pertains to falls in hospitalized patients and recommends that preventive actions be taken.<sup>132</sup> Estimates of falls in hospitalized patients are somewhere between 700,000 and 1,000,000 events every year.<sup>120</sup> One retrospective study demonstrated that 1.5 percent of surgical inpatients experience postoperative falls, and that the average age of patients who fell was 64 years of age.<sup>133</sup>

Most falls are caused by complex interactions and combinations of factors.<sup>134</sup> Consequently, multifactorial interventions, generally comprising a risk assessment and addressing each risk factor, have proven to be most effective across various practice settings.

- All postoperative older adult patients should undergo an evaluation of their fall risk either through identification of risk factors or through the use of a risk scale (see Appendix VI for a commonly used fall risk scale).

### **RISK FACTORS FOR FALLS IN THE HOSPITALIZED PATIENT<sup>133,135</sup>**

- Altered mental status
- Dehydration
- Frequent toileting
- History of falls
- Impaired gait or mobility
- Medications
- Visual impairment

### ***Fall prevention***

Fall prevention interventions in the hospitalized older adult were reviewed in a 2010 Cochrane review, which examined studies in the acute hospital and nursing home setting. In both, multicomponent interventions, including supervised exercises, environmental elements, assistive technology, and knowledge interventions, were found to significantly reduce the rate of falls and number of patients who fell.<sup>134</sup>

The Agency for Health care Research and Quality (AHRQ) has also produced a toolkit designed to facilitate development and implementation of sustainable fall prevention programs which includes several important interventions.<sup>120</sup>

- I. Universal Fall Precautions are indicated in all older adult patients. Fall risk precautions should not interfere with early mobilization and ambulation in the postoperative setting.

#### AHRQ UNIVERSAL FALL PRECAUTIONS<sup>120</sup>

- Familiarize patient with environment
- Demonstrate call light use
- Maintain call light within reach
- Keep personal possessions within reach
- Sturdy handrails in bathrooms, room, and hallway
- Hospital bed in low position when patient resting; raised to comfortable height when patient transferring
- Hospital bed brakes locked
- Wheelchair wheels locked when stationary
- Nonslip, comfortable, well-fitting footwear
- Night light or supplemental lighting use
- Keep floor surfaces clean and dry; clean spills promptly
- Keep patient care areas uncluttered
- Follow safe patient handling practices

2. Older adult patients with specific risk factors for falls in the postoperative period should receive targeted care planning for fall prevention.

#### TARGETED FALL PREVENTION<sup>120,136</sup>

Risk Factor	Assessment/Intervention
Altered mental status	Assess for delirium Frequent checks Review medications
Dehydration	Adequate hydration Monitor for orthostatic hypotension
Frequent toileting	Scheduled toileting
History of falls	Assess injury risk (history of osteoporosis or low-trauma fractures) Identify patients on anticoagulant medications Review physical environment to reduce injury risk Assistive walking devices (for example, walkers) at bedside if used as outpatient
Impaired gait or mobility	Participation in mobility program focused on positioning assistance and balance and gait training Early physical and/or occupational therapy
Medications	Daily medication review Check for orthostatic hypotension
Visual impairment	Corrective lens within reach

## D. Nutrition in the Postoperative Period

Older adult patients who are hospitalized have high rates of malnutrition (up to 38.7 percent).<sup>137</sup> Several studies have also highlighted the association of postoperative malnutrition markers with adverse outcomes.<sup>138-140</sup>

Several studies and systematic reviews have reported that early feeding in select patients does not contribute harm.<sup>141,142</sup> Studies that have not demonstrated harm due to early feeding have notably excluded older adult patients; as such, there is no consensus on the true benefit or harm of early feeding in elderly populations. The European Society for Clinical Nutrition and Metabolism (ESPEN), among others, has established guidelines for enteral nutrition in both postoperative and geriatric patients.<sup>143,144</sup>

1. Older adult patients should undergo daily evaluation of their ability to intake adequate nutrition, and this includes risk of aspiration. There should be an initiation of dietary consultation and/or formal swallowing assessment if indicated.

### GENERAL SIGNS AND SYMPTOMS OF DYSPHAGIA<sup>145</sup>

- Coughing or choking with swallowing
- Difficulty initiating swallowing
- Sensation of food sticking in throat
- Drooling
- Change in dietary habits
- Change in voice or speech
- Nasal regurgitation
- Oral or pharyngeal regurgitation
- History of aspiration pneumonia

2. Older adult patients who use dentures should have them easily available and accessible.
3. The following aspiration precautions should be instituted in all older adult patients who undergo inpatient surgery:<sup>5</sup>
  - a. Head of bed elevation at all times with repositioning
  - b. Sitting upright while eating and one hour after completion of eating
4. Older adult patients should undergo daily evaluation of fluid status for at least first five postoperative days, such as daily recording of input/output or daily weights.



### ESPEN GUIDELINES ON POSTOPERATIVE ENTERAL NUTRITION<sup>146</sup>

1. Normal food intake or enteral feeding should be started as early as possible after gastrointestinal surgery (Grade A).
2. Apply tube feeding in patients in whom early oral nutrition cannot be initiated, with special regard to those
  - a. Undergoing major head/neck or gastrointestinal surgery for cancer (Grade A)
  - b. With severe trauma (Grade A)
  - c. With obvious undernutrition at the time of surgery (Grade A)
  - d. In whom oral intake will be inadequate (<60 percent) for more than 10 days (Grade C)
  - e. Initiate tube feeding for patients in need within 24 h after surgery (Grade A)
  - f. Start tube feeding at low flow rate due to limited intestinal tolerance (for example, 10-20 mL/hr) (Grade C)
  - g. It may take 5-7 days to reach target intake and this is not considered harmful (Grade C)
  - h. Reassess nutritional status regularly during the stay in hospital and, if necessary, continue nutritional support after discharge, in patients who have received nutritional support perioperatively (Grade C)

Below, the ESPEN Guidelines on Supplemental Nutrition in older adults, though not specific to postoperative patients, are provided.

### GENERAL ESPEN GUIDELINES ON SUPPLEMENTAL ENTERAL NUTRITION: GERIATRICS<sup>146</sup>

1. In older adult patients who are undernourished or at risk for undernutrition, use oral nutritional supplementation to increase energy, protein, and micronutrient intake, maintain or improve nutritional status, and improve survival (Grade A).
2. Oral nutritional supplementation should be used in the following patient groups to improve or maintain nutritional status:
  - a. Frail elderly (Grade B).
  - b. Patients with severe neurological dysphagia (Grade A).
  - c. Patients with early and moderate dementia (Grade C).
3. Oral nutritional supplementation should be used in postoperative period following hip fracture and orthopaedic surgery to reduce adverse outcomes (Grade A).
4. Oral nutritional supplementation, particularly with high protein content, can reduce the risk of developing pressure ulcers (Grade A).

## E. Urinary Tract Infection Prevention

Urinary tract infections (UTI) are among the most common postoperative complications, representing 32 to 40 percent of all nosocomial infections,<sup>147-149</sup> and are associated with significant health care costs.<sup>150</sup> Older adults are at particular risk for UTI, especially if immobilized.

- I. Health care professionals should implement strategies prior to, during, and after the insertion of urinary catheters to prevent UTI.

PREVENTION OF UTI <sup>151</sup>	
<b>Prior to Insertion of Urinary Catheter</b>	
<ul style="list-style-type: none"> <li>• Determine if urinary catheter is appropriate per CDC Guidelines<sup>148</sup></li> <li>• Consider frequent, scheduled toileting with assistance in incontinence patients</li> <li>• Consider alternative bladder drainage methods</li> <li>• Educate staff regarding proper insertion and maintenance of urinary catheters</li> </ul>	
<b>During Insertion of Urinary Catheter</b>	
<ul style="list-style-type: none"> <li>• Ensure that only trained personnel insert urinary catheters</li> <li>• Use smallest appropriate urinary catheter (14 Fr., 5 mL or 10 mL balloon usually appropriate)</li> <li>• Practice hand hygiene immediately prior to insertion of catheter</li> <li>• Use standard barrier precautions prior to any manipulation of the catheter/drainage system</li> </ul>	
<b>After Insertion of Urinary Catheter</b>	
<ul style="list-style-type: none"> <li>• Properly secure to prevent movement/urethral traction</li> <li>• Maintain sterile, closed drainage systems</li> <li>• Position drainage bag below bladder and off floor</li> <li>• Perform routine daily meatal care (use of antiseptics is not necessary)</li> <li>• Practice hand hygiene and wear clean gloves prior to any manipulation of the catheter/drainage system</li> <li>• Obtain urine sample aseptically from sampling port.</li> <li>• Avoid routine catheter irrigation. If obstruction is anticipated, closed continuous irrigation closed continuous irrigation may be used. To relieve obstruction due to mucus or clots, an intermittent method may be used.</li> </ul>	
Adapted from the ACS NSQIP Best Practices Guidelines: Prevention of Catheter Associated Urinary Tract Infections.	

2. If an older adult patient has an indwelling catheter, daily review and documentation of its indication should be completed and attempts be made to remove catheter as soon as possible.

#### **INDICATIONS FOR INDWELLING BLADDER CATHETERIZATION<sup>148,151</sup>**

- Patients undergoing genitourologic surgery, colorectal surgery, or surgery with extensive pelvic dissection
- Anticipated prolonged duration of surgery (these catheters should be removed in the postanesthesia care unit)
- Patients anticipated to receive large-volume infusions or diuretics during surgery
- Need for intraoperative monitoring of urinary output
- Need for short-term frequent monitoring of urine output in critically ill patients
- Management of acute urinary retention or obstruction
- Need to facilitate healing of advanced pressure ulcers in incontinent patients
- Patient preference to improve comfort

Indwelling catheters should be not be used as a substitute for nursing care of the older adult patient who is incontinent. They are also not indicated as a means of obtaining urine culture when a patient can void, nor should they routinely be used for patients receiving thoracic epidural anesthesia/analgesia.<sup>148,151</sup>

## F. Functional Decline

Elderly patients are at a high risk for functional decline during and after hospitalization. Over 30 percent of older persons develop a new disability pertaining to activities of daily living during hospitalization; by one year, less than 50 percent of these patients have recovered to previous levels of functioning.<sup>152</sup>

Though much of the literature on functional decline has focused on elderly patients hospitalized with medical illness, the stress of surgery further increases the risk of functional decline during the postoperative period. Of note, many of the risk factors for falls are also risk factors for functional decline. Though related, they remain distinct phenomena, and clinicians should take steps to address both separately.

- Health care professionals should implement interventions for the prevention of functional decline in the postoperative older adult.

### RISK FACTORS FOR FUNCTIONAL DECLINE<sup>153</sup>

- Advanced age
- Frailty
- Cognitive Impairment
- Poor mobility or functional impairment
- Depression
- Low social functioning
- Presence of other geriatric syndromes (falls, incontinence, pressure ulcers)

### INTERVENTIONS FOR PREVENTING FUNCTIONAL DECLINE<sup>5,154,155,120,121</sup>

#### Care models (Appendix VII)

- Hospital Elderly Life Program
- Acute Care for Elderly units<sup>156,157</sup>
- Nurses Improving Care of Health System Elders (NICHE)

#### Structural characteristics

- Handrails
- Uncluttered hallways
- Large clocks
- Large calendars

#### Staffing

- Nursing staff education
- Daily multidisciplinary rounds

#### Patient-based

- Promotion of family participation in care
- Early mobilization
- Early physical/occupational therapy referral
- Geriatric consultation
- Comprehensive discharge planning
- Nutritional support

### ***Geriatric models of care***

A model of care is a concept which broadly defines the way health services are delivered. In the context of older adult patients, there are several models of care that are designed to address their unique needs. The goals of these models of care include prevention of age-related complications – the so-called “geriatric syndromes” – and addressing hospital characteristics that contribute to increased risk.<sup>98</sup>

In addition to preventing some of the age-related complications discussed above, geriatric models of care are also designed to reduce cost and length of hospital stay, reduce risk of mortality, increase likelihood of discharge to home, improve care transitions, and improve patient satisfaction and functional status at discharge.<sup>158,159</sup>

#### **COMPONENTS OF GERIATRIC CARE MODELS<sup>98</sup>**

- Educate health-care providers in core geriatric principles
- Target risk factors for age-related complications
- Incorporate patient and family preferences and treatment goals
- Employ evidence-based interventions
- Multi- and interdisciplinary communication
- Emphasize care transitions

See **Appendix VI** for a summary of four geriatric care models that are currently in use in hospitals today.

## G. Pressure Ulcer Prevention and Treatment

The hospitalized elderly are at high risk for developing pressure ulcers, largely due to their co-morbidity burden. Up to two-thirds of pressure sores develop in patients over the age of 70. The majority of these occur in the acute hospital setting, usually during the first two weeks of hospitalization<sup>78,79,160-163</sup>

- I. Health care teams should assess pressure ulcer risk in all older adult postoperative patients.

There are several validated scales, including the Braden scale (Appendix VIII),<sup>164</sup> Waterlow score,<sup>165,166</sup> or Norton risk-assessment scale.<sup>167</sup> These tools stratifying patients at risk by assessing sensory perception, moisture, activity level, mobility, nutrition, and the potential for friction and shear. There is no consensus on which is the optimal scale, though the Braden is the most common. The use of a scale may be more accurate than clinical judgment in predicting pressure ulcer risk.<sup>168</sup>

### **PRESSURE ULCER RISK FACTORS<sup>160,161,169-172</sup>**

- Abnormal positioning due to spasticity or contracture
- Advanced age
- Chronic moisture
- Edema
- High co-morbidity burden (cardiovascular, neurological, or orthopaedic disease)
- Immunoincompetence
- Incontinence
- Infection
- Limited mobility
- Loss of sensation
- Shearing forces
- Skin fragility
- Unrelieved pressure

2. Health care teams should implement multicomponent interventions to prevent and treat pressure ulcers in the postoperative patient at risk for developing pressure ulcers.

<b>PRESSURE ULCER PREVENTION AND TREATMENT</b> <sup>162,163,173-177</sup>	
<b>Reduce/minimize pressure, friction, humidity, shear force</b>	
<ul style="list-style-type: none"> <li>• Turning patient every one to two hours</li> <li>• Avoid sliding patients</li> <li>• Use of lower pressure air mattress or air-fluidized chronic pressure- shifting bed</li> <li>• Higher specification foam mattresses</li> <li>• Consultation with physiatry and/or physical therapy</li> </ul>	
<b>Restoration of nutrition</b>	
<ul style="list-style-type: none"> <li>• Evaluate nitrogen exchange and food choices to estimate requirements and adequacy of current intake</li> <li>• Vitamin, essential mineral, or meal supplements (for example, protein shakes)</li> <li>• Consider pharmacologic enhancement of appetite (for example, megestrol)*</li> <li>• Tube feeding or parenteral nutrition, if indicated</li> <li>• Evaluate and treat other chronic illnesses, including anemia, diabetes, heart failure, HIV, kidney/ liver disease</li> </ul>	
<b>Wound care</b>	
<ul style="list-style-type: none"> <li>• Recognize and debride nonviable and/or devascularized tissue</li> <li>• Allow healing by secondary intention with dressing changes, negative pressure therapy,</li> <li>• Indwelling/sheath catheter or colostomy in incontinent patients, to increase likelihood of healing</li> </ul>	
<p>*Controversial<sup>178-186</sup> – the evidence of benefit is limited, and there are important adverse effects to these drugs, including venous thromboembolism and CNS side effects.</p>	

## Section IV. Care Transitions

Transitional care refers to interventions that intend to ensure continuity and coordination of care as patients move between health care settings. The transfer of patient care from the hospital to community settings can often be an unsystematic, unstandardized, fragmented process. The process is frequently fraught with poor understanding of posthospitalization recovery on the part of patients due to both low health literacy and poor communication on the part of providers. These and other factors can lead to increased rates of adverse events and subsequent rehospitalization.<sup>187</sup>

Up to one out of five Medicare beneficiaries experience readmission within 30 days.<sup>188</sup> Optimal care transitions from the hospital to home or postacute care settings can help reduce hospital lengths of stay, emergency department use, and rates of rehospitalization.<sup>189</sup>

Improving care transitions for the older adult requires a reorientation of hospital care. In addition to understanding the specific needs of the patient population, adapting to resource limitations, it is also important that there is commitment to improving geriatric care from senior administration. There are several models of transitional care that are designed to address the pitfalls of care transitions.<sup>190,191</sup>

Common components of these models, drawn from the literature and various resources, including AHRQ and the Institute for Health care Improvement's State Action on Avoidable Rehospitalizations State Action on Avoidable Rehospitalization (STAAR) initiative, are outlined below. See **Appendix IX** for a list of well-known models of transitional care.

### COMMON COMPONENTS OF MODELS OF TRANSITIONAL CARE<sup>188,190-196</sup>

- Coordinated care, particularly with primary care physician
- Engagement of patient, family, and/or caregiver
- Patient-centered medical record (for example, a medical record that the patient understands)
- Postdischarge follow up plan
- Medication management
- Knowledge of important signs and symptoms

The importance of consistent communication between the inpatient health care team, the patient, any family or caregivers, and primary care doctors regarding the inpatient course and expectations for recovery postoperative cannot be emphasized enough. This includes ensuring that a patient's home environment is evaluated adequately, comprehension of medication lists is ensured, follow-up plans for any postoperative events or assessments are initiated.



## Discharge planning in the older adult following surgery<sup>5</sup>

1. The health care team should assess the patient's social support and need for home health prior to discharge. Where appropriate, the family and caregivers should be involved with discharge planning.
  - a. Patient or patient caregiver should be given a complete list of all medications and dosages to continue upon discharge from the hospital. Medication changes made during the hospital stay should be emphasized
2. A discussion with the patient or patient caregiver should be held and documented with a health care professional regarding the purpose of each drug, how it is to be taken, and the expected side effects and adverse reactions of new medications.
3. Patients should undergo assessments of the following prior to discharge, and an appropriate follow-up plan should be initiated:
  - a. Nutrition (Mini Nutritional Assessment)
  - b. Cognition (3-Item Recall or Mini Mental State Exam)
  - c. Ambulation ability (Timed Up and Go Test)
  - d. Functional status
  - e. Presence of delirium
4. If an elderly patient undergoes elective or nonelective inpatient surgery and is being discharged from a hospital to home or to a nursing home, then written discharge instructions should be given and the following should be performed:
  - a. Comprehension of verbal discharge instructions should be assessed by checking ability of patient or caretaker to repeat back to the health care provider the discharge instructions
  - b. Documentation of pending laboratory tests or diagnostic studies, if applicable
  - c. Documentation of follow-up appointment for nonsurgeon physician visits or medical treatments, if applicable
  - d. Documentation of follow-up appointment with the surgeon or telephone contact with the surgeon within two to four weeks of discharge
5. The health care team should document and communicate the clinical history of the patient's operation, its results, and any postoperative events or concerns with the patient's primary care doctor.

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## Appendices

<b>Appendix I</b>	Advance Directive Position Statements
<b>Appendix II</b>	Older Adult Patient Groups at High Risk for VTE
<b>Appendix III</b>	Suggested Intraoperative Anesthetic Dose Adjustments in Older Patients
<b>Appendix IV</b>	Perioperative Risk Factors for Delirium
<b>Appendix V</b>	The CAM-ICU
<b>Appendix VI</b>	Morse Fall Scale
<b>Appendix VII</b>	The Braden Scale for Assessing Pressure Ulcer Risk
<b>Appendix VIII</b>	Four Geriatric Models of Care
<b>Appendix IX</b>	Care Transitions Models

## Appendix I. Advance Directive Position Statements

SUMMARY OF POSITION STATEMENTS REGARDING PERIOPERATIVE ADVANCE DIRECTIVES	
American College of Surgeons (ACS) <sup>197</sup>	The optimal approach is a policy of “required reconsideration” of the existing DNR orders. This means the patient or designated surrogate and <b>the caring physician should, when possible, discuss the new intraoperative and perioperative risks associated with the surgical procedure, the patient’s treatment goals, and an approach for potentially life-threatening problems consistent with the patient’s values and preferences.</b>
American Society of Anesthesiologists (ASA)	<p>Prior to initiation of anesthesia, any existing directives to limit the use of resuscitation procedures (for example, do-not-resuscitate orders and/or advance directives) should, when possible, be reviewed, clarified, or modified based on patient preferences. <b>One of the three following alternatives may provide for a satisfactory outcome in many cases:</b></p> <ul style="list-style-type: none"> <li>• <b>Full Attempt at Resuscitation:</b> Full suspension of existing directives during the anesthetic and immediate postoperative period.</li> <li>• <b>Limited Attempt at Resuscitation Defined With Regard to Specific Procedures:</b> The patient or designated surrogate may elect to continue to refuse certain specific resuscitation procedures (for example, chest compressions, defibrillation or tracheal intubation). The anesthesiologist should inform the patient or designated surrogate about which procedures are 1) essential to the success of the anesthesia and the proposed procedure, and 2) which procedures are not essential and may be refused.</li> <li>• <b>Limited Attempt at Resuscitation Defined With Regard to the Patient’s Goals and Values:</b> The patient or designated surrogate may allow the anesthesiologist and surgical/procedural team to use clinical judgment in determining which resuscitation procedures are appropriate in the context of the situation and the patient’s stated goals and values.</li> </ul>
Association of Perioperative Registered Nurses (AORN) <sup>11,198</sup>	<p><b>Reconsideration of do-not-resuscitate or all-natural-death orders is required in patients undergoing surgery or other invasive procedures.</b> Health care providers should have a discussion with the patient or patient’s surrogate about the risks, benefits, implications, and potential outcomes of anesthesia and surgery in relation to the do-not-resuscitate or allow-natural-death orders before initiating anesthesia, surgery, or other invasive procedures; clear identification methods (for example, standardized wrist bands) for the patient who has do-not-resuscitate or allow-natural-death orders and avoiding the use of acronyms and abbreviations (for example, DNR, do not attempt resuscitation, allow natural death) decrease the risk of miscommunication.”<sup>11,198 11,198 11,198 11,198 11,198</sup></p>

## Appendix II. Older Adult Patient Groups at High Risk for VTE

VTE PROPHYLAXIS IN HIGH RISK GROUPS*		
Patient Group	Recommended Regimen	Notes
Orthopaedic patients: total hip or knee arthroplasty	LMWH (starting either 12 h or more preoperatively or 12 h or more postoperatively) for a minimum of 10-14 days and up to 35 days	Alternatives: LDUH, fondaparinux, apixaban, dabigatran, rivaroxaban, VKA, ASA, or an IPC device if high bleeding risk
Orthopaedic patients: hip fracture	LMWH (starting either 12 h or more preoperatively or 12 h or more postoperatively) for a minimum of 10-14 days and up to 35 days	Alternatives: LDUH, fondaparinux, apixaban, dabigatran, rivaroxaban, VKA, ASA, or an IPC device
Nonorthopaedic surgery†	LMWH or LDUH AND mechanical prophylaxis with IPC	Alternatives: low dose ASA, fondaparinux
Cancer	Extended-duration LMWH (4 weeks) after hospital discharge	
Craniotomy/spinal surgery	IPC	LMWH or LDUH once adequate hemostasis established and risk of bleeding decreased
Cardiac surgery	IPC	LMWH or LDUH if length of stay prolonged due to nonhemorrhagic surgical complications
Major trauma and spinal cord injury	LDUH/LMWH and IPC if not contraindicated due to bleeding risk or lower extremity injury	
<p>VTE, venous thromboembolism; LMWH, low-molecular weight heparin; LDUH, low-dose unfractionated heparin; VKA, vitamin K antagonist; ASA, aspirin; IPC, intermittent pneumatic compression</p> <p>*Based on the Caprini score, age&gt;60, major open or laparoscopic surgery&gt;45 minutes, malignancy, craniotomy, major trauma, and orthopaedic surgery confer a minimum of moderate risk of VTE automatically;</p> <p>†This includes general, abdomino-pelvic, bariatric, vascular, plastic/reconstructive, and thoracic surgery</p>		

### Appendix III. Suggested Dose Adjustments for Anesthetic Medications in Older Patients

Drug	Usual Quoted Dosage	Suggested Adjustment
Induction agents		
Propofol	Bolus 2–2.5 mg/kg Infusion 100–250 µg/kg/min	1.5–1.8 mg/kg or 20 percent reduction in bolus dose  30 percent reduction in infusion
Thiopentone (thiopental sodium)	2.5–5 mg/kg	2.1–4.2 mg/kg or 20 percent reduction in bolus dose
Midazolam	0.2–0.3 mg/kg	0.05–0.15 mg/kg in premedicated patients  20 percent reduction in patients aged >55 y  75 percent reduction in patients aged >90 y
Etomidate	0.3–0.4 mg/kg	0.2 mg/kg
Inhalational agents		
Isoflurane	1.2 percent <sup>l</sup>	Minimum alveolar concentration (MAC) is reduced by 6 percent per decade of increasing age
Sevoflurane	1.8 percent <sup>l</sup>	
Desflurane	6.6 percent <sup>l</sup>	
Opioids		
Morphine	0.1–0.2 mg/kg intraoperatively  1–2 mg boluses titrated to effect for acute postoperative analgesia	50 percent reduction in dose  No change
Fentanyl	1–2 µg/kg for short-term analgesia	50 percent reduction in dose
Remifentanyl	Bolus 0.5–1 µg/kg Infusion 0.2–0.5 µg/min	50 percent reduction in bolus dose 33 percent reduction in infusion
Minimum Alveolar Concentration (MAC) values shown; Adapted from Das et al. <sup>33</sup>		

## Appendix IV. Perioperative Risk Factors for Delirium

<b>PREOPERATIVE RISK FACTORS</b> <sup>5,101,102,109,111,112</sup>	<b>INTRAOPERATIVE AND POSTOPERATIVE RISK FACTORS</b> <sup>105,111</sup>
<ul style="list-style-type: none"> <li>• Age greater than 65</li> <li>• Visual or hearing impairment</li> <li>• Preexisting cognitive impairment</li> <li>• Severe illness (for example, ICU admission)</li> <li>• Presence of infection</li> <li>• Depression</li> <li>• Alcohol abuse</li> <li>• Current hip fracture</li> <li>• Renal insufficiency</li> <li>• Anemia</li> <li>• Poor nutrition</li> <li>• Poor functional status</li> <li>• Limited mobility</li> <li>• Unintentional injury (for example, falls)</li> <li>• Polypharmacy</li> <li>• Aortic procedures</li> <li>• Frailty</li> </ul>	<ul style="list-style-type: none"> <li>• Infection</li> <li>• Surgical stress</li> <li>• Cardiopulmonary complications</li> <li>• Procedure complications</li> <li>• Inadequately controlled pain</li> <li>• Sleep deprivation</li> <li>• Hospital-acquired conditions</li> <li>• Medication toxicity/sensitivity</li> <li>• New pressure ulcers</li> <li>• Malnutrition</li> <li>• Use of physical restraints</li> <li>• &gt;3 medications added</li> <li>• Inappropriate medications (for example, Beers criteria medications)</li> <li>• Use of bladder catheters</li> </ul>

## Appendix V. The CAM-ICU

### CAM-ICU Worksheet

Feature 1: Acute Onset or Fluctuating Course	Score	Check here if Present
Is the patient different than his/her baseline mental status? OR Has the patient had any fluctuation in mental status in the past 24 hours as evidenced by fluctuation on a sedation/level of consciousness scale (i.e., RASS/SAS), GCS, or previous delirium assessment?	Either question Yes →	<input type="checkbox"/>
<b>Feature 2: Inattention</b>		
<b>Letters Attention Test</b> (See training manual for alternate Pictures)  <b>Directions:</b> Say to the patient, "I am going to read you a series of 10 letters. Whenever you hear the letter 'A,' indicate by squeezing my hand." Read letters from the following letter list in a normal tone 3 seconds apart.  <b>S A V E A H A A R T or C A S A B L A N C A or A B A D B A D A A Y</b>  <b>Errors are counted when patient fails to squeeze on the letter "A" and when the patient squeezes on any letter other than "A."</b>	Number of Errors >2 →	<input type="checkbox"/>
<b>Feature 3: Altered Level of Consciousness</b>		
Present if the Actual RASS score is anything other than alert and calm (zero)	RASS anything other than zero →	<input type="checkbox"/>
<b>Feature 4: Disorganized Thinking</b>		
<b>Yes/No Questions</b> (See training manual for alternate set of questions)  1. Will a stone float on water? 2. Are there fish in the sea? 3. Does one pound weigh more than two pounds? 4. Can you use a hammer to pound a nail?  <b>Errors are counted when the patient incorrectly answers a question.</b>  <b>Command</b> Say to patient: "Hold up this many fingers" (Hold 2 fingers in front of patient) "Now do the same thing with the other hand" (Do not repeat number of fingers) *If the patient is unable to move both arms, for 2 <sup>nd</sup> part of command ask patient to "Add one more finger"  <b>An error is counted if patient is unable to complete the entire command.</b>	Combined number of errors >1 →	<input type="checkbox"/>
<b>Overall CAM-ICU</b>  <b>Feature 1 <u>plus</u> 2 <u>and</u> either 3 <u>or</u> 4 present = CAM-ICU positive</b>	Criteria Met →	<input type="checkbox"/> <b>CAM-ICU Positive</b> (Delirium Present)
	Criteria Not Met →	<input type="checkbox"/> <b>CAM-ICU Negative</b> (No Delirium)

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**More information:** [www.icudelirium.org/delirium/monitoring.html](http://www.icudelirium.org/delirium/monitoring.html)

## Appendix VI. Morse Fall Scale

ITEM	ITEM SCORE	PATIENT SCORE
1. History of falling (immediate or previous)	No 0 Yes 25	_____
2. Secondary diagnosis (≥ 2 medical diagnoses in chart)	No 0 Yes 15	_____
3. Ambulatory aid None/bedrest/nurse assist Crutches/cane/walker Furniture	0 15 30	_____
4. Intravenous therapy/heparin lock	No 0 Yes 20	_____
5. Gait Normal/bedrest/wheelchair Weak* Impaired†	0 10 20	_____
6. Mental status Oriented to own ability Overestimates/forgets limitations	0 15	_____
Total Score‡: Tally the patient score and record.		_____
<25: Low risk 25-45: Moderate risk >45: High risk		_____
<p>Adapted from Morse JM, Morse RM, Tylko SJ. Development of a scale to identify the fall-prone patient. <i>Can J Aging</i> 1989;8:366-7. Reprinted with the permission of Cambridge University Press.</p> <p>*Weak gait: Short steps (may shuffle), stooped but able to lift head while walking, may seek support from furniture while walking, but with light touch (for reassurance).</p> <p>†Impaired gait: Short steps with shuffle; may have difficulty arising from chair; head down; significantly impaired balance, requiring furniture, support person, or walking aid to walk.</p> <p>‡Suggested scoring based on Morse JM, Black C, Oberle K, et al. A prospective study to identify the fall-prone patient. <i>Soc Sci Med</i> 1989; 28(1):81-6. However, note that Morse herself said that the appropriate cut-points to distinguish risk should be determined by each institution based on the risk profile of its patients.</p> <p>For details, see Morse JM, Morse RM, Tylko SJ. Development of a scale to identify the fall-prone patient. <i>Can J Aging</i> 1989; 8; 366-7.</p>		



## Appendix VII. Four Geriatric Models of Care

FOUR GERIATRIC MODELS OF CARE			
Care Model	Element(s) Addressed	Examples	Benefits
Geriatric Consultation Service <sup>98</sup>	Comprehensive geriatric assessment	-geriatrician, geriatric nurse specialist, or interdisciplinary team consulted to perform CGA to evaluate a specific condition (ex. delirium) or situation (ex. family support)	-unclear; difficult to evaluate outcomes due to compliance issues <sup>199,200</sup> -identification of new medical conditions in trauma patients <sup>201</sup>
Acute Care for Elders (ACE) <sup>157,202,203</sup>	Hospital environment	-carpeted floors, handrails -raised toilet seats and door levers -space for dining/visiting between patients and family members -uncluttered hallways	-improved independent functioning <sup>203</sup> -shorter length of stay <sup>157,203,204</sup> -lower cost <sup>157,203,204</sup> -decreased functional decline <sup>157</sup>
	Patient-centered care	-daily comprehensive assessment by nurses -multidisciplinary rounds	
	Early discharge planning	-emphasis on returning home -needs assessment at admission	
	Regular review of care to reduce complications	-daily review of medications and planned procedures -protocols to minimize adverse effects of procedures and medications	
Hospital Elder Life Program (HELP; <a href="http://www.hospitalelderlife.org">www.hospitalelderlife.org</a> ) <sup>205,206</sup>	Cognitive impairment	-orientation board with names of caregivers and providers and daily schedule; orienting communication -therapeutic activities (word games, current events discussion)	-delirium prevention <sup>206</sup> -prevention of cognitive and functional decline <sup>205</sup> -reduced use of sedative drugs <sup>205</sup>
	Sleep deprivation	-nonpharmacologic: music, massage, warm drink -noise-reduction, schedule adjustments	
	Immobility	-early mobilization or ambulation and active range of motion three times daily	
	Visual impairment	-visual aids and adaptive equipment	
	Hearing impairment	-portable amplifying equipment	
	Dehydration	-early recognition, encouragement of oral intake and feeding assistance	
Nurses Improving Care for Healthsystem Elderly (NICHE; <a href="http://www.nicheprogram.org">www.nicheprogram.org</a> ) <sup>207-209</sup>	Nurse practice environment	-Geriatric resource nurse (GRN)- a staff nurse with additional specialized training -ACE units -Nurse-initiated protocols	-improved nurse-reported geriatric care quality -improved clinical outcomes -improved rate of compliance with institutional protocols

## Appendix VIII. The Braden Scale for Assessing Pressure Ulcer Risk

<b>Sensory Perception</b> ability to respond meaningfully to pressure-related discomfort	<b>1. Completely Limited:</b> Unresponsive (does not moan, flinch, or grasp) to painful stimuli, due to diminished level of consciousness or sedation. OR limited ability to feel pain over most of body surface.	<b>2. Very Limited:</b> Responds only to painful stimuli. Cannot communicate discomfort except by moaning or restlessness. OR has a sensory impairment which limits the ability to feel pain or discomfort over 1/2 of body.	<b>3. Slightly Limited:</b> Responds to verbal commands, but cannot always communicate discomfort or need to be turned. OR has some sensory impairment which limits ability to feel pain or discomfort in 1 or 2 extremities.	<b>4. No Impairment:</b> Responds to verbal commands, has no sensory deficit which would limit ability to feel or voice pain or discomfort.
<b>Moisture</b> degree to which skin is exposed to moisture	<b>1. Constantly Moist:</b> Skin is kept moist almost constantly by perspiration, urine, etc. Dampness is detected every time patient is moved or turned.	<b>2. Very Moist:</b> Skin is often, but not always, moist. Linen must be changed at least once a shift.	<b>3. Occasionally Moist:</b> Skin is occasionally moist, requiring an extra linen change approximately once a day.	<b>4. Rarely Moist:</b> Skin is usually dry, linen only requires changing at routine intervals.
<b>Activity</b> degree of physical activity	<b>1. Bedfast:</b> Confined to bed.	<b>2. Chairfast:</b> Ability to walk severely limited or nonexistent. Cannot bear weight and/or must be assisted into chair or wheelchair.	<b>3. Walks Occasionally:</b> Walks occasionally during day, but for very short distances, with or without assistance. Spends majority of each shift in bed or chair.	<b>4. Walks Frequently:</b> Walks outside the room at least twice a day and inside room at least once every 2 hours during waking hours.
<b>Mobility</b> ability to change and control body position	<b>1. Completely Immobile:</b> Does not make even slight changes in body or extremity position without assistance.	<b>2. Very Limited:</b> Makes occasional slight changes in body or extremity position but unable to make frequent or significant changes independently.	<b>3. Slightly Limited:</b> Makes frequent though slight changes in body or extremity position independently.	<b>4. No Limitations:</b> Makes major and frequent changes in position without assistance.
<b>Nutrition</b> <i>usual</i> food intake pattern	<b>1. Very Poor:</b> Never eats a complete meal. Rarely eats more than 1/3 of any food offered. Eats 2 servings or less of protein (meat or dairy products) per day. Takes fluids poorly. Does not take a liquid dietary supplement. OR is NPO and/or maintained on clear liquids or IV's for more than 5 days.	<b>2. Probably Inadequate:</b> Rarely eats a complete meal and generally eats only about 1/2 of any food offered. Protein intake includes only 3 servings of meat or dairy products per day. Occasionally will take a dietary supplement. OR receives less than optimum amount of liquid diet or tube feeding.	<b>3. Adequate:</b> Eats over half of most meals. Eats a total of 4 servings of protein (meat, dairy products) each day. Occasionally will refuse a meal, but will usually take a supplement if offered. OR is on a tube feeding or TPN regimen which probably meets most of nutritional needs.	<b>4. Excellent:</b> Eats most of every meal. Never refuses a meal. Usually eats a total of 4 or more servings of meat and dairy products. Occasionally eats between meals. Does not require supplementation.
<b>Friction and Shear</b>	<b>1. Problem:</b> Requires moderate to maximum assistance in moving. Complete lifting without sliding against sheets is impossible. Frequently slides down in bed or chair, requiring frequent repositioning with maximum assistance. Spasticity, contractures or agitation lead to almost constant friction.	<b>2. Potential Problem:</b> Moves feebly or requires minimum assistance. During a move skin probably slides to some extent against sheets, chair, restraints, or other devices. Maintains relatively good position in chair or bed most of the time but occasionally slides down.	<b>3. No Apparent Problem:</b> Moves in bed and in chair independently and has sufficient muscle strength to lift up completely during move. Maintains good position in bed or chair at all times.	

Reference: [www.bradenscale.com/images/bradenscale.pdf](http://www.bradenscale.com/images/bradenscale.pdf)

Instructions: Complete the form by scoring each item from 1-4 (1 for low level of functioning and 4 for highest level of functioning) for the first five risk factors and 1-3 for the last risk factor.

Add the final score for each risk factor for total score (range 6-23). 19-23, No Risk; 15-18, Mild Risk; 13-14, Moderate Risk; 10-12, High Risk; 6-9, Very High Risk

## Appendix IX. Care Transitions Models

*The Re-Engineered Discharge (RED) ([www.bu.edu/fammed/projectred/](http://www.bu.edu/fammed/projectred/))<sup>210</sup>*

Developed at the Boston University Medical Center, Project RED has been shown to reduce rehospitalizations and improve patient satisfaction. The RED Toolkit, freely available online, provides guidance on the implementation of RED for all patients.

Project RED consists of twelve inter-related interventions performed by the hospital during and following a hospital stay designed to ease the transition between health care settings.

### THE 12 COMPONENTS OF THE RED

- Evaluate need for and obtain language assistance
- Make follow-up appointments
- Plan for follow-up of results from pending tests and labs
- Organize postdischarge outpatient services and medical equipment
- Identify the correct medicines and a plan for a patient to obtain them
- Reconcile the discharge plan with national guidelines
- Teach a written discharge plan the patient can understand
- Educate the patient about his or her diagnosis and medicines
- Review with the patient what to do if a problem arises
- Assess the degree of the patient's understanding of the discharge plan
- Expedite the transmission of the discharge summary to clinicians accepting care of the patient
- Provide telephone reinforcement of the discharge plan

*The Transitional Care Model ([www.transitionalcare.info](http://www.transitionalcare.info))*

The Transitional Care Model (TCM) was developed by a multidisciplinary team at the University of Pennsylvania. Essential to the TCM is the transitional care nurse, who is the primary coordinator of care over the course of an acute illness. This model has been shown to reduce readmissions, lower health care costs, and improve patient satisfaction, functional status, and quality of life.<sup>193-195</sup>

### TRANSITIONAL CARE MODEL ELEMENTS

- Coordinated care delivery from transitional care nurse
- Comprehensive assessment of patient's needs, goals, and preferences
- Collaboration with patients, caregivers, and team members in care plan implementation
- Regular home visits from transitional care nurse
- Continuity of health care between care settings facilitated by transitional care nurse
- Active engagement of patients and family caregivers
- Early identification and response to health care signs and symptoms
- Multidisciplinary approach to care
- Strong collaboration and communication between team members
- Ongoing performance evaluation and improvement

*The Care Transitions Program ([www.caretransitions.org](http://www.caretransitions.org))*

The Care Transitions Program uses a nurse transitions coach to follow the patient in the hospital and following discharge. The emphasis of this model is in engaging patients and their caregivers, so that they assume more active roles during care transitions. It also has been shown to reduce hospital readmissions and improve patient satisfaction.<sup>188</sup>

### THE CARE TRANSITIONS PROGRAM COMPONENTS

- Medication self-management
- Patient-centered record
- Primary care and specialist follow-up
- Knowledge of warning symptoms and signs indicating a worsening condition

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The following organizations were instrumental in the development of these Best Practices Guidelines: the American Geriatrics Society, the John A. Hartford Foundation, the American College of Surgeons, and the American Society of Anesthesiologists.

The American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) and the American Geriatrics Society (AGS) Best Practices Guidelines have been developed for quality improvement purposes. The documents may be downloaded and printed for personal use by health care professionals, and may also be used in quality improvement initiatives or programs. The documents may not be distributed for profit without the written consent of the American College of Surgeons and the American Geriatrics Society.

The intent of the ACS NSQIP/AGS Best Practices Guidelines is to provide health care professionals with evidence-based recommendations regarding the prevention, diagnosis, or treatment of common postsurgical complications. The Best Practices Guidelines do not include all potential options for prevention, diagnosis, and treatment. The responsible physician or health care provider must make the final decisions regarding patient care and take into account the patient's individual clinical presentation. The ACS NSQIP/AGS Best Practices Guidelines may be modified without notice.

The John A. Hartford Foundation: Founded in 1929, the John A. Hartford Foundation's mission is to improve the health of older Americans. The Foundation is a committed champion of health care training, research, and service system innovations that will ensure the well-being and vitality of older adults. For more information, please visit [www.jhartfound.org](http://www.jhartfound.org).

The American Geriatrics Society: The American Geriatrics Society (AGS) is a not-for-profit organization of more than 6,000 health professionals devoted to improving the health, independence, and quality of life of all older people. The Society provides leadership to health care professionals, policy makers, and the public by implementing and advocating for programs in patient care, research, professional and public education, and public policy. For more information, please visit [www.americangeriatrics.org](http://www.americangeriatrics.org).



**The American College of Surgeons:** The American College of Surgeons (ACS) is a scientific and educational organization of surgeons that was founded in 1913 to improve the care of the surgical patient and to safeguard standards of care in an optimal and ethical practice environment. ACS is dedicated to the ethical and competent practice of surgery. Its achievements have significantly influence the course of evidence-based surgery in America and have established ACS as an important advocate for all surgical patients. For more information, please visit [www.facs.org](http://www.facs.org).

**The American Society of Anesthesiologists:** The American Society of Anesthesiologists is an educational, research and scientific association of physicians with over 53,000 members organized to raise the standards of the medical practice of anesthesiology and to improve patient care. For more information, please visit [www.asahq.org](http://www.asahq.org).

## REFERENCES

1. Werner C. *The Older Population: 2010*. Washington, DC: U.S. Census Bureau; November 2011.
2. Dall TM, Gallo PD, Chakrabarti R, West T, Semilla AP, Storm MV. An aging population and growing disease burden will require a large and specialized health care workforce by 2025. *Health Aff. (Millwood)*. Nov 2013;32(11):2013-2020.
3. Kim S, Han H, Jung H, et al. MULTIdimensional frailty score for the prediction of postoperative mortality risk. *JAMA surgery*. 2014.
4. Bell RH, Jr., Drach GW, Rosenthal RA. Proposed competencies in geriatric patient care for use in assessment for initial and continued board certification of surgical specialists. *J. Am. Coll. Surg.* Nov 2011;213(5):683-690.
5. McGory ML, Kao KK, Shekelle PG, et al. Developing quality indicators for elderly surgical patients. *Ann. Surg.* Aug 2009;250(2):338-347.
6. Whinney C. Perioperative medication management: General principles and practical applications. *Cleve. Clin. J. Med.* November 1, 2009 2009;76(Suppl 4):S126-S132.
7. Silveira MJ, Kim SY, Langa KM. Advance directives and outcomes of surrogate decision making before death. *N. Engl. J. Med.* Apr 1 2010;362(13):1211-1218.
8. Yang AD, Bentrem DJ, Pappas SG, et al. Advance directive use among patients undergoing high-risk operations. *Am. J. Surg.* Jul 2004;188(1):98-101.
9. Redmann AJ, Brasel KJ, Alexander CG, Schwarze ML. Use of advance directives for high-risk operations: a national survey of surgeons. *Ann. Surg.* Mar 2012;255(3):418-423.
10. Temel JS, Greer JA, Muzikansky A, et al. Early Palliative Care for Patients with Metastatic Non-Small-Cell Lung Cancer. *N. Engl. J. Med.* 2010;363(8):733-742.
11. Cohen CB, Cohen PJ. Required reconsideration of "do-not-resuscitate" orders in the operating room and certain other treatment settings. *Law. Med. Health Care*. Winter 1992;20(4):354-363.
12. American College of Surgeons. Statement of the American College of Surgeons on Advance Directives by Patients: "Do Not Resuscitate" in the Operating Room. *Bull Am Coll of Surg.* 2014;99(1):42-43.
13. American Society of Anesthesiologists. Ethical guidelines for the anesthesia care of patients with Do-Not-Resuscitate orders or other directives that limit treatment. 2008. Accessed September 23, 2014.
14. AORN. AORN Position Statement on Perioperative Care of Patients with Do-Not-Resuscitate or Allow-Natural-Death Orders. 2014; [http://www.aorn.org/Clinical\\_Practice/Position\\_Statements/Position\\_Statements.aspx](http://www.aorn.org/Clinical_Practice/Position_Statements/Position_Statements.aspx). Accessed September 23, 2014.
15. American Society of Anesthesiologists. Practice guidelines for preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration: application to healthy patients undergoing elective procedures: an updated report by the American Society of Anesthesiologists Committee on Standards and Practice Parameters. *Anesthesiology*. Mar 2011;114(3):495-511.
16. Brady M, Kinn S, Stuart P. Preoperative fasting for adults to prevent perioperative complications. *The Cochrane database of systematic reviews*. 2003(4):CD004423.
17. Radtke FM, Franck M, MacGuill M, et al. Duration of fluid fasting and choice of analgesic are modifiable factors for early postoperative delirium. *Eur. J. Anaesthesiol.* May 2010;27(5):411-416.
18. Classen DC, Evans RS, Pestotnik SL, Horn SD, Menlove RL, Burke JP. The timing of prophylactic administration of antibiotics and the risk of surgical-wound infection. *N. Engl. J. Med.* Jan 30 1992;326(5):281-286.
19. Silber JH, Rosenbaum PR, Trudeau ME, et al. Preoperative antibiotics and mortality in the elderly. *Ann. Surg.* Jul 2005;242(1):107-114.
20. Cohn SL, ed *Perioperative Medicine*. London: Springer-Verlag 2011.
21. Neumayer L, Hosokawa P, Itani K, El-Tamer M, Henderson WG, Khuri SF. Multivariable predictors of postoperative surgical site infection after general and vascular surgery: results from the patient safety in surgery study. *J. Am. Coll. Surg.* Jun 2007;204(6):1178-1187.
22. Cheadle WG. Risk factors for surgical site infection. *Surg. Infect. (Larchmt.)*. 2006;7 Suppl 1:S7-11.
23. Pessaux P, Msika S, Atalla D, Hay JM, Flamant Y. Risk factors for postoperative infectious complications in noncolorectal abdominal surgery: a multivariate analysis based on a prospective multicenter study of 4718 patients. *Arch. Surg.* Mar 2003;138(3):314-324.
24. Bratzler DW, Dellinger EP, Olsen KM, et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. *Am. J. Health Syst. Pharm.* 2013;70(3):195-283.

25. Falck-Ytter Y, Francis CW, Johanson NA, et al. Prevention of vte in orthopaedic surgery patients: Antithrombotic therapy and prevention of thrombosis, 9th ed: american college of chest physicians evidence-based clinical practice guidelines. *CHEST Journal*. 2012;141(2\_suppl):e278S-e325S.
26. Gould MK, Garcia DA, Wren SM, et al. Prevention of vte in nonorthopaedic surgical patients: Antithrombotic therapy and prevention of thrombosis, 9th ed: american college of chest physicians evidence-based clinical practice guidelines. *CHEST Journal*. 2012;141(2\_suppl):e227S-e277S.
27. Rogers SO, Jr., Kilaru RK, Hosokawa P, Henderson WG, Zinner MJ, Khuri SF. Multivariable predictors of postoperative venous thromboembolic events after general and vascular surgery: results from the patient safety in surgery study. *J. Am. Coll. Surg.* Jun 2007;204(6):1211-1221.
28. Caprini JA, Arcelus JL, Hasty JH, Tamhane AC, Fabrega F. Clinical assessment of venous thromboembolic risk in surgical patients. *Semin. Thromb. Hemost.* 1991;17 Suppl 3:304-312.
29. Chow WB, Rosenthal RA, Merkow RP, et al. Optimal preoperative assessment of the geriatric surgical patient: a best practices guideline from the American College of Surgeons National Surgical Quality Improvement Program and the American Geriatrics Society. *J. Am. Coll. Surg.* Oct 2012;215(4):453-466.
30. LacKamp AN, Sieber FE. Physiologic Response to Anesthesia in the Elderly. In: Rosenthal RA, Zenilman ME, Katlic MR, eds. *Principles and Practice of Geriatric Surgery*. New York: Springer; 2011:291-303.
31. Rooke GA. Cardiovascular aging and anesthetic implications. *J. Cardiothorac. Vasc. Anesth.* Aug 2003;17(4):512-523.
32. Rivera R, Antognini JF. Perioperative drug therapy in elderly patients. *Anesthesiology*. May 2009;110(5):1176-1181.
33. Das S, Forrest K, Howell S. General anaesthesia in elderly patients with cardiovascular disorders: choice of anaesthetic agent. *Drugs Aging*. Apr 1 2010;27(4):265-282.
34. Sprung J, Gajic O, Warner DO. Review article: age related alterations in respiratory function - anesthetic considerations. *Can. J. Anaesth.* Dec 2006;53(12):1244-1257.
35. Beaupre LA, Allyson Jones C, Duncan Saunders L, Johnston DWC, Buckingham J, Majumdar SR. Best Practices for Elderly Hip Fracture Patients. *J. Gen. Intern. Med.* 2005;20(11):1019-1025.
36. Rodgers A, Walker N, Schug S, et al. Reduction of postoperative mortality and morbidity with epidural or spinal anaesthesia: results from overview of randomised trials. *BMJ*. 2000-12-16 00:00:00 2000;321(7275):1493.
37. Guay J, Choi P, Suresh S, Albert N, Kopp S, Pace NL. Neuraxial blockade for the prevention of postoperative mortality and major morbidity: an overview of Cochrane systematic reviews. *The Cochrane database of systematic reviews*. 2014;1:CD010108.
38. Parker MJ, Handoll HH, Griffiths R. Anaesthesia for hip fracture surgery in adults. *The Cochrane database of systematic reviews*. 2004(4):CD000521.
39. Barbosa FT, Juca MJ, Castro AA, Cavalcante JC. Neuraxial anaesthesia for lower-limb revascularization. *The Cochrane database of systematic reviews*. 2013;7:CD007083.
40. Mauermann WJ, Shilling AM, Zuo Z. A comparison of neuraxial block versus general anesthesia for elective total hip replacement: a meta-analysis. *Anesth. Analg.* Oct 2006;103(4):1018-1025.
41. Lawrence VA, Cornell JE, Smetana GW. Strategies to reduce postoperative pulmonary complications after noncardiothoracic surgery: systematic review for the American College of Physicians. *Ann. Intern. Med.* Apr 18 2006;144(8):596-608.
42. Nordquist D, Halaszynski TM. Perioperative Multimodal Anesthesia Using Regional Techniques in the Aging Surgical Patient. *Pain research and treatment*. 2014;2014:902174.
43. Luger TJ, Kammerlander C, Gosch M, et al. Neuroaxial versus general anaesthesia in geriatric patients for hip fracture surgery: does it matter? *Osteoporos. Int.* 2010/12/01 2010;21(4):555-572.
44. Choi PT, Bhandari M, Scott J, Douketis J. Epidural analgesia for pain relief following hip or knee replacement. *The Cochrane database of systematic reviews*. 2003(3):CD003071.
45. Werawatganon T, Charuluxanun S. Patient controlled intravenous opioid analgesia versus continuous epidural analgesia for pain after intra-abdominal surgery. *The Cochrane database of systematic reviews*. 2005(1):CD004088.
46. Nishimori M, Low JH, Zheng H, Ballantyne JC. Epidural pain relief versus systemic opioid-based pain relief for abdominal aortic surgery. *The Cochrane database of systematic reviews*. 2012;7:CD005059.
47. Jorgensen H, Wetterslev J, Moiniche S, Dahl JB. Epidural local anaesthetics versus opioid-based analgesic regimens on postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery. *The Cochrane database of systematic reviews*. 2000(4):CD001893.
48. Sherman KL, Merkow RP, Shah AM, Wang CE, Bilimoria KY, Bentrem DJ. Assessment of advanced gastric cancer management in the United States. *Ann. Surg. Oncol.* Jul 2013;20(7):2124-2131.
49. Milford CE, Hutter MM, Lillemo KD, Ferris TG. Optimizing appropriate use of procedures in an era of payment reform. *Ann. Surg.* Aug 2014;260(2):202-204.

50. Urwin SC, Parker MJ, Griffiths R. General versus regional anaesthesia for hip fracture surgery: a meta-analysis of randomized trials. *Br. J. Anaesth.* April 1, 2000;84(4):450-455.
51. Kettner SC, Willschke H, Marhofer P. Does regional anaesthesia really improve outcome? *Br. J. Anaesth.* December 1, 2011;107(suppl 1):i90-i95.
52. Memtsoudis SG, Sun X, Chiu YL, et al. Perioperative comparative effectiveness of anesthetic technique in orthopaedic patients. *Anesthesiology*. May 2013;118(5):1046-1058.
53. Memtsoudis SG, Sun X, Chiu YL, et al. Utilization of critical care services among patients undergoing total hip and knee arthroplasty: epidemiology and risk factors. *Anesthesiology*. Jul 2012;117(1):107-116.
54. Pugely AJ, Martin CT, Gao Y, Mendoza-Lattes S, Callaghan JJ. Differences in short-term complications between spinal and general anesthesia for primary total knee arthroplasty. *J. Bone Joint Surg. Am.* Feb 6 2013;95(3):193-199.
55. Liu J, Ma C, Elkassabany N, Fleisher LA, Neuman MD. Neuraxial anesthesia decreases postoperative systemic infection risk compared with general anesthesia in knee arthroplasty. *Anesth. Analg.* Oct 2013;117(4):1010-1016.
56. Cepeda MS, Farrar JT, Baumgarten M, Boston R, Carr DB, Strom BL. Side effects of opioids during short-term administration: effect of age, gender, and race. *Clin. Pharmacol. Ther.* Aug 2003;74(2):102-112.
57. Moore RA, McQuay HJ. Prevalence of opioid adverse events in chronic non-malignant pain: systematic review of randomized trials of oral opioids. *Arthritis Res. Ther.* 2005;7(5):R1046-1051.
58. The American Geriatrics Society 2012 Beers Criteria Update Expert Panel. American Geriatrics Society updated Beers Criteria for potentially inappropriate medication use in older adults. *J. Am. Geriatr. Soc.* Apr 2012;60(4):616-631.
59. Practice guidelines for acute pain management in the perioperative setting: an updated report by the American Society of Anesthesiologists Task Force on Acute Pain Management. *Anesthesiology*. Feb 2012;116(2):248-273.
60. Chou R, Fanciullo GJ, Fine PG, et al. Clinical Guidelines for the Use of Chronic Opioid Therapy in Chronic Noncancer Pain. *The Journal of Pain*. 10(2):113-130.e122.
61. Critchley LA. Hypotension, subarachnoid block and the elderly patient. *Anaesthesia*. Dec 1996;51(12):1139-1143.
62. Hang J. The controversy of regional vs. general anesthesia in surgical outcomes. In: Seiber F, ed. *Geriatric anesthesia*. Philadelphia: McGraw Hill; 2007:253-266.
63. Paul JE, Arya A, Hurlburt L, et al. Femoral nerve block improves analgesia outcomes after total knee arthroplasty: a meta-analysis of randomized controlled trials. *Anesthesiology*. Nov 2010;113(5):1144-1162.
64. Joshi GP, Bonnet F, Shah R, et al. A systematic review of randomized trials evaluating regional techniques for postthoracotomy analgesia. *Anesth. Analg.* Sep 2008;107(3):1026-1040.
65. Neuman MD, Rosenbaum PR, Ludwig JM, Zubizarreta JR, Silber JH. Anesthesia technique, mortality, and length of stay after hip fracture surgery. *JAMA*. 2014;311(24):2508-2517.
66. Macario A, Weinger M, Carney S, Kim A. Which clinical anesthesia outcomes are important to avoid? The perspective of patients. *Anesth. Analg.* Sep 1999;89(3):652-658.
67. Gold BS, Kitz DS, Lecky JH, Neuhaus JM. Unanticipated admission to the hospital following ambulatory surgery. *JAMA*. Dec 1 1989;262(21):3008-3010.
68. Gan TJ, Diemunsch P, Habib AS, et al. Consensus guidelines for the management of postoperative nausea and vomiting. *Anesth. Analg.* Jan 2014;118(1):85-113.
69. Apfel CC, Laara E, Koivuranta M, Greim CA, Roewer N. A simplified risk score for predicting postoperative nausea and vomiting: conclusions from cross-validations between two centers. *Anesthesiology*. Sep 1999;91(3):693-700.
70. Koivuranta M, Laara E, Snare L, Alahuhta S. A survey of postoperative nausea and vomiting. *Anaesthesia*. May 1997;52(5):443-449.
71. American Society of PeriAnesthesia Nurses. ASPAN's Evidence-Based Clinical Practice Guideline for the Prevention and/or Management of PONV/PDND. *J. Perianesth. Nurs.* 2006;21(4):230-250.
72. Gan TJ, Meyer TA, Apfel CC, et al. Society for Ambulatory Anesthesia guidelines for the management of postoperative nausea and vomiting. *Anesth. Analg.* Dec 2007;105(6):1615-1628, table of contents.
73. McCracken G, Houston P, Lefebvre G. Guideline for the management of postoperative nausea and vomiting. *Journal of obstetrics and gynaecology Canada: JOGC= Journal d'obstetrique et gynecologie du Canada: JOGC*. 2008;30(7):600-607, 608-616.
74. Aronovitch SA. Intraoperatively acquired pressure ulcer prevalence: a national study. *J. Wound Ostomy Continence Nurs.* May 1999;26(3):130-136.
75. Aronovitch SA. Intraoperatively acquired pressure ulcers: are there common risk factors? *Ostomy Wound Manage.* Feb 2007;53(2):57-69.
76. Nixon J, Cranny G, Bond S. Skin alterations of intact skin and risk factors associated with pressure ulcer development in surgical patients: a cohort study. *Int. J. Nurs. Stud.* Jul 2007;44(5):655-663.

77. Schoonhoven L, Defloor T, van der Tweel I, Buskens E, Grypdonck MH. Risk indicators for pressure ulcers during surgery. *Appl. Nurs. Res.* Aug 2002;15(3):163-173.
78. Cox J. Predictors of pressure ulcers in adult critical care patients. *Am. J. Crit. Care.* Sep 2011;20(5):364-375.
79. Kemp MG, Keithley JK, Smith DW, Morreale B. Factors that contribute to pressure sores in surgical patients. *Res. Nurs. Health.* Oct 1990;13(5):293-301.
80. Hoshowsky VM, Schramm CA. Intraoperative pressure sore prevention: an analysis of bedding materials. *Res. Nurs. Health.* Oct 1994;17(5):333-339.
81. Stevens J, Nicholson E, Linehan WM, et al. Risk factors for skin breakdown after renal and adrenal surgery. *Urology.* Aug 2004;64(2):246-249.
82. LacKamp A, Seiber F. Physiologic Response to Anesthesia in the Elderly. In: Rosenthal R, Zenilman M, Katlic M, eds. *Principles and Practice of Geriatric Surgery*. New York: Springer; 2011:300.
83. Esnaola NF, Cole DJ. Perioperative normothermia during major surgery: is it important? *Adv. Surg.* 2011;45:249-263.
84. Sakai T, Planinsic RM, Quinlan JJ, Handley LJ, Kim TY, Hilmi IA. The incidence and outcome of perioperative pulmonary aspiration in a university hospital: a 4-year retrospective analysis. *Anesth. Analg.* Oct 2006;103(4):941-947.
85. Warner MA, Warner ME, Weber JG. Clinical significance of pulmonary aspiration during the perioperative period. *Anesthesiology.* Jan 1993;78(1):56-62.
86. Roberts J, Lawrence V, Esnaola N. ACS NSQIP Best Practices Guidelines: Prevention of Postoperative Pulmonary Complications. Chicago: American College of Surgeons; 2010.
87. Grosse-Sundrup M, Henneman JP, Sandberg VVS, et al. Intermediate acting non-depolarizing neuromuscular blocking agents and risk of postoperative respiratory complications: prospective propensity score matched cohort study. *BMJ.* 2012;345:e6329.
88. Forbes SS, Eskicioglu C, Nathens AB, et al. Evidence-Based Guidelines for Prevention of Perioperative Hypothermia. *J. Am. Coll. Surg.* 10// 2009;209(4):492-503.e491.
89. Frank SM, Fleisher LA, Breslow MJ, et al. Perioperative maintenance of normothermia reduces the incidence of morbid cardiac events: A randomized clinical trial. *JAMA.* 1997;277(14):1127-1134.
90. Lawson L, Bridges EJ, Ballou I, et al. Accuracy and precision of noninvasive temperature measurement in adult intensive care patients. *Am. J. Crit. Care.* Sep 2007;16(5):485-496.
91. Erickson RS, Kirklin SK. Comparison of ear-based, bladder, oral, and axillary methods for core temperature measurement. *Crit. Care Med.* Oct 1993;21(10):1528-1534.
92. Fred C, Ford S, Wagner D, Vanbrackle L. Intraoperatively acquired pressure ulcers and perioperative normothermia: a look at relationships. *AORN J.* Sep 2012;96(3):251-260.
93. Lobo DN. Fluid overload and surgical outcome: another piece in the jigsaw. *Ann. Surg.* Feb 2009;249(2):186-188.
94. Brandstrup B. Fluid therapy for the surgical patient. *Best Pract. Res. Clin. Anaesthesiol.* Jun 2006;20(2):265-283.
95. Holte K, Sharrock NE, Kehlet H. Pathophysiology and clinical implications of perioperative fluid excess. *Br. J. Anaesth.* Oct 2002;89(4):622-632.
96. Grocott MP, Dushianthan A, Hamilton MA, Mythen MG, Harrison D, Rowan K. Perioperative increase in global blood flow to explicit defined goals and outcomes following surgery. *The Cochrane database of systematic reviews.* 2012;11:CD004082.
97. Pearse RM, Harrison DA, MacDonald N, et al. Effect of a perioperative, cardiac output-guided hemodynamic therapy algorithm on outcomes following major gastrointestinal surgery: a randomized clinical trial and systematic review. *JAMA.* Jun 4 2014;311(21):2181-2190.
98. Capezuti E, Boltz M, Kim H. Geriatric Models of Care. In: Rosenthal R, Zenilman M, Katlic M, eds. *Principles and Practice of Geriatric Surgery*. New York: Springer; 2011:253-266.
99. AGS Expert Panel on Postoperative Delirium in Older Adults. *American Geriatrics Society Clinical Practice Guideline for Postoperative Delirium in Older Adults*. 2014.
100. Ansaloni L, Catena F, Chattat R, et al. Risk factors and incidence of postoperative delirium in elderly patients after elective and emergency surgery. *Br. J. Surg.* Feb 2010;97(2):273-280.
101. Dasgupta M, Dumbrell AC. Preoperative risk assessment for delirium after noncardiac surgery: a systematic review. *J. Am. Geriatr. Soc.* Oct 2006;54(10):1578-1589.
102. Demeure MJ, Fain MJ. The elderly surgical patient and postoperative delirium. *J. Am. Coll. Surg.* Nov 2006;203(5):752-757.
103. Elie M, Cole MG, Primeau FJ, Bellavance F. Delirium risk factors in elderly hospitalized patients. *J. Gen. Intern. Med.* 1998;13(3):204-212.
104. Flinn DR, Diehl KM, Seyfried LS, Malani PN. Prevention, diagnosis, and management of postoperative delirium in older adults. *J. Am. Coll. Surg.* Aug 2009;209(2):261-268; quiz 294.



105. Inouye SK, Charpentier PA. Precipitating factors for delirium in hospitalized elderly persons. Predictive model and interrelationship with baseline vulnerability. *JAMA*. Mar 20 1996;275(11):852-857.
106. Inouye SK, Viscoli CM, Horwitz RI, Hurst LD, Tinetti ME. A predictive model for delirium in hospitalized elderly medical patients based on admission characteristics. *Ann. Intern. Med.* 1993;119(6):474-481.
107. Inouye SK, Zhang Y, Jones RN, Kiely DK, Yang F, Marcantonio ER. Risk factors for delirium at discharge: development and validation of a predictive model. *Arch. Intern. Med.* Jul 9 2007;167(13):1406-1413.
108. NICE. Delirium: Diagnosis, prevention and management. *NICE clinical guideline 103* 2010; NICE guideline. Available at: [www.nice.org.uk/CG103](http://www.nice.org.uk/CG103).
109. Robinson TN, Raeburn CD, Tran ZV, Angles EM, Brenner LA, Moss M. Postoperative delirium in the elderly: risk factors and outcomes. *Ann. Surg.* Jan 2009;249(1):173-178.
110. Witlox J, Eurelings LM, de Jonghe JM, Kalisvaart KJ, Eikelenboom P, van Gool WA. Delirium in elderly patients and the risk of postdischarge mortality, institutionalization, and dementia: A meta-analysis. *JAMA*. 2010;304(4):443-451.
111. The American Geriatrics Society Expert Panel on Postoperative Delirium in Older Adults. Postoperative Delirium in Older Adults: Best Practice Statement from the American Geriatrics Society. *J. Am. Coll. Surg.* (0).
112. Marcantonio ER, Goldman L, Mangione CM, et al. A clinical prediction rule for delirium after elective noncardiac surgery. *JAMA*. Jan 12 1994;271(2):134-139.
113. Barr J, Fraser GL, Puntillo K, et al. Clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the intensive care unit. *Crit. Care Med.* Jan 2013;41(1):263-306.
114. Greer N, Rossom R, Anderson P, MacDonald R, Tacklind J, Rutks I. Delirium: Screening, Prevention, and Diagnosis—A Systematic Review of the Evidence [Internet]. Washington (DC): Department of Veterans Affairs (US). Washington DC: Department of Veterans Affairs (US). 2011.
115. Young J, Murthy L, Westby M, Akunne A, O'Mahony R. Diagnosis, prevention, and management of delirium: summary of NICE guidance. *BMJ*. 2010;341:c3704.
116. Marcantonio E, Ta T, Duthie E, Resnick NM. Delirium severity and psychomotor types: their relationship with outcomes after hip fracture repair. *J. Am. Geriatr. Soc.* May 2002;50(5):850-857.
117. Robinson TN, Eiseman B. Postoperative delirium in the elderly: diagnosis and management. *Clin. Interv. Aging*. 06/2008;3(2):351-355.
118. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 5th ed. Washington, DC: American Psychiatric Association; 2013.
119. Inouye SK, van Dyck CH, Alessi CA, Balkin S, Siegel AP, Horwitz RI. Clarifying confusion: the confusion assessment method. A new method for detection of delirium. *Ann. Intern. Med.* Dec 15 1990;113(12):941-948.
120. AHRQ. Preventing Falls in Hospitals: A Toolkit for Improving Quality of Care. *AHRQ Publication No. 13-0015-EF* 2013; <http://www.ahrq.gov/research/ltr/fallpxtoolkit/index.html>.
121. Ely E, Inouye SK, Bernard GR, et al. Delirium in mechanically ventilated patients: Validity and reliability of the confusion assessment method for the intensive care unit (cam-icu). *JAMA*. 2001;286(21):2703-2710.
122. Wei LA, Fearing MA, Sternberg EJ, Inouye SK. The Confusion Assessment Method: a systematic review of current usage. *J. Am. Geriatr. Soc.* May 2008;56(5):823-830.
123. Siddiqi N, Holt R, Britton AM, Holmes J. Interventions for preventing delirium in hospitalised patients. *Cochrane Database of Systematic Reviews*. 2007;2007(2).
124. IOM (Institute of Medicine). *Clinical Practice Guidelines We Can Trust*. Washington, DC 2011.
125. Khuri SF, Henderson WG, DePalma RG, Mosca C, Healey NA, Kumbhani DJ. Determinants of long-term survival after major surgery and the adverse effect of postoperative complications. *Ann. Surg.* Sep 2005;242(3):326-341; discussion 341-323.
126. Qaseem A, Snow V, Fitterman N, et al. Risk assessment for and strategies to reduce perioperative pulmonary complications for patients undergoing noncardiothoracic surgery: a guideline from the American College of Physicians. *Ann. Intern. Med.* Apr 18 2006;144(8):575-580.
127. Smetana GW, Lawrence VA, Cornell JE, American College of P. Preoperative pulmonary risk stratification for noncardiothoracic surgery: systematic review for the American College of Physicians. *Ann. Intern. Med.* Apr 18 2006;144(8):581-595.
128. Smetana GW. Postoperative pulmonary complications: an update on risk assessment and reduction. *Cleve. Clin. J. Med.* Nov 2009;76 Suppl 4:S60-65.
129. Moller AM, Villebro N, Pedersen T, Tonnesen H. Effect of preoperative smoking intervention on postoperative complications: a randomised clinical trial. *Lancet*. Jan 12 2002;359(9301):114-117.
130. American Speech-Language-Hearing Association. Clinical indicators for instrumental assessment of dysphagia [Guidelines]. 2000; [www.asha.org/policy](http://www.asha.org/policy).

131. Gillespie LD, Robertson MC, Gillespie WJ, et al. Interventions for preventing falls in older people living in the community. *The Cochrane database of systematic reviews*. 2009(2):Cd007146.
132. National Quality Forum. *Safe Practices for Better Health care - 2010 Update: A Consensus Report*. Washington, DC 2010.
133. Amador LF, Loera JA. Preventing Postoperative Falls in the Older Adult. *J. Am. Coll. Surg.* 3// 2007;204(3):447-453.
134. Cameron ID, Murray GR, Gillespie LD, et al. Interventions for preventing falls in older people in nursing care facilities and hospitals. *The Cochrane database of systematic reviews*. 2010(1):Cd005465.
135. American Geriatrics Society/British Geriatrics Society Panel on Prevention of Falls in Older Persons. Summary of the Updated American Geriatrics Society/British Geriatrics Society Clinical Practice Guideline for Prevention of Falls in Older Persons. *J. Am. Geriatr. Soc.* 2011;59(1):148-157.
136. Amador LF, Loera JA. Preventing postoperative falls in the older adult. *J. Am. Coll. Surg.* Mar 2007;204(3):447-453.
137. Kaiser MJ, Bauer JM, Ramsch C, et al. Frequency of malnutrition in older adults: a multinational perspective using the mini nutritional assessment. *J. Am. Geriatr. Soc.* Sep 2010;58(9):1734-1738.
138. Potter J, Klipstein K, Reilly JJ, Roberts M. The nutritional status and clinical course of acute admissions to a geriatric unit. *Age Ageing*. Mar 1995;24(2):131-136.
139. Herrmann FR, Safran C, Levkoff SE, Minaker KL. Serum albumin level on admission as a predictor of death, length of stay, and readmission. *Arch. Intern. Med.* Jan 1992;152(1):125-130.
140. Sullivan DH. Risk factors for early hospital readmission in a select population of geriatric rehabilitation patients: the significance of nutritional status. *J. Am. Geriatr. Soc.* Aug 1992;40(8):792-798.
141. Andersen HK, Lewis SJ, Thomas S. Early enteral nutrition within 24h of colorectal surgery versus later commencement of feeding for postoperative complications. *The Cochrane database of systematic reviews*. 2006(4):Cd004080.
142. Lewis SJ, Andersen HK, Thomas S. Early enteral nutrition within 24 h of intestinal surgery versus later commencement of feeding: a systematic review and meta-analysis. *J. Gastrointest. Surg.* Mar 2009;13(3):569-575.
143. Datta J, Lewis RS, Jr., Mamtani R, et al. Implications of inadequate lymph node staging in resectable gastric cancer: a contemporary analysis using the National Cancer Data Base. *Cancer*. Sep 15 2014;120(18):2855-2865.
144. Paruch J, Merkow R, Bentrem D, et al. Impact of Hepatectomy Surgical Complexity on Outcomes and Hospital Quality Rankings. *Ann. Surg. Oncol.* 2014/06/01 2014;21(6):1773-1780.
145. Palmer JB, Drennan JC, Baba M. Evaluation and treatment of swallowing impairments. *Am Fam Physician*. Apr 15 2000;61(8):2453-2462.
146. Volkert D, Berner Y, Berry E, et al. ESPEN guidelines on enteral nutrition: geriatrics. *Clin. Nutr.* 2006;25(2):330-360.
147. Kleven RM, Edwards JR, Richards CL, Jr., et al. Estimating health care-associated infections and deaths in U.S. hospitals, 2002. *Public Health Rep.* Mar-Apr 2007;122(2):160-166.
148. Gould CV, Umscheid CA, Agarwal RK, Kuntz G, Pegues DA. Guideline for prevention of catheter-associated urinary tract infections 2009. *Infect. Control Hosp. Epidemiol.* Apr 2010;31(4):319-326.
149. Wald HL, Ma A, Bratzler DW, Kramer AM. Indwelling urinary catheter use in the postoperative period: analysis of the national surgical infection prevention project data. *Arch. Surg.* Jun 2008;143(6):551-557.
150. Saint S. Clinical and economic consequences of nosocomial catheter-related bacteriuria. *Am. J. Infect. Control*. Feb 2000;28(1):68-75.
151. Frencher S, Esnaola N. ACS NSQIP Best Practices Guidelines: Prevention of Catheter-Associated Urinary Tract Infections. American College of Surgeons; 2009.
152. Covinsky KE, Palmer RM, Fortinsky RH, et al. Loss of independence in activities of daily living in older adults hospitalized with medical illnesses: increased vulnerability with age. *J. Am. Geriatr. Soc.* Apr 2003;51(4):451-458.
153. Covinsky KE, Pierluissi E, Johnston C. Hospitalization-associated disability: "she was probably able to ambulate, but i'm not sure". *JAMA*. 2011;306(16):1782-1793.
154. Fulmer T, Mezey M, Bottrell M, et al. Nurses Improving Care for Healthsystem Elders (NICHE): using outcomes and benchmarks for evidenced-based practice. *Geriatric Nursing*. 2002;23(3):121-127.
155. Tillou A, Kelley-Quon L, Burruss S, et al. Long-term postinjury functional recovery: Outcomes of geriatric consultation. *JAMA surgery*. 2014;149(1):83-89.
156. Baztán JJ, Suárez-García FM, López-Arrieta J, Rodríguez-Mañas L, Rodríguez-Artalejo F. Effectiveness of acute geriatric units on functional decline, living at home, and case fatality among older patients admitted to hospital for acute medical disorders: meta-analysis. *BMJ*. 2009-01-23 00:13:49 2009;338.
157. Counsell SR, Holder CM, Liebenauer LL, et al. Effects of a multicomponent intervention on functional outcomes and process of care in hospitalized older patients: a randomized controlled trial of Acute Care for Elders (ACE) in a community hospital. *J. Am. Geriatr. Soc.* Dec 2000;48(12):1572-1581.
158. Rubenstein LZ, Josephson KR, Wieland GD, English PA, Sayre JA, Kane RL. Effectiveness of a Geriatric Evaluation Unit. *N. Engl. J. Med.* 1984;311(26):1664-1670.

159. Applegate WB, Miller ST, Graney MJ, Elam JT, Burns R, Akins DE. A Randomized, Controlled Trial of a Geriatric Assessment Unit in a Community Rehabilitation Hospital. *N. Engl. J. Med.* 1990;322(22):1572-1578.
160. Bates-Jensen BM, McCreath HE, Kono A, Apeles NC, Alessi C. Subepidermal moisture predicts erythema and stage I pressure ulcers in nursing home residents: a pilot study. *J. Am. Geriatr. Soc.* Aug 2007;55(8):1199-1205.
161. Bergstrom N, Braden B. A prospective study of pressure sore risk among institutionalized elderly. *J. Am. Geriatr. Soc.* Aug 1992;40(8):747-758.
162. Lyder CH. Pressure ulcer prevention and management. *JAMA.* Jan 8 2003;289(2):223-226.
163. National Guideline Clearinghouse. Pressure ulcers: prevention and management of pressure ulcers. <http://www.guideline.gov/content.aspx?id=48026&search=pressure>. Accessed 10/9/2014.
164. Bergstrom N, Braden BJ, Laguzza A, Holman V. The Braden Scale for Predicting Pressure Sore Risk. *Nurs. Res.* Jul-Aug 1987;36(4):205-210.
165. Waterlow J. Pressure sores: a risk assessment card. *Nurs. Times.* Nov 27-Dec 3 1985;81(48):49-55.
166. Thorn CC, Smith M, Aziz O, Holme TC. The Waterlow score for risk assessment in surgical patients. *Ann. R. Coll. Surg. Engl.* Jan 2013;95(1):52-56.
167. Norton D, McLaren R, Exton-Smith A. *An Investigation of Geriatric Nursing Problems in Hospital.* London: National Corporation for the Care of Old People; 1962.
168. Pancorbo-Hidalgo PL, Garcia-Fernandez FP, Lopez-Medina IM, Alvarez-Nieto C. Risk assessment scales for pressure ulcer prevention: a systematic review. *J. Adv. Nurs.* Apr 2006;54(1):94-110.
169. Rosenthal RA, Zenilman ME, Katlic MR, eds. *Principles and practice of geriatric surgery.* New York: Springer; 2011.
170. Schnelle JF, Adamson GM, Cruise PA, et al. Skin disorders and moisture in incontinent nursing home residents: intervention implications. *J. Am. Geriatr. Soc.* Oct 1997;45(10):1182-1188.
171. Desai H. Ageing and wounds. Part 2: Healing in old age. *J. Wound Care.* May 1997;6(5):237-239.
172. Lin A, McGrath M. Pressure Sores in the Elderly. In: Rosenthal R, Zenilman M, Katlic M, eds. *Principles and Practice of Geriatric Surgery.* New York: Springer; 2011:1257-1271.
173. Reddy M, Gill SS, Rochon PA. Preventing pressure ulcers: A systematic review. *JAMA.* 2006;296(8):974-984.
174. Reuler JB, Cooney TG. The pressure sore: pathophysiology and principles of management. *Ann. Intern. Med.* May 1981;94(5):661-666.
175. McInnes E, Jammali-Blasi A, Bell-Syer SE, Dumville JC, Cullum N. Support surfaces for pressure ulcer prevention. *The Cochrane database of systematic reviews.* 2011(4):Cd001735.
176. Stratton RJ, Ek AC, Engfer M, et al. Enteral nutritional support in prevention and treatment of pressure ulcers: a systematic review and meta-analysis. *Ageing research reviews.* Aug 2005;4(3):422-450.
177. Bourdel-Marchasson I. Nutritional supplementation in elderly people during the course of catabolic illnesses. *J. Nutr. Health Aging.* 2000;4(1):28-30.
178. Pascual Lopez A, Roque i Figuls M, Urrutia Cuchi G, et al. Systematic review of megestrol acetate in the treatment of anorexia-cachexia syndrome. *J. Pain Symptom Manage.* Apr 2004;27(4):360-369.
179. Berenstein EG, Ortiz Z. Megestrol acetate for the treatment of anorexia-cachexia syndrome. *The Cochrane database of systematic reviews.* 2005(2):Cd004310.
180. Reuben DB, Hirsch SH, Zhou K, Greendale GA. The effects of megestrol acetate suspension for elderly patients with reduced appetite after hospitalization: a phase II randomized clinical trial. *J. Am. Geriatr. Soc.* Jun 2005;53(6):970-975.
181. Yeh SS, Wu SY, Lee TP, et al. Improvement in quality-of-life measures and stimulation of weight gain after treatment with megestrol acetate oral suspension in geriatric cachexia: results of a double-blind, placebo-controlled study. *J. Am. Geriatr. Soc.* May 2000;48(5):485-492.
182. Bodenner D, Spencer T, Riggs AT, Redman C, Strunk B, Hughes T. A retrospective study of the association between megestrol acetate administration and mortality among nursing home residents with clinically significant weight loss. *Am. J. Geriatr. Pharmacother.* Jun 2007;5(2):137-146.
183. Kropfky B, Shi Y, Cherniack EP. Incidence of deep-venous thrombosis in nursing home residents using megestrol acetate. *J. Am. Med. Dir. Assoc.* Sep-Oct 2003;4(5):255-256.
184. Beal JE, Olson R, Laubenstein L, et al. Dronabinol as a treatment for anorexia associated with weight loss in patients with AIDS. *J. Pain Symptom Manage.* Feb 1995;10(2):89-97.
185. Volicer L, Stelly M, Morris J, McLaughlin J, Volicer BJ. Effects of dronabinol on anorexia and disturbed behavior in patients with Alzheimer's disease. *Int. J. Geriatr. Psychiatry.* Sep 1997;12(9):913-919.
186. Wilson MM, Philpot C, Morley JE. Anorexia of aging in long term care: is dronabinol an effective appetite stimulant?--a pilot study. *J. Nutr. Health Aging.* Mar-Apr 2007;11(2):195-198.
187. Chugh A, Williams MV, Grigsby J, Coleman EA. Better transitions: improving comprehension of discharge instructions. *Front. Health Serv. Manage.* Spring 2009;25(3):11-32.



188. Jencks SF, Williams MV, Coleman EA. Rehospitalizations among patients in the Medicare fee-for-service program. *N. Engl. J. Med.* Apr 2 2009;360(14):1418-1428.
189. Chiu WK, Newcomer R. A systematic review of nurse-assisted case management to improve hospital discharge transition outcomes for the elderly. *Professional Case Management.* 2007;12(6):330-336; quiz 337-338.
190. Boutwell A, Hwu S. *Effective Interventions to Reduce Rehospitalizations: A Survey of the Published Evidence.* Cambridge, MA: Institute for Health care Improvement; 2009.
191. Kane RL, Flood S, Bershadsky B, Keckhafer G. Effect of an innovative medicare managed care program on the quality of care for nursing home residents. *Gerontologist.* Feb 2004;44(1):95-103.
192. Institute for Health care Improvement. Institute for Health care Improvement STate Action on Avoidable Rehospitalizations. <http://www.ihc.org/Engage/Initiatives/Completed/STAAR/Pages/Materials.aspx>, 2014.
193. Naylor MD, Broton D, Campbell R, et al. Comprehensive discharge planning and home follow-up of hospitalized elders: a randomized clinical trial. *JAMA.* Feb 17 1999;281(7):613-620.
194. Naylor MD, Broton DA, Campbell RL, Maislin G, McCauley KM, Schwartz JS. Transitional care of older adults hospitalized with heart failure: a randomized, controlled trial. *J. Am. Geriatr. Soc.* May 2004;52(5):675-684.
195. Naylor MD, McCauley KM. The effects of a discharge planning and home follow-up intervention on elders hospitalized with common medical and surgical cardiac conditions. *J. Cardiovasc. Nurs.* 1999;14(1):44-54.
196. Care Transitions Program. The Care Transitions Program. 2007; <http://www.caretransitions.org/>.
197. American College of Surgeons. Statement of the American College of Surgeons on Advance Directives by Patients: "Do Not Resuscitate" in the Operating Room. *Bull Am Coll of Surg.* 2014;99(1):42-43.
198. American Nurses Association. Nursing Care and Do Not Resuscitate (DNR) and Allow Natural Death (AND) Decisions. 2012; <http://nursingworld.org/dnrposition>.
199. Deschodt M, Flamaing J, Haentjens P, Boonen S, Milisen K. Impact of geriatric consultation teams on clinical outcome in acute hospitals: a systematic review and meta-analysis. *BMC Med.* 2013;11:48.
200. Allen CM, Becker PM, McVey LJ, Saltz C, Feussner JR, Cohen HJ. A randomized, controlled clinical trial of a geriatric consultation team. Compliance with recommendations. *JAMA.* May 16 1986;255(19):2617-2621.
201. Fallon WF, Jr., Rader E, Zyzanski S, et al. Geriatric Outcomes Are Improved by a Geriatric Trauma Consultation Service. *Journal of Trauma and Acute Care Surgery.* 2006;61(5).
202. Palmer RM, Landefeld CS, Kresevic D, Kowal J. A medical unit for the acute care of the elderly. *J. Am. Geriatr. Soc.* May 1994;42(5):545-552.
203. Landefeld CS, Palmer RM, Kresevic DM, Fortinsky RH, Kowal J. A randomized trial of care in a hospital medical unit especially designed to improve the functional outcomes of acutely ill older patients. *N. Engl. J. Med.* May 18 1995;332(20):1338-1344.
204. Barnes DE, Palmer RM, Kresevic DM, et al. Acute care for elders units produced shorter hospital stays at lower cost while maintaining patients' functional status. *Health Aff. (Millwood).* Jun 2012;31(6):1227-1236.
205. Inouye SK, Bogardus ST, Jr., Baker DI, Leo-Summers L, Cooney LM, Jr. The Hospital Elder Life Program: a model of care to prevent cognitive and functional decline in older hospitalized patients. Hospital Elder Life Program. *J. Am. Geriatr. Soc.* Dec 2000;48(12):1697-1706.
206. Inouye SK, Bogardus ST, Charpentier PA, et al. A Multicomponent Intervention to Prevent Delirium in Hospitalized Older Patients. *N. Engl. J. Med.* 1999;340(9):669-676.
207. Capezuti E, Boltz M, Cline D, et al. Nurses Improving Care for Healthsystem Elders - a model for optimising the geriatric nursing practice environment. *J. Clin. Nurs.* Nov 2012;21(21-22):3117-3125.
208. NICHE/NYU College of Nursing. Nursing Improving Care for Healthsystem Elders. 2014; [www.nicheprogram.org/](http://www.nicheprogram.org/), 2014.
209. Boltz M, Capezuti E, Bowar-Ferres S, et al. Changes in the Geriatric Care Environment Associated with NICHE (Nurses Improving Care for HealthSystem Elders). *Geriatr. Nurs.* May-Jun 2008;29(3):176-185.
210. Re-Engineered Discharge (RED) Toolkit. <http://www.ahrq.gov/professionals/systems/hospital/red/toolkit/index.html>.