DETECTING ADULT MALNUTRITION THROUGH NUTRITION FOCUSED PHYSICAL ASSESSMENT: ELEVATING THE ROLE OF NUTRITION FOR IMPROVED PATIENT OUTCOMES

Medical Science Liaison
Abbott Nutrition
Medical Affairs

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- Please type your **name** and **credentials** into the chat box

- Let us know whether you are a:
  - ❑ RD
  - ❑ RN
  - ❑ Case manager
  - ❑ Physician
  - ❑ Other/Student/Intern

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DISCLOSURE

- The content of this program has met the continuing education criteria of being evidence-based, fair and balanced, and non-promotional
- This educational event is supported by Abbott Nutrition Health Institute, Abbott Nutrition
- I am an employee of Abbott Nutrition

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OBJECTIVES

1. Discuss the prevalence and identification of adult malnutrition
2. Identify the basics of physical assessment including functional status
3. Define and identify micronutrient deficiencies
4. Synthesize and practice the components of a comprehensive head-to-toe physical assessment
5. Discuss best practice strategies for improved patient outcomes including nutrition intervention

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RECOMMENDED READINGS

- White JV, et al. Academy Malnutrition Work Group, A.S.P.E.N. Malnutrition Task Force and the A.S.P.E.N. Board of Directors 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 J Parenter Enteral Nutr*. 2012;36(3):275-283.
- Jensen GL, et al. Adult starvation and disease-related malnutrition: a proposal for etiology-based diagnosis in the clinical practice setting from the International Consensus Guideline Committee. *JPEN J Parenter Enteral Nutr*. 2010;34(2):156-159.
- Jensen GL, et al. GLIM criteria for the diagnosis of malnutrition: a consensus report from the global clinical nutrition community. *JPEN J Parenter Enteral Nutr*. 2019;43(1):32-40.

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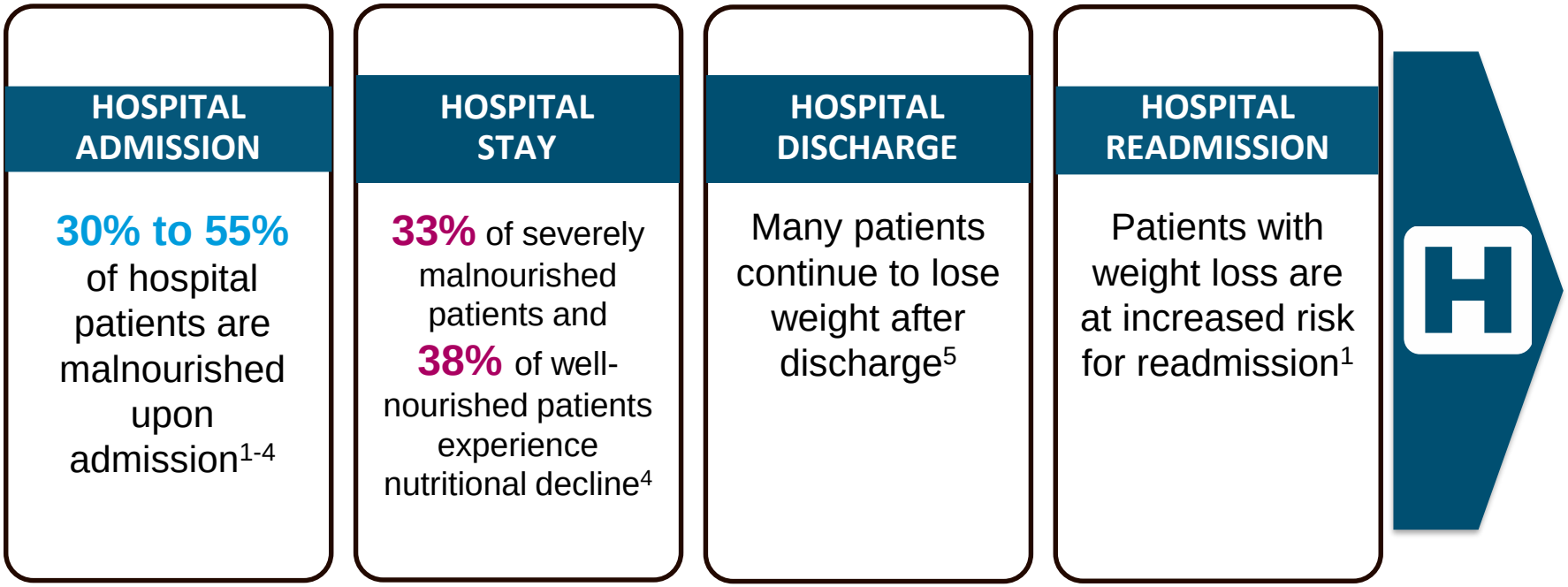
PREVALENCE OF MALNUTRITION



1. Tappenden KA, et al. *JPEN J Parenter Enteral Nutr.* 2013;37(4):482-497.
2. Naber TH, et al. *Am J Clin Nutr.* 1997;66(5):1232-1239.
3. Somanchi M, et al. *J Parenter Enteral Nutr.* 2011;35(2):209-216.
4. Braunschweig C, et al. *J Am Diet Assoc.* 2000;100(11):1316-1322.
5. Beattie AH, et al. *Gut.* 2000;46(6):813-818.

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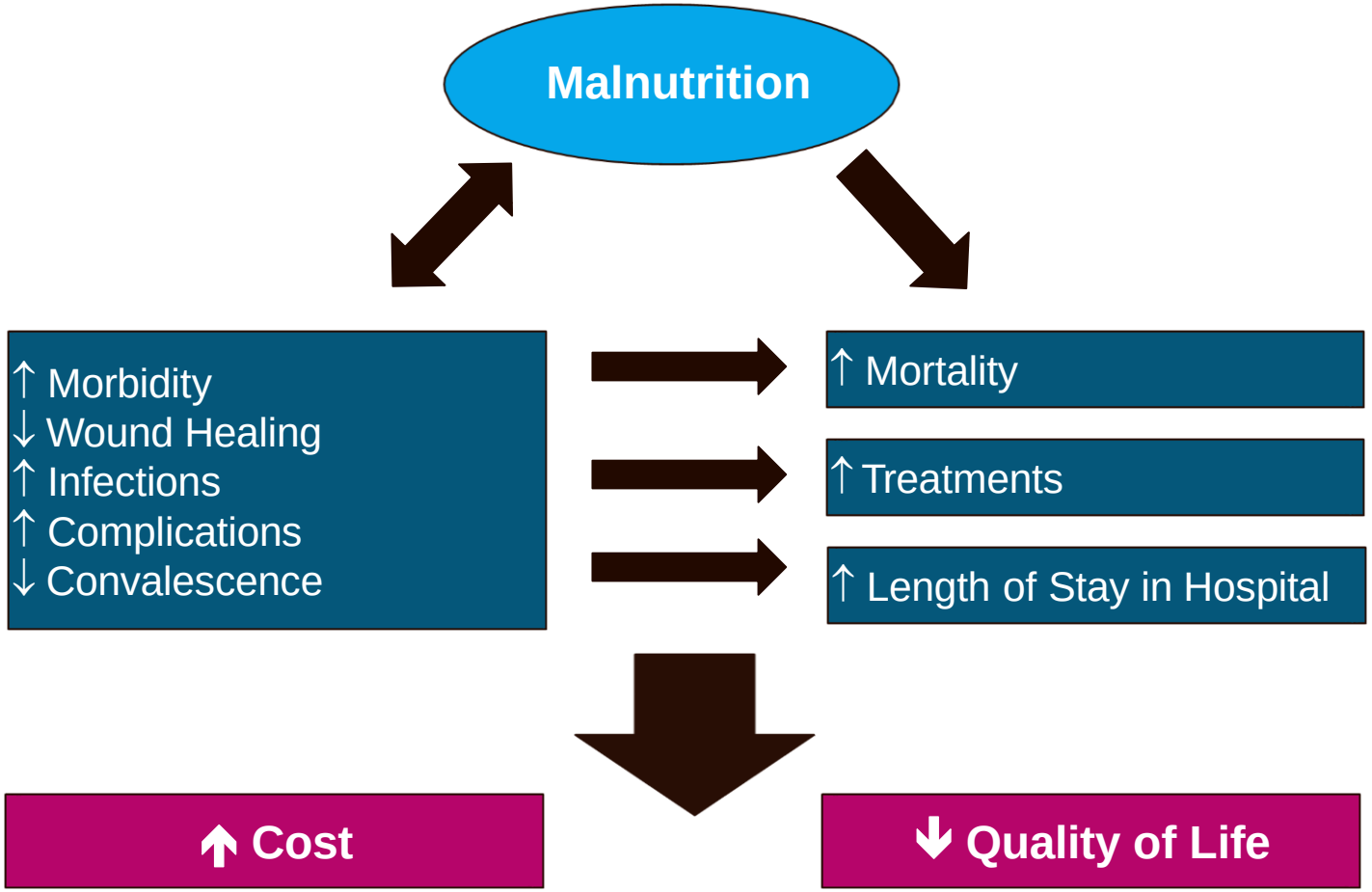
MALNUTRITION NEGATIVELY IMPACTS PATIENT OUTCOMES



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Adapted from Norman K, et al. *Clin Nutr.* 2008;27(1):5-15.
Allaudeen N, et al. *J Hosp Med.* 2011;6(2):54-60.

NUTRITION FOCUSED PHYSICAL EXAM (NFPE)

Benefits:

- Contribute to more effective care plans
- Determine appropriate interventions
- Increase dietitian proficiency

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CURRENT STATE OF MALNUTRITION DOCUMENTATION

- AND DNS Survey results of n=542 RDN respondents (24% response rate)

Survey Questions	%
RDN diagnoses malnutrition	79%
RDN consistently performs NFPE	44%
Provider documents malnutrition	93%
Institutions codes for malnutrition when present	21%
Barriers to coding for malnutrition	
Provider disagrees with diagnosis	35%
RDs lack NFPE training	33%
Providers documenting malnutrition incorrectly	42%

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Academy of Nutrition and Dietetics Dietitians in Nutrition Support Dietetic Practice Group (AND DNS)
Dobak S, et al. *J Acad Nutr Diet.* 2018;118(6);978–983.

OUTCOMES ASSOCIATED WITH NFPE MALNUTRITION DOCUMENTATION – HOSPITAL PATIENTS

- Chart review of Veteran's Hospital August 2012 – December 2014 after implementation of Consensus Statement
- Statistical model predicted readmission or death in 84% of all cases

Outcome	Malnourished (n=202)	Nonmalnourished (n=202)	OR (95% CI) Unadjusted
Met composite endpoint†	108 (53%)	36 (18%)	5.30 (3.36-8.34)*
Readmit w/in 30d	63 (21%)	24 (12%)	3.36 (1.99-5.65)*
Died w/in 90d	65 (32%)	16 (8%)	5.52 (3.06-9.95)*
LOS >7d	83 (41%)	28 (14%)	4.33 (2.66-7.06)*
DC nursing home	52 (26%)	24 (11.9%)	
DC home	113 (56%)	165 (81.7%)	
Mean LOS, d (SD)	9.8 (11.5)	4.4 (4.5)	

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† Readmitted within 30 days or die within 90 days of discharge
*P<0.001
Length of stay (LOS), Discharge (DC)
Hiller LD, et al. *JPEN J Parenter Enteral Nutr.* 2017;41(8):1316-1324.

OUTCOMES ASSOCIATED WITH NFPE MALNUTRITION DOCUMENTATION

Outcome	Mosquera[1]	Guerra[2-3]	Hand[4]
Patients	Surgical	In-patient	In-patient
Complications	↑ ~20%		
Severe complications	↑ ~85%		
LOS	8 vs 6d	↑ ~35% w/ LOS ≥7d[2]	√
Total costs	↑ ~50%	↑ ~20%[3]	√
Readmission	↑ ~55%		√
Mortality	↑ ~200%		√

Length of stay (LOS)

1. Mosquera C, et al. *J Surg Res.* 2016;205(1):95-101.
2. Guerra RS, et al. *J Acad Nutr Diet.* 2016;115(6):927-38.
3. Guerra RS, et al. *J Hum Nutr Diet*. 2016;29(2):165-73.
4. Hand RK, et al. *J Acad Nutr Diet.* 2016;116(5):856-64.

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VALIDATED SCREENING TOOLS[1-3]

- Malnutrition Screening Tool (MST)
  - All patient use, quick and easy
  - Endorsed by AND
- Malnutrition Universal Screening Tool (MUST)
  - Community use in geriatrics
- Nutrition Risk Screening (NRS-2002)
  - Uses MUST components plus disease severity
  - Endorsed by European Society for Clinical Nutrition and Metabolism (ESPEN)
- Subjective Global Assessment (SGA)
  - Most validated tool for multiple disease settings
- Mini Nutrition Assessment (MNA)
  - Validated for use in age 65 or older

"It is the position of the Academy of Nutrition and Dietetics (AND) that, based upon current evidence, the Malnutrition Screening Tool should be used to screen adults for malnutrition (undernutrition) regardless of their age, medical history, or setting."

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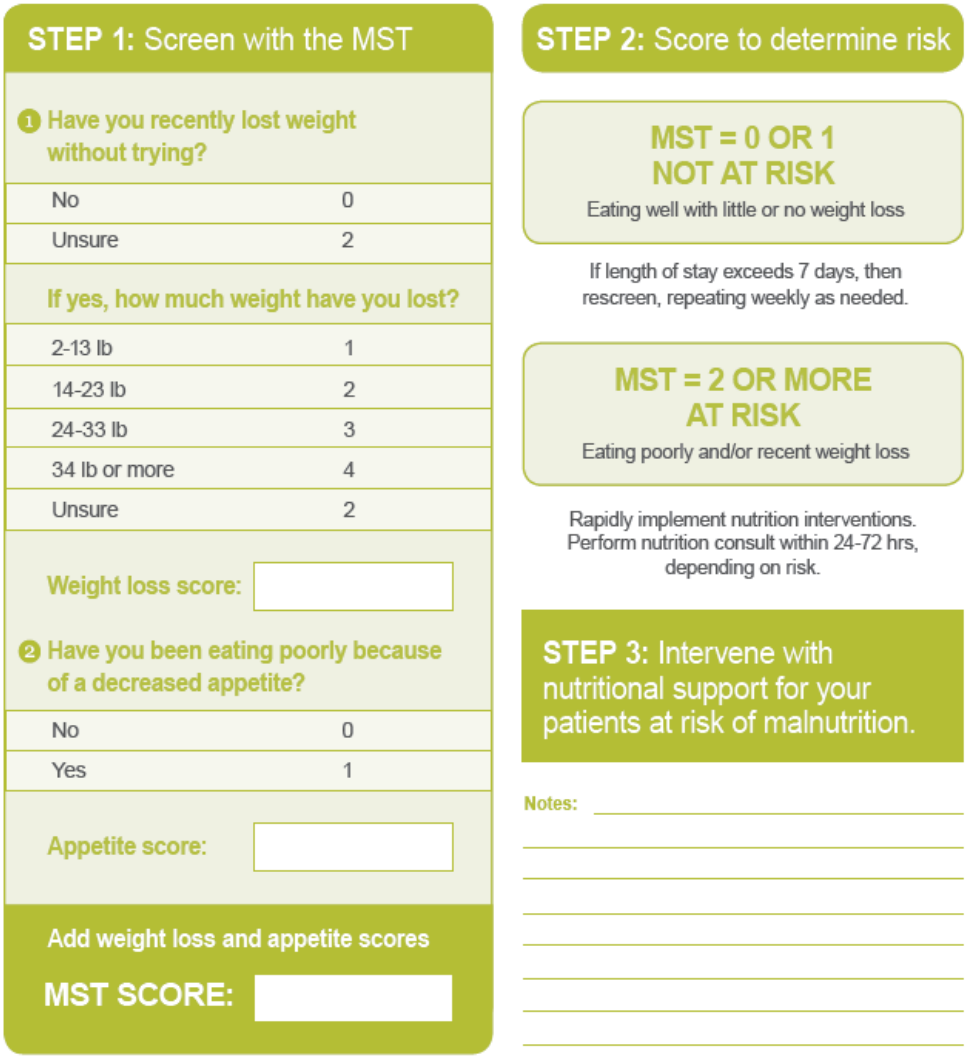
1. Jensen GL, et al. *JPEN J Parenter Enteral Nutr.* 2013:37(6):802-807.
2. Anthony PS. *Nutr Clin Pract.* 2008;23(4):373-382.
3. Skipper A, et al. *J Acad Nutr Diet.* 2020;120(4):709-713.

MALNUTRITION SCREENING TOOL (MST)



STEP 1: Screen with the MST

1. **Have you recently lost weight without trying?**

No	0
Unsure	2

If yes, how much weight have you lost?

2-13 lb	1
14-23 lb	2
24-33 lb	3
34 lb or more	4
Unsure	2

Weight loss score:

2. **Have you been eating poorly because of a decreased appetite?**

No	0
Yes	1

Appetite score:

Add weight loss and appetite scores

MST SCORE:

STEP 2: Score to determine risk

MST = 0 OR 1
NOT AT RISK
Eating well with little or no weight loss

If length of stay exceeds 7 days, then rescreen, repeating weekly as needed.

MST = 2 OR MORE
AT RISK
Eating poorly and/or recent weight loss

Rapidly implement nutrition interventions. Perform nutrition consult within 24-72 hrs, depending on risk.

STEP 3: Intervene with nutritional support for your patients at risk of malnutrition.

Notes:

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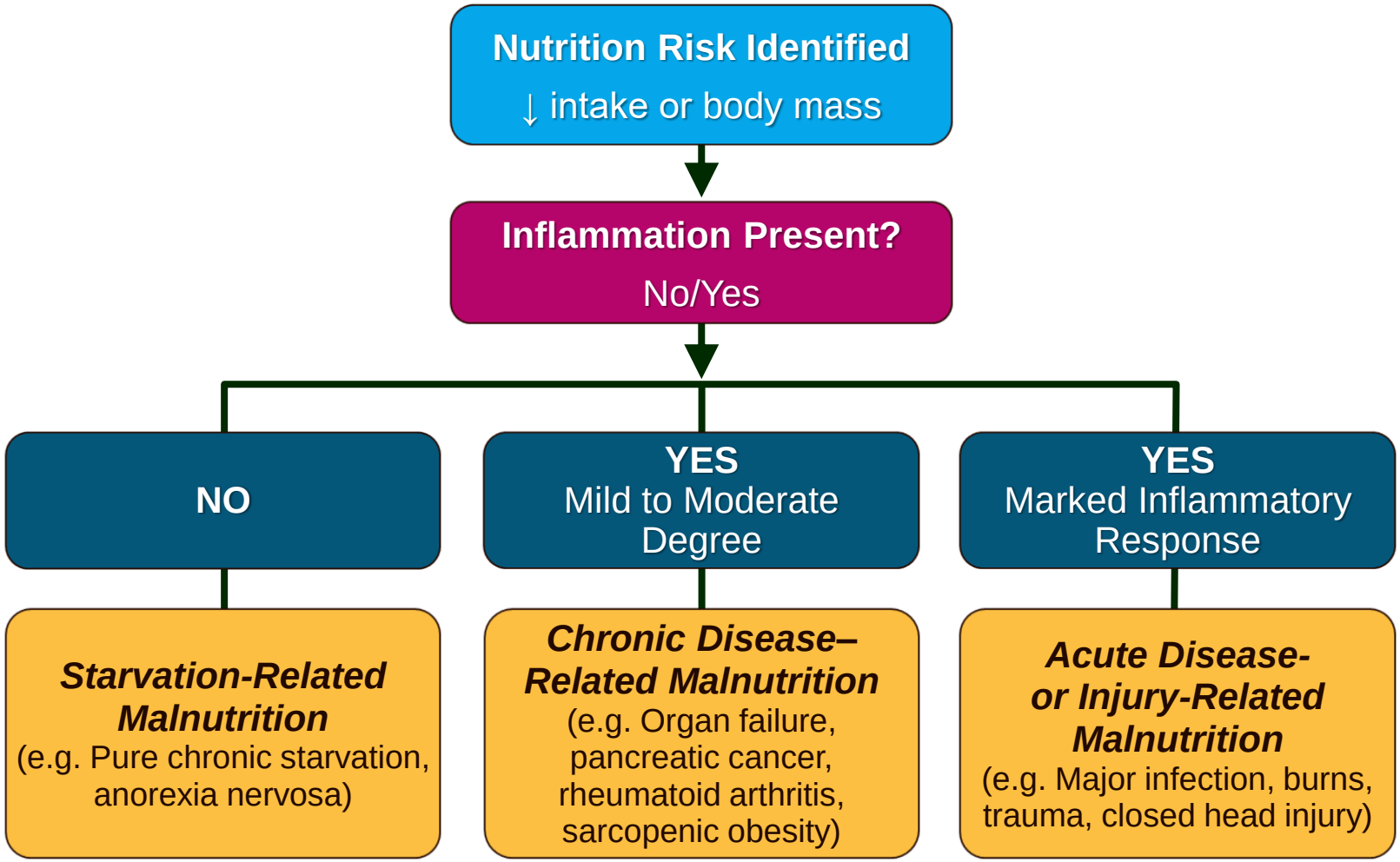
Malnutrition Screening Tool (MST). https://static.abbottnutrition.com/cms-prod/abbottnutrition-2016.com/img/Malnutrition%20Screening%20Tool_FINAL_tcm1226-57900.pdf. Accessed December 15, 2020.

ETIOLOGY-BASED DEFINITIONS OF MALNUTRITION



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Jensen GL, et al. *JPEN J Parenter Enteral Nutr.* 2009;33(6):710-716.

MARKERS OF INFLAMMATION

Acute	Chronic	Abnormal vitals
• Swelling • Erythema • Hyperthermia • Pain • Elevated CRP • Leukocytosis	• Similar to acute • Lesser degree • Longer duration of time • May lack ‘classic’ signs	• Vitals • Biochemical markers • Imaging studies • May not be related to nutrition status

Acute – defense, clearance and adaption and repair response
Chronic – low grade response to restore and achieve homeostasis
Abnormal vitals – only consider supportive when determining etiology

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Hamilton C, ed. *Nutrition-Focused Physical Exam: An Illustrated Handbook*. Silver Spring, MD: ASPEN; 2016.

ANALYZING ACUTE PHASE PROTEINS

Positive Acute Phase Proteins	Negative Acute Phase Proteins
Antibodies	Albumin
Complement	Transferrin
C-Reactive Protein	Prealbumin
Fibrinogen, Prothrombin	Retinol-binding protein
Cytokines: TNF-alpha, IL-6	
Metallothionein	
Ceruloplasmin	
α1-acid glycoprotein	
Haptoglobin	

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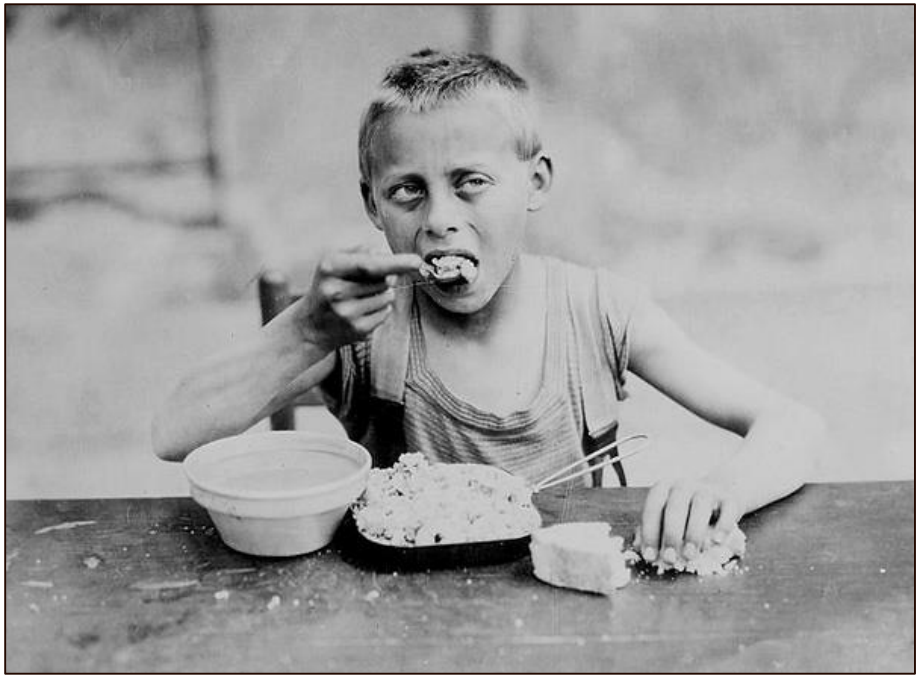
Hornig M, et al. *J Affect Disord.* 1998;49(1):9-18.

STARVATION-RELATED MALNUTRITION

- Caused by social/environmental factors
- Chronic
- No inflammation present
- Examples:
  - Poor food access
  - Cognitive dysfunction
  - Emotional disturbances
  - Physical impairment



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Jensen GL, et al. *JPEN J Parenter Enteral Nutr*. 2012;36(3):267-274.

CHRONIC DISEASE-RELATED MALNUTRITION[1-2]

- Mild to moderate inflammation
- 3 months or longer
- Examples:
  - Rheumatoid arthritis
  - Diabetes
  - Cancer
  - Chronic pancreatitis
  - IBD, Celiac disease
  - Cardiovascular disease
  - Congestive heart failure
  - Lupus
  - Sarcopenic obesity

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1. Jensen GL, et al. *JPEN J Parenter Enteral Nutr*. 2012;36(3):267-274.
2. Hamilton C, ed. *Nutrition-Focused Physical Exam: An Illustrated Handbook*. Silver Spring, MD: ASPEN; 2016.

ACUTE DISEASE/INJURY-RELATED MALNUTRITION

- Severe inflammation
- Acute onset/duration
- Examples:
  - Sepsis
  - Major infection or surgery
  - Closed head injury
  - ARDS
  - Trauma
  - Burns

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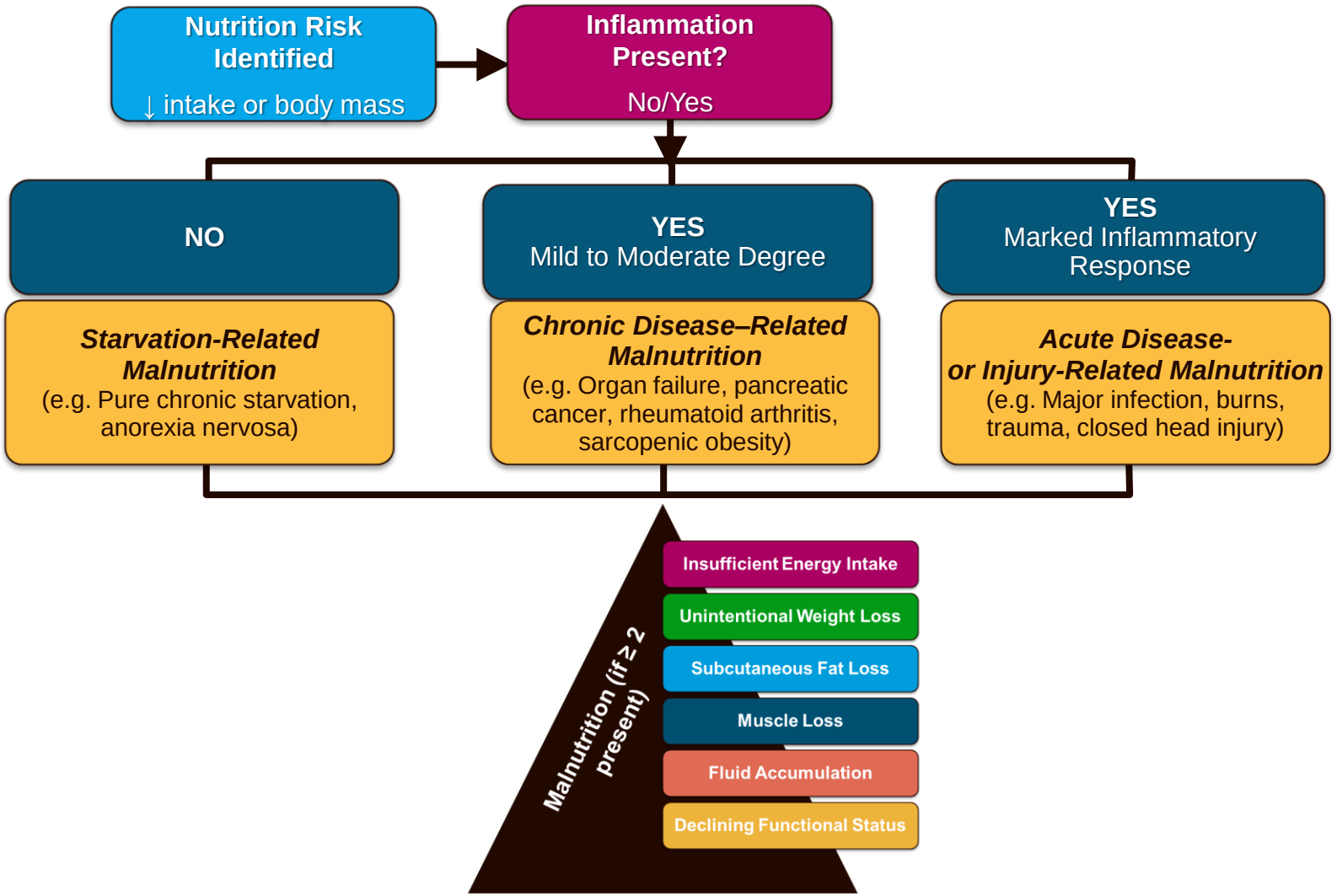
ARDS: Acute respiratory distress syndrome

Jensen GL, et al. *JPEN J Parenter Enteral Nutr*. 2012;36(3):267-274.

DIAGNOSING MALNUTRITION (AND/ASPEN)[1-2]



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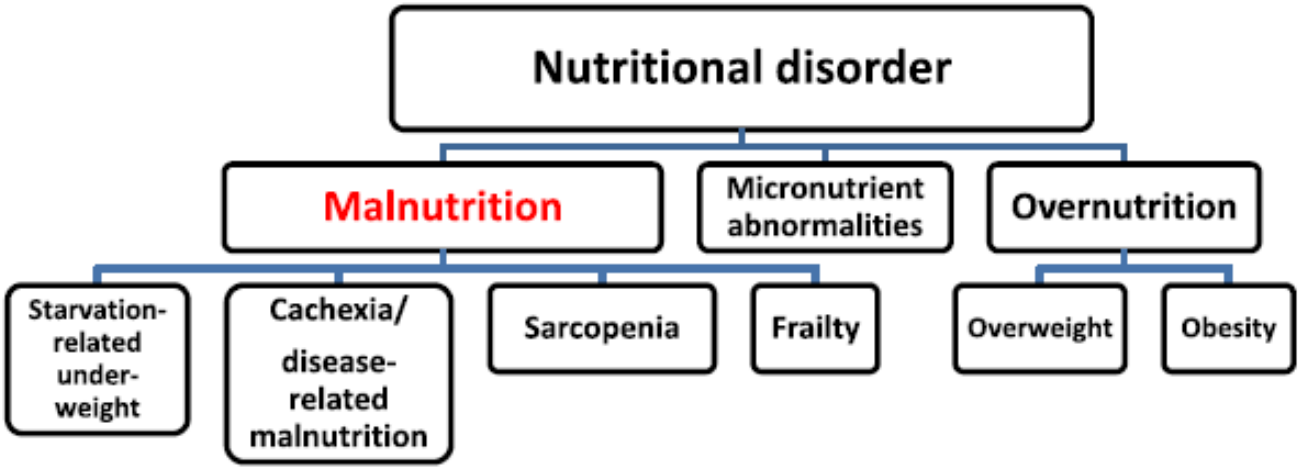
1. Jensen GL, et al. *JPEN J Parenter Enteral Nutr.* 2009;33(6):710-716.
2. Fischer M, et al. *JPEN J Parenter Enteral Nutr.* 2015;30(2):239-248.

DIAGNOSING MALNUTRITION (ESPEN 2015)

- BMI <18.5 kg/m2

OR

- Weight loss (unintentional) > 10% indefinite of time, or >5% over the last 3 months combined with either
  - BMI <20 kg/m2 if <70 years of age, or <22 kg/m2 if 70 years of age or
  - FFMI <15 and 17 kg/m2 in women and men, respectively. (FFMI: Fat Free Mass Index)



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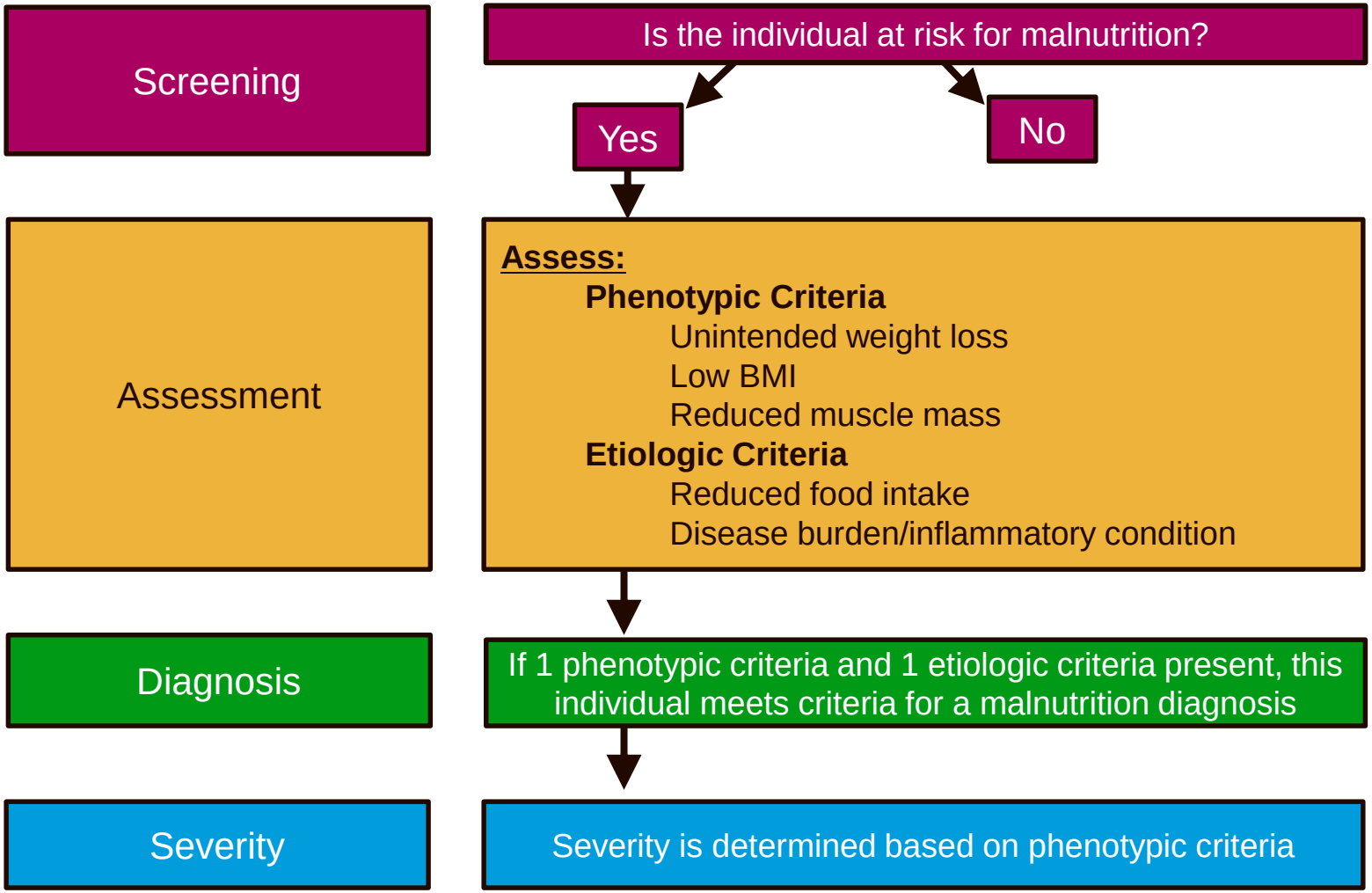
Cederholm T, et al. *Clin Nutr.* 2015;34(3):335-340.

GLOBAL LEADERSHIP INITIATIVE ON MALNUTRITION (GLIM) CRITERIA FOR DIAGNOSING MALNUTRITION



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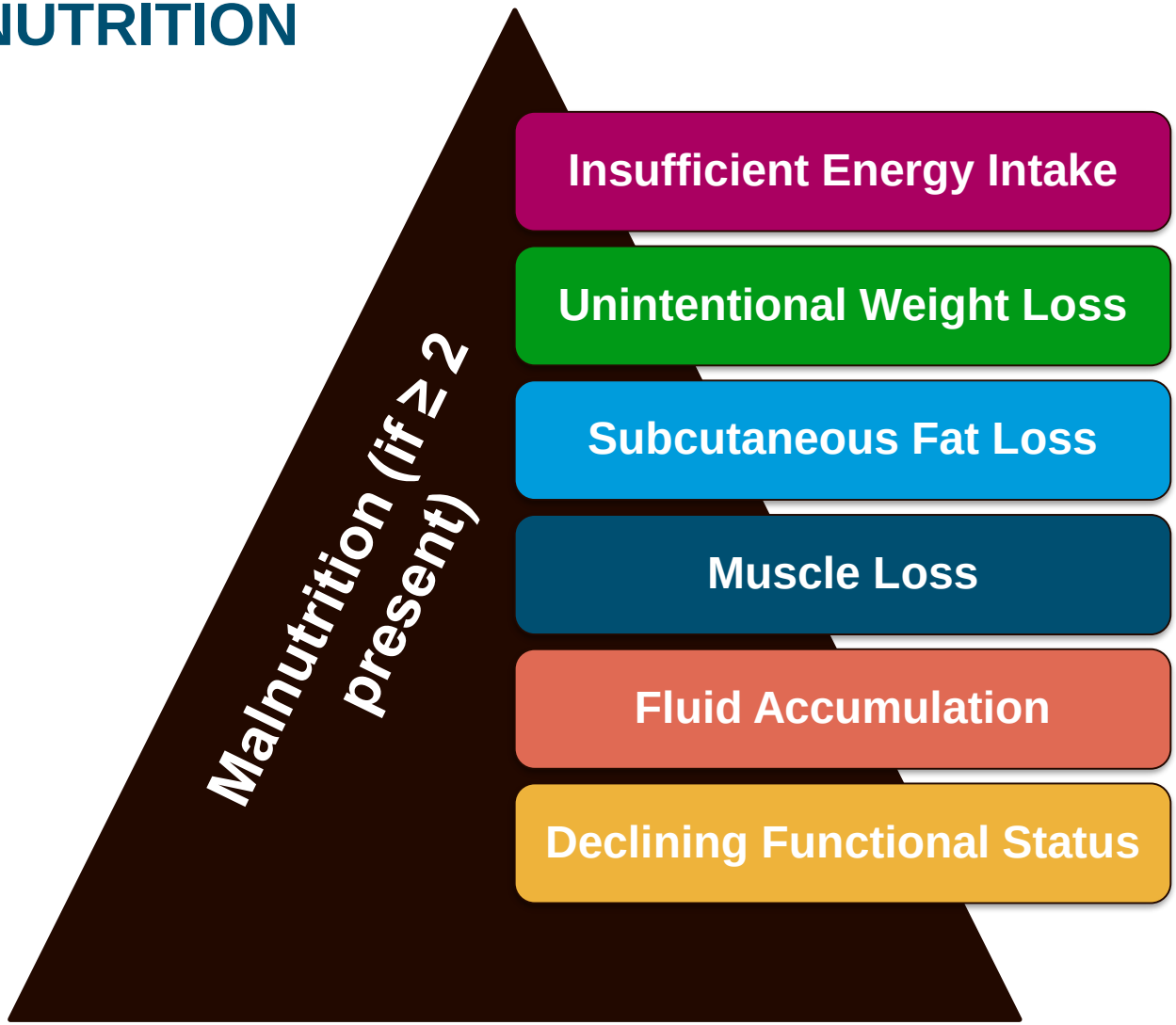
Jensen GL, et al. *JPEN J Parenter Enteral Nutr.* 2019;43(1):32-40.

SIX CHARACTERISTICS FOR IDENTIFYING ADULT MALNUTRITION



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White J, et al. *JPEN J Parent Enteral Nutr.* 2012;36(3):275-283.

INCORPORATION OF ASSESSMENT

- History and Clinical Diagnosis
- Physical Exam/Clinical Signs
  - Weight loss, fluid status, muscle and/or fat loss, specific macro/micronutrient deficiencies
  - Inflammation, other signs of non-specific systemic inflammatory response
- Anthropometric Data
  - Unintended weight loss is a well validated indicator of malnutrition
- Laboratory Data
- Nutrient Intake
- Functional Assessment
  - Hand-grip strength should be used to document a decline in physical function, as appropriate to patient circumstance.

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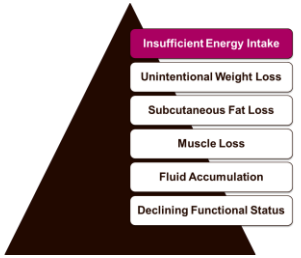
White J, et al. *JPEN J Parent Enteral Nutr.* 2012;36(3):275-283.

SIX CHARACTERISTICS: INTAKE



Malnutrition Type	Moderate	Severe
Acute Disease/Injury-related	<75% EER >7 days	≤50% EER ≥5 days
Chronic Disease-related	<75% EER ≥1 month	≤75% EER ≥1 month
Social/Environment	<75% EER ≥3 months	≤50% EER ≥1 month

EER = estimated energy requirement

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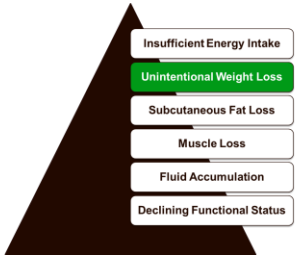
White J, et al. *JPEN J Parent Enteral Nutr.* 2012;36(3):275-283.

SIX CHARACTERISTICS: WEIGHT LOSS



Duration	Acute Disease/Trauma		Chronic Disease		Starvation	
1 week	1-2%	>2%				
1 month	5%	>5%	5%	>5%	5%	>5%
3 months	7.5%	>7.5%	7.5%	>7.5%	7.5%	>7.5%
6 months			10%	>10%	10%	>10%
1 year			20%	>20%	20%	>20%

= Moderate Malnutrition
= Severe Malnutrition

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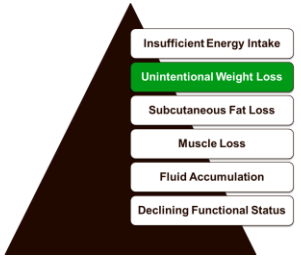
White J, et al. *JPEN J Parent Enteral Nutr.* 2012;36(3):275-283.

ASSESSING WEIGHT LOSS



- Be aware of:
  - Measurements vs. estimations
  - Fluid status (dehydrated vs. edematous)
  - Current disease state
  - Error (recall, equipment)
  - Alterations due to clothes/shoes and differences between scales

Weight loss is likely the most valid nutrition assessment parameter[1,2]

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1. Jensen GL, et al. *JPEN J Parent Enteral Nutr*. 2012;36(3):267-274.
2. Dewys WD, et al. *Am J Med*. 1980;69:491-497.

GETTING STARTED:
4 TECHNIQUES USED DURING NFPE:

- Inspection
  - Visual observation of color, shape, texture and size
- Palpation
  - Touch to examine location, texture, size, temperature, tenderness and mobility. Use fingertips and pads to assess pulsation and tenderness. Use the back of hand to assess temperature
- Percussion
  - Tapping of the fingers against body surfaces, listening for sounds that reflect solids, fluids, or gas
- Auscultation
  - Listening to sounds that reflect the movement of fluid or air through organs and viscera

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Litchford MD. Getting Started. In: *Nutrition Focused Physical Assessment: Making Clinical Connections*. Greensboro, NC: Case Software & Books; 2013:16-17.

PREP FOR EXAM

Cleaning precautions:

- Wash hands
- Use gloves, mask, gown, etc. if appropriate
- Clean equipment with hospital-grade disinfectant

Talk with patient:

- Introduce yourself
- Explain what you will be doing & how long it will take
- Ask for permission to touch

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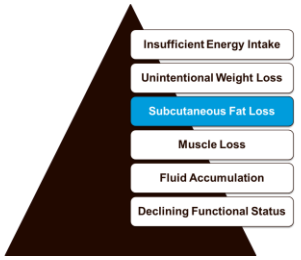
Fischer M, et al. *JPEN J Parent Enteral Nutr.* 2015;30(2):239-248.

SIX CHARACTERISTICS: FAT LOSS



- Orbital Region (Surrounding Eye)
  - Temporal Bone
  - Zygomatic Arch (Cheekbone)
- Upper Arm Region
  - Triceps
- Thoracic and Lumbar Region
  - Ribs
  - Lower Back
  - Mid-axillary Line

	Moderate Malnutrition	Severe Malnutrition
Acute Injury	Mild	Moderate
Chronic Illness	Mild	Severe
Social/Env.	Mild	Severe

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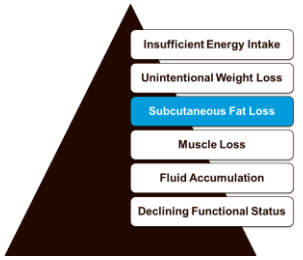
Fischer M, et al. *JPEN J Parent Enteral Nutr.* 2015;30(2):239-248.

SIX CHARACTERISTICS: FAT LOSS[1-2]



Orbital Region

- Exam: Visually assess for loss of fat under the eyes and lightly palpate above cheekbone
- Findings:
  - Severe loss – pronounced hollowness/depression, dark circles, loose saggy skin
  - Moderate loss – somewhat hollowness, slightly dark circles
  - No loss – slight bulging

1. Fischer M, et al. *JPEN J Parent Enteral Nutr.* 2015;30(2):239-248.
2. Hamilton C, ed. *Nutrition-Focused Physical Exam: An Illustrated Handbook*. Silver Spring, MD: ASPEN; 2016.

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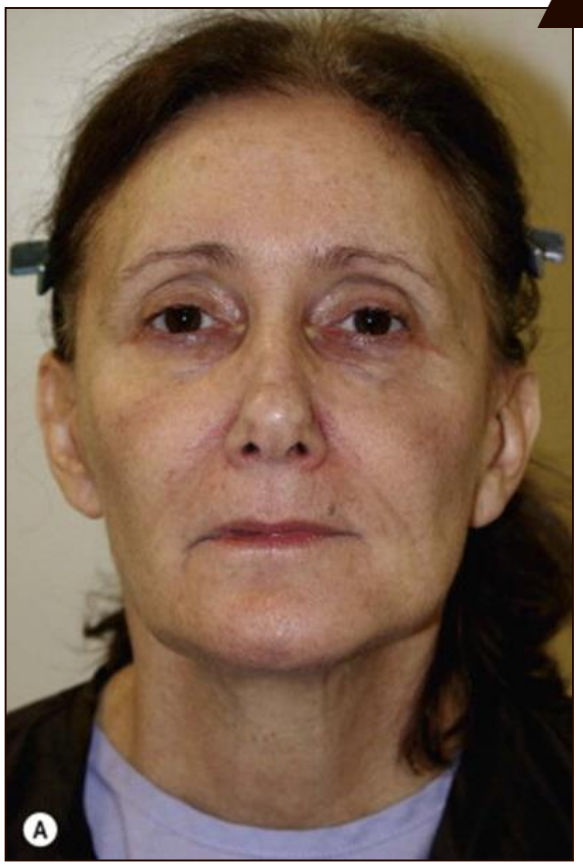
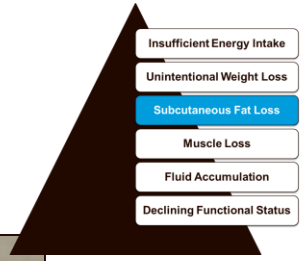
EXAMPLES

Connolly AJ, et al. *Autopsy Pathology: A Manual and Atlas*. 3rd ed. Philadelphia, PA: Elsevier; 2016:186-319.



Marten TJ, Elyassnia D. In: Neligan P, Rubin JP, eds. *Plastic Surgery: Volume 2: Aesthetic Surgery*. 4th ed; London: Elsevier; 2018:240-272.e14.



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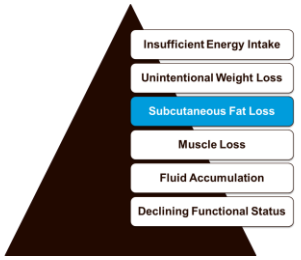
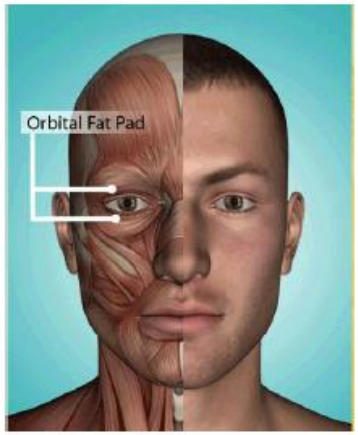
EXAMPLES



Orbital Fat Pads



NOTE: Water retention can mask subcutaneous fat loss in orbital fat pads

TIP: Look at patient straight on, observe area under eyes

Slightly bulged fat pads	Somewhat hollow look, slightly dark circles	Hollow look, eyes sunken, dark circles, loose skin

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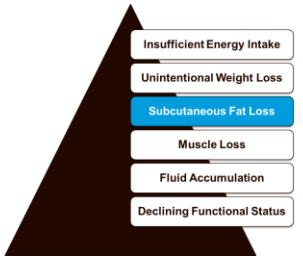
SIX CHARACTERISTICS: FAT LOSS



Upper Arm Region

- Exam: Bend arm at 90 degrees, pinch arm at midpoint and roll down until free of muscle and only pinching fat
- Findings:
  - Severe loss – mostly skin
  - Moderate loss – some fat tissue, not ample
  - No loss – ample fat tissue

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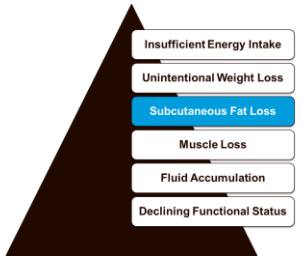
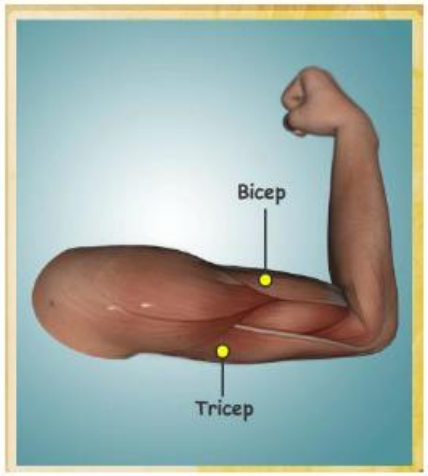
Fischer M, et al. *JPEN J Parent Enteral Nutr.* 2015;30(2):239-248.

SUBCUTANEOUS FAT LOSS IN TRICEPS



Triceps & Biceps



TIP: Arm bent to 90° angle, do not include muscle in pinch, roll skin b/w fingers

Normal	Mild-Moderate	Severe
Ample fat tissue between folds of skin	Fingers almost touch, some depth to pinch	Very little space between fingers or fingers touch

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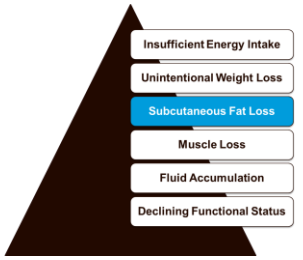
SIX CHARACTERISTICS: FAT LOSS



Thoracic & Lumbar Region

- Exam: Visually examine lower back and mid-axillary line (are ribs visible?), have patient press against you and physically examine fat stores above iliac crest
- Findings:
  - Severe loss – ribs visible with prominent depressions, iliac crest prominent
  - Moderate loss – ribs visible with mild depressions, iliac crest somewhat prominent
  - No loss – chest is full, ribs not visible, iliac crest with little to no protrusion

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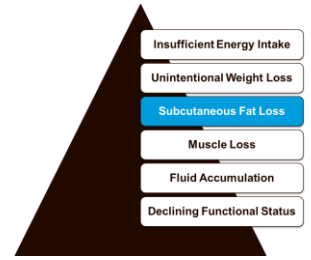
Fischer M, et al. *JPEN J Parent Enteral Nutr.* 2015;30(2):239-248.

EXAMPLES



Ortega-Roldan B, et al. *PLoS One*. 2014;9(7):e102595.

Karahmadi M, et al. *J Res Med Sci*. 2011;16(10):1378-1381.

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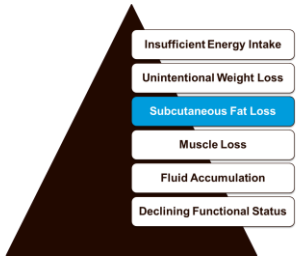
EXAMPLES



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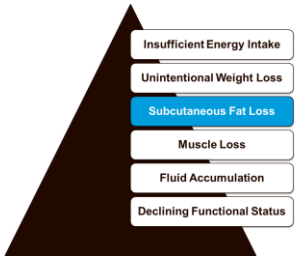
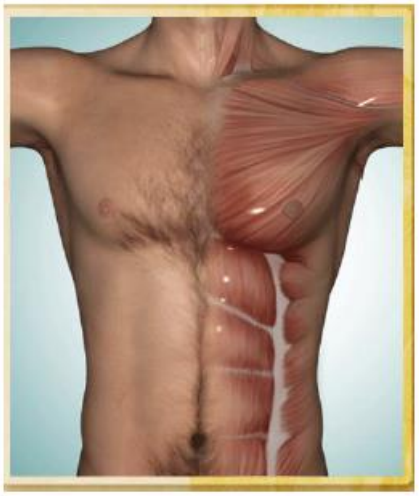
EXAMPLES



Anterior Ribs



TIP: Examine the lower rib region for loss of fullness or loose skin

Normal	Mild-Moderate	Severe
Ample fat tissue around ribs, fullness, taut skin	General loss of fullness, loose skin, ribs somewhat visible	Prominent, well-defined ribs; skin over ribs appears stretched

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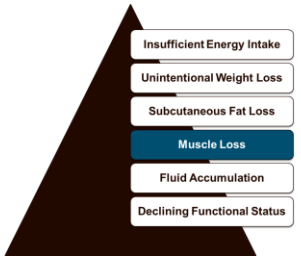
SIX CHARACTERISTICS: MUSCLE LOSS



- Temple Region: Temporalis
- Clavicle Bone Region: Pectoralis Major, Deltoids, Trapezius
- Acromion Region: Deltoid
- Scapular Bone Region: Latissimus Dorsi, Trapezius, Supraspinatus, Infraspinatus
- Dorsal Hand Region: Interosseous
- Patellar Region & Anterior Thigh Region: Quadriceps
- Posterior Calf Region: Gastrocnemius

	Moderate Malnutrition	Severe Malnutrition
Acute Injury	Mild	Moderate
Chronic Illness	Mild	Severe
Social/Env.	Mild	Severe

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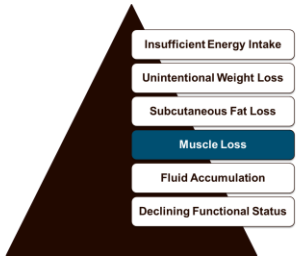
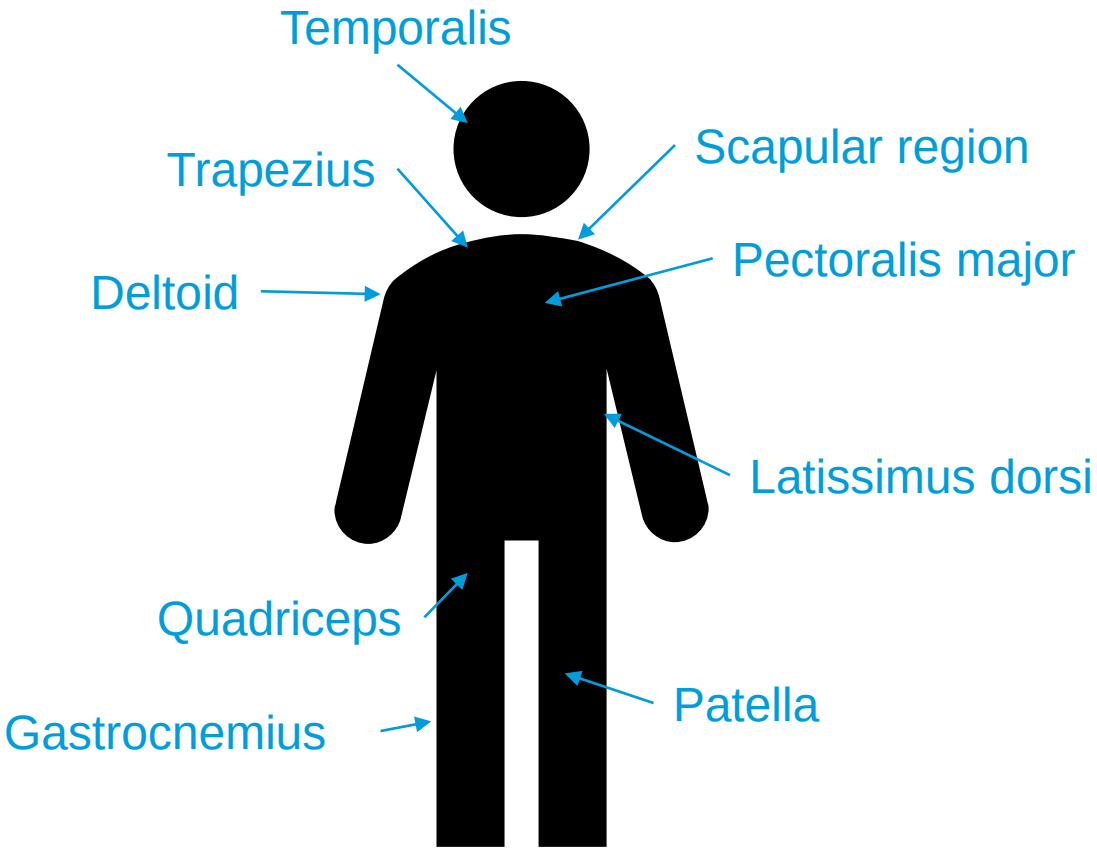
Fischer M, et al. *JPEN J Parent Enteral Nutr.* 2015;30(2):239-248.



ANATOMY



Areas commonly assessed for muscle loss (in blue)

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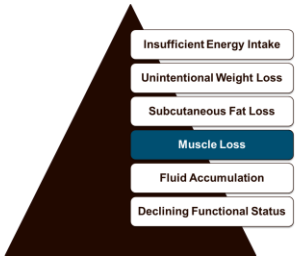
Figure adapted from Fischer M, et al. *JPEN J Parent Enteral Nutr.* 2015;30(2):239-248.

SIX CHARACTERISTICS: MUSCLE MASS[1-2]



Temple Region

- Exam: Observe from front and side, touch temples in a cross-type motion, consider having patient bite down
- Findings:
  - Severe loss – deep hollowing/scooping, lack of muscle to touch, facial bones well define
  - Moderate loss – slight depression
  - No loss – can see/feel muscle, may look flat or bulged

1. Fischer M, et al. *JPEN J Parent Enteral Nutr.* 2015;30(2):239-248.
2. Hamilton C, ed. *Nutrition-Focused Physical Exam: An Illustrated Handbook*. Silver Spring, MD: ASPEN; 2016.

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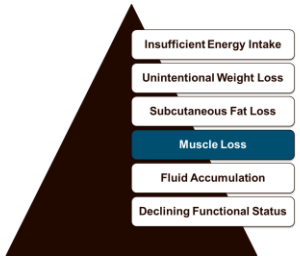
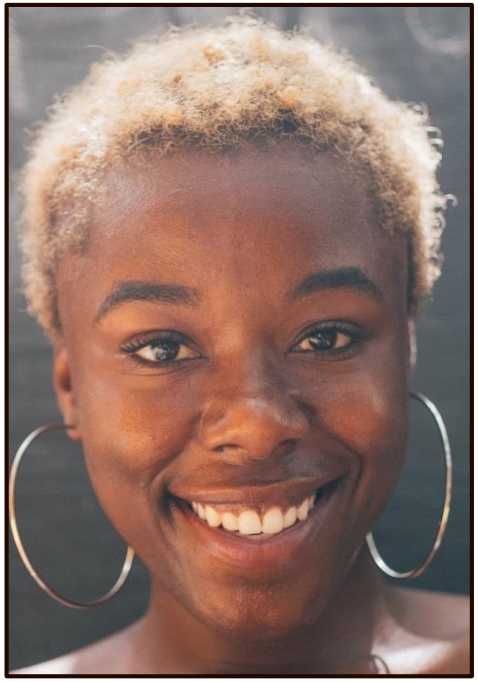
EXAMPLES





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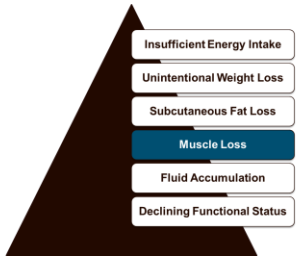
EXAMPLES



TIP: Observe patient straight on, have them turn head to side to side

Normal	Mild- Moderate	Severe
Well-defined muscle	**Slight depression**	**Hollowing, scooping depression; brow bone prominent**

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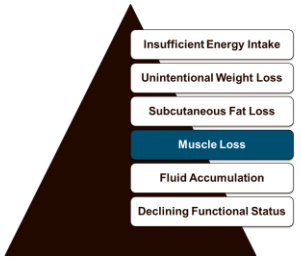
SIX CHARACTERISTICS: MUSCLE MASS[1-2]



Clavicle Bone Region

- Exam: Have patient sit up straight, visually examine bone, physically examine surrounding muscle
- Findings:
  - Severe loss – protruding, prominent bone
  - Moderate loss – some protrusion, bone more visible
  - No loss – well defined muscle surrounding the bone, clavicle likely not visible in males, maybe in females

1. Fischer M, et al. *JPEN J Parent Enteral Nutr.* 2015;30(2):239-248.
2. Hamilton C, ed. *Nutrition-Focused Physical Exam: An Illustrated Handbook*. Silver Spring, MD: ASPEN; 2016.

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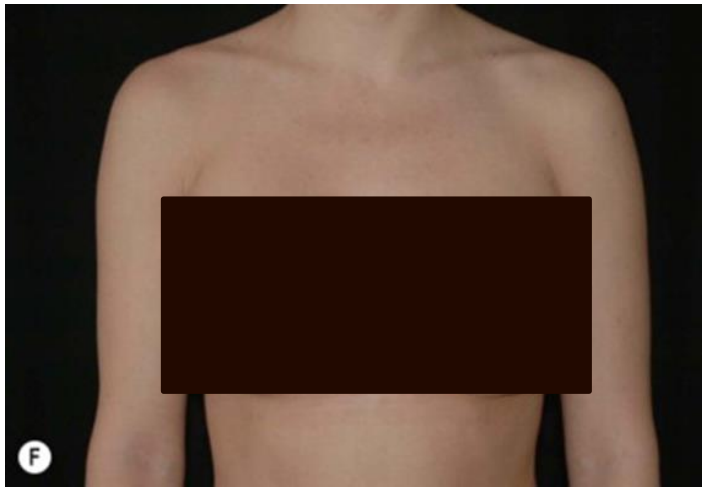
EXAMPLES



Hedén P. Chapter 24. In Hall-Findlay E, Evans G: *Aesthetic and Reconstructive Surgery of the Breast.* Saunders Ltd; 2010:357-386.

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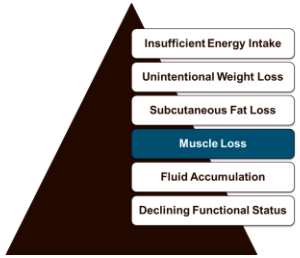
EXAMPLES



Clavicle

TIP: Inspect patient straight on with arms at their sides, look for prominent bone

Normal	Mild- Moderate	Severe
Clavicle may protrude slightly, no area of depression behind bone	Some protrusion of clavicle, slight depression behind the clavicle	Clavicle very protruded, area behind clavicle significantly depressed

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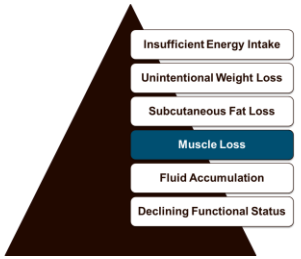
SIX CHARACTERISTICS: MUSCLE MASS



Acromion Bone Region

- Exam: Patient may be sitting or standing and have arms at sides
- Findings:
  - Severe loss – squared shoulders, bones and acromion process protrusion prominent
  - Moderate loss – acromion may slightly protrude, some shoulder angling
  - No loss – rounded shoulder, curves at shoulder/neck

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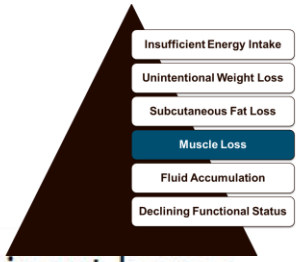
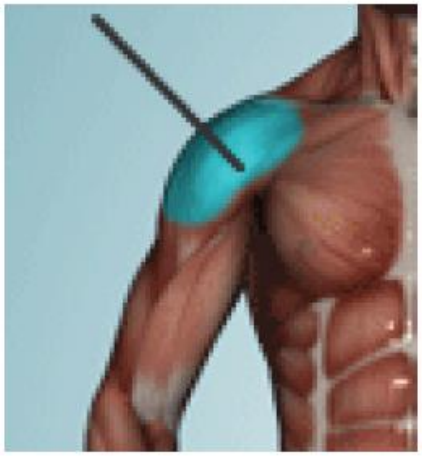
Fischer M, et al. *JPEN J Parent Enteral Nutr.* 2015;30(2):239-248.

EXAMPLES



Shoulder

TIP: Inspect patient with arms at their sides, look for prominent bones, observe shape of shoulder



Normal	Mild- Moderate	Severe
Nice curvature, roundness from neck to shoulder and down to arm	Acromion process may protrude slightly, shoulder may appear slightly squared-off	Bones prominent, significant squaring of shoulders, acromion process clearly visible

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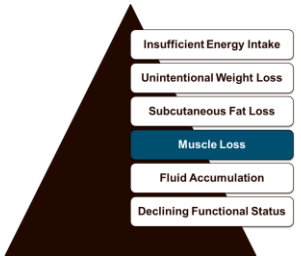
SIX CHARACTERISTICS: MUSCLE MASS



Scapular Bone Region

- Exam: Patient may be sitting or standing, extend hands straight out and press against solid object
- Findings:
  - Severe loss – prominent bones, depressions easily visible between ribs, scapula, spine and shoulders
  - Moderate loss – mild depressions, bones may show slightly
  - No loss – bones not prominent, no significant depressions

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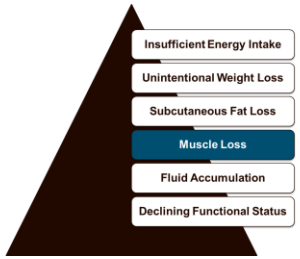
Fischer M, et al. *JPEN J Parent Enteral Nutr.* 2015;30(2):239-248.

EXAMPLES



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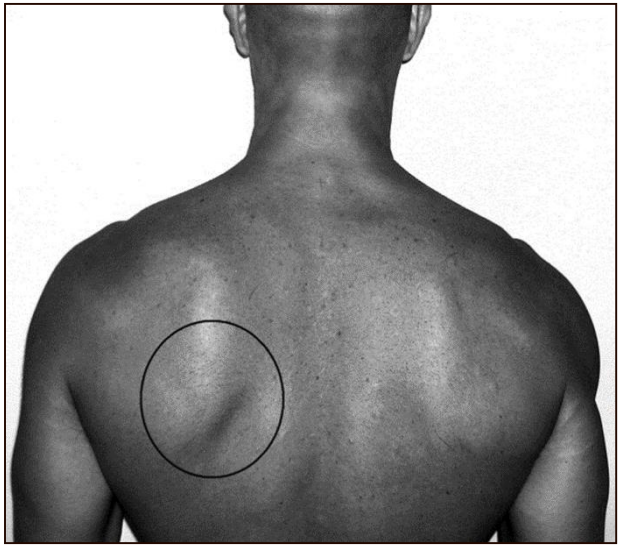

Gumina S, et al. *Arthroscopy*. 2009;25(1):40-45.

Karahmadi M, et al. *J Res Med Sci.* 2011;16(10);1378-1381.

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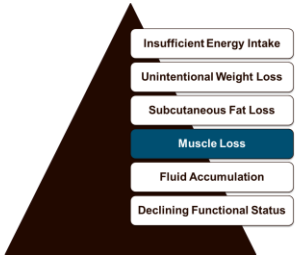
EXAMPLES



Scapula

TIP: Have patient push hands against a solid object (such as a wall), look for prominent bones or depression between bones

Normal	Mild- Moderate	Severe
Bone not prominent, no significant depressions	Mild depression or bone may show slightly	Prominent, visible bone; depressions between ribs, scapula & shoulder, or spine

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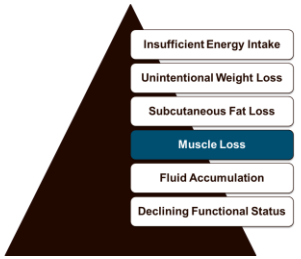
SIX CHARACTERISTICS: MUSCLE MASS



Dorsal Hand Region

- Exam: Observe hand, looking for depressions on the back of hand. Have patient make an 'OK' sign and feel for musculature
- Findings:
  - Severe loss – prominent depression
  - Moderate loss – slight depression
  - No loss – no depression

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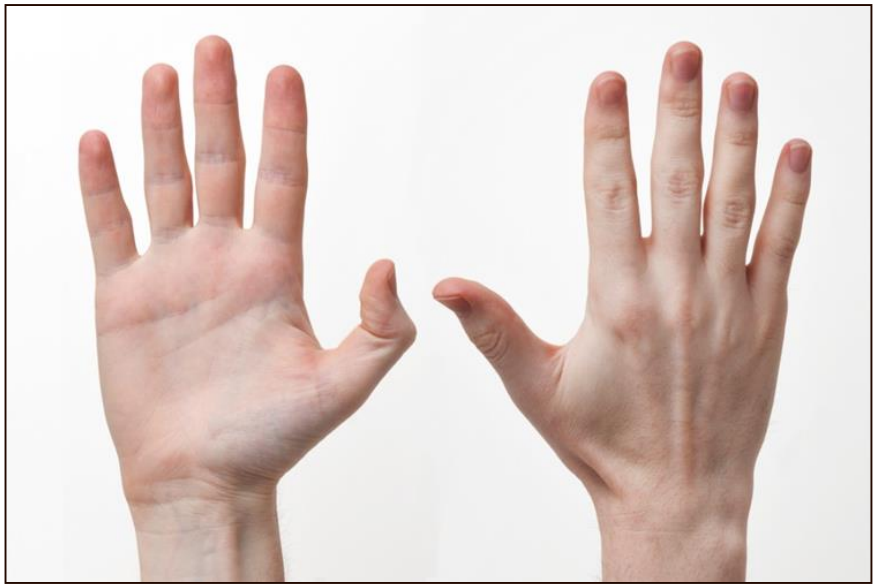
Fischer M, et al. *JPEN J Parent Enteral Nutr.* 2015;30(2):239-248.

EXAMPLES



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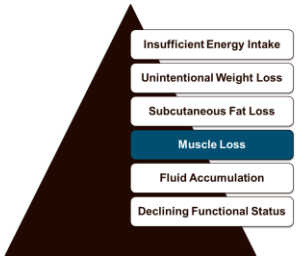
Senior K. *Lancet Oncol*. 2007;8(8):671-672.

EXAMPLES



Interosseous

TIP: Observe back of patient's hand, have them move thumb & forefinger back and forth

Normal	Mild- Moderate	Severe
Muscle protrudes, could be flat in well-nourished females	**Slightly depressed or flat**	**Flat or depressed area between thumb and forefinger**

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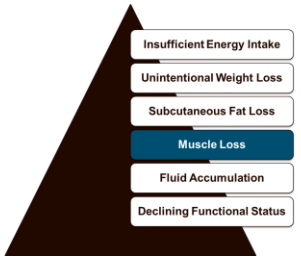
SIX CHARACTERISTICS: MUSCLE MASS



Patellar Region

- Exam: Examine with knee bent
- Findings:
  - Severe loss – prominent bone, square looking, very little muscle definition around patella
  - Moderate loss – patella more prominent, less muscle definition around patella
  - No loss – muscles protrude around patella, difficult to see bone

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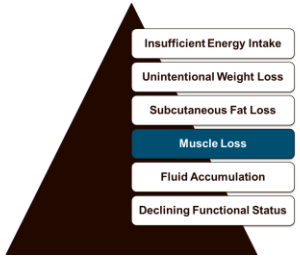
Fischer M, et al. *JPEN J Parent Enteral Nutr.* 2015;30(2):239-248.

EXAMPLES



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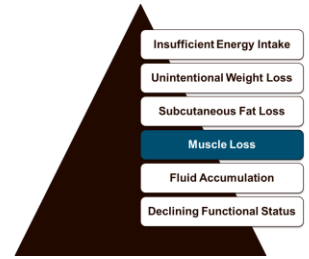
Sharff K, et al. *Case Rep Orthop*. 2015;2015:963138.

EXAMPLES - KNEE



Knee

TIP: Have patient sit with legs propped up on low stool

Normal	Mild- Moderate	Severe
Patella not prominent, muscles visible	**Patella slightly prominent, muscles less obvious**	**Patella very prominent, areas along both sides depressed, muscle minimal or absent**

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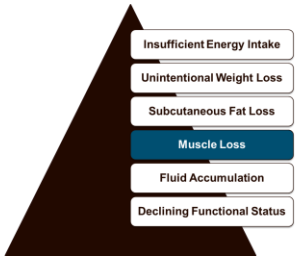
SIX CHARACTERISTICS: MUSCLE MASS



Anterior Thigh Region

- Exam: Have patient sit with leg propped up and bent at knee. Grasp quads bilaterally
- Findings:
  - Severe loss – line/depression along thigh, thin
  - Moderate loss – mild depression of inner thigh
  - No loss – muscles protrude and are well-rounded and well developed, bones not visible

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Fischer M, et al. *JPEN J Parent Enteral Nutr.* 2015;30(2):239-248.

EXAMPLES

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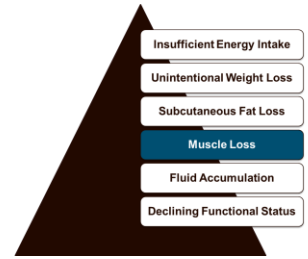
Karahmadi M, et al. *J Res Med Sci*. 2011;16(10):1378-1381.

EXAMPLES - THIGH



TIP: Observe patient in supine position or sitting with feet propped up on low stool

Normal	Mild- Moderate	Severe
Quadriceps well-rounded, no depressions	Mild depression along inner thigh, upper leg appears thin	Significant depression of inner thigh region, upper leg obviously thin

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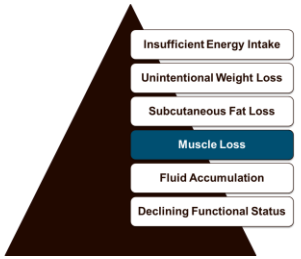
SIX CHARACTERISTICS: MUSCLE MASS



Posterior Calf Region

- Exam: Grasp back of lower leg, observe/examine bilaterally
- Findings:
  - Severe loss – thin with very little definition/firmness
  - Moderate loss – some roundedness, slight firmness
  - No loss – well rounded, firm, well developed muscle

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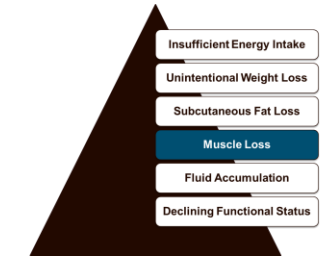
Fischer M, et al. *JPEN J Parent Enteral Nutr.* 2015;30(2):239-248.

EXAMPLES - CALF



Calf

TIP: Observe patient in supine position with knees bent

Normal	Mild- Moderate	Severe
Well-developed bulb of calf muscle	**Calf muscle not well-defined/well-developed**	**Thin, no muscle definition**

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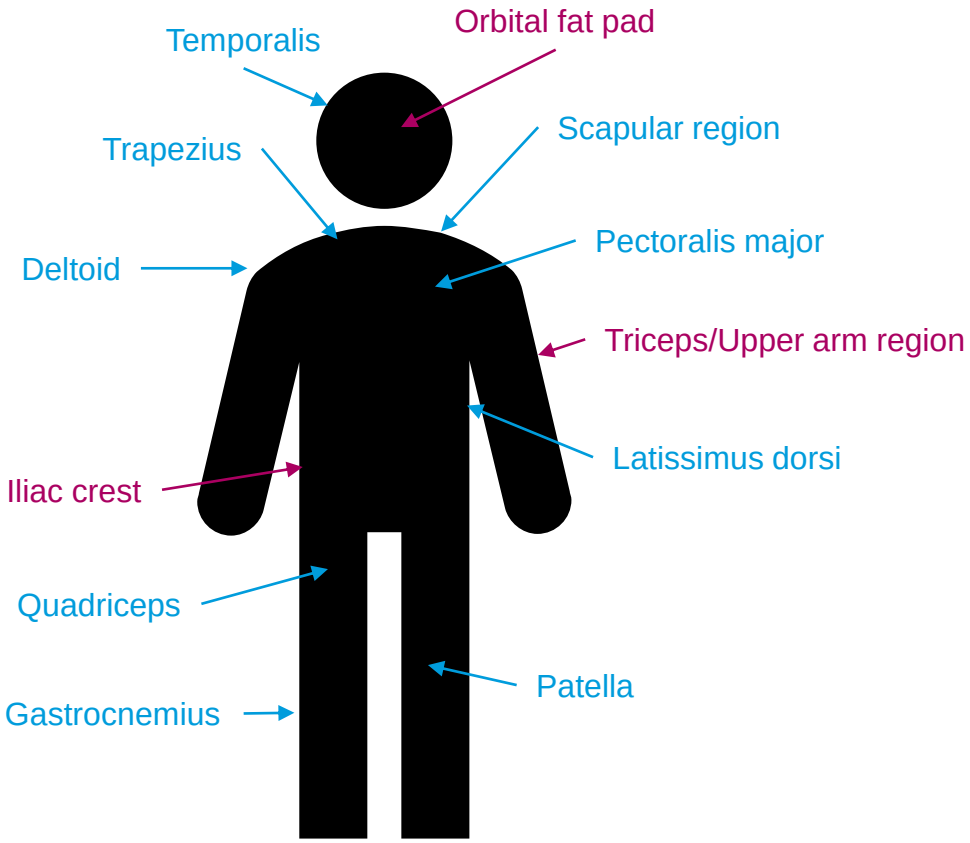
TIME FOR (VIRTUAL) PRACTICE!

NUTRITION-FOCUSED PHYSICAL EXAM



Areas commonly assessed for subcutaneous fat loss (in magenta) and muscle loss (in blue)

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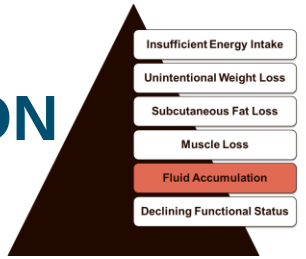
Figure adapted from Fischer M, et al. *JPEN J Parent Enteral Nutr.* 2015;30(2):239-248.

SIX CHARACTERISTICS: FLUID ACCUMULATION



Types of Edema:

Term	Definition
Ascites	Accumulation of fluid around the abdomen resulting in distention; percussed shifting dullness and fluid wave
Anasarca	Massive, general whole-body edema
Peripheral	Swollen lower extremities with tendency to accumulate in dependent areas and may interfere with ambulation
Pitting	Leaves indentation when pressure is applied for at least 5 seconds and reflects the movement of excess interstitial fluid
Non-pitting or brawny	No indentation after pressure is applied to edematous area, thickening, dark color, dry/scaly patches, induration, liposclerosis

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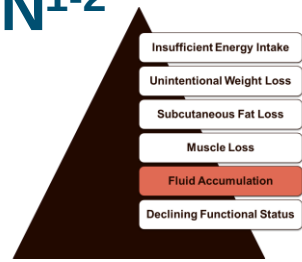
Hamilton C, ed. *Nutrition-Focused Physical Exam: An Illustrated Handbook*. Silver Spring, MD: ASPEN; 2016.

SIX CHARACTERISTICS: FLUID ACCUMULATION[1-2]



- Presentation of edema
  - Fluid movement into the third space
  - Gross deficiency of protein for a long period of time
  - Physiological responses to refeeding syndrome
- Rarely direct manifestation of malnutrition
- Usually is masking weight loss, as well as fat and muscle loss

	Moderate Malnutrition	Severe Malnutrition
Acute injury	Mild	Mod > Severe
Chronic illness	Mild	Severe
Social/Env.	Mild	Severe

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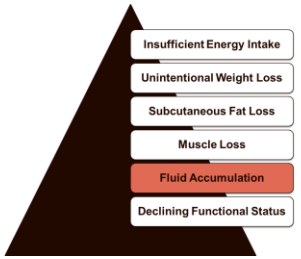
1. White JV, et al. *JPEN J Parenter Enteral Nutr*. 2012;36(3):275-283.
2. Hamilton C, ed. *Nutrition-Focused Physical Exam: An Illustrated Handbook*. Silver Spring, MD: ASPEN; 2016.

MEASURING EDEMA



- Locations to evaluate for edema
  - Face/neck – observation (swelling/distention of jugular)
  - Hands – observation, palpation
  - Feet/ankles – observation, palpation
  - Abdomen – observation, percussion

- Considerations
  - Patient conditions that are characterized by edema
  - I/Os and Labs that may confirm findings
  - Edematous areas may be sensitive

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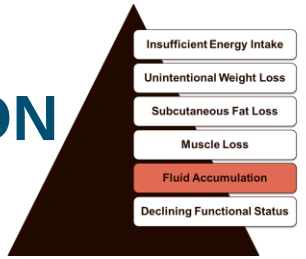
Ratliff A. *Support Line.* 2015;37(5):5-10.

SIX CHARACTERISTICS: FLUID ACCUMULATION



- Pitting Edema
  - Apply pressure with pad of index finger to a bony prominence for ~5 seconds, release and examine for remaining indentation

Edema Grade	Description	Depth	Refill Time
1+	Mild	0-1/4”	<10 sec
2+	Moderate	¼-1/2”	10-15 sec
3+	Severe	½-1”	1-2 min
4+		>1”	5 min or greater

- Non-pitting Edema
  - Skin is tight & firm, does not depress when pressure applied

Dehydration

- Skin Turgor (tenting)
  - Pinch skin on back of hand/forearm, skin should return to a normal flat position within 3 seconds
- Capillary Refill
  - Press fingernail until it is white, color should return within 3 seconds

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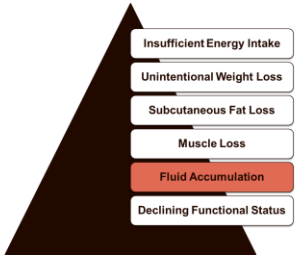
Ratliff A. *Support Line.* 2015;37(5):5-10.

MEASURING PITTING EDEMA



1+	Barely detectable impression when finger is pressed into skin.
2+	Slight indentation. 15 seconds to rebound
3+	Deeper indentation. 30 seconds to rebound.
4+	> 30 seconds to rebound.

O'Sullivan SB, Schmitz TJ, eds. *Physical rehabilitation: assessment and treatment.* 5th ed. Philadelphia, PA: F. A. Davis Co.; 2007:659.

1+	2mm depression, barely detectable. Immediate rebound.
2+	4mm deep pit. A few seconds to rebound.
3+	6mm deep pit. 10-12 seconds to rebound.
4+	8mm: very deep pit. >20 seconds to rebound.

Hogan, M. *Medical-Surgical Nursing.* 2nd ed. Salt Lake City, UT: Prentice Hall; 2007.

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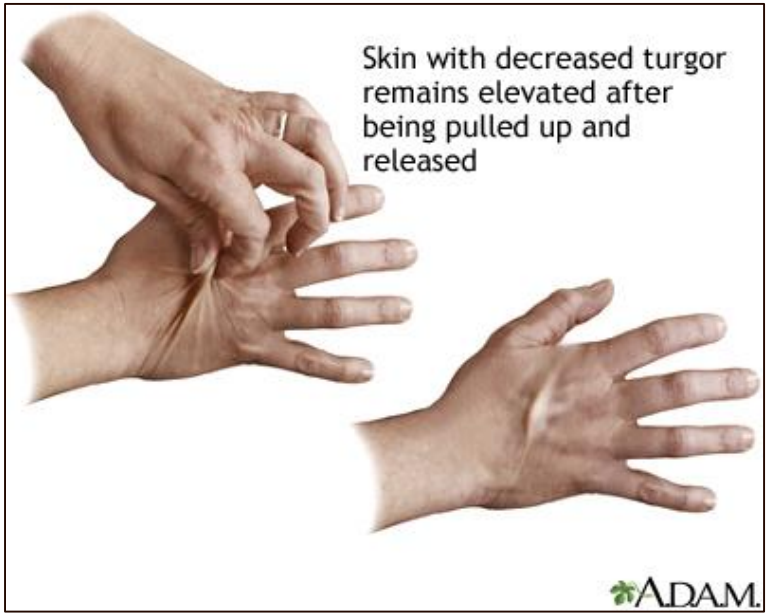
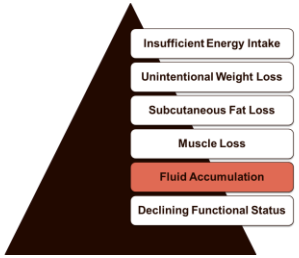
EXAMPLES

CDC Public Health Image Library. https://phil.cdc.gov. Accessed January 5, 2021.

Lymphedema. *Wikemedia Commons, the free media repository.* https://commons.wikimedia.org/wiki/File:Puffy_feet.jpg.. Accessed January 5, 2021.



MedlinePlus.gov. https://medlineplus.gov/ency/imagepages/17223.htm. Accessed January 5, 2021.



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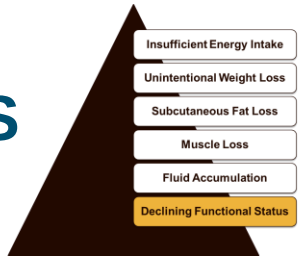
SIX CHARACTERISTICS: FUNCTIONAL STATUS



Hand Grip Strength

- Recommended technique to measure functional status[1]
- Measures[2]
  - muscle functionality[2]
  - poor protein intake
  - decreased musculature
  - decreased function
- Responds earlier to nutritional deprivation and repletion[2]

	Moderate Malnutrition	Severe Malnutrition
Acute injury	N/A	Measurably reduced
Chronic illness	N/A	Measurably reduced
Social/ Env.	N/A	Measurably reduced

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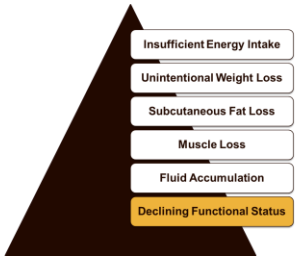
1. White J, et al. *J Acad Nutr Diet.* 2012;36: 275-283.
2. Norman K, et al. *Clin Nutr.* 2011;30:135-142.

TECHNIQUES FOR USING DYNAMOMETERS[1-2]



SET UP

- Patient should sit upright, shoulders supported with the chair; or sit on the edge of the bed with feet touching floor/stool
- Arm should NOT be resting on the chair
- Test dominant hand only or both hands; use appropriate normative values
- Arm should be relaxed, elbow at 90° angle, wrist is neutral
- Patient will hold the dynamometer with fingers lightly wrapped around the handle
- Gently support the dynamometer at the base
- Grip should be applied smoothly without wrenching or jerking motion

INSTRUCTIONS

1. Feedback should not be given to the patient during the test
2. “We will test your grip strength 3 times. I will tell you to squeeze and the let go, make sure to just release the squeeze”
3. “When I say squeeze, squeeze as hard as you can, but make sure not to jerk or wrench while you are squeezing”
4. “You will grip for about 3-5 seconds”
5. “Are you ready?”

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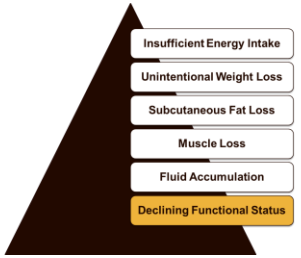
1. Scollard T. *Support Line.* 2017;39(2):7-13
2. Hamilton C, ed. *Nutrition-Focused Physical Exam: An Illustrated Handbook*. Silver Spring, MD: ASPEN; 2016.

LIMITATIONS AND ALTERNATIVES



Limitations

- Characteristics used to measure functional status may expand[1]
- No consensus on measurement protocols[2]
- Measures upper limb strength only; cannot replace assessment of ADLs[2]
- Reliable cut off values need to be proposed; validated to determine patients at risk[2]

Alternatives[3]

- 30-second chair stand
- Stair climb
- 4x10 meter fast-paced walk
- Timed up-and-go
- 6-minute walk test

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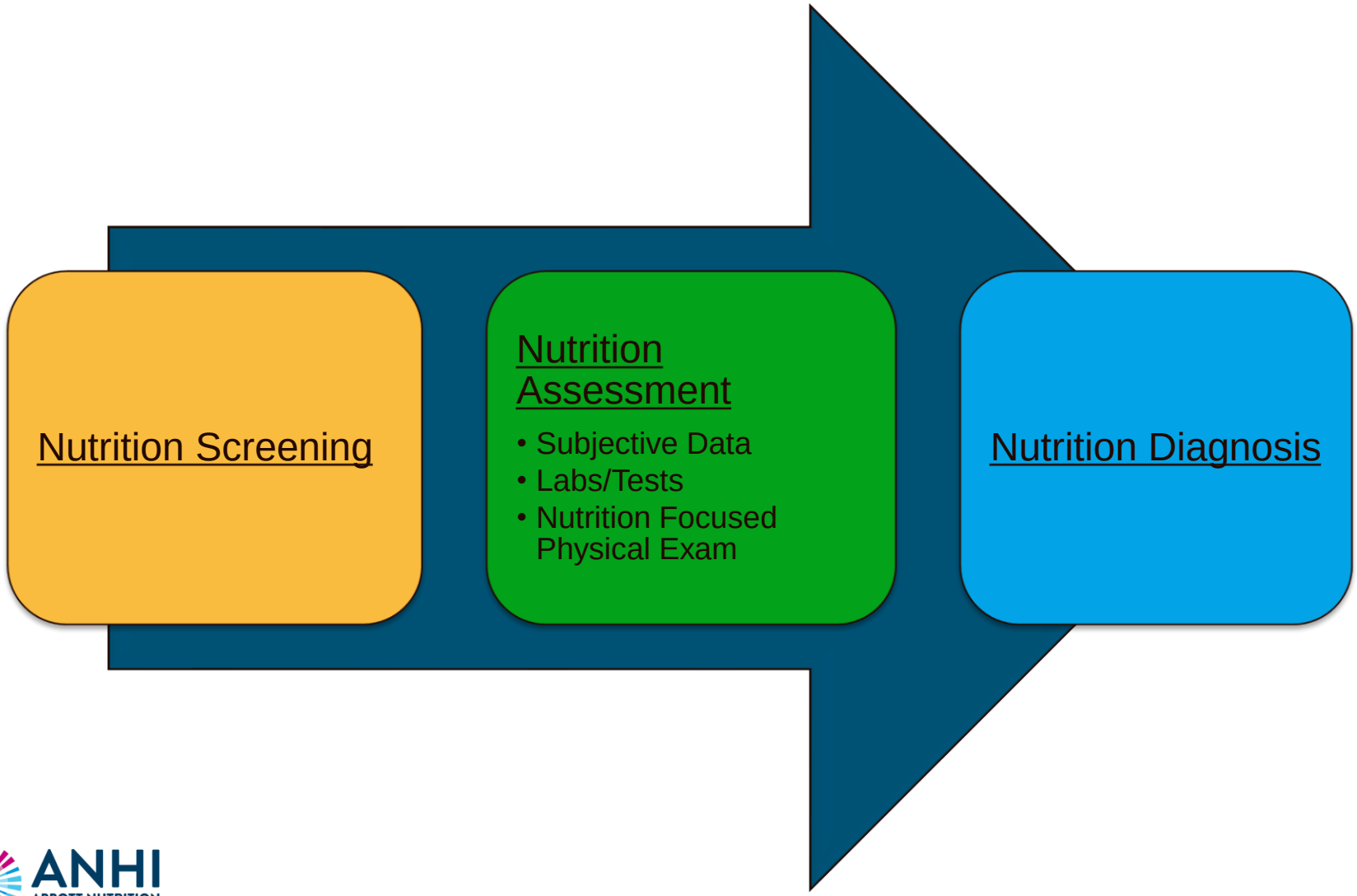
1. White J, et al. *J Acad Nutr Diet.* 2012;36: 275-283.
2. Norman K, et al. *Clin Nutr.* 2011;30:135-142.
3. Russell, M. *Nutr Clin Pract.* 2015;30:211-8.

PUTTING IT ALL TOGETHER



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PUTTING IT ALL TOGETHER

Etiology of Malnutrition:
Acute Illness/Injury *or* Chronic Illness *or* Social/Environmental

Body area	Finding			
Temple	Normal	Moderate	Severe	Unable to determine
Orbital area	Normal	Moderate	Severe	Unable to determine
Clavicle	Normal	Moderate	Severe	Unable to determine
Shoulders/deltoid	Normal	Moderate	Severe	Unable to determine
Scapula	Normal	Moderate	Severe	Unable to determine
Thoracic/lumbar	Normal	Moderate	Severe	Unable to determine
Triceps	Normal	Moderate	Severe	Unable to determine
Interosseous	Normal	Moderate	Severe	Unable to determine
Quadriceps	Normal	Moderate	Severe	Unable to determine
Calf	Normal	Moderate	Severe	Unable to determine

Edema Present: Normal *or* Moderate *or* Severe
Overall Muscle loss: Normal *or* Moderate *or* Severe
Overall Fat Loss: Normal *or* Moderate *or* Severe
Handgrip: Normal *or* Reduced

Fat loss

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PUTTING IT ALL TOGETHER

		Acute Illness/Injury	Chronic Illness	Social/ Environmental
Moderate	Weight Loss	1-2% 1 wk 5% 1m 7.5% 3m	5% 1m 7.5% 3m 10% 6m 20% 12m	5% 1m 7.5% 3m 10% 6m 20% 12m
	Energy Intake	<75% EER for >7d	<75% EER for ≥1m	<75% EER for ≥3m
Severe	Weight Loss	>2% 1wk >5% 1m >7.5% 3m	>5% 1m >7.5% 3m >10% 6m >20% 12m	>5% 1m >7.5% 3m >10% 6m >20% 12m
	Energy Intake	≤50% EER for ≥5d	≤75% EER for ≥1m	≤50% EER for ≥1m

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CASE STUDY

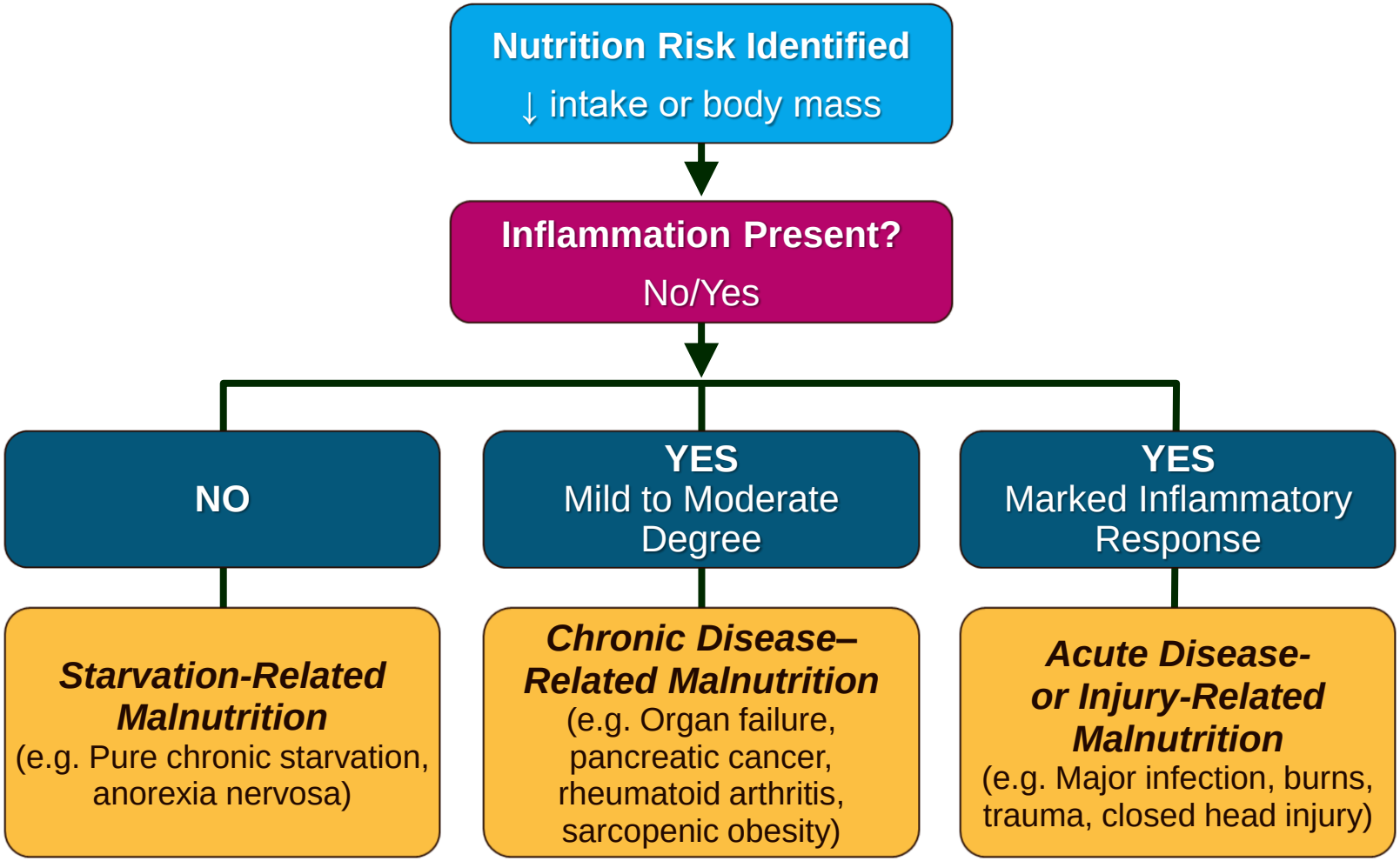
CASE STUDY #1

54 y.o. male with worsening liver failure over past 3-4 months. Patient states he has been hospitalized past few months on several occasions with multiple issues due to liver disease. States about 50% of intake from most meals past few months. Patient thinks they lost weight around 15 kg past 6 months, but hard to tell with fluid in abdomen area and lower extremities. (Pitting 3+ edema found on exam).

- PMHX: Cirrhosis (2014)
- Labs: Albumin 1.7, Pre-Albumin 13.2, Glucose 96
- Ht: 167.6cm, Wt: 50kg, UBW: 64kg

- Exam findings: unable to determine fat loss as patient is edematous. Wasting of temples noticed with hollowing/scooping appearance. Also noted protruding and prominent clavicle bone. Measurably reduced grip strength.

WHICH ETIOLOGY APPLIES TO THIS CASE?



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Jensen GL, et al. *JPEN J Parent Enteral Nutr.* 2009;33(6):710-716.

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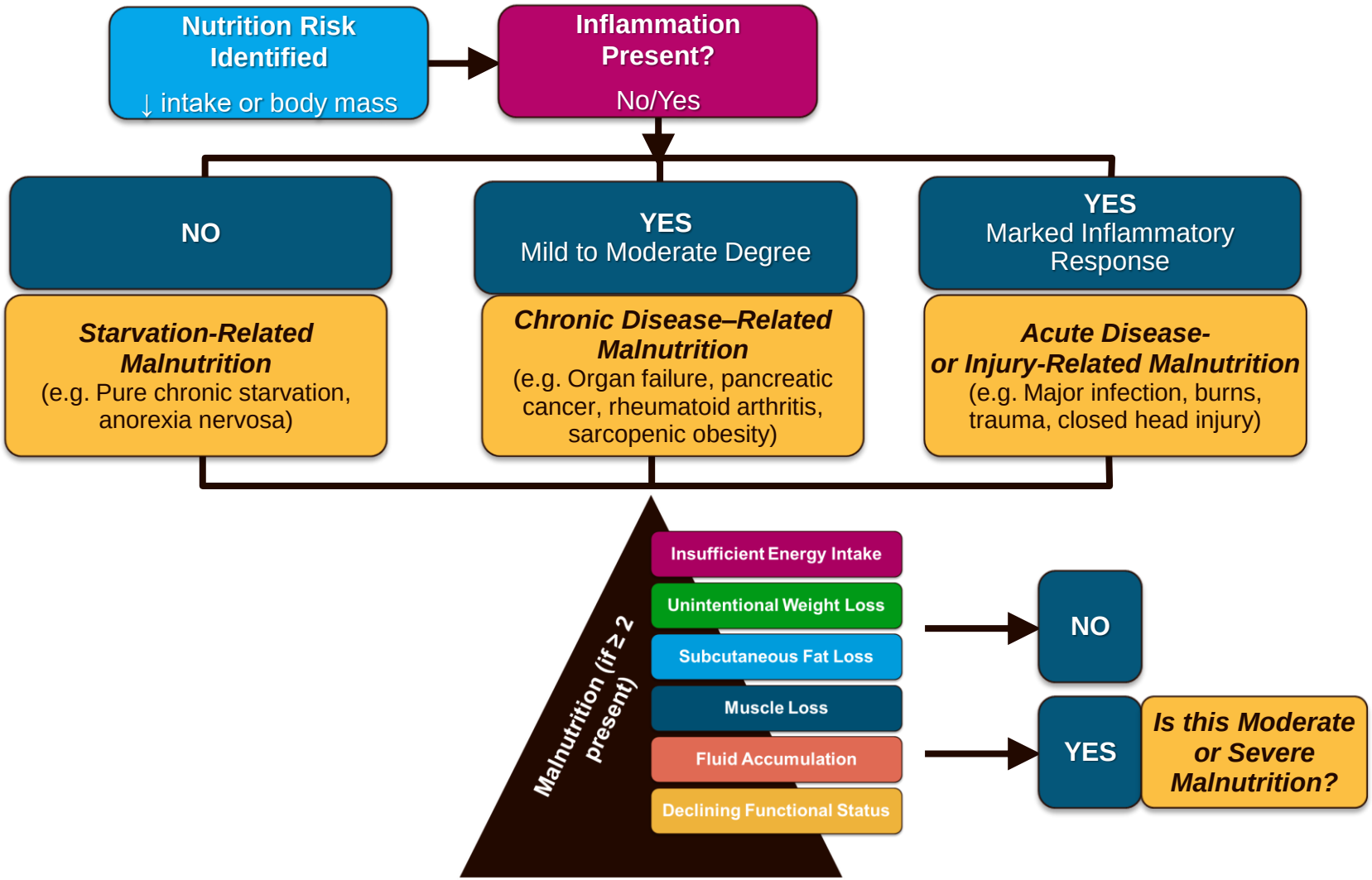
IS THIS MODERATE OR SEVERE MALNUTRITION?

DIAGNOSING MALNUTRITION (AND/ASPEN)[1-2]



1. Jensen GL, et al. *JPEN J Parent Enteral Nutr.* 2009;33(6):710-716.
2. Fischer M, et al. *JPEN J Parent Enteral Nutr.* 2015;30(2):239-248.

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IDENTIFICATION & DOCUMENTATION OF MALNUTRITION

	Malnutrition in the Context of Acute Illness or Injury				Malnutrition in the Context of Chronic Illness				Malnutrition in the Context of Social or Environmental Circumstances			
Clinical characteristics	**Non-severe (moderate) malnutrition**		**Severe malnutrition**		**Non-severe (moderate) malnutrition**		**Severe malnutrition**		**Non-severe (moderate) malnutrition**		**Severe malnutrition**	
Energy intake	<75% of estimated Energy requirement for >7 days		≤50% of estimated Energy requirement for ≥5 days		<75% of estimated Energy requirement for ≥1 month		≤75% of estimated Energy requirement for ≥1 month		<75% of estimated Energy requirement for ≥3 months		≤50% of estimated Energy requirement for ≥1 month	
Weight loss	**%**	**Time**	**%**	**Time**	**%**	**Time**	**%**	**Time**	**%**	**Time**	**%**	**Time**
	1-2	1 wk	>2	1 wk	5	1 mo	>5	1 mo	5	1 mo	>5	1 mo
	5	1 mo	>5	1 mo	7.5	3 mo	>7.5	3 mo	7.5	3 mo	>7.5	3 mo
	7.5	3 mos	>7.5	3 mos	10	6 mo	>10	6 mo	10	6 mo	>10	6 mo
					20	1y	>20	1y	20	1y	>20	1y
Body fat	Mild		Moderate		Mild		Severe		Mild		Severe	
Muscle mass	Mild		Moderate		Mild		Severe		Mild		Severe	
Fluid accumulation	Mild		Moderate to Severe		Mild		Severe		Mild		Severe	
Reduced grip strength	N/A*		Measurably reduced		N/A		Measurably reduced		N/A		Measurably reduced	

*A minimum of two of the six characteristics above is recommended for diagnosis of either severe or non-severe malnutrition. Height and weight should be measured rather than estimated to determine body mass index. Usual weight should be obtained in order to determine the percentage and to interpret the significance of weight loss. Basic indicators of nutritional status such as body weight, weight change, and appetite may substantively improve with refeeding in the absence of inflammation. Refeeding and/or nutrition support may stabilize but not significantly improve nutrition parameters in the presence of inflammation. The National Center for Health Statistics defines "chronic" as a disease/condition lasting 3 months or longer. Serum proteins such as albumin and prealbumin are not included as defining characteristics of malnutrition because recent evidence analysis shows that serum levels of these proteins do not change in response to changes in nutrient intake.

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White JV, et al. *JPEN J Parenter Enteral Nutr*. 2012;36(3):275-283.

CASE STUDY #1 ANSWER

(DX: Severe Malnutrition in context of chronic illness)

	Malnutrition in the Context of Acute Illness or Injury				Malnutrition in the Context of Chronic Illness				Malnutrition in the Context of Social or Environmental Circumstances			
Clinical characteristics	**Non-severe (moderate) malnutrition**		**Severe malnutrition**		**Non-severe (moderate) malnutrition**		**Severe malnutrition**		**Non-severe (moderate) malnutrition**		**Severe malnutrition**	
Energy intake	<75% of estimated Energy requirement for >7 days		≤50% of estimated Energy requirement for ≥5 days		<75% of estimated Energy requirement for ≥1 month		≤75% of estimated Energy requirement for ≥1 month		<75% of estimated Energy requirement for ≥3 months		≤50% of estimated Energy requirement for ≥1 month	
Weight loss	**%**	**Time**	**%**	**Time**	**%**	**Time**	**%**	**Time**	**%**	**Time**	**%**	**Time**
	1-2	1 wk	>2	1 wk	5	1 mo	>5	1 mo	5	1 mo	>5	1 mo
	5	1 mo	>5	1 mo	7.5	3 mo	>7.5	3 mo	7.5	3 mo	>7.5	3 mo
	7.5	3 mos	>7.5	3 mos	10	6 mo	>10	6 mo	10	6 mo	>10	6 mo
					20	1y	>20	1y	20	1y	>20	1y
Body fat	Mild		Moderate		Mild		Severe		Mild		Severe	
Muscle mass	Mild		Moderate		Mild		Severe		Mild		Severe	
Fluid accumulation	Mild		Moderate to Severe		Mild		Severe		Mild		Severe	
Reduced grip strength	N/A*		Measurably reduced		N/A		Measurably reduced		N/A		Measurably reduced	

*A minimum of two of the six characteristics above is recommended for diagnosis of either severe or non-severe malnutrition. Height and weight should be measured rather than estimated to determine body mass index. Usual weight should be obtained in order to determine the percentage and to interpret the significance of weight loss. Basic indicators of nutritional status such as body weight, weight change, and appetite may substantively improve with refeeding in the absence of inflammation. Refeeding and/or nutrition support may stabilize but not significantly improve nutrition parameters in the presence of inflammation. The National Center for Health Statistics defines "chronic" as a disease/condition lasting 3 months or longer. Serum proteins such as albumin and prealbumin are not included as defining characteristics of malnutrition because recent evidence analysis shows that serum levels of these proteins do not change in response to changes in nutrient intake.

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White JV, et al. *JPEN J Parenter Enteral Nutr*. 2012;36(3):275-283.

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WHAT ABOUT NFPE FOR PEDIATRIC PATIENTS?

ADULT VS. PEDIATRIC MALNUTRITION INDICATORS[1-3]

	Adult	Pediatric
# Diagnostic Criteria	≥ 2 indicators present	1 or more indicators present
Severity Levels	Moderate; Severe	Mild; Moderate; Severe
# of Etiology Based Definitions	3	6
# of Indicators	6	8
Energy Intake & Weight Loss Indicators	Over specified amount of time	No time range necessary/specified

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1. White JV, et al. *JPEN J Parenter Enteral Nutr*. 2012;36(3):275-283.
2. Becker PJ, et al. *J Acad Nutr Diet.* 2014;114(12):1988-2000.
3. Mehta NM, et al. *JPEN J Parent Enteral Nutr.* 2013;37(4):460-481.

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ASSESSING FOR MICRONUTRIENT DEFICIENCIES USING THE NFPE

RECOMMENDED READINGS

- White JV, et al. Academy Malnutrition Work Group, ASPEN Malnutrition Task Force and the ASPEN Board of Directors 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 J Parenter Enteral Nutr*. 2012(3);36(3):275-283.
- Jensen GL, et al. Adult starvation and disease-related malnutrition: a proposal for etiology-based diagnosis in the clinical practice setting from the International Consensus Guideline Committee. *JPEN J Parenter Enteral Nutr*. 2010;34(2):156-159.
- Esper DH. Utilization of Nutrition-Focused Physical Assessment in Identifying Micronutrient Deficiencies. *Nutr Clin Pract*. 2015;30(2):194-202.
- Radler DR & Lister T. Nutrient deficiencies associated with nutrition-focused physical findings of the oral cavity. *Nutr Clin Pract.* 2013;28(6):710-721.
- Malone A, Hamilton C. The AND/ASPEN Consensus Malnutrition Characteristics: Application in Practice. *Nutr Clin Pract.* 2013;28(6):639-650.
- Hipskind P, Galang M, Jevenn A, Pogatschnik C. *Nutrition-Focused Physical Exam: An Illustrated Handbook.* Silver Spring, MD: ASPEN; 2016.
- Mordarski B, Wolff J, eds. *Nutrition Focused Physical Exam Pocket Guide.* Academy of Nutrition and Dietetics; 2018.

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NUTRITION FOCUSED PHYSICAL EXAM

- The 6 characteristics used to identify the adult patient with malnutrition do not take into consideration micronutrients

- A nutrition focused physical exam should be part of an overall comprehensive assessment

- Examine patient from head-to-toe to consider possible micronutrient deficiencies

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1. White JV, et al. *J Acad Nutr Diet*. 2012;36(3):275-283.
2. Mueller C, et al. *JPEN J Parent Enteral Nutr*. 2010;35(1):16-24.

MICRONUTRIENT DEFICIENCIES FREQUENT SCENARIOS

- Geriatric Patients
- ETOH Abuse
- Cancer and/or Malignancies
- Altered GI Structure/Function
  - Short Bowel Syndrome, Fistulas, Small Bowel Bacterial Overgrowth, Diarrhea, Severe and Chronic Nausea/Vomiting, and s/p Bariatric Surgery
- Liver Disease
- Renal Disease with RRT
- Immune Deficiencies

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Johnson KA, et al. *Clin Ger Med.* 2002;18(4):773.

SITE OF MICRONUTRIENT ABSORPTION

Site of Absorption	Nutrients
Stomach	Copper, Iodine, Fluoride, Molybdenum
Duodenum	Calcium, Phosphorus, Magnesium, Iron, Copper, Selenium, Thiamin, Riboflavin, Niacin, Biotin, Folate, Fat- Soluble Vitamins (A, D, E, K)
Jejunum	Thiamin, Riboflavin, Niacin, Pantothenic Acid, Biotin, Folate, Vitamin B6, Vitamin C, Fat-Soluble Vitamins (A, D, E, K), Calcium, Phosphorus, Magnesium, Iron, Zinc, Chromium, Manganese, Molybdenum
Ileum	Vitamin C, Folate, Vitamin B12 (Needs Intrinsic Factor Produced in the Stomach), Vitamin D, Vitamin K, Magnesium, Others (depending upon transit time)
Colon	Vitamin K, Biotin, Sodium, Chloride, Potassium

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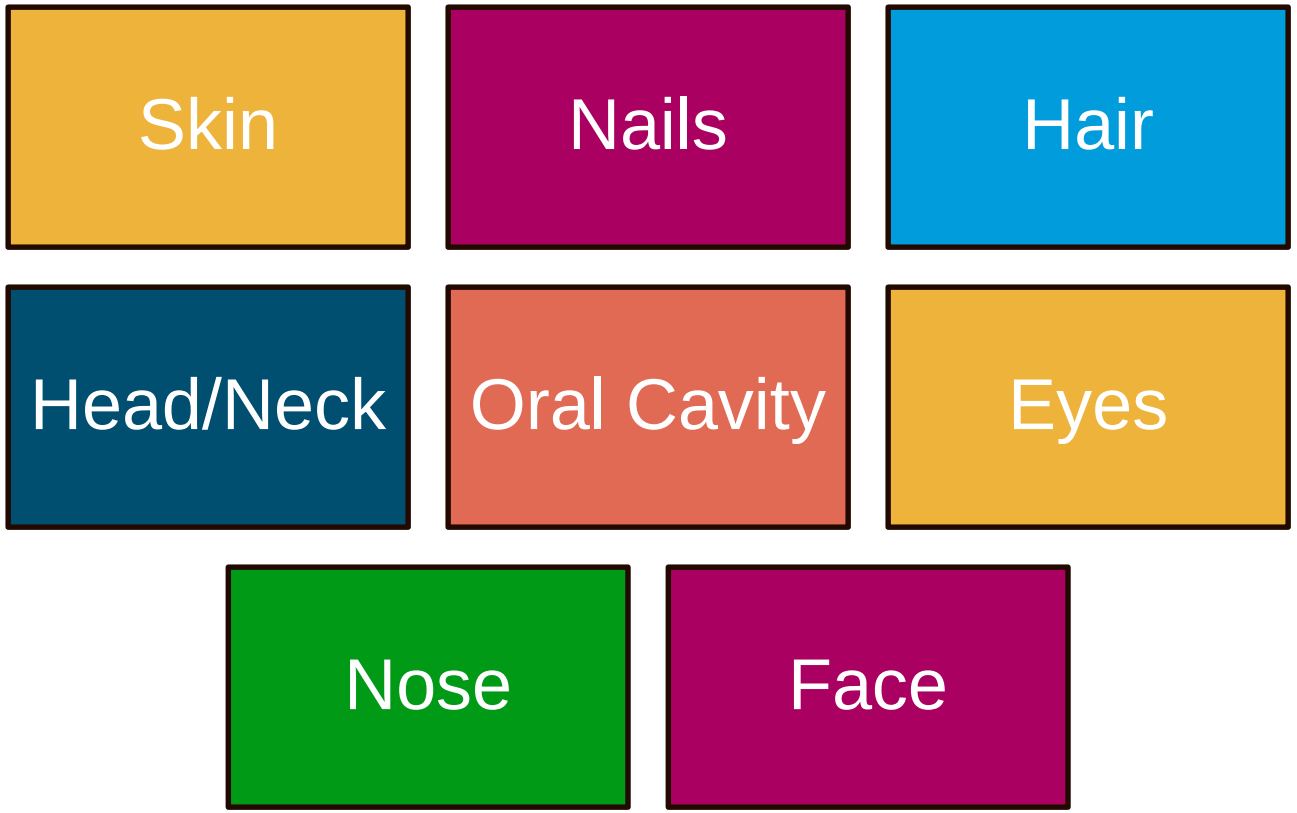
Modified from: Gropper SS, Smith JL. *Advanced Nutrition and Human Metabolism*. 6th ed. Belmont, CA: Wadsworth/Cengage Learning; 2013.

MICRONUTRIENT DEFICIENCIES PRESENT IN MANY AREAS OF THE BODY



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SKIN

- Reflect vitamin and mineral deficiencies

Assess for:

- Temperature
- Turgor
- Moisture
- Color
- Bruises
- Rashes
- Ulcers
- Hygiene

Skin is the largest organ and often shows vitamin/mineral deficiencies

Abnormalities can show up in 10-30 days due to rapid turnover of skin cell

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SKIN

Physical Signs	Possible Nutrient Deficiency
Paleness: Pallor	Iron
Poor, delayed wound healing	Protein, Zinc, Vitamins C & A
Xerosis: abnormal dryness	Vitamin A, Essential Fatty Acids
Follicular hyperkeratosis: plaque	Vitamin A, C, Essential Fatty Acids
Perifolliculitis: pigmented plaque	Vitamin C
Petechiae, ecchymosis: hemorrhagic spots on skin, membranes	Vitamins K & C
Dermatitis	Zinc, Essential Fatty Acids
Pellagrous dermatitis: hyperpigmentation on areas sun exposed	Niacin, Tryptophan
Flaky paint dermatosis: hyperpigmented patches (back of thighs, buttocks) that peel off to reveal hyper pigmented skin	Protein

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Pogatshnik C, Hamilton C. *Support Line.* 2011;33(2):7-13.

VITAMIN C DEFICIENCY

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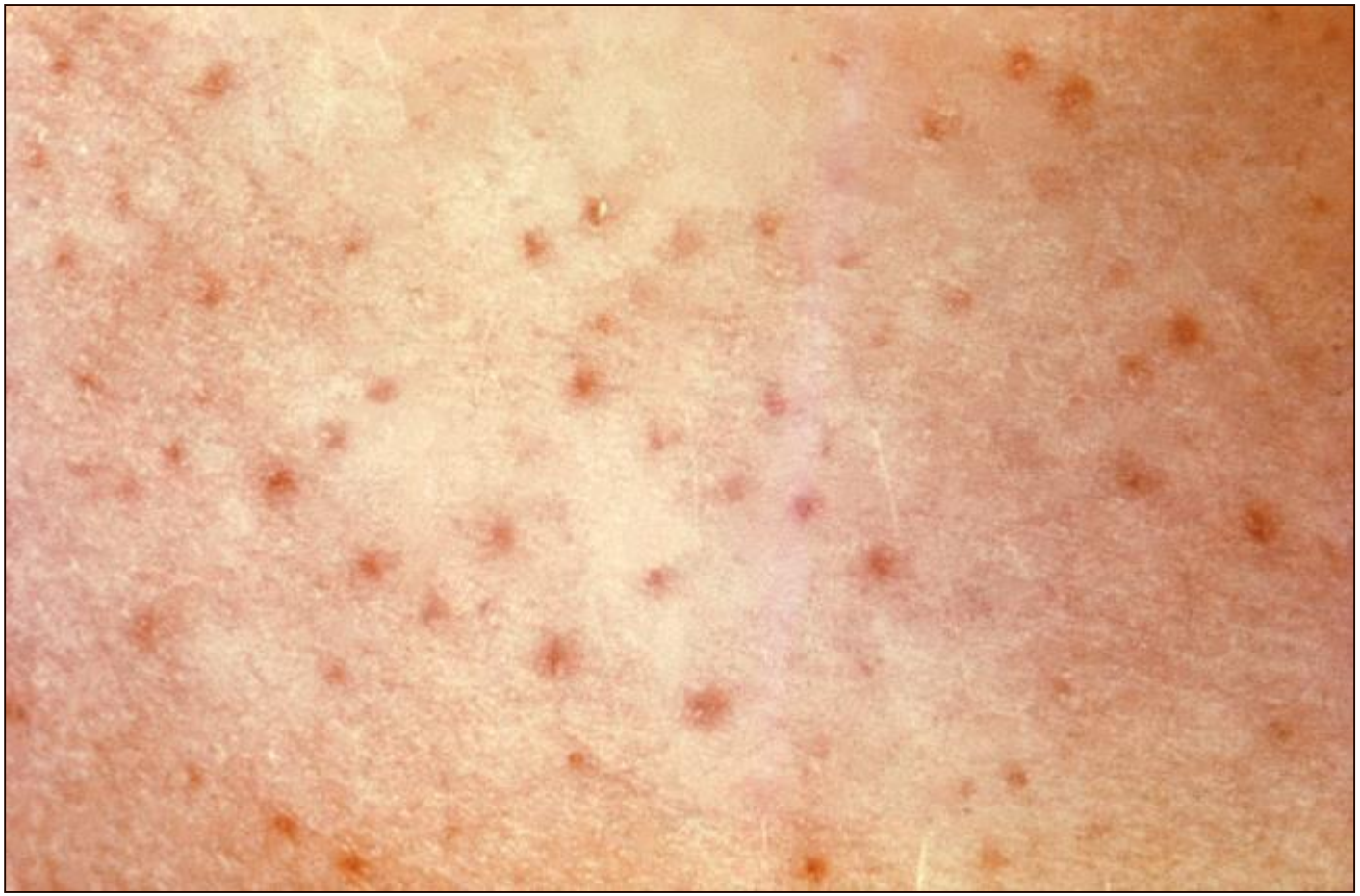
CDC Public Health Image Library. https://phil.cdc.gov.
Accessed January 5, 2021.

PERIFOLLICULAR HEMORRHAGES - SCURVY



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CDC Public Health Image Library. https://phil.cdc.gov.
Accessed January 5, 2021.

PELLAGROUS DERMATITIS – NIACIN DEFICIENCY

May also be seen with Tryptophan or vitamin B6 deficiency or those with Psoriasis or skin/chemical burns

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CDC Public Health Image Library. https://phil.cdc.gov. Accessed January 5, 2021.

FOLLICULAR HYPERKERATOSIS – VITAMIN A OR C DEFICIENCY

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CDC Public Health Image Library. https://phil.cdc.gov.
Accessed January 5, 2021.

ZINC DEFICIENCY RELATED DERMATITIS

Figure. Generalized alopecia and erythematous, scaly rash involving face and scalp.

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Maskarinec SA, Fowler Jr VG. *JAMA*. 2016;315(20):2223-2224.

ACANTHOSIS NIGRICANS – INSULIN RESISTANCE

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Dulebohn S. Acanthosis Nigricans. In: Brady MF, Rawla P. *StatPearls [Internet*]. Treasure Island (FL): StatPearls Publishing; 2020.

NAILS

- Nail plate is composed of keratin, fibrous protein, and should be firmly adherent to the nail bed, feel smooth and appear uniformly thick and symmetric

- Inspect for :

  - Color
  - Length
  - Cleanliness
  - Symmetry
  - Configuration

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NAILS

- Color or hue of nails can assess for circulation or capillary refill time
- Normal nails are translucent, with a pink hue from the complex capillary system underneath the nail plate

- To assess for refill time:
  - Palpate the nail by squeezing between thumb and forefinger
  - The nail blanches white and should return to original pinkish color almost immediately
  - Refill time is less than 3 seconds

NAILS

Physical Signs	Possible Nutrient Deficiency
Koilonychia: thin, concave nails, raised edges (spoon shaped)	Iron with or without anemia, Protein
Lackluster, dull	Protein
Mottled, pale, poor blanching	Vitamins A & C
Splinter hemorrhages: distal ends of nails, multiple	Vitamin C
Ridging, transverse: more than one extremity (Beau's lines)	Protein, Calcium
Flaky nail plates	Magnesium, Selenium

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Pogatshnik C, Hamilton C. *Support Line.* 2011;33(2):7-13.

MALNUTRITION'S EFFECTS ON NAILS

Koilonychia

Possible iron deficiency with or without anemia, protein deficiency. Also seen in patients with lupus or hypothyroidism

Splinter Hemorrhages

Possible vitamin C deficiency. Also seen in patients with trichinosis, vascular disease or bacterial endocarditis

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CDC Public Health Image Library. https://phil.cdc.gov. Accessed January 5, 2021.

MALNUTRITION'S EFFECTS ON NAILS

Muehrcke's Lines: Hypopigmentation

Possible hypoalbuminemia or chronic liver/renal disease

Beau's Lines: Horizontal Ridges

Possible severe zinc deficiency; protein deficiency; hypocalcemia or severe illness; immunosuppressive therapy

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Image credits:

1. Muehrcke's lines. *Wikemedia Commons, the free media repository.* https://commons.wikimedia.org/wiki/File:Muehrcke%27s_lines.jpg. Accessed January 5, 2021.
2. Beau's lines. *Wikemedia Commons, the free media repository.* https://commons.wikimedia.org/wiki/File:Beau%27s_line_on_left,_middle_fingernail.jpg. Accessed January 5, 2021.

HAIR

- Poor hair qualities are often associated with protein, zinc, essential fatty acid and biotin deficiencies. Hair should be shiny, smooth and resilient

Physical Signs	Possible Nutrient Deficiency
Easily plucked, thin, sparse, lackluster	Protein, Essential Fatty Acids
Alternating bands of depigmentation	Protein
Corkscrew hair, looped hair arms/leg in elderly (related to follicular hyperkeratosis)	Copper, Vitamin C (scurvy)
Depigmentation of normal hair	Protein, Copper
Hypertrichosis (a.k.a. lanugo)	Energy deficiency (anorexia and/or bulimia)
Alopecia	Zinc, Protein, Biotin

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Pogatshnik C, Hamilton C. *Support Line.* 2011;33(2):7-13.

MALNUTRITION'S EFFECTS ON HAIR

Lanugo

Calorie deficiency

Corkscrew hair

Vitamin C or copper deficiency, Menkes syndrome

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CDC Public Health Image Library. https://phil.cdc.gov. Accessed January 5, 2021.

OROFACIAL

- Exam of the face, eyes, lips and oral cavity can reveal deficiencies and correlate with findings from skin, hair and nails

	Physical Signs	Possible Nutrient Deficiency
Eyes	Night blindness, Bitot's spots, abnormal dryness in cornea, progressed to keratomalacia, or hazy, dry, softened corneas	Vitamin A
	Angular palpebritis: inflammation of lid margins/corners	B2, Niacin, B6
Mouth	Cheilosis (dry, swollen, or ulcerated lips)	B6, B2, Niacin, Severe Iron Deficiency
	Glossitis (inflammation of the tongue) possible magenta/purple color	B2, B6, B12, Niacin, Folate, Severe Iron Deficiency
	Angular stomatitis (lesions in corners of the mouth)	B2, B6, Niacin, Iron

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Pogatshnik C, Hamilton C. *Support Line.* 2011;33(2):7-13.

Vision Impairment

Nyctalopia (Night Blindness) or Blindness: Vitamin A and/or Zinc

Photophobia: Riboflavin

Conjunctiva (Eye Lid)

Conjunctival Xerosis: Vitamin A

Pale: Iron, Folate, and/or Vitamin B12

Blepharitis: Riboflavin, Vitamin B6, Biotin, and/or Zinc

Cornea

Corneal Xerosis (dull, milky or opaque) or Keratomalacia (softening): Vitamin A

Corneal Vascularization: Riboflavin

Movement

Opthalmoplegia: Thiamin

Nystagmus: Thiamin and/or Vitamin E

Sclera

Bitot's spots (foamy white spots), Dry/Dull or Rough Appearance: Vitamin A

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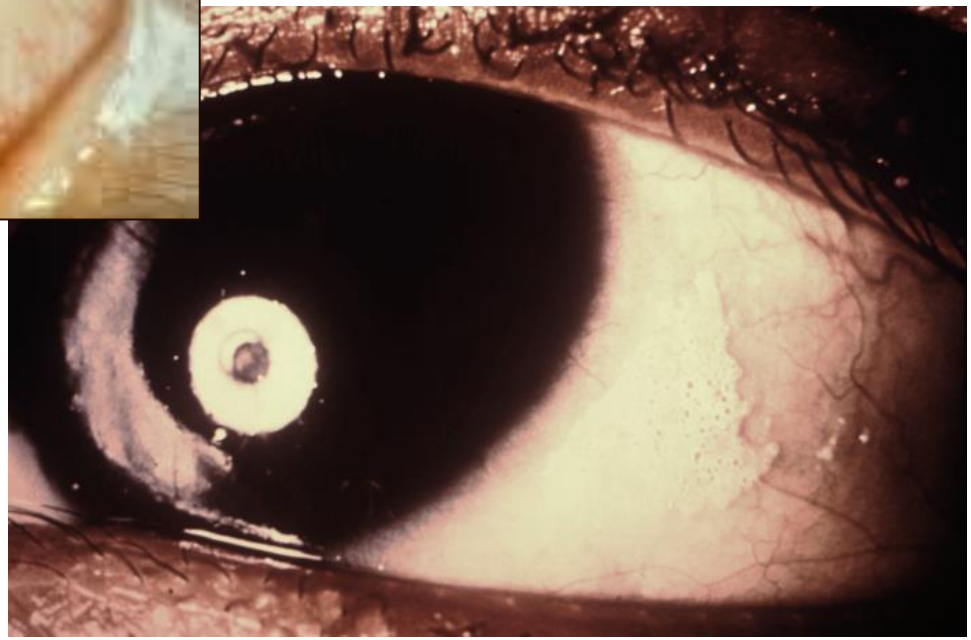
Mordarski B, Wolff J, eds. *Nutrition Focused Physical Exam Pocket Guide*. 2nd ed. Chicago, IL: Academy of Nutrition and Dietetics; 2018.

BITOT'S SPOTS – VITAMIN A DEFICIENCY



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CDC Public Health Image Library. https://phil.cdc.gov.
Accessed January 5, 2021.

Sensation

Burning:
Thiamin, Riboflavin, Vitamin B6, Vitamin B12, Folate, and/or Zinc

Texture/Appearance

Atrophic Lingual Papillae or Glossitis (smooth, slick, loss of papillae):
Riboflavin, Niacin, Vitamin B6, Vitamin B12, Folate, Biotin, Iron, and/or Vitamin C

Geographic tongue

Malamos D. Geographic tongue. *Wikemedia Commons, the free media repository.* https://commons.wikimedia.org/w/index.php?title=File:Geographic_tongue_01.JPG&oldid=464379652. Accessed January 5, 2021.

Taste

Dysguesia, Hypoguesia/ Aguesia:
Zinc

TONGUE

Color

Magenta Tongue (Beefy Red Tongue):
Riboflavin, Folate, and/or Vitamin B12

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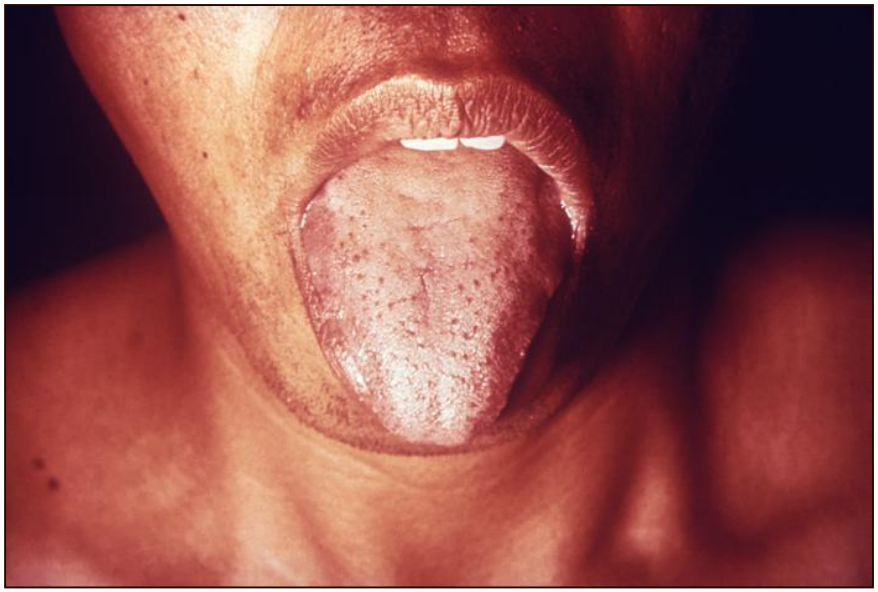
Mordarski B, Wolff J, eds. *Nutrition Focused Physical Exam Pocket Guide*. 2nd ed. Chicago, IL: Academy of Nutrition and Dietetics; 2018.

GLOSSITIS



May be related to Riboflavin, Niacin, Vitamin B6, Vitamin B12, Folate, Biotin, Iron, and/or Vitamin C

Alternative causes: Crohn's, Uremia, Trauma, Anti-cancer therapy

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CDC Public Health Image Library. https://phil.cdc.gov. Accessed January 5, 2021.

PAPILLARY HYPERTROPHY – VITAMIN A DEFICIENCY

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CDC Public Health Image Library. https://phil.cdc.gov.
Accessed January 5, 2021.

Mucosa of Mouth/Gums

Pallor: Iron, Vitamin B12, and/or Folate

Hyperemia and Edema of Pharyngeal and Oral Mucosa: Riboflavin

Dryness: Vitamin E

Bleeding, Inflammation: Vitamin C

Lips

Cheilosis, Cheilitis, or Angular Stomatitis (bilateral cracks on corners): Riboflavin, Niacin, Vitamin B6, Vitamin B12, and/or Folate

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Mordarski B, Wolff J, eds. *Nutrition Focused Physical Exam Pocket Guide*. 2nd ed. Chicago, IL: Academy of Nutrition and Dietetics; 2018.

ANGULAR STOMATITIS

Sign of riboflavin, niacin, vitamin B6, vitamin B12, iron deficiency or vitamin A toxicity

Alternative causes: dry skin, dehydration, herpes

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CDC Public Health Image Library. https://phil.cdc.gov. Accessed January 5, 2021.

MUSCULOSKELETAL

Physical Signs	Possible Nutrient Deficiency
Rickets; knock knees, bow leg	Vitamin D, Calcium, Phosphate
Epiphyseal enlargement (ends of long bones)	Vitamin D (painless) Vitamin C (painful)
Swollen, painful joints	Vitamin C
Dwarfism/Hypogonadism	Zinc

Rickets due to vitamin D deficiency

CDC Public Health Image Library. https://phil.cdc.gov. Accessed January 5, 2021.

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Pogatshnik C, Hamilton C. *Support Line.* 2011;33(2):7-13.

NEUROLOGIC

Physical Signs	Possible Nutrient Deficiency
Lower extremity motor weakness	Thiamine
Mental confusion, hyperirritability, apathy	Protein
Peripheral neuropathy: weakness, ataxia	Thiamine, B12 and B6, Copper
Tetany: lips, tongue, fingers, feet; generalized muscle aching; carpopedal, facial musculature spasm	Calcium Vitamin D
Bilateral calf tenderness	Thiamine
Dementia	Niacin, Vitamin B-12

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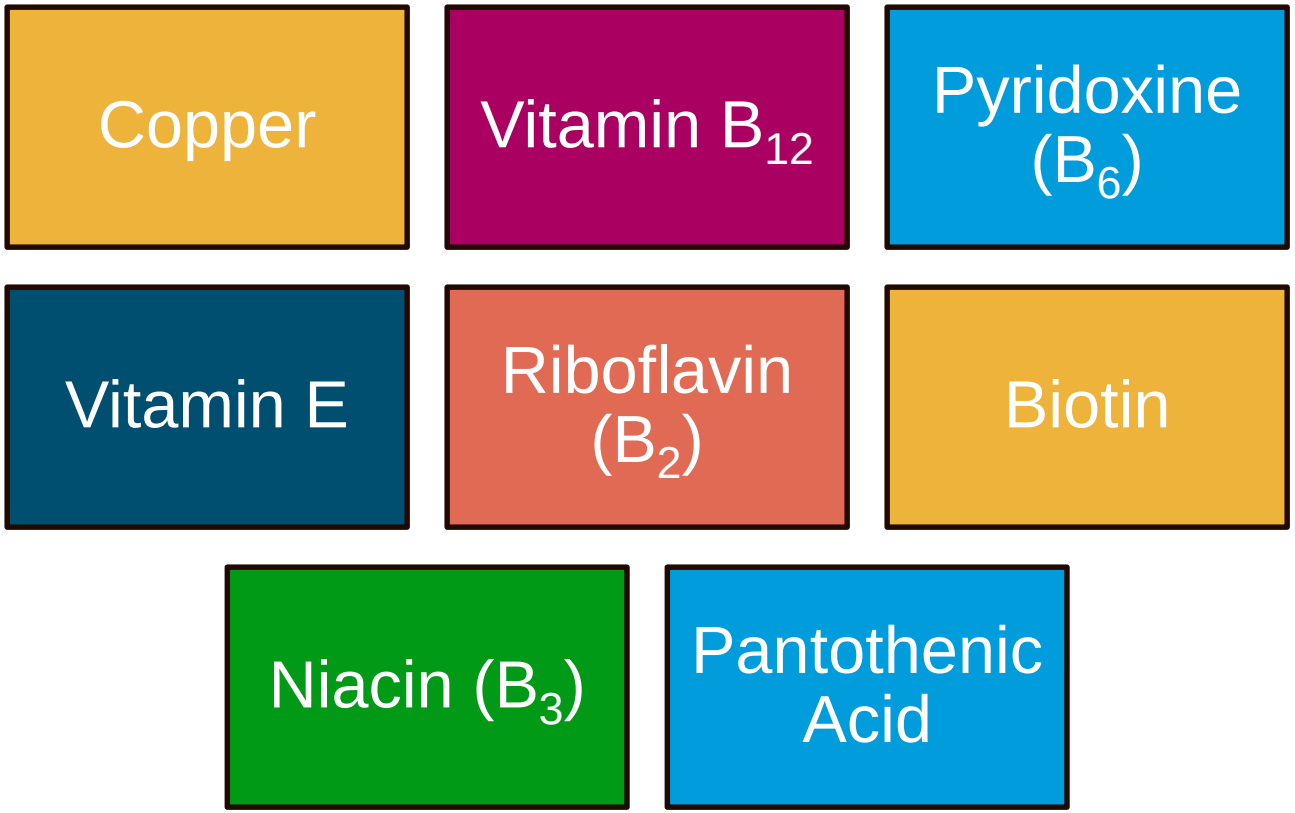
Pogatshnik C, Hamilton C. *Support Line.* 2011;33(2):7-13.

OTHER DEFICIENCIES THAT MAY RESULT IN NEUROPATHY



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MALNUTRITION INTERVENTIONS

NUTRITION SUPPORT IS ASSOCIATED WITH POSITIVE PATIENT OUTCOMES

- 27 studies with 6803 participants with malnutrition or at-risk for malnutrition
  - 5 studies were published between 2015-2019 (Included NOURISH (n=652) and EFFORT (n=2,028))
- Results: Nutritional support when compared with no support was associated with:
  - ↓ **mortality** (8.3% vs. 11.0%, OR: 0.73 (95%CI, 0.56-0.97) *P*=0.03).
  - ↓ **hospital readmissions** (14.7% vs. 18.0%, OR: 0.76 (95%CI, 0.60-0.96) *P*=0.02)
  - ↑ **protein intake** during hospital admission (1618 kcal vs. 1331 kcal, P<0.00001)
  - ↑ **energy intake** during hospital admission (59g vs. 48g, P<0.00001)
  - ↑ **body weight** (+0.63kg vs. -0.19kg, P=0.0004)
  - No difference in infection rates, LOS, or functional outcome.

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NOURISH: Nutrition Effect on Unplanned Readmissions and Survival in Hospitalized Patients
EFFORT: Effect of early nutritional support on Frailty, Functional Outcomes, and Recovery of malnourished medical inpatients Trial
Gomes F, et al. *JAMA Netw Open.* 2019;2(11):e1915138.

MANAGING MALNUTRITION THROUGHOUT THE CONTINUUM OF CARE

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STATE OF THE NUTRITION CARE PROCESS IN US HOSPITALS

	N	(%)
Patients admitted	107,106	100
Patients screened of those admitted	96,377	89.98
Patients identified as at-risk for malnutrition of those screened	27,691	28.73
Of those identified as at-risk for malnutrition, those receiving oral nutrition supplement order	18,507	66.83
Of those identified as at-risk for malnutrition, those with a RDN consult	17,370	62.73
Of those identified as at-risk for malnutrition, those with a malnutrition diagnosis	3,977	14.36
Of those identified as at-risk for malnutrition, those with a discharge recommendation/prescription for oral nutrition supplement	2,467	8.91

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Sherry CL, et al. *Curr Dev Nutr.* 2017;1(11):e001297.

QUALITY IMPROVEMENT STUDY EXAMPLE

Study Design
Multi-site, 2-group, pre-post QIP study

Patient Population
(N=1269*; 45.2% at risk for malnutrition)

- Older adults; mean age of 66.6 ± 17.2 years
- Most were white/Caucasian (70.4%)
- Admitted for a primary medical diagnosis (77.3%)

Study Scheme

Two hospitals implemented a QIP-basic program—QIP-b	Two hospitals implemented a QIP-enhanced program—QIP-e

Study Hypothesis:

- Nutrition-focused QIP **will decrease 30-day readmission rate** compared with existing ONS protocol in patients at risk/malnourished

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*2,808 patients were screened with 1,269 patients enrolled.
Quality Improvement Program-basic (QIP-b), Quality Improvement Program-enhanced (QIP-e)
Sriram K, et al. *JPEN J Parenter Enteral Nutr*. 2017;41(3):384-391.

DIFFERENCES BETWEEN BASELINE, QIP-E AND QIP-B PROTOCOLS

	Pre-QIP	QIP-b	QIP-e
MST is a part of EMR	-	√	√
RN completes MST	-	√	√
ONS selection via automatic drop-down menu by RN	-	-	√
ONS ordered by MD, RN, or RD	√	√	√
RD consultation	√	√	√
Time to RD consultation: <24 hours	-	-	√
Time to ONS delivery (in hours)	-	24 – 48 h	1 – 24 h
Discharge planning instructions	√	√	√
Discharge materials including coupons and literature	-	-	√
Standard post-discharge phone calls (24-72 hours)	-	√	√*
Nutrition-focused post-discharge phone calls (N=4)	-	-	√*

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Sriram K, et al. *JPEN J Parenter Enteral Nutr*. 2017;41(3):384-391.

MST=Malnutrition Screening Tool
EMR=Electronic Medical Record
*Nutrition-focused questions were incorporated in the standard post-discharge phone calls.

QIP ACHIEVED REDUCTIONS IN READMISSIONS & LOS

REDUCTION IN READMISSIONS AND LENGTH OF STAY (LOS)

	Pre-QIP	QIP-Basic	QIP-Enhanced
	Readmission Rate: 22%; Length of Stay: 7.2 days	Reduction in Readmission Rate: 25.8%; Reduction in LOS 25% (1.8 days)	Reduction in Readmission Rate: 29.4%; Reduction in LOS 26.4% (1.9 days)
SCREENING	Non-validated screening tool	Validated screening tool (MST) integrated into EMR	Validated screening tool (MST) integrated into EMR
INTERVENTION	No early intervention	ONS intervention within 24-48 hours	ONS intervention within 24 hours
EDUCATION	No formalized nutrition discharge education	No formalized nutrition discharge education	Formal nutrition discharge education with coupons
POST-DISCHARGE	Follow up post-discharge phone calls	Follow up post-discharge phone calls	Post-discharge phone calls Assessed ONS adherence

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Data from QIP-e intervention, percentage expressed as relative risk reduction (RRR) compared to pre-QIP.
Sriram K, et al. *JPEN J Parenter Enteral Nutr*. 2017;41(3):384-391.

QIP-E PROGRAMS REDUCED READMISSIONS, LOS, AND COSTS[1,2]

All-cause 30-day Readmissions[1]

-29%*

QIP-e, including ONS therapy, reduced **all cause 30-day readmission rates** by 29% vs pre-QIP

Length of Hospital Stay[1]

-26%*

QIP-e, including ONS therapy, reduced **length of hospital stay** by 26% (1.9 [± 3.6] days) vs pre-QIP

Costs[2]

Estimated 6-Month Savings:

$4,896,758

A Healthcare Quality Outcomes Study that included interventions with Abbott Nutrition formulary for the QIP hospitals during a 6-month period **reduced healthcare costs from avoided readmissions and reduced LOS†**

*Data from QIP-e intervention, percentage expressed as relative risk reduction (RRR) compared to pre-QIP.
†Data from baseline comparison cohort: 6-month hospital savings for the 4 QIP hospitals was $5,452,309 (when QIP program cost is subtracted).

1. Sriram K, et al. *JPEN J Parenter Enteral Nutr*. 2017;41(3):384-391.
2. Sulo S, et al. *Am Health Drug Benefits.* 2017;10(5):262-270.

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3 STEPS FOR ADDRESSING MALNUTRITION:

1. Recognize and Assess
   - All patients at risk of loss of lean body mass

2. Rapidly Implement Nutrition Interventions
   - Nutritional supplements, amino acids, bioactive metabolites; and continue to monitor patient

3. Develop a Discharge Plan
   - For ongoing patient nutrition care and intervention

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THINGS TO CONSIDER

- Those at high risk may not be malnourished
- Signs of malnourishment may be present in those who aren't malnourished
  - 80-90 year old patient who habitually consumes “less than recommended calories” and maintains a stable weight and able to function well[1]
  - Weight loss in patients with various forms of nerve injury/muscular dystrophy who are consuming adequate nutrition[1]
- Context important!
  - Assess whole patient
  - Watch trends
- Frequent re-assessment key, especially when patient is changing clinically
- Lots of practice helps

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White JV, et al. *J Acad Nutr Diet.* 2012;36:275-283.

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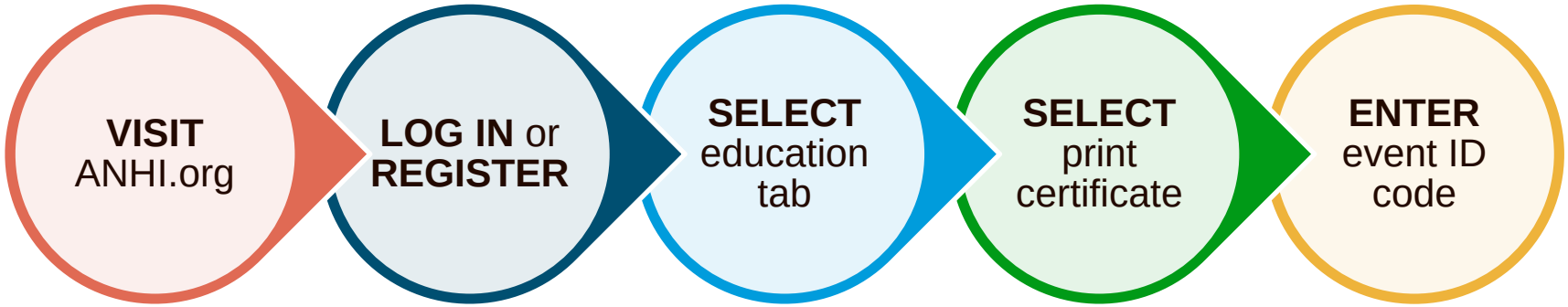

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THANK YOU,

QUESTIONS?