Optimizing Nutritional Status Prior to Surgery

Enhancing Recovery and Patient Outcomes

THE UNIVERSITY OF TEXAS
MD Anderson Cancer Center
Making Cancer History®

SCCM Symposium – October 2019

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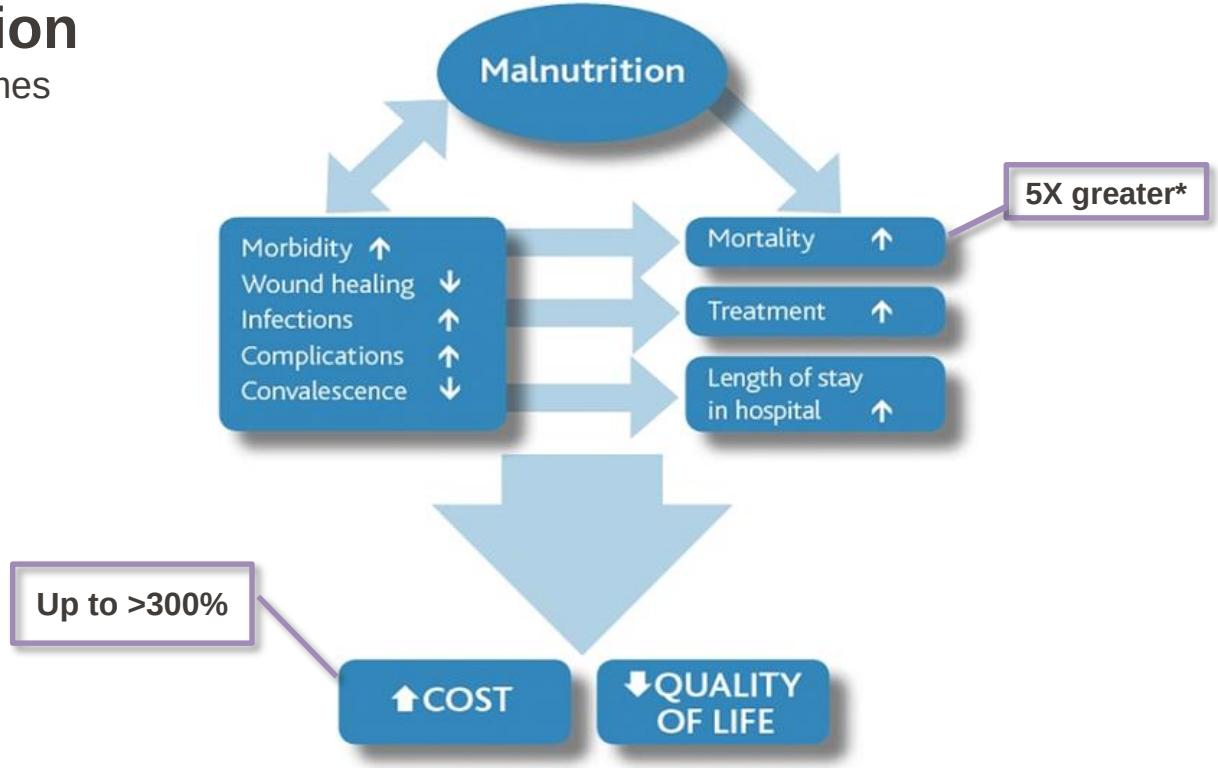
Objective

- Discuss Enhanced Recovery After Surgery (ERAS) protocols and implementation
- Describe the benefits of Enhanced Recovery pathways on clinical outcomes
- Review the prevalence and impact of malnutrition
- Highlight key points of nutrition management of surgical patients

Malnutrition

Surgical outcomes



Malnutrition – most important modifiable risk factor

Isabel M, et al. *Clin Nutr* 2003; 22(3):235-39
Cerantola Y, et al. *J Urol* 2013; 190:2126-35

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*Wischmeyer & Molinger. *ICU Mgt & Prac* 2019. 13(3):167-72
Corkins M et al. *JEPEN* 2014. 38(2):186-95

Malnutrition

Prevalence

Up to 1 in 2 (30-50%) patients are malnourished at ICU admission

Estimated up to 80% of advanced patients with cancer have malnutrition

A 2012 study found 79% of patients identified as malnourished were normal weight, overweight, or obese

Risk of malnutrition is highest in GI and Oncologic surgery

Davidson W, et al. *Oncol Nurs Forum* 2012;39(4):E340-345
Wischmeyer PE, et al. *Anesth Analg* 2018;126(6):1883-1895 Norman K et al. *Clin Nutr* 2008; 2(1):5-15

Overweight & Obese Population

Objective

Determine demographics of today's ICU and describe most appropriate EN delivery

Design

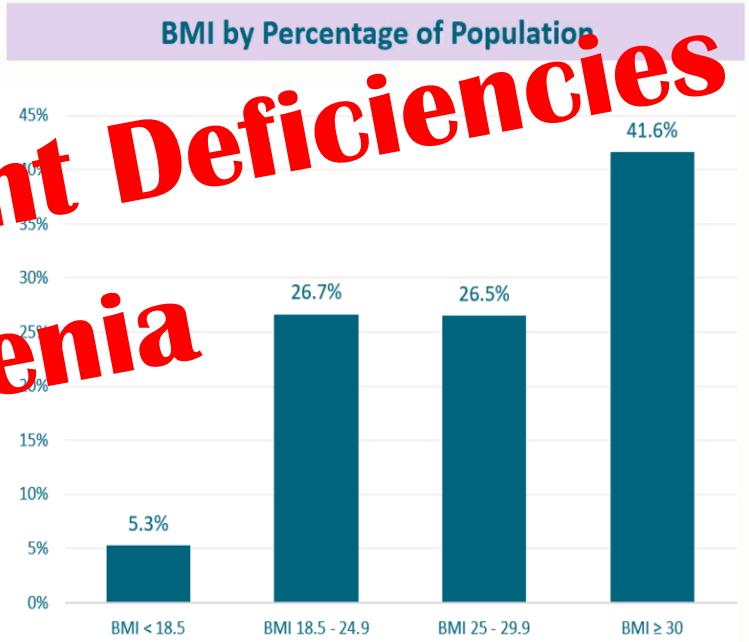
- Retrospective analysis of 2,000 ICU patient encounters
- [illegible] 12.1 days

Results

- 62.2 years old / 55.2% male
- Hosp LOS 13.6 days / ICU LOS 6.9 days
- Days on mechanical ventilation 4
- 30-day readmission 19.3%
- **70% overweight or obese**

Protein & Nutrient Deficiencies

Sarcopenia



Muscle protein catabolism is a hallmark feature of critical illness, regardless of BMI

Hussein R, Berger A, *Ochoa-Gautier J. Abstract at ISIECM 2019, Brussels, Belgium and ASPEN 2019, Phoenix, AZ

Study funded by Nestlé Health Science. * Nestlé employee

Nestlé Nutrition Institute

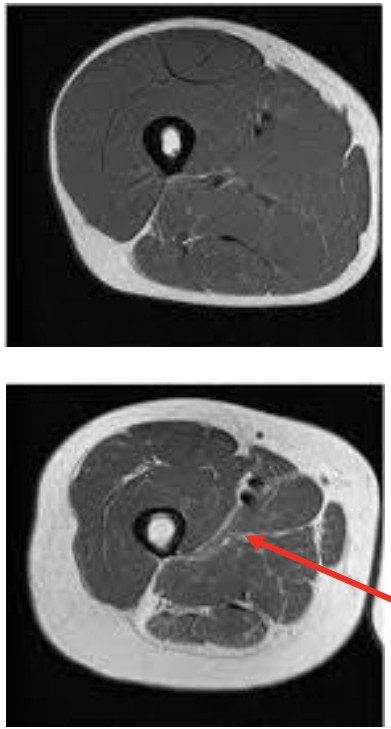
Sarcopenic Obesity

- Disproportional loss of muscle with accumulation of adipose tissue
  - Added inflammatory burden of adiposity (adipokines)
- Loss of muscle mass & muscle strength strongly accelerated in sarcopenic obese ICU pts
  - Both are independent predictors of ICU survival

❖ **BMI ignores the composition of weight**

  - *Sarcopenia can occur at any BMI*

- High body weight with low contribution of metabolically active FFM can lead to overestimation of energy needs = overfeeding



Tieland M, et al. *Curr Opin Clin Nutr Metab Care* 2019; 22(2):162–166 Trouwborst I, et al. *Nutrients*. 2018; 10(5):605
Verlaan S, et al. *Clin Nutr* 2018; 37:551–557 Weijs P, et al. *Crit Care* 2014; 18:R12

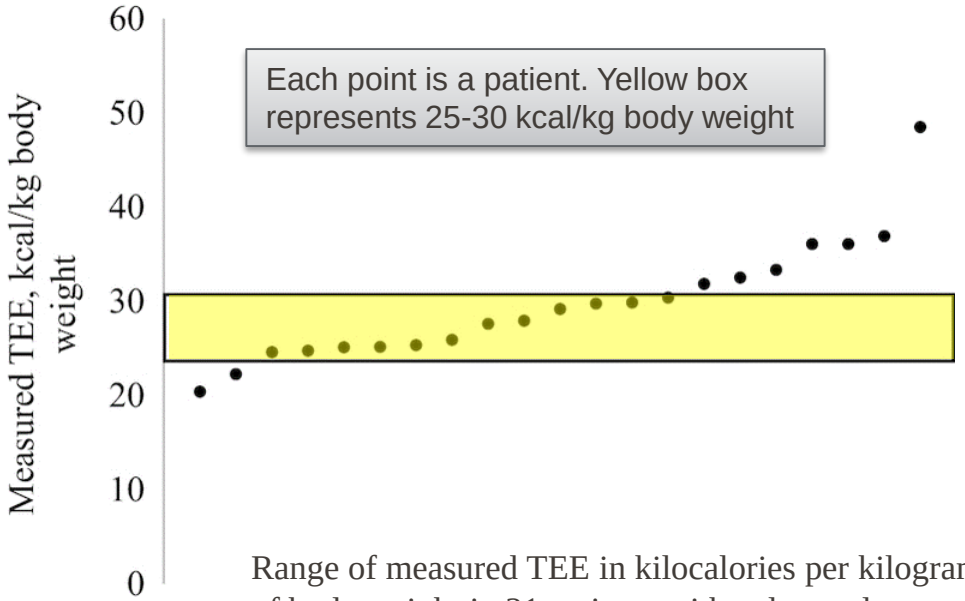
IMAT = intramuscular adipose tissue
FFM – fat free mass

Estimating Energy Needs

The American Journal of CLINICAL NUTRITION

Energy needs are highly variable and not consistently captured by predictive equations

- Energy requirements based on weight alone are poor assessments of energy needs
- 43% outside of rec'd range
  - Off by ~50% (over or under prediction)



Range of measured TEE in kilocalories per kilogram of body weight in 21 patients with colorectal cancer

Purcell SA, et al. *AM J Clin Nutr*. 2019;110(2): 367-376

TEE = Total Energy Expenditure

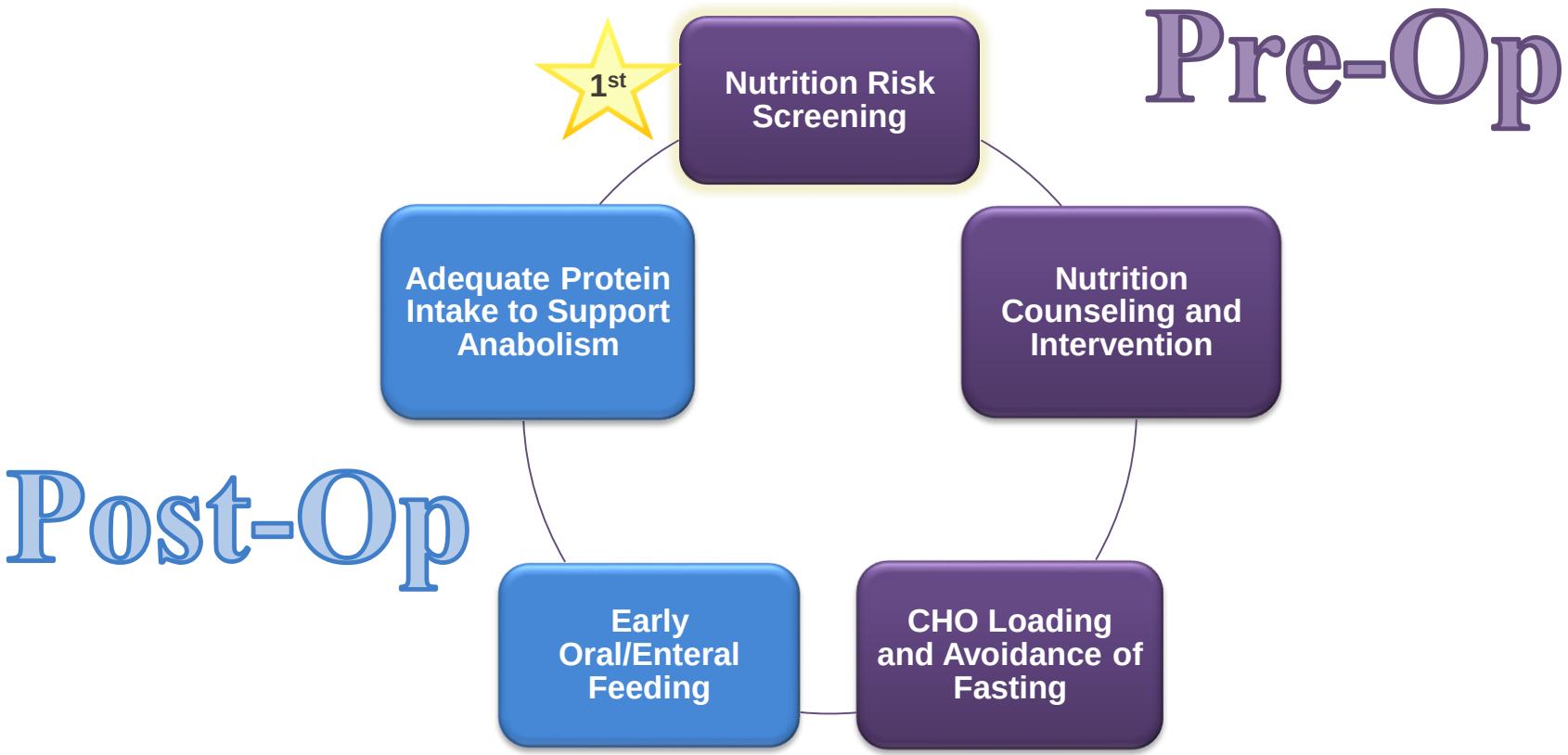
Objective Data to Guide pre-op Nutrition Risk and Personalized Nutrition Needs

Table 1. New Personalised Nutrition Care Monitoring Devices for Muscle/Body Composition and Energy Needs

Measure	Endpoint	Descrirption
Muscle Ultrasound	Muscle Mass	Ultrasound-based measurement of skeletal muscle mass as well as quality measures of intramuscular glycogen content (IMGC), intramuscular Adipose Tissue (IMAT), and muscle size (MS).
Lean Body Mass via CT Scan	Muscle Mass	Lean body mass obtained from admission abdominal CT scan. Hounsfield Unit boundaries analysed by SliceOmatic software to reflect whole-body muscle
Segmantal Bioelectrical Impedance Spectroscopy (S-BIS)	Muscle Quality/ Intracellular Water	Segmental BIS can distinguish intracellular water (ICW) and extracellular water (ECW). ICW reflects muscle cell mass, whereas ECW represents the sum of interstitial and ECW are only affected by segmental volume, so the ECW/ICW ratio could indicate the ratio of non-contractile tissue to contractile tissue regardless of assessed somatotype (age, gender, disease state).
Indirect calorimetry	Resting Metabolic Rate	Measures the oxygen consumption (V02) and the carbon dioxide (VCO2) production at the mouth (mask or ventilated hood) in a non-invasive way. V02 and VC02 corresponds to the whole-body cellular respiration and makes it possible to calculate the whole-body energy expenditure (EE) and resting metabolic rate (RMR).

Wischmeyer P & Molinger J. *ICU Management & Practice* 2019. 13(3):167-172

Key Nutrition Components of ERAS



World J Surg 2013; 37:259–84

The Future of Pre-op Screening

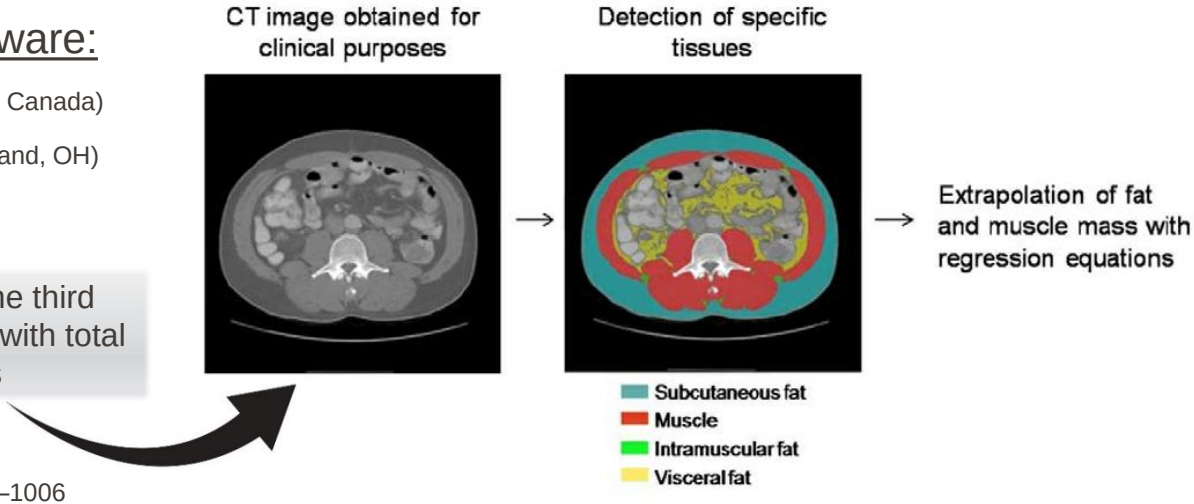
Evaluation of lean body mass via abdominal CT scan

- Assess pre-op metabolic reserve and nutritional risk
- More accurate estimation of energy needs post-op
- Images can be segmented by trained technicians using image analysis software
- CT imaging is routinely preformed for diagnostic purposes

Examples of Image analysis software:

- SliceOmatic v5.0 (Tomovision, Montreal, QC, Canada)
- MIM software (MIM 6.5, MIM Software, Cleveland, OH)
  - *uses Hounsfield Unit boundaries*

Cross-sectional analysis of tissue at the third lumbar vertebra (L3) strongly correlates with total body adipose and muscle mass



Shen W, et al. *J Appl Physiol.* 2004; 97(6):2333-8
Mourtzakis M, et al. *Appl Physiol Nutr Metab.* 2008; 33: 997–1006

Muscle Ultrasound

Non-invasive measurement of skeletal muscle mass done at ICU bedside

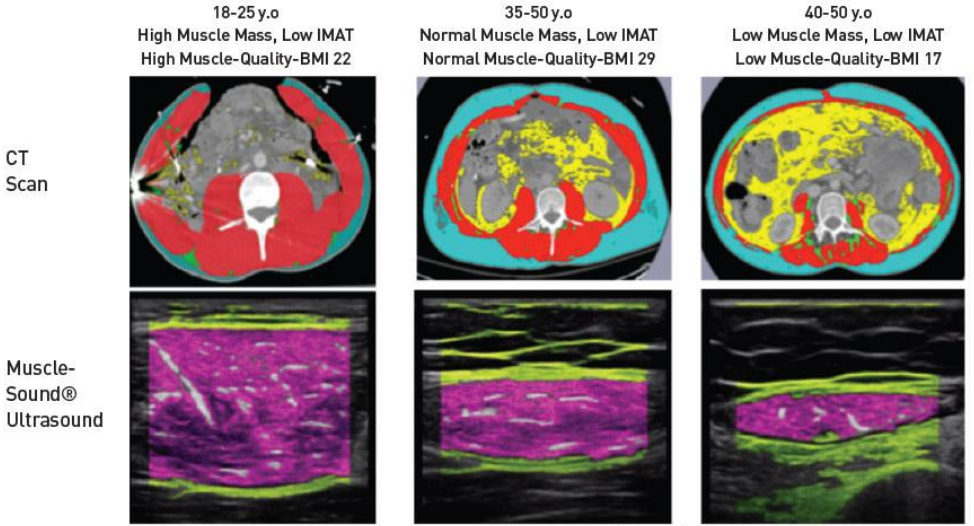


Figure 1. Examples of Muscle Quality and Mass evaluation via CT Scan (level L3) and MuscleSound® analyses (short-axis rectus femoris muscle) assessed at the same time.

Can Measure:

- ✓ Intramuscular Glycogen Content (IMGC)
  - Monitor nutrition delivery & utilization
- ✓ Intramuscular Adipose Tissue (IMAT)
  - Muscle quality *i.e. muscle strength*
- ✓ Muscle size

Muscle specific U/S device
(Musclesound Inc, Colorado, USA)

- Handheld, easy to carry
- Connects to portable tablet device
- Rapid, accurate measures of LBM
- Built-in guidance to ensure reproducible measurements

Wischmeyer P & Molinger J. *ICU Management & Practice* 2019. 13(3):167-172

Nutrition Screening

Tools

- **Screening Tools**
  - NRS 2002, MST, MUST, SGA, SNAQ
- **NRS 2002**
  - Validated for surgical patients
  - Allows for a gradation of disease
    - ❖ specific scoring for abdominal surgery & ICU patients
  - No nutritional or specialized training required by examiner

✓ Automatic Nutrition Referral

✓ Aggressively treat those found with risk of malnutrition

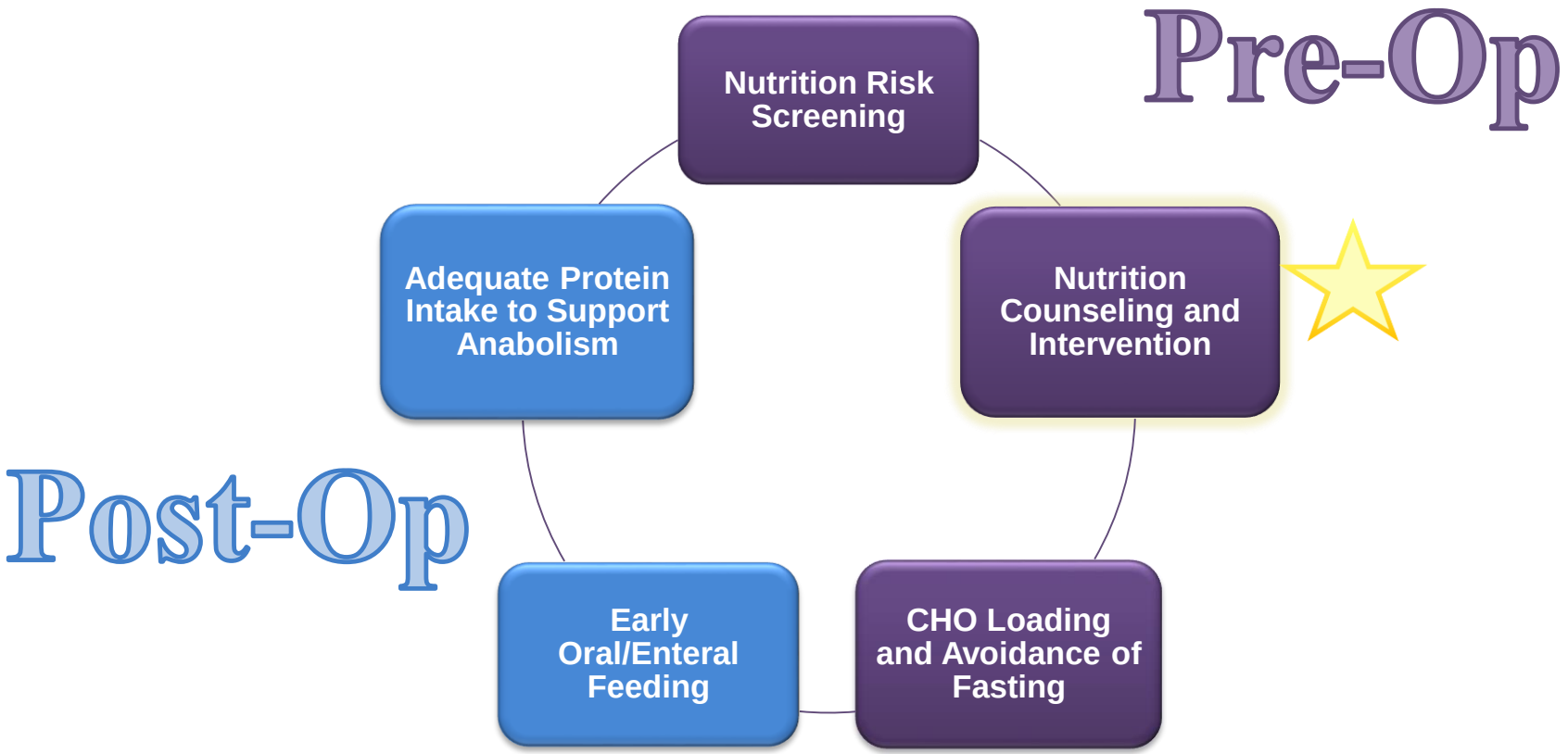
↳ Initiate goal-directed nutrition therapy

↳ Oral supplements, protein modular and/or enteral nutrition as appropriate

NRS = Nutrition Risk Screening, MUST = Malnutrition Universal Screening Tool, MST = Malnutrition Screening Tool, SGA = Subject Global Assessment, SNAQ = Short Nutritional Assessment Questionnaire

Tobert CM, et al. *J Urol* 2017; 198:511-519
Sarhill N, et al. *Supp Care Can* 2003; 11:652-659

Key Nutrition Components of ERAS



World J Surg 2013; 37:259–84

Preoperative Nutrition

Nutrition Counseling/Intervention

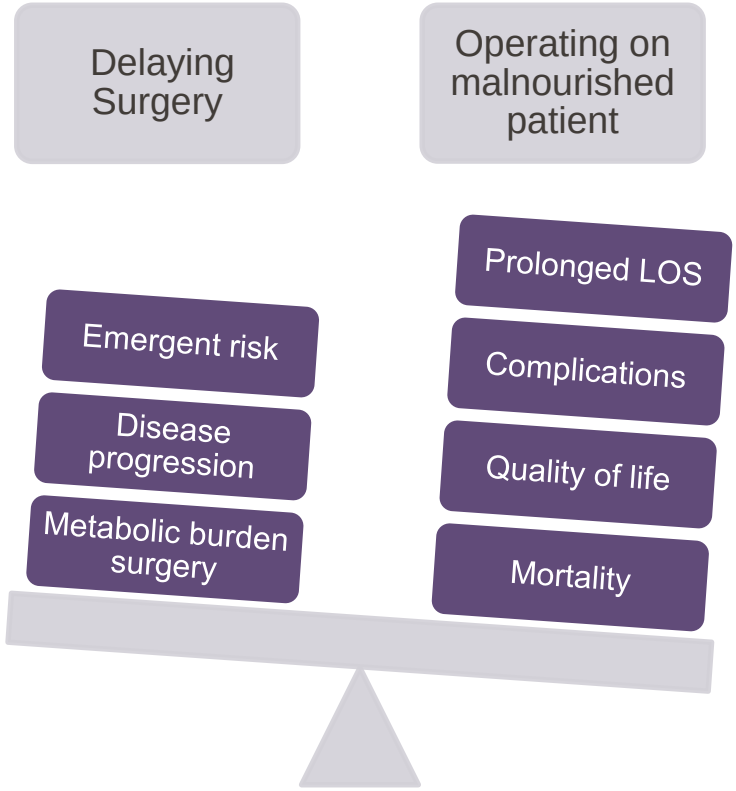
When to Focus on Nutrition Optimization?

The earlier the better

Minimum of 7–14 days

- *NOTE: 5–7 days of pre-op nutrition therapy in malnourished can lead to a **50% reduction in post-op morbidity***

IMPORTANT to weigh the risk of delaying surgery against the significant risk of operating on a malnourished patient



If able to postpone surgery…

- **Nutrition consult**
  - *GI referral for feeding tube placement?*
- **Physical Medicine/Rehab/PT**

Wischmeyer PE, et al. *Anesth Analg* 2018; 126(6):1883-1895

Preoperative Nutrition

Nutrition Counseling/Intervention

Reaching protein goal MORE IMPORTANT than total calories in Pre-op period

Goal: Protein intake >1.2 g/kg/day (~1 g/lb/day of IBW/ABW for obese pts)

- up to 2g/kg/day in stressed pts

❖ Whey & Casein – best quality protein for muscle synthesis

Protein goals can be achieved with:

- High-Protein ONS (2-3x/day, minimum 18g protein/dose)
- IMN formulas (arginine, fish oil, nucleotides)

Recommended for Pre-Op use

Regardless of Nutritional Status
ASER consensus

Recommend feeding tube placement for enteral nutrition (EN) if unable to orally achieve goals

- Initiate EN pre-operatively for at least 7 days

Wischmeyer PE, et al. *Anesth Analg* 2018; 126(6):1883-1895
McClave SA, et al. *JPEN* 2016; 40:159–211

IBW – Ideal Body Weight; ABW – Adjusted Body Weight
IMN – Immunonutrition; ONS – Oral Nutrition Supplement

Immunonutrition (IMN)

8 oz serving
45g CHO per bottle
Does Not contain nucleotides

6 oz serving
15g CHO per bottle
Contains all 3 nutrients

Specific nutrients:

- Arginine
- Omega-3 (n-3) fatty acids
- Nucleotides
- Antioxidants

Recommended use: 5-7 days pre-op and 5-7 days post-op (strongest evidence-based outcomes)
***NOTE: still see benefit with post-op use alone*

- ❖ IMN should be considered for all major elective surgeries
  - ***especially major abdominal surgery and oncologic surgery***
- ❖ Modulate metabolic response to surgery (stress) by enhancing immune function

Outcomes include: ↓ infectious complications, ↓ length of stay, ↑ wound healing

Drover JW, et al. *J Am Coll Surg* 2011; 212(3):385-399
Osland E, et al. *JPEN* 2014; 38(1):53-69

Immunonutrition in Critical Care

Marik & Zaloga, 2008

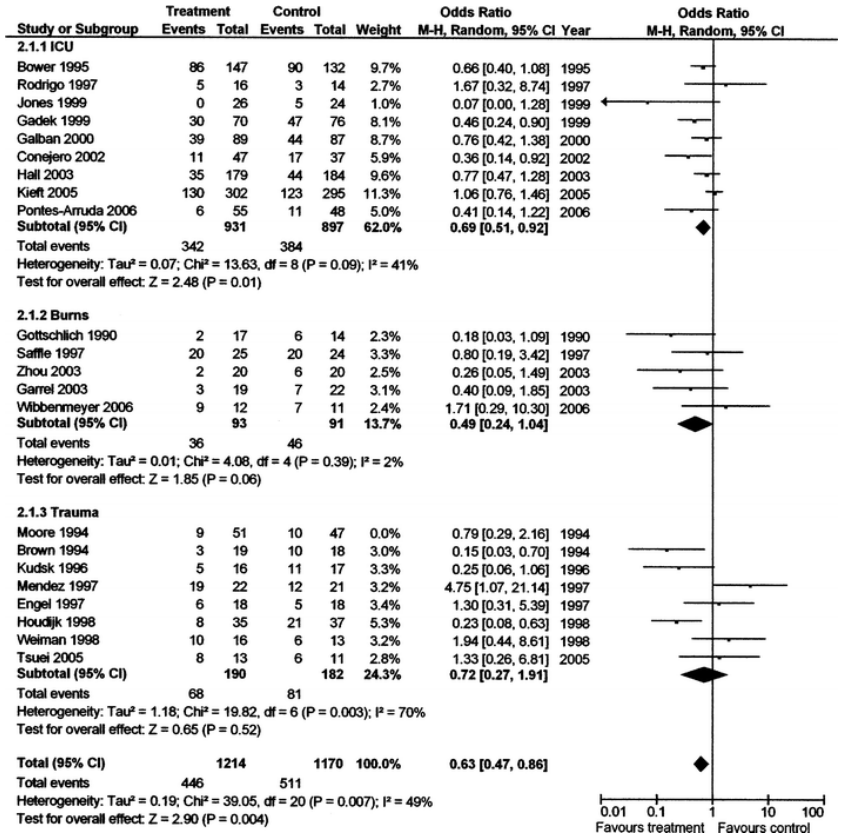
Meta-analysis of 24 RCT's comparing outcome of critically ill pts on IMN vs. control

- 12 studies included ICU pts, 5 w/ burn pts, 7 w/ trauma pts

IMD with Fish Oil improved the outcome of medical ICU patients (with SIRS/sepsis/ARDS)

IMD with arginine *without* Fish Oil did not offer advantage over standard EN formulas in ICU, trauma and burn pts

Synergistic Effect

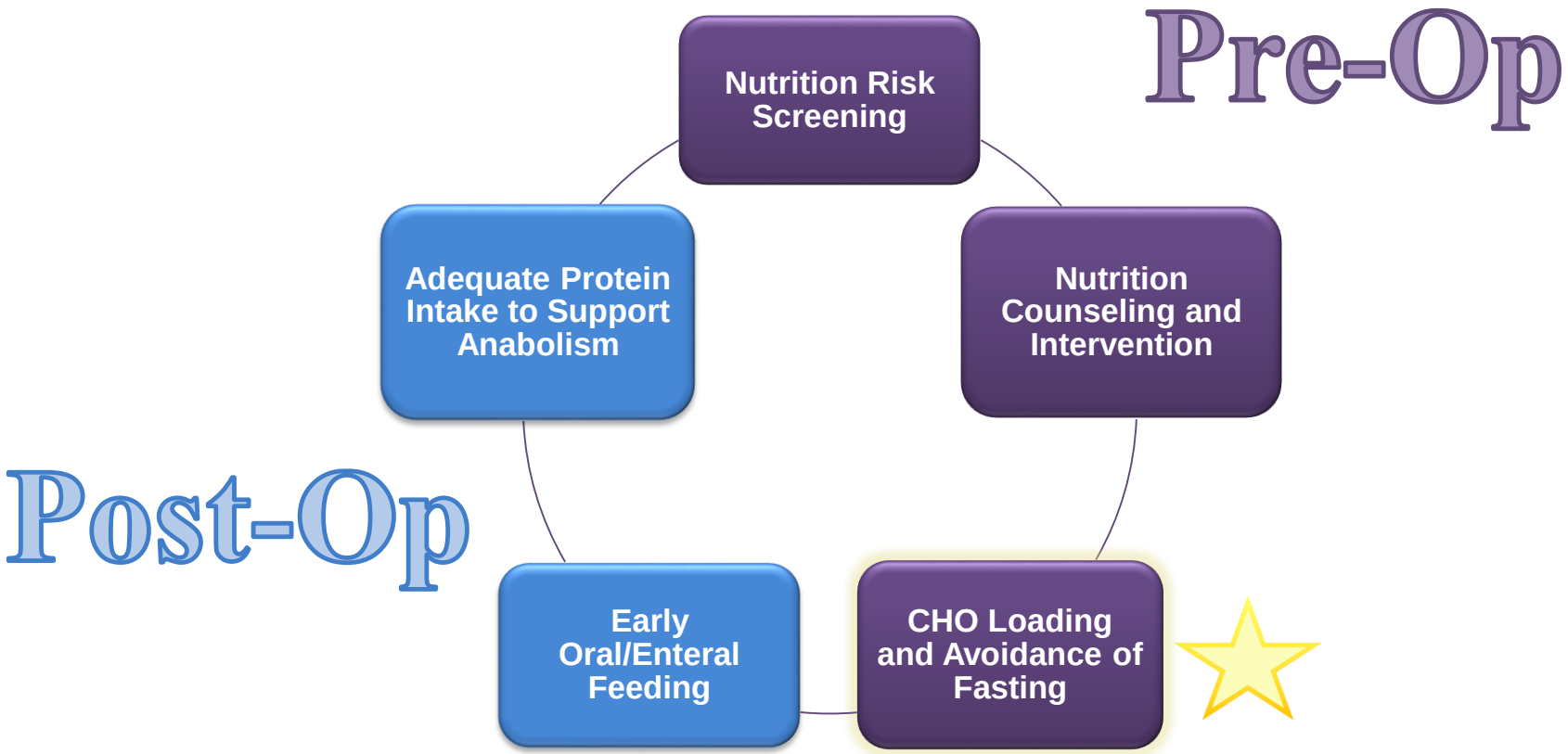


Effect of IMD on acquisition of new infections

Marik & Zaloga. *Intensive Care Med* 2008; 34:1980-1990

IMD = Immune Modulating Diet

Key Nutrition Components of ERAS



World J Surg 2013; 37:259–84

Preoperative CHO Loading

What we know:

- Surgery (stress) induces peripheral insulin resistance which and lead to hyperglycemia
- Pre-op load of 50g complex CHO (e.g. maltodextrin) stimulates an insulin response which can improve insulin sensitivity by ~50%
  - ❖ **It is unclear if attenuating post-op insulin resistance effects significant outcomes**
    - ***i.e. LOS, complications***
- Can improve energy stores (glycogen)
  - *Start surgery in metabolically fed state vs catabolic state*

We can feel confident that:

- Safe – no increased risk of aspiration
- **Reduces patient discomfort**

  ↓ pre-op thirst, hunger & anxiety

Bottom Line: **Avoid going into surgery starved and dehydrated**

Amer MA, et al. *BJS* 2017; 104: 187-197 Bilku DK, et al. *Ann R Coll Surg Engl* 2014; 96: 15-22

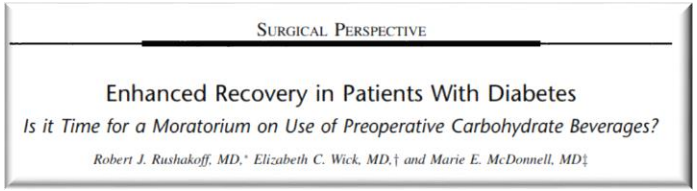
Preoperative CHO Loading

Contraindications

- Gastroparesis/delayed gastric emptying* or severe GERD
  - *Gastric retention of >10% at 4 hours
- Fluid restricted (e.g., dialysis, CHF)
- Difficult airways
- Type 1 Diabetes; Insulin pump
- S/p major GI resection (e.g., esophagectomy, Whipple, gastrectomy)
- *Type 2 Diabetes?…*

ASA Guidelines Update. *Anesth* 2011; 114(3):495-511

Preoperative CHO Loading:
Type 2 Diabetes


SURGICAL PERSPECTIVE

Enhanced Recovery in Patients With Diabetes

Is it Time for a Moratorium on Use of Preoperative Carbohydrate Beverages?

Robert J. Rushakoff, MD, Elizabeth C. Wick, MD,† and Marie E. McDonnell, MD‡*

Gustafsson et al, 2008

35 Subjects (OAD-treated=14, Insulin-treated=11, Healthy Control=10)

- Similar gastric emptying times for DM & non-DM
  - *slightly faster in DM patients*
- Peak glucose higher in DM subjects (242 vs. 138 mg/dl) and occurred later (60 vs. 30 min) (P<0.01)
- Glucose levels back to baseline at 180 min in DM vs.120 min healthy subjects (P<0.01)

Rushakoff et al, 2019

- Little-to-no data on this population (prediabetes, IGT, DM)
- CHO loading in DM doesn't reduce IR, but dose induce hyperglycemia
  - *possibly increasing risk of adverse events*

Pre-op CHO drink NOT recommended in DM patients on an ERAS pathway

Gustafsson UO, et al. *Acta Anaesthesiol Scand* 2008; 52:946-95
Rushakoff RJ, et al. *Ann Surg* 2019; 269:411–412

IGT = Impaired Glucose Tolerance
IR = Insulin Resistance; OAD = Oral Anti-Diabetic Drugs

American Society for Enhanced Recovery and Perioperative Quality Initiative Joint Consensus Statement on Nutrition Screening and Therapy Within a Surgical Enhanced Recovery Pathway

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Director, Perioperative Research, Duke Clinical Research Institute (DCRI)

Department / Division
Anesthesiology / Critical Care Medicine

Duke Anesthesiology
Duke University School of Medicine

EBPOM
Evidence Based Perioperative Medicine

Figure 2. Summary of key recommendations for perioperative nutrition care. POQI indicates Perioperative Quality Initiative.

Enhanced Recovery After Surgery

Active Patient Involvement

Pre-operative	Intra-operative	Post-operative
•Pre-admission education	•Active warming	•Early oral nutrition
•Early discharge planning	•Opioid-sparing technique	•Early ambulation
•Reduced fasting duration	•Surgical techniques	•Early catheter removal
•Carbohydrate loading	•Avoidance of prophylactic NG tubes & drains	•Use of chewing gum
•No/selective bowel prep		•Defined discharge criteria
•Venous thromboembolism prophylaxis	•Goal directed peri-operative fluid management	
•Antibiotic prophylaxis	•Pain & nausea management	
•Pre-warming		

Audit of compliance & outcomes

Whole Team Involvement

Implementation of ERAS programs have resulted in:

- Shorter postsurgical admissions
- Fewer post-op complications
- Decreased use of opioids
- Improved functional recovery

Potential need for post-op ICU admission should be discussed with the patient PRE-operatively

Jovanovic´ G, et al. *Front Med* 2018; 5:256 Ljungqvist O, et al. *JAMA Surg* 2017; 152(3):292–98

ERAS® Society
erassociety.org

Enhanced Recovery After Surgery (ERAS)

Mission: develop peri-operative care and improve recovery through research, education, audit and implementation of evidence-based practice

9 ERAS Society Guidelines Available

- Colonic surgery
- Pancreaticoduodenectomy
- Elective rectal/Pelvic surgery
- Radical cystectomy
- Liver
- Bariatric
- Head and Neck cancer surgery
- Gastrectomy
- Breast surgery

Modified ERAS Guidelines exist for

- Colorectal liver metastasis surgery
- Gynecology
- Thoracic
- Vascular
- Pediatric
- Urologic
- Orthopedic
- Esophagectomy

aserhq.org

ERAS® USA
erasusa.org

Jovanovic´ G, et al. *Front Med* 2018; 5:256
Steenhagen E. *Nutr Clin Pract* 2016; 31:18–29

Key Nutrition Components of ERAS

How to achieve:

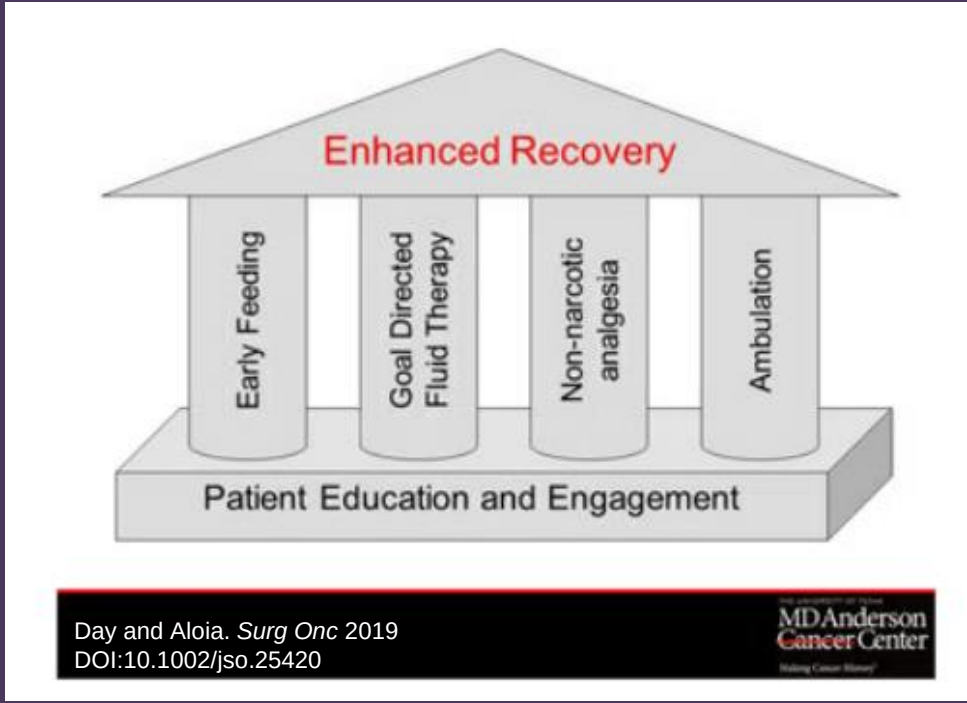
- ✓ Care bundles for early nutritional interventions
- ✓ Implementation of nutritional protocols (developed by multidisciplinary ICU teams)
  - Additional nutrition-specific aspects: minimizing postoperative nausea and vomiting, fluid optimization, and early feeding of normal food with automatic inclusion of high-protein oral nutritional supplements

Key Components for ANY Successful ERAS Program

- ✓ Multidisciplinary steering committee
- ✓ Regular [weekly] meetings
- ✓ Physician and Nurse Champions
- ✓ Involve inpatient and outpatient staff
- ✓ Staff education - *continuous*
- ✓ Patient Education
- ✓ Audit of outcomes
  - Disseminate results to committee and stakeholders
- ✓ Celebrate Teams accomplishments
- ✓ Continue to engage patients and family

Know that it takes time to change culture

…but it's worth it!



Day and Aloia. *Surg Onc* 2019
DOI:10.1002/jso.25420

MD Anderson Cancer Center

Thank You

Learning Assessment Question #1

Malnutrition is a modifiable risk factor shown to impact which of the following:

a) Wound healing

b) Length of stay

c) Hospital costs

d) All of the above

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Malnutrition is a modifiable risk factor shown to impact which of the following:

a) Wound healing

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d) All of the above

Learning Assessment Question #2

Which of the following is best for assessing pre-operative nutrition risk and guiding daily estimated energy needs?

a) BMI

b) Weight

c) Muscle ultrasound

d) Albumin

Learning Assessment Question #2

Which of the following is best for assessing pre-operative nutrition risk and guiding daily estimated energy needs?

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