

Adult Malnutrition

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Disclosure

The speaker is an employee of Fresenius Kabi USA, as a Medical Science Liaison, Department of Medical Affairs, Parenteral Nutrition

Fresenius Kabi is a leading company in infusion therapy, IV generic drugs, clinical nutrition, transfusion technology and application devices. It is focused on the therapy and care of critically and chronically ill patients in and outside of the hospital.

Objectives



Describe incidence and identification of malnutrition



Outline conditions or diseases associated with nutrition risk



Review malnutrition clinical guidelines and recommendations



Discuss outcomes associated with malnutrition



Assess published interventions to prevent malnutrition

Malnutrition may be obvious



Barbara Durer age 63, 1514
Albrecht Dürer

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Less Obvious Malnutrition



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Incidence of Malnutrition in Adults



Malnutrition remains in the closet

“The Skeleton in the Hospital Closet”

- Butterworth, Nutrition Today 1974¹

❖ 1970's Bistrian, Blackburn: 44% medical ward pts, >50% general surgical pts malnourished^{2,3}

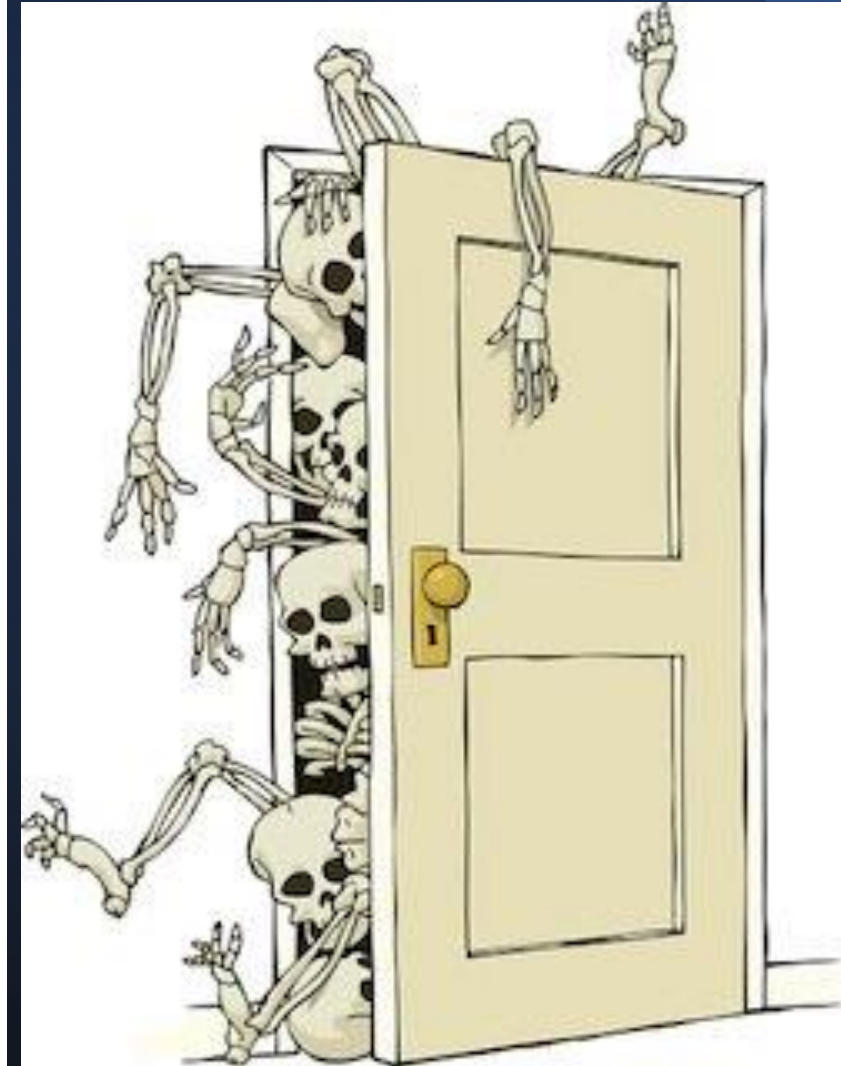
❖ 2003: 33% hospitalized adults malnourished⁴

❖ Malnutrition still among greatest silent epidemics facing hospitalized patients⁵

❖ Estimated 20% - 50% of US hospitalized patients malnourished⁶

1. Butterworth CE Jr. The skeleton in the hospital closet. Nutr Today. 1974;9(2):4-8.
2. Bistrian BR, Blackburn GL, et al. Prevalence of malnutrition in general medical patients. JAMA. 1976;235(15):1567-1570.
3. Bistrian BR, Blackburn GL, Hallowell E, Heddle R. Protein status of general surgical patients. JAMA. 1974;230(6):858-860.
4. Robinson MK, Trujillo EB, Mogensen KM et al. Improving nutritional screening of hospitalized patients: the role of prealbumin. JPEN J Parenter

5. Kirkland LL, Kashiwagi DT, Brantley S, et al. Nutrition in the hospitalized patient. J Hosp Med 2013; 8(1):52-58.
6. Souza TT, Sturion CJ, Faintuch J. Is the skeleton still in the hospital closet? A review of hospital malnutrition emphasizing health economic aspects. Clin Nutr. 2015;34(6):1088-1092

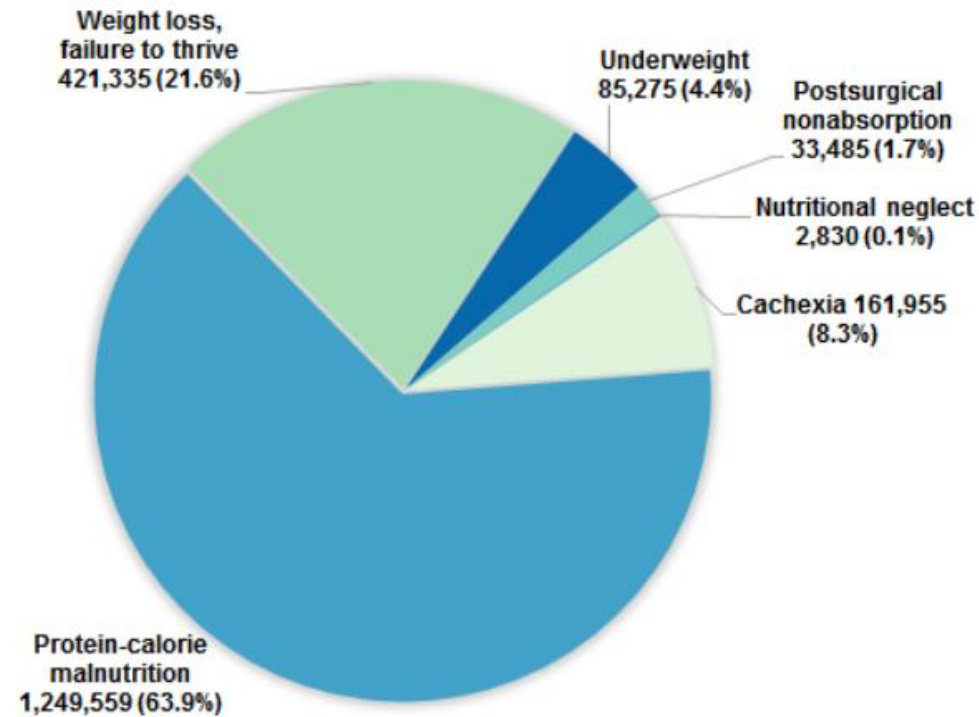


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Malnutrition in Hospitals, 2013

- Hospital stays involving malnutrition, 2013: distribution of 6 types of malnutrition among hospital inpatient stays

Figure 1. Types of malnutrition among hospital stays with malnutrition, 2013



Malnutrition in Hospitals, 2018

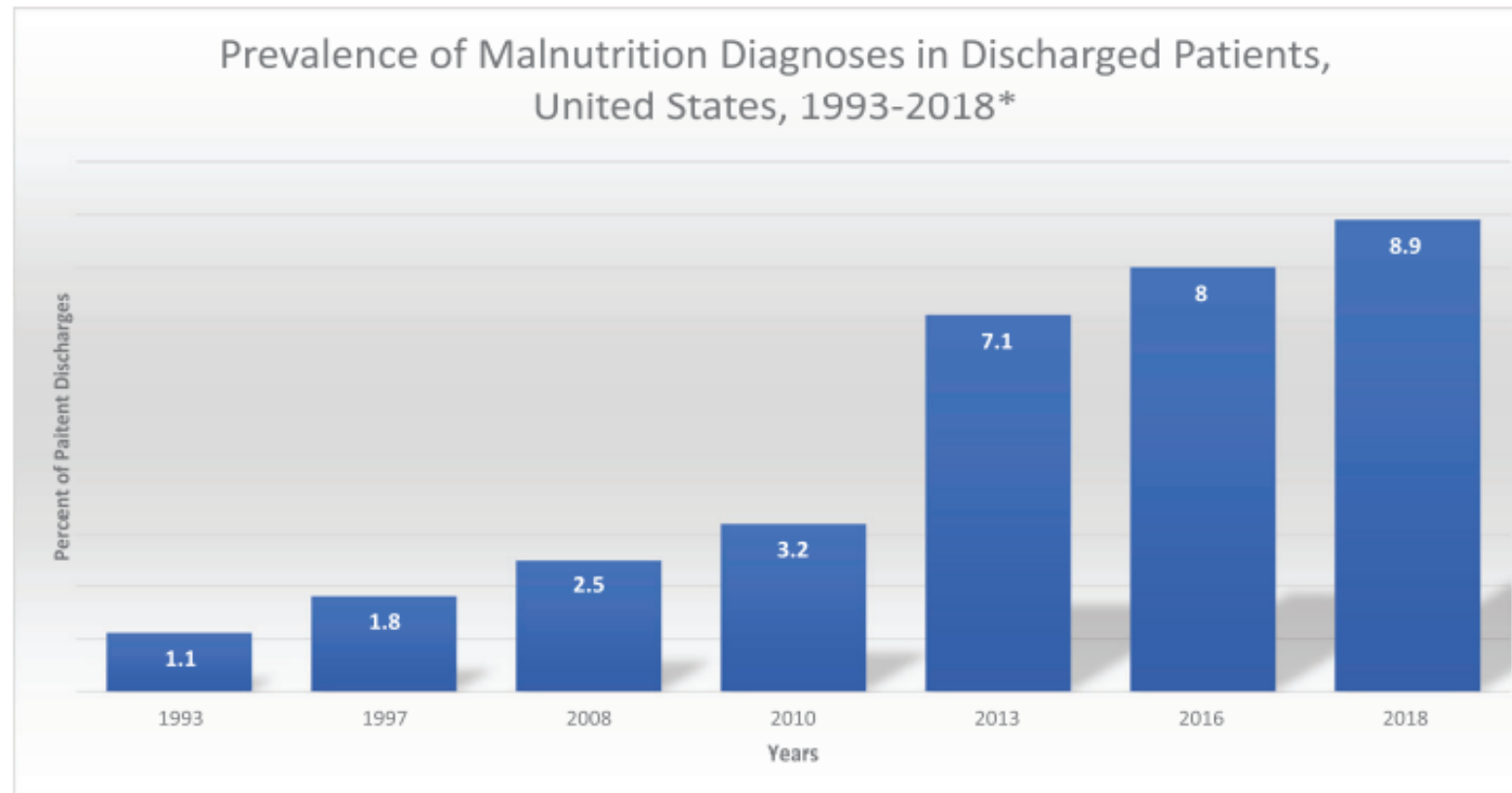


FIGURE 1 Percentage of hospital discharges with malnutrition diagnoses, by year, US National Inpatient Sample. *Years 1993–2010 were all hospital discharges; 2013–2018 were non-maternal, non-neonatal hospital discharges

nutritionDay in US- a one day picture



nutritionDay worldwide
benchmark & monitor your nutrition care

2005: Project performed for first time with use of network and expertise of ESPEN (European Society for Clinical Nutrition and Metabolism) in a pilot study in 5 countries

<https://www.nutritionday.org/>



nutritionDay in the US: 2018

- **9,959 adult patients from 601 units/wards evaluated**
 - Prevalence of malnutrition risk: 32.7%
 - ↑ in infectious disease (46.1%), long-term care (45.8%)
 - ↓ in orthopedic surgery (23.7%)
 - 32.1% of patients ate ≤ 25% of all meals on nutritionDay
 - Mortality hazard ratio (HR) vs. pts eating all meals: 3.24 (95%CI: [1.73, 6.07]; p <0.001)
 - For patients allowed to consume food:
 - Patients who ate nothing: Mortality HR of 5.99 (95% CI: [3.03; 11.84]; p <0.0001) vs. those who ate all meals served
- **~ 33% hospitalized patients at risk for malnutrition, ↑ mortality risk in pts w/decreased PO**

How does malnutrition affect outcomes?

- Impairs effective immune response, wound healing, muscle mass, strength and function¹
- Increases morbidity and mortality for hospitalized patients¹⁻⁵
 - 4 - 5x higher mortality rate vs. well nourished⁵
 - Preexisting malnutrition ± weight loss associated with 2-3x ↑ risk of *C. difficile*, surgical site infections, post-op pneumonia⁴
 - 4x higher rate of pressure ulcers
 - 5x risk of CABG surgical site infection and catheter associated UTI⁴

TC Int J Environ Res Public Health. 2011;8(2):514-527.

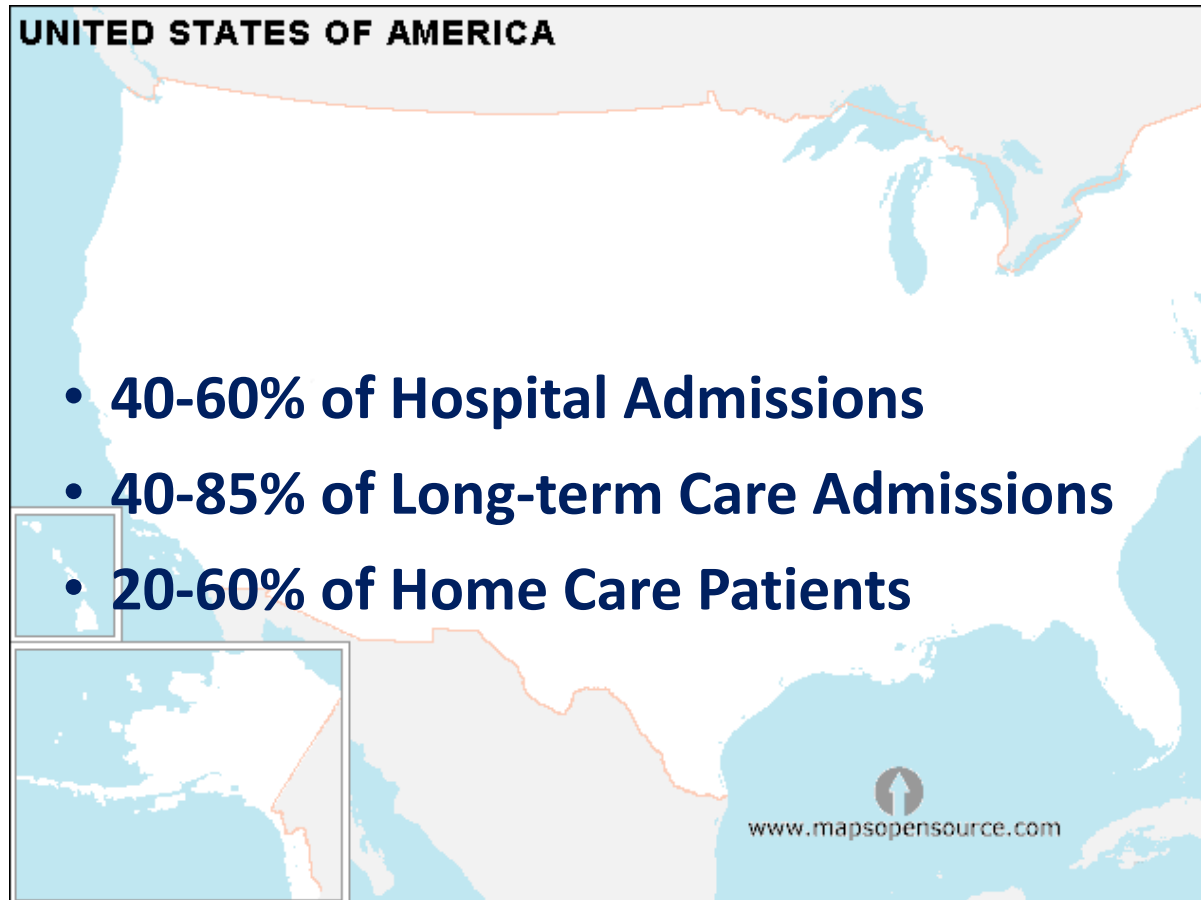
2. Norman K, Pichard C, Lochs H, Pirlich M. Clin Nutr. 2008;27(1):5-15.

3. Weiss AJ, Fingar KR, Barrett ML, et al Statistical Brief #210. Rockville, MD: Agency for Healthcare Research and Quality;Sept 2016.

4. Fry DE, Pine M, Jones BL, Meimban RJ Arch Surg. 2010;145(2):148-151.

5. Correia MI, Waitzberg DL. Clin Nutr. 2003;22(3):JPEN 2014;38(2):186-195

Where is US Malnutrition?



Malnutrition is under-recognized and increases costs

Coded diagnosis only 5% (range 0.6%-18.6%) among 105 institutions¹

- Only 3.2% of malnourished patients recognized and diagnosed²

Malnutrition is associated with²⁻⁹

- ↑ length of stay
- ↑ readmission rates
- ↑ costs of care^{3,4}
 - Example (UK): Annual expenditure of managing patients at medium/high risk of disease related malnutrition: \$11.4 billion
- More than 50% of the cost related to hospital care
- **~1/3 of patients BECOME malnourished during hospital stay**

Preventable causes of malnutrition include

- Lack of standardized screening/assessment/protocols/monitoring
- Prolonged NPO status related to medical procedures

1. Tobert CM et al. J Acad Nutr Diet. 2018 Jan;118(1):125-131.

2. Corkins MR, et al. JPEN 2014;38(2):186-195

3. Norman K et al. Clin Nutr. 2008;27(1):5-15.

4. Correia MI, Waitzberg DL. Clin Nutr. 2003;22(3):235-239.

5. Allaudeen N, et al.. J Hosp Med. 2011;6(2):54-60.

6. Russell CA. Clin Nutr Suppl. 2007;2(1):25-32.

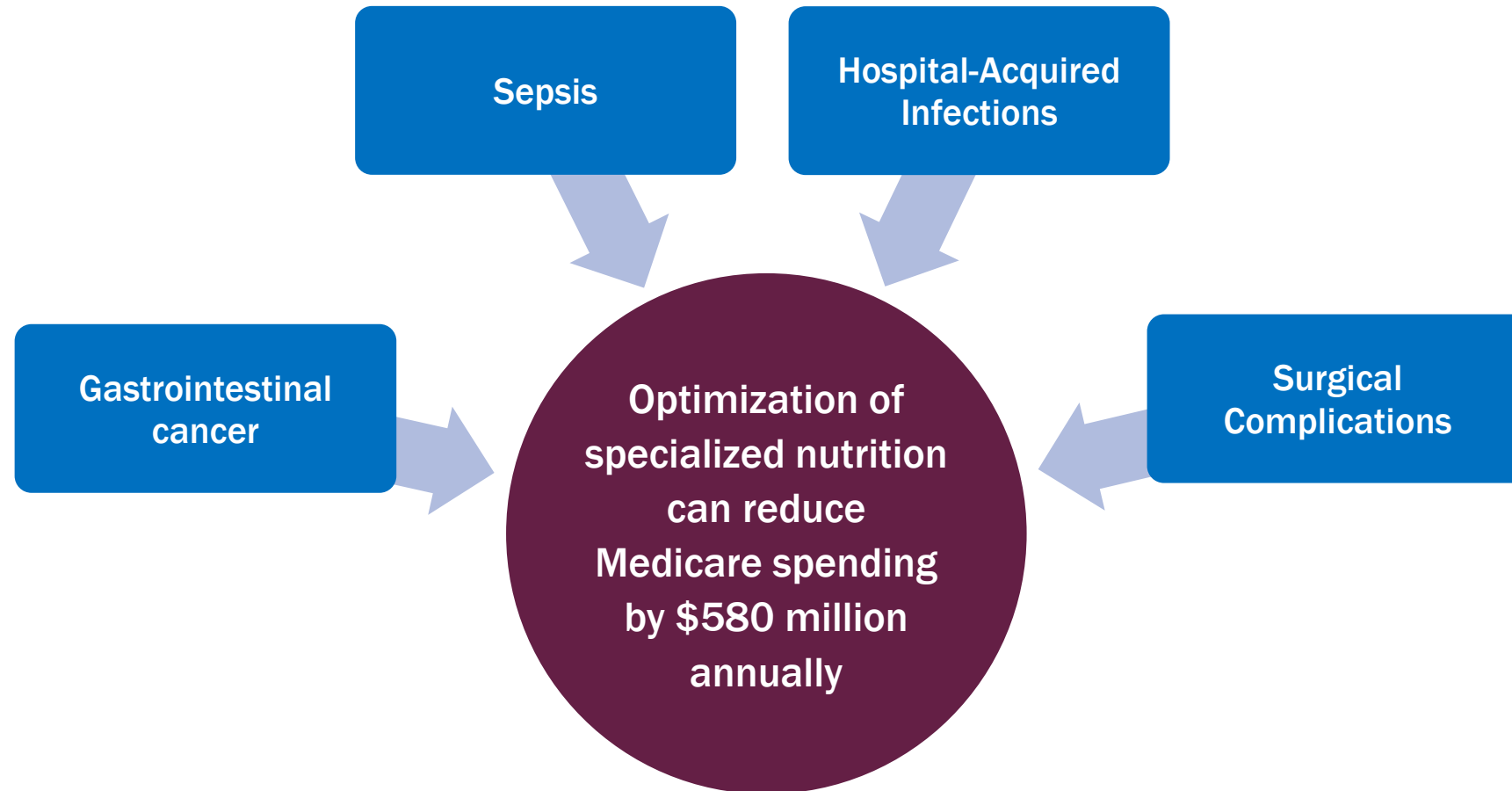
7. Allard JP et al. Clin Nutr 2016; 35:144-152

8. Braunschweig C, et al. J Am Diet Assoc. 2000;100(11):1316-132

9. Almeida AI, et al. Br J Nutr. 2013;109(2):322-328.

ASPEN Value Project: [Nutritioncare.org/ValueProject](https://nutritioncare.org/ValueProject)

- **Nutrition Support for Patients in Specific Therapeutic Areas Improves Outcomes and Saves Medicare \$580M Annually**



ASPEN Value Project: [Nutritioncare.org/ValueProject](https://nutritioncare.org/ValueProject)

Nutrition support could save the Medicare program \$580M each year through shorter hospital stays and complication avoidance

Accomplishment: Evaluated financial and quality impact of nutrition support therapy

Supports value-based medicine (healthcare outcomes and patient satisfaction vs cost of care)

Nutrition support benefits patients with **sepsis, gastrointestinal cancer, hospital-acquired conditions/infections, and surgical complications** through shorter hospital stays and complication avoidance.

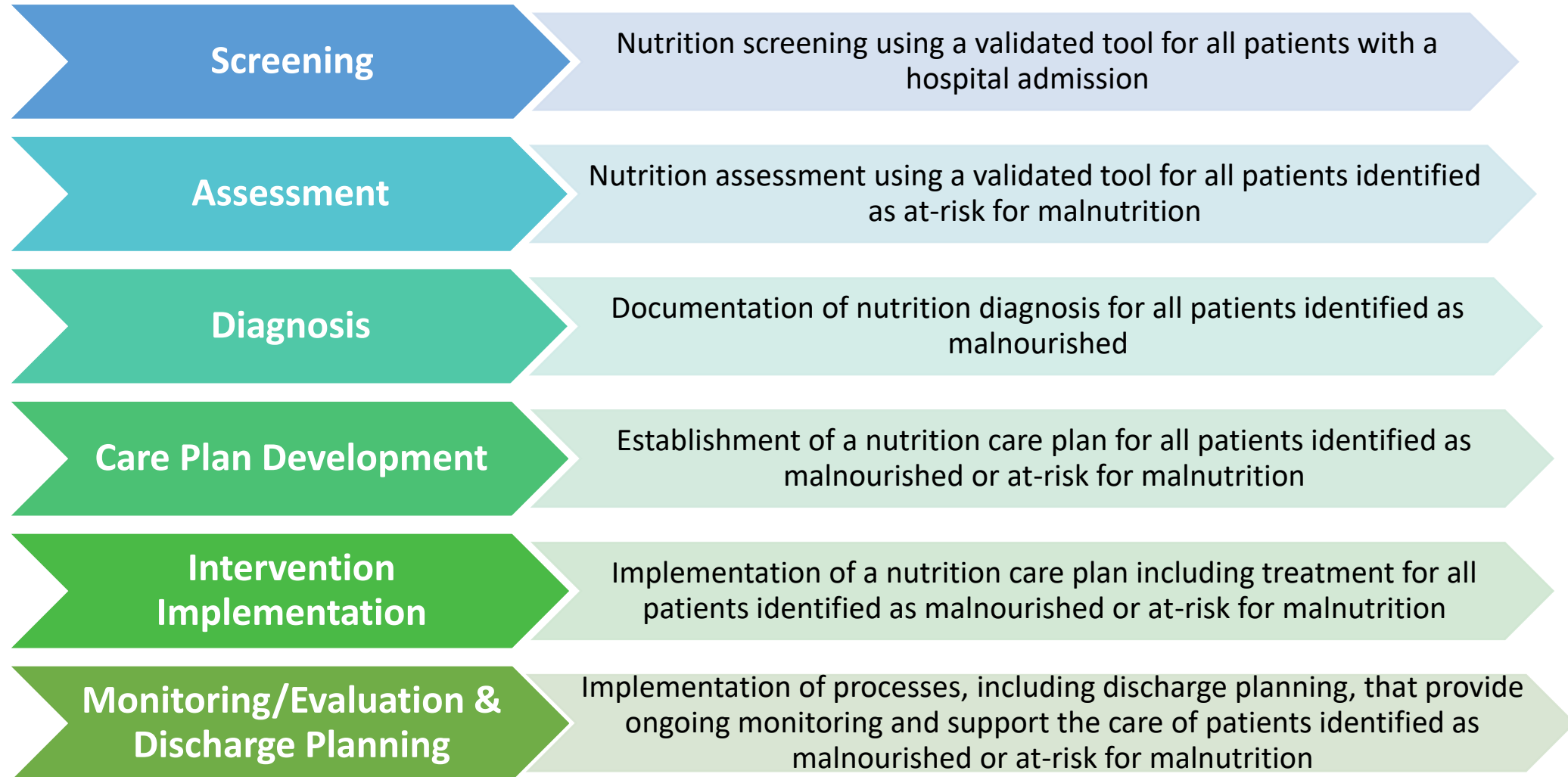
Suggests additional application of this methodology beyond limited group of conditions

Call to Action: *Healthcare professionals, payers, and policymakers should harness the benefits of nutrition support to provide patients with cost-effective, cost-efficient, high-quality healthcare.*

Identifying Malnutrition



Malnutrition Care Workflow



From: AND Malnutrition Measures Specification Manual, v1.2, October 2017

<http://www.eatrightpro.org/~media/eatrightpro%20files/practice/quality%20management/quality%20improvement/malnutrition-measurespecificationmanual.ashx>

Screening for Nutrition Risk

Joint Commission

- Mandated universal screening and assessment of hospitalized patients for malnutrition since 1995

When applicable for patient's condition, nutrition screening must be completed within 24 hours after inpatient admission (PC-010203,EP-7)

Nutrition risk screening usually part of admission process

Validated nutrition screening tool appropriate for the patient population recommended

Conditions or diseases which increase nutrition risk

- **Gastrointestinal Issues:**

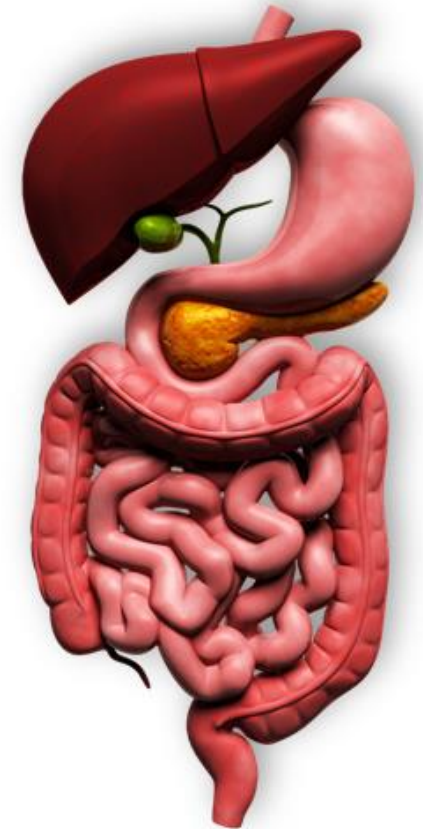
- Previous GI surgery
- Intestinal resection
- Severe GI hemorrhage
- Enterocutaneous fistula
- Gastrointestinal obstruction
- Mesenteric ischemia
- Severe acute pancreatitis
- Chronic pancreatitis
- Inflammatory bowel disease

- **Solid or hematologic malignancy**

- **Bone marrow transplant**

- **Acquired immune deficiency syndrome**

- **Organ failure/transplant (kidney, liver, heart, lung, gut)**



Team Approach to Improve Clinical Outcomes



Validated Nutrition Screening Tools

Screening Tools	Patients	Includes
Nutrition Risk Screening (NRS) 2002¹	Critical Care	Wt loss, BMI, intake, diagnosis
Nutrition Risk in Critically Ill (NUTRIC)^{2,3}	Critical Care	Age, Apache II, SOFA, Co-morbidities, Hosp to ICU days, (IL-6)
Malnutrition Universal Screening Tool (MUST)⁴	Med/Surg	BMI, wt change, acute disease
Malnutrition Screening Tool (MST)⁵	Acute, Med/Surg	Appetite, unintentional weight loss

1. Kondrup J, Rasmussen HH et al. Clinical Nutrition 2003; 22(3): 321-36

2. Heyland DW, Dahliwal R et al. Crit Care 2011; 15(6): R268.

3. Rahman A. et al Clin Nutr 2016; 35(1) 158-162.

4. Weekes CE, Elia M, Emery PW. Clin Nutr. 2004;23:1104-12

5. Ferguson M, et al. Australas Radiol. 1999;43:325-327.

6. Skipper A et al. JPEN 2012; 36 (3): 292-298

Nutrition Risk Assessment Tool: NUTRIC Score

Nutrition Risk in Critically Ill Score

Designed to quantify risk of critically ill patients developing adverse events that may be modified by aggressive nutrition therapy

- Scoring is from 1 – 10, based on 6 variables

A score of ≥ 6 indicates high risk for malnutrition

- If IL-6 NOT used, ≥ 5 indicates high risk (modified Nutric/mNutric)
- Note: in the US, additional indicators being tested to replace IL-6, such as red cell distribution width³, which may improve mortality prediction

High risk: associated with worse outcomes

- Increased mortality, longer duration of mechanical ventilation

1. Heyland DW, Dahliwal R et al. Crit Care 2011; 15(6): R268.

2. Rahman A. et al Clin Nutr 2016; 35(1) 158-162.

3. Otero T, Canales C, Belcher D et al. ASPEN 2018 Abstract of distinction presentation, Las Vegas.

Case Study

59 year old male admitted to the MICU with COVID-19

Ht: 5'8", usual body weight: 100 kg, BMI: 33 kg/m²

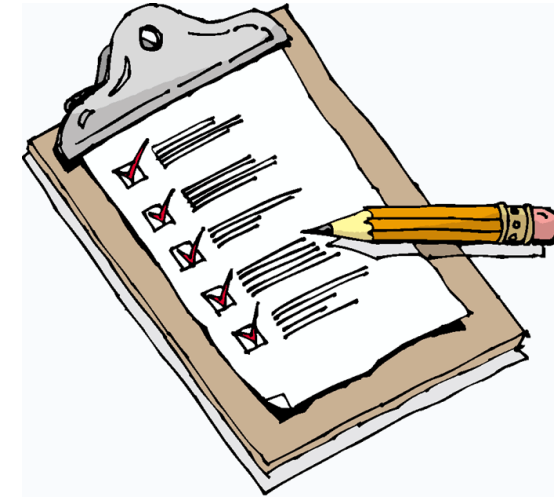
PMH: Hypertension, Diabetes

History of poor oral intake for 10 days, estimated 10 lb weight loss

Screening tool: NRS 2002

Nutrition Risk Score: NRS 2002

- **Risk based on the following variables:**
 - Weight loss (%)
 - BMI
 - Food intake
 - Age (correction for age > 70)
 - Severity of disease (stress metabolism)
- **Scoring from 0 – 6 (if correcting for age, 7)**
- **Scores of ≥ 3 indicates high risk patients who will benefit from nutrition support**



Case Study: NRS 2002 Score

Impaired nutritional status		Severity of Disease (~ stress metabolism)	
Absent Score 0	Normal nutritional status	Absent Score 0	Normal nutritional requirements
Mild Score 1	Wt loss >5% in 3 months 10 lb wt loss/5% - or - Food intake below 50-75% of normal requirements in preceding week	Mild Score 1	Hip fracture Chronic patients, in particular with acute complications: cirrhosis, COPD Chronic hemodialysis, diabetes, oncology
Moderate Score 2	Wt loss >5% in 2 months Or BMI 18.5-20.5 + impaired general condition Or Food intake 25 - 50% of normal requirements in preceding week	Moderate Score 2	Major abdominal surgery, Stroke Severe pneumonia, hematologic malignancy
Severe Score 3	Wt loss >5% in 1 month (+>15% in 3 months) Or BMI <18.5 + impaired general condition Or Food intake 0-25% of normal requirements in preceding week	Severe Score 3	Head Injury Bone marrow transplantation Intensive care patients (APACHE >10)
Score=	1	Score=	3
Calculate the total score	<ol style="list-style-type: none"> Find score (0-3) for Impaired nutritional status (only one: choose the variable with the highest score) and Severity of disease (~stress metabolism, i.e. increase in nutritional requirements). Sum of two scores (4 = total score) If age ≥ 70 years: add 1 to the total score to correct for frailty of the elderly If age-corrected total ≥ 3: start nutritional support 		

Nutrition Risk: a guide to individualized intervention?

SCCM/ASPEN 2016 Critical Care Guidelines

ICU patients are heterogeneous

Categorize based on nutrition risk

- Using validated tools such as NUTRIC, NRS-2002

High/very high-risk patients require nutrition support ASAP

- **More likely to benefit from nutrition support**
- More likely to be harmed by iatrogenic underfeeding
- More likely to benefit from non-nutritional benefits of NST

Low/Moderate risk don't appear to benefit from early nutrition support

Nutrition Screening vs Assessment

Features	Nutrition Screening	Nutrition Assessment
Purpose	Identifies risk factors	Provides diagnosis
ASPEN¹ Guidelines Definition	“a process to identify an individual who is malnourished or who is at risk for malnutrition to determine if a detailed nutrition assessment is indicated.”	“a comprehensive approach to diagnosing nutrition problems... medical, nutrition, and medication histories; physical examination; anthropometric measurements; and laboratory data.”
Performed by	RN/hospital employee within 24 hours of admission; patient, family member	Trained health care professional (usually RD); includes nutrition focused physical exam

Nutrition Screening vs Assessment

Features	Nutrition Screening	Nutrition Assessment
Components	<u>Simple, Quick</u> <ul style="list-style-type: none">• Current weight/BMI• Unintentional weight loss (5-10%)• Reduced food intake (1-2 weeks)• Severity of disease	<u>More Complex, lengthy</u> <ul style="list-style-type: none">• Diet and medical history• Clinical status• Medications• Anthropometric data• Laboratory data• Nutrition Focused Physical assessment• Strength and function• Socio-economic information• Estimate nutrient requirements• Develop treatment plan

Does screening-based intervention work? RCTs

Study	NRS ≥ 3 (n=132)	Energy	Protein	Complications	Antibiotics	Re-hosp
Starke¹	Intervention (n=66)	24 kcal/kg*	1 g/kg*	6%*	1.5%*	25.7%*
	Control (n=66)	18 kcal/kg	0.7 g/kg	19/7%	12.1%	42.4%

*p < 0.05

Study	NRS all pts (n=212)	Complications	NRS	LOS-NDI	LOS 28
Johansen²	Intervention	18	3.4	14.07d*	17.27d**
	Control	14	3.6	19.67	22.2d

*Compared to control group with complications: P<0.015.

**Compared to control group with complications: P<0.028

NDI= Nutrition Discharge Index (last day to need assistance w/ toilet, fever, IV access)

1. Starke, J. et al. Clin Nutr 2011; 30:194-201

2. Johansen N. et al. Clin Nutr 2004; 23:539-550

Nutrition Screening and Outcomes

Study	Population	Study Groups	Results
Sorensen 2008	Multinational, multicenter acute care	Descriptive Cohort N=5501	NRS 2002 predicted LOS, Morbidity and Mortality
Scheisser 2008	Elective GI Surgery	Descriptive Cohort N=608	NRS 2002 predicted morbidity. Longer LOS in high-risk pts
Amaral 2008	Oncology	Descriptive Cohort N=130	MUST best identified pts at risk for longer LOS
Scheisser 2009	Elective GI Surgery	Descriptive Cohort N=200	NRS 2002 prognostic of postsurgical complications
Ozkalkanli 2009	Orthopedic surgery	Descriptive Cohort N=256	NRS 2002 and SGA predicted complications

Adapted from: Mueller C et al. JPEN. 2011;35(1):16-24.

Improvement in malnutrition screening

Root cause analysis: Johns Hopkins Hospital

- Role of early nutrition intervention on LOS, diagnosis coding of malnutrition cases, calculating case mix index, and reducing delays in implementing nutrition support to patients
- Demographic data, anthropometric measurements, LOS, and serum albumin levels collected from 400 patients in 2 medical wards to determine prevalence of malnutrition and potential delays in nutrition consultation

Results of nutrition intervention vs standard of care:

- 400 patients assessed, 53% had malnutrition
- Nutrition intervention ↓ LOS an average of 1.93 days in cohort group and 3.2 days in severely malnourished group
- Case mix index and female gender positively associated with LOS in malnourished group
- **Nutrition intervention reduced delays in implementing nutrition support to patients by 47%**

Learning Assessment

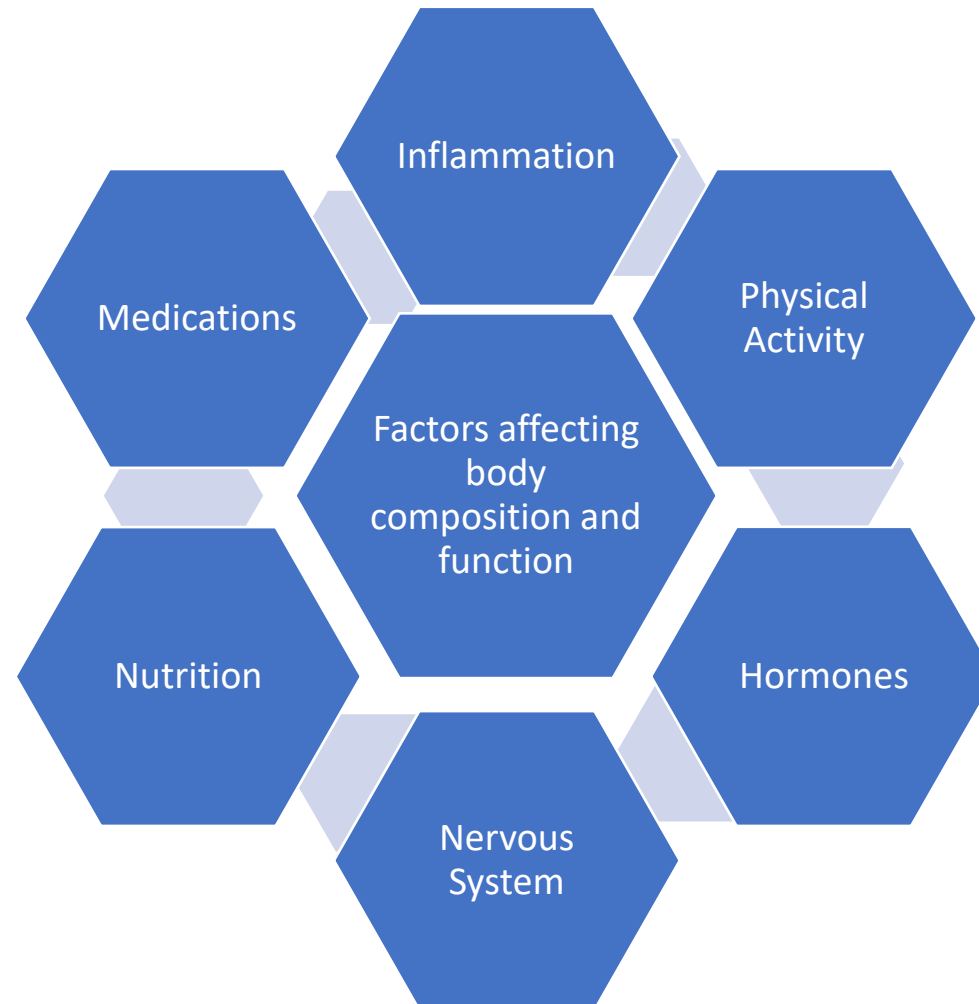
1. Nutrition screening tools have all been validated for patients in the ICU:
True or False?

False. Not every tool has been validated for ICU patients. Does your institution use a validated tool?

Assessment: Diagnosis of Malnutrition



Considerations for Nutrition Assessment



Malnutrition Considerations: Inflammation

- **Inflammation associated with metabolic alterations**
 - Cytokine-mediated responses: IL-6, IL-2, IL-18, and α -TNF
 - Loss of lean body mass and diminished function
 - Anorexia
 - Elevated energy expenditure
 - Acute phase protein (APP) changes
 - Fluid shifts to extracellular compartment
- **Inflammation limits effectiveness of nutritional interventions**
- **Associated malnutrition may compromise clinical response to medical therapy**



Visceral Proteins and Malnutrition

- Albumin and prealbumin not reliable indicators of nutrition status
- Production of both ↓ 2/2 inflammatory response and are independent of nutrition intervention
- Acute phase protein (APP) response = increased positive APPs with decrease in negative APPs
 - Positive APPs = C-Reactive Protein, fibrinogen, procalcitonin
 - Negative APPs = albumin, prealbumin, transferrin and retinol-binding protein
- ↓ synthesis of albumin and other visceral proteins alter oncotic pressure and promote fluid accumulation

Inflammation and Visceral Proteins

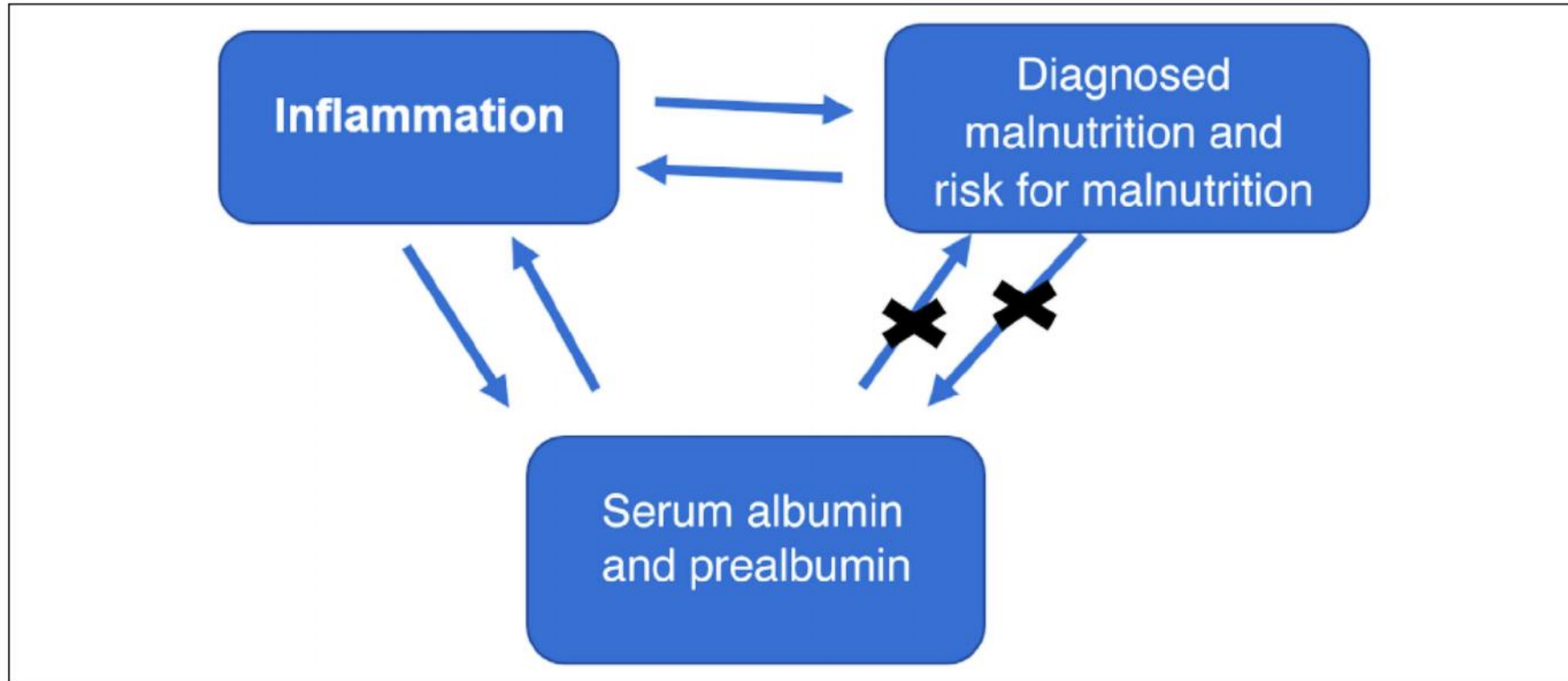


Figure 1. Relationship between malnutrition, inflammation, and visceral proteins.

Other Considerations: Laboratory Indicators

No single test or panel can diagnose malnutrition

Findings must be used in combination with other assessments

- **Albumin and prealbumin** ↓ by acute systemic inflammatory response to injury, disease or inflammation
- **C-reactive protein (CRP)** acute phase reactant may indicate presence of inflammation
- **Cytokines** such as IL-6 may indicate inflammatory status
- **Leukocytosis and hyperglycemia** may indicate inflammation
- **24-hour urinary urea nitrogen:** anticipate ↑ losses in severe acute systemic inflammatory response

Medication Considerations

- **Side effects may include:**

- Changes in taste, smell, xerostomia, GI discomfort
- Decreased gastric motility, early satiety, thirst
- Anorexia, decreased appetite and energy intake, leading to weight loss
- Weight gain



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1. Drug-nutrient interactions: a broad view with implications for practice. J Acad Nutr Diet. 2012;112:506-517.

2. Alibhai SM, Greenwood C, Payette H. An approach to the management of unintentional weight loss in elderly people. CMAJ. 2005;172:773-780.

3. Stajkovic S, Aitken EM, Holroyd-Leduc J. Unintentional weight loss in older adults. CMAJ. 2011;183:443-449.

4. Heuberger RA, Caudell K. Polypharmacy and nutritional status in older adults: a cross-

sectional study. Drugs Aging. 2011;28:315-323.

5. 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. 2012;60:616-631.

6. Chan LN. Drug-nutrient interactions. JPEN J Parenter Enteral Nutr. 2013;37:450-459.

Nutrition Assessment: Etiology-based Malnutrition Diagnoses

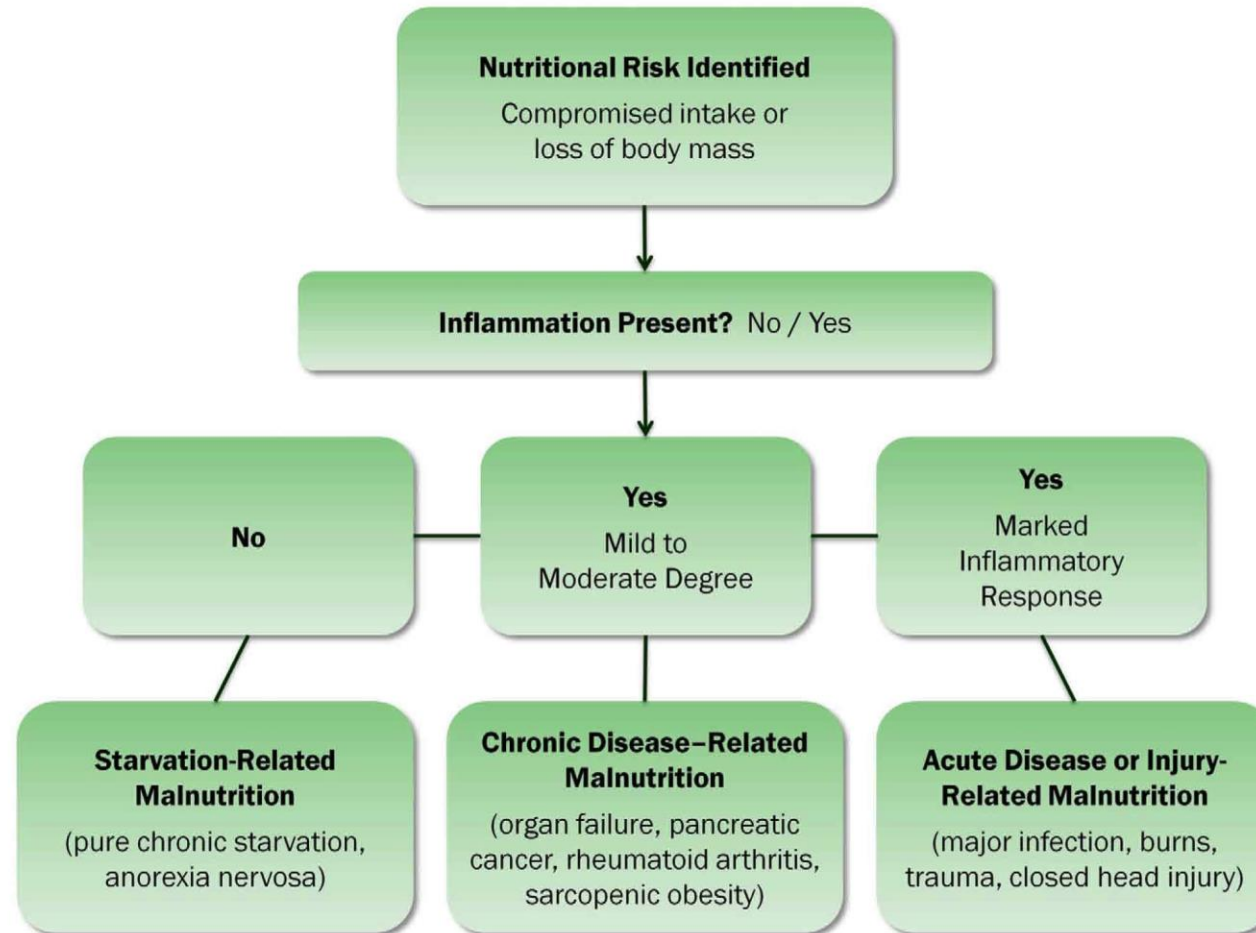


Figure. Etiology-Based Malnutrition Definitions. Adapted with permission from reference (8): Jensen GL, Bistran B, Roubenoff R, Heimburger DC. Malnutrition syndromes: A conundrum vs. continuum. *JPEN J Parenter Enteral Nutr.* 2009;33(6):710-716.

Etiology- based Malnutrition Diagnoses

Starvation related malnutrition: Chronic starvation without inflammation (e.g., anorexia nervosa)

Chronic disease-related malnutrition: inflammation is chronic and of mild to moderate degree (e.g. organ failure, pancreatic cancer, rheumatoid arthritis or sarcopenic obesity)

Acute disease or injury-related malnutrition: inflammation is acute and of severe degree (e.g., major infection, burns, trauma or closed head injury)

Malnutrition Clinical Characteristics (MCC)

- **Clinical Characteristics to Support a Diagnosis of Malnutrition (AND/ASPEN criteria)**
- **The identification of ≥ 2 characteristics recommended**
 - Insufficient energy intake
 - % Weight loss
 - **Loss of muscle mass**
 - **Loss of subcutaneous fat**
 - **Localized or generalized fluid accumulation (may mask weight loss)**
 - **Diminished functional status (measured by handgrip strength)**
- **Malnutrition identified as moderate or severe, depending on results of Nutrition Focused Physical Exam (NFPE) and energy intake/%wt loss**

Physical Exam

Note: Above criteria are in the process of validation

Case Study: Assessment and Diagnosis

59 year old male admitted to the MICU with COVID-19

- PMH: HTN, Diabetes. Currently with fever, shortness of breath
- Ht 5'8", UBW 100 kg, BMI 33
- History of poor oral intake for 10 days (**<75% of estimated needs**); 10 lb wt loss (**4.5%**)
- NRS Score 4, high risk as previously calculated at admission

Physical Exam: NFPE deferred; per RN, no visual signs of wasting; +2 edema

Est needs per ASPEN recs = 11-14 kcal/kg/d, 2-2.5 g/kg IBW (1400Kcal, 140g pro/d)

Non-Severe, Moderate malnutrition determined, acute illness

Case Study : Non-Severe (Moderate) Malnutrition

Characteristics	Acute illness or injury related malnutrition	Chronic disease related malnutrition	Social or environmental related malnutrition
Weight Loss	1-2%/1 week 5%/1 month 7.5%/3 months	4.5% weight loss over 7-10d 10%/6 months 10%/1 year	5%/1 month 7.5%/3 months 10%/6 months 10%/1 year
Energy intake	<75% for > 7 days	Decreased PO intake x 10d	<75% for ≥ 3 months
Body Fat	Mild Depletion	Unable to perform NFPE d/t COVID-19	Mild Depletion
Muscle Mass	Mild Depletion		Mild Depletion
Fluid Accumulation	Mild	+2 pitting edema to extremities per RN note	Mild
Grip Strength	Not applicable	Unable to perform grip strength d/t COVID-19	Not applicable

White JV et al. Consensus Statement: Academy of Nutrition and Dietetics and American Society for Parenteral and Enteral Nutrition. Characteristics Recommended for the Identification and Documentation of Adult Malnutrition (Undernutrition) JPEN 2012; 36: 275-283

≥ 2 characteristics: Severe Malnutrition

Characteristics	Acute illness or injury related malnutrition	Chronic disease related malnutrition	Social or environmental related malnutrition
Weight Loss	> 2%/1 week > 5%/1 month > 7.5%/3 months	> 5%/1 month > 7.5%/3 months > 10%/6 months > 20%/1 year	> 5%/1 month > 7.5%/3 months > 10%/6 months > 20%/1 year
Energy intake	≤50% for ≥ 5 days	<75% for ≥ 1 month	≤50% for ≥ 1 months
Body Fat	Moderate Depletion	Moderate Depletion	Severe Depletion
Muscle Mass	Moderate Depletion	Moderate Depletion	Severe Depletion
Fluid Accumulation	Moderate → Severe	Severe	Severe
Grip Strength	Not rec. in ICU	Reduced for Age/Gender	Reduced for Age/Gender

White JV et al. JPEN 2012; 36: 275-283

Efforts to Validate AND/ASPEN Malnutrition Clinical Characteristics (MCC)

- **Retrospective cohort study of large population**
 - Population: 18 years or older
 - 5606 patients with ICU stay
 - Readmissions excluded
 - Severe malnutrition versus no malnutrition
- **Results**
 - 13% severely malnourished
 - ↑ICU length of stay
 - ↑Hospital length of stay
 - ↑Mortality
- **Justified clinical relevance of AND/ASPEN MCC to measure effect of severe malnutrition on hospital LOS, ICU LOS and mortality**
- **Malnutrition strongly predicts longer LOS and ↑ mortality rates**

Nutrition Assessment: Subjective Global Assessment

- **Subjective Global Assessment (SGA): validated tool/gold standard**
- **Commonly used nutrition screening and assessment tool**
- **Assesses nutrition status via questionnaire**
 - Weight and dietary intake change
 - GI symptoms
 - Changes in functional capacity
 - Evaluation of fat and muscle stores
 - Presence of edema and ascites



Nutrition Assessment Tool: SGA



Allows for malnutrition diagnosis:

A—well-nourished

B—mildly/moderately
malnourished

C—severely malnourished



Captures change patterns

e.g., weight loss patterns vs.
absolute weight loss



High degree of inter-rater reproducibility

91% of surgical patients classified
by SGA had two clinicians agree on
SGA classification

Nutrition Assessment Tools and Outcomes

Study	Population	Study Group	Results
Wakahara 2007	GI Disease	Descriptive cohort N=262 (110 with cancer)	SGA best predicted LOS
Atalay 2008	Crit ill elderly PN/EN	Retrospective, descriptive cohort N=119	SGA did not predict mortality
Sungertekin 2008/9	Med/Surg Crit ill	Descriptive cohort N=124	SGA correlated w/APACHE II and SAPS II
Ozkalkanli 2009	Ortho Surgery	Descriptive cohort N=256	SGA and NRS 2002 predicted post-op complications

Global Leadership Initiative in Malnutrition (GLIM)

Joint initiative by ASPEN, ESPEN, FELANPE, PENSA

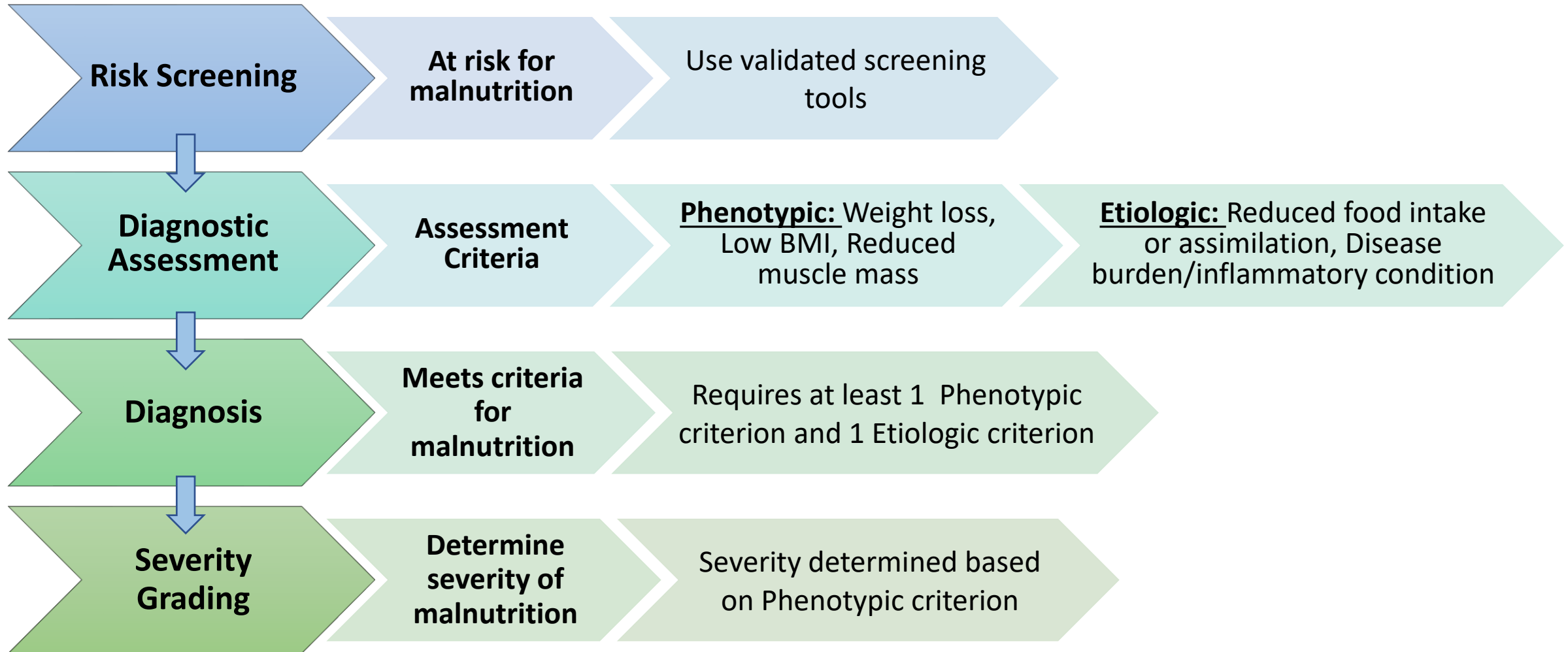
- Goal: a simple consensus criteria intended for global application **with only modest training required**
- Intent: to promote global use of criteria that can be readily used with other approaches and additional criteria (i.e. SGA, ASPEN/AND MCC)

What is it?

- > screening, but < comprehensive assessment
- Framework for malnutrition diagnosis that may be complemented by comprehensive nutrition assessment
- Not a malnutrition definition

Validation efforts in progress

GLIM: Diagnostic Scheme



GLIM Diagnostic Assessment & Severity Grading

	Phenotypic criteria			Etiologic Criteria	
	Weight loss (%)	Low BMI (kg/m²)	Reduced muscle mass	Reduced food intake/assimilation	Inflammation
	>5% within past 6 mo, or > 10% beyond 6 mo	<20 if <70 yr, or <22 if >70 yr Asia: <18.5 if <70 yr, or <20 if >70 yr	Reduced by validated body composition measuring techniques	≤50% of ER >1 wk, or any reduction for >2 wk, or any chronic GI condition that adversely impacts food assimilation of absorption	Acute disease/injury or chronic disease-related
Patient must have at least 1 phenotypic criteria and 1 etiologic criteria above for Malnutrition Diagnosis					
If malnutrition present, determine stage (requires 1 phenotypic criterion that meets stage):					
Stage 1 Moderate Malnutrition	5-10% within past 6 mo, or 10-20% beyond 6 mo	<20 if <70 yr, <22 if ≥70 yr	Mild to moderate deficit (per validated assessment methods)		
Stage 2 Severe Malnutrition	>10% within past 6 mo, or >20% beyond 6 mo	<18.5 if <70 yr, <20 if ≥70 yr	Severe deficit (per validated assessment methods)		

Learning Assessment

2. Malnutrition is associated with:

- A. Longer length of stay, increased risk of infection and complications
- B. Higher use of resources and cost of care
- C. Higher readmission rate
- D. Higher mortality rate
- E. All of the above

Nutrition Intervention and Outcomes



Interventions for Malnutrition

- **Earlier intervention for severely malnourished patients reduced hospital length of stay by 3.2 days (\$1514 cost savings per patient)¹**
- **Implementation of a malnutrition clinical pathways program decreased 30d readmission rate from 16.5% to 7.1%, $P < 0.001$ ²**
- **Nurses play critical roles in nutrition-related care³**
 - Screening for malnutrition on admission
 - Monitoring for and addressing conditions that impede nutrition intake
 - Ensuring that prescribed nutrition interventions delivered and administered or consumed
 - May contribute to better patient outcomes at lower costs



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1. Somanchi M, Tao X, Mullin GE. The facilitated early enteral and dietary management effectiveness trial in hospitalized patients with malnutrition. JPEN J Parenter Enteral Nutr. 2011;35(2):209-216.

2. Brugler L, DiPrinzio MJ, Bernstein L. The five-year evolution of a malnutrition treatment program in a community

hospital. Jt Comm J Qual Improv. 1999;25(4):191-206.

3. Meehan A, Partridge J, Jonnalagadda SS. Clinical and Economic Value of Nutrition in Healthcare: A Nurse's Perspective. NCP 2019; 34: 832-838

Nutrition Intervention and Outcomes

Study	Population	Study Groups	Results
Hurt R et al. JPEN 2015;39(8): 948-52.	Trauma Patients n=121 Prospective	Experimental Group (EG): additional education and nutrition support Control Group (CG): standard of care	EG: Higher % goal calories vs CG (30.1 ±18.5%, 22.1 ±23.7%, P=0.024) Mean caloric deficit NS EG: ↓ clear liquid days, ICU LOS, MV (P<0.05) EG: ↓ nosocomial infections (10.6% vs 23.6%) and ↓ organ failure (NS)
Wang CY et al. Nutrients 2017: (5):527-539	Retrospective Review: Volume Based Feeding Protocol (FP)	Pre-FP: 214 Post-FP: 198	Post-FP: Significantly ↑ daily EN intake from ICU d1 - d7 or discharge <ul style="list-style-type: none"> No difference in ICU mortality rates Subgroup analysis: Energy intake > 65% goal calories assoc. w/ ↓ mortality (OR 1.6, CI 1.01-2.47)
Riley K et al. JPEN 2020; 44(1):58-68	Pre-Post QI Program with ONS@ 2 home health agencies (HHA) Dec. 2016-Dec.2017	QIP: 1546 at risk pts provided with ONS at 2 HHA Control: 7413 (historic), 5235 (concurrent-no ONS provided)	Intervention group: ↓ risk of hospital readmission by 12-24%(90-60-30d) avg cost savings \$1500/pt or \$2,318,894 by preventing readmission in 90d

Obesity-Malnutrition Paradox

- **Retrospective study utilizing the National Inpatient Sample (NIS), 2005 - 2014**
 - Analyzed differences between Obese (BMI \geq 30) and Non-Obese patients with malnutrition
 - Primary outcomes: Demographic and clinical characteristics, vitamin and mineral deficiencies
 - Secondary outcomes: in-hospital mortality, LOS, and hospital cost, risk factors
- **Results:**
 - Older female obese patients at higher risk for malnutrition
 - Medicare, West Coast higher risk vs other regions



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EFFORT

Effect of Early Nutritional Support on Frailty, Functional Outcomes, and Recovery of Malnourished Medical Inpatients Trial

- Pragmatic, open-label, multicenter study, 8 Swiss hospitals
- 2088 patients, LOS >4 days; April 1, 2014, and Feb 28, 2018
- Randomized to: Protocol guided nutrition (intervention) for protein & calorie goals vs standard hospital food (control)

Results:

- **Intervention: 800 (79%) reached caloric goals; 770 (76%) reached protein goals**
- Control: 547 (54%) reached caloric goals; 557 (55%) reached protein goals
 - Mean intake higher in intervention group:
 - 22kcal/kg vs 18 kcal/kg and 0.84 g pro/kg/d vs 0.70 g pro/kg/d
 - 8 pts received EN and 12 received PN in intervention group

EFFORT: Outcomes

Outcomes	<u>Intervention Group</u> Protocol led Nutrition (n=1015)	<u>Control Group</u> Standard Nutrition (n=1013)	Odds Ratio and Confidence Interval	p-value
Mortality d30	73 (7%)	100 (10%)	0.65 (0.47-0.91)	0.011
Adverse Clinical Outcome	232 (23%)	272 (27%)	0.79 (0.64-0.97)	0.023
Decline in functional status of ≥10%*	35 (4%) of 942	55 (6%) of 913	0.62 (0.40- 0.96)	0.034
No statistical significance: Side effects from PN/EN, LOS, ICU admission, hospital readmission				

Secondary Analysis of EFFORT

Association of Baseline Inflammation With Effectiveness of Nutritional Support Among Patients With Disease-Related Malnutrition

- Participants with C-Reactive Protein (CRP) on admission included
- Based on CRP at admission, patients stratified into low, moderate, or high inflammation groups

Results:

- n=1950, median 75 years; 52.6% men
 - 533 (27.3%) low CRP, 894 (45.9%) moderate CRP, 523 (26.8%) high CRP

Intervention group: significant reduction in 30d mortality, regardless of CRP

- OR, 0.61; 95% CI, 0.43-0.86; $P = .005$

Subgroup of patients with high CRP: no beneficial effect of nutritional support

Conclusion: inflammation has significant modifying association on clinical outcomes ($P = 0.005$)

Conclusion: Inflammation diminishes effectiveness of nutrition support

Systematic review and Meta-Analysis

Nutritional Support and Clinical Outcomes among malnourished or nutritionally at-risk inpatients

- 27 trials (n = 6803); 5/27 published 2015-2019 (n = 3067)

Patients receiving nutritional support vs control

- **Significantly lower rates of mortality**
 - **230 of 2758 [8.3%] vs 307 of 2787 [11%]**
 - **OR 0.73; 95% CI, 0.56-0.97**

Nutritional support associated with

- ↓ in nonelective hospital readmissions
- ↑ energy and protein intake
- ↑ weight

No significant differences in rates of infections, functional outcome, and hospital LOS

Case Study: Inflammatory Markers

59 year old male admitted with COVID-19

- PMH: HTN, Diabetes. Currently with fever, shortness of breath
- Ht 5'8", UBW 100 kg, BMI 33
- History of poor oral intake for 10 days (<75% of estimated needs); 10 lb wt loss (4.5%)
- NRS Score 4, high risk as previously calculated at admission
- Physical Exam: NFPE deferred, per RN, no visual signs of wasting; +2 edema
- Est needs per ASPEN recs = 11-14 kcal/kg/d, 2-2.5 g/kg IBW (1400Kcal, 140g pro/d)
- **Non-Severe, Moderate malnutrition determined, acute illness**

C-Reactive Protein (CRP) 50 mg/L (high- inflammation)

ASPEN/SCCM COVID-19 Guidelines

<https://www.nutritioncare.org/COVID19/>

Early PN should be initiated ASAP in the high-risk patient for whom early gastric EN is not feasible^{1,2}

- High-risk patients: sepsis or shock requiring escalating or multiple vasopressors, or when high pressure respiratory support is required (NIV, CPAP, or PEEP)

Threshold for switching to PN may need to be lower:

- Bowel ischemia is rare in shock, clinical trials reporting an overall incidence of 0.3%³
- However, in COVID-19, concern for ischemic bowel may be greater and a prolonged ICU stay is expected

Early PN will subvert concerns for ischemic bowel and reduce droplet aerosol transmission to HCPs by avoiding enteral access device placement and maintenance

Withhold SO ILE during the first week of ICU admission or provide an alternative ILE⁴

1. McClave SA, et al. JPEN. 2016 Feb; 40(2):159-211.

2. Taylor BE, et al. Critical Care Medicine. 2016 Feb;44(2):390-438.

3. Patel JJ, Rice T, Heyland DK. JPEN epub Feb 12 2020. doi: 10.1002/jpen.1793.

4. Singer P, et al. Clinical Nutrition. 2019 Feb;38(1):48-79..

Case Study: Nutrition Intervention

Previously estimated needs and nutrition diagnosis:

- 11-14 kcal/kg/d, 2-2.5 g/kg IBW (1400Kcal, 140g pro/d)
- Non-Severe, Moderate malnutrition determined, acute illness

Patient now intubated, prone position, OGT feeds not well tolerated for 5 days (est. 360 kcal, 30 g protein per day)

Started on supplemental PN, 1000mL, 100g Dextrose, 50 g amino acids, 50 g 4-oil ILE

EN intolerance persisted with abdominal distension noted/GRV deferred. EN discontinued.

PN increased to goal 1500mL, 1570 kcal, 150 g Dextrose, 140g amino acids, 50 g 4- oil ILE

Monitor labs and response to PN. Monitor GI function for eventual transition back to EN/oral intake.

Diagnosis of Malnutrition (CDM) vs Treatment

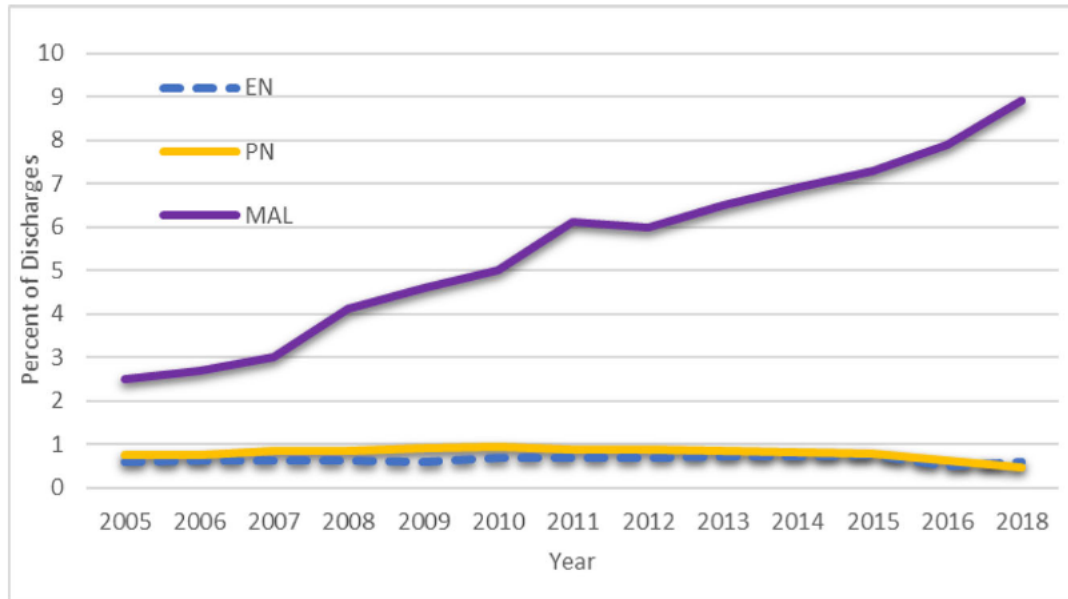


FIGURE 1 Malnutrition and use of EN and PN as percentage of discharged patients over time. Data from HCUPnet.gov.⁵ EN, enteral nutrition; PN, parenteral nutrition

WHY AREN'T Malnourished Patients Receiving PN/EN? (note-ONS data unable to collect)

Among Medicare patients with CDM rates 14%-31%, only **2%-16%** received EN/PN.
Use of EN/PN **<5%** in pts w/critical illness, sepsis, cancer

1. Guenter P, Blackmer A, Malone A, et al. Update on use of enteral and parenteral nutrition in hospitalized patients with a diagnosis of malnutrition in the United States. *Nutrition in Clinical Practice*. 2022;n/a(n/a).

ASPEN Recommendations

- **Implement** comprehensive continuous QI nutrition care plan (screening, assessment, documentation, interventions, coding malnutrition & therapies)
- **Application** to practice: Code patients as malnourished whenever receiving PN/EN
 - Therapy treats and prevents malnutrition
- **Prioritize** and document delivery of nutrition support
- **Conduct** research: monitor pts diagnosed/at-risk for malnutrition, provide appropriate aggressive nutrition support therapies, measure impact on outcomes
- **Interdisciplinary** collaboration: ASPEN, AND, ASHP, Documentation Specialists

Conclusion: Malnutrition affects Clinical Outcomes

Longer length of stay¹⁻⁴

Increased risk of infection and complications⁵

Higher use of resources and cost of care⁶

Higher readmission rate^{3,6}

Increased mortality rate^{3,7}

GOOD NEWS:
Optimization of specialized nutrition can reduce Medicare spending by \$580 million annually⁸

1. Pichard C, Kyle UG, Morabia A. et al. Nutritional assessment: lean body mass depletion at hospital admission is associated with an increased length of stay. *Am J Clin Nutr* 2004; 79:613-618.
2. Guerra RS, Sousa AS, Fonseca I. et al. Usefulness of six diagnostic and screening measures for undernutrition in predicting length of hospital stay: A comparative analysis. *J Acad Nutr Diet*. 2015;115:927-938.
3. Hiller LD, Shaw RF, Fabri P. Difference in composite end point of readmission and death between malnourished and nonmalnourished veterans assessed using AND/ASPEN clinical characteristics. *JPEN* 2016;41:1316-1324.
4. Mosquera C, Koutlas NJ, Edwards KC et al. Impact of malnutrition on gastrointestinal surgical patients. *J Surg Res* 2016;205:95-101.
5. Schneider SM, Veyres P, Pivrot X et al. Malnutrition is an independent factor associated with nosocomial infections. *Br J. Nutr* 2004; 92:105-11.
6. Weiss J, Elixhauser A., Agency for Healthcare Research and Quality Statistical Brief #210: December 2016.
7. Heismayr M, Schindler K, Pernicka E, et al. Decreased food intake is a risk factor for mortality in hospitalised patients: The NutritionDay Survey 2006. *Clin Nutr*. 2009; 28: 484-491.
8. Tyler et al. Value of Nutrition Support Therapy: Impact on Clinical and Economic Outcomes in the United States. *JPEN*. 2020; Published Jan. 29, 2020 DOI:10.1002/jpen.1768

Learning Assessment

3. Which 2 of the following characteristics are required for a diagnosis of malnutrition according to the AND/ASPEN Malnutrition Clinical Characteristics:

- A. Insufficient energy intake**
- B. Gain of muscle mass**
- C. % Weight loss**
- D. Increase in subcutaneous fat**

Learning Assessment

4. Among patients with a diagnosis of malnutrition, check all that apply:

- A. 75% received EN or PN**
- B. Estimated 2/3 of patients malnourished on admission experience improvement of their nutrition status during hospital stay**
- C. More than 1/3 of patients not malnourished on admission, become malnourished while in the hospital**
- D. Hospital readmission rates increase**

Available Resources: ASPEN and AND

- www.nutritioncare.org
- http://www.nutritioncare.org/guidelines_and_clinical_resources/Malnutrition_Solution_Center/

Malnutrition Solution Center



For more than 40 years, ASPEN has focused on reducing the incidence of malnutrition through educational support and resources to healthcare professionals and consumers, and through our advocacy work for malnutrition prevention and treatment.

Every September since 2012, we hold **Malnutrition Awareness Week™**, our annual campaign to help everyone understand this often poorly diagnosed condition.

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Malnutrition Resources from the Academy of Nutrition and Dietetics

[Academy of Nutrition and Dietetics Health Informatics Infrastructure](#)

ANDHII provides the tools to track malnutrition in practice. Through the electronic nutrition care process and terminology, ANDHII can be used to track and report the incidence and prevalence of malnutrition alongside the impact of nutrition care on the clinical characteristics of malnutrition and patient outcomes.



Thank You!

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