Key Approaches to Diagnosing Malnutrition

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Objectives

• Describe the importance of proper diagnosis of malnutrition in the hospital setting.

• Describe the three key malnutrition diagnostic approaches highlighting their similarities and differences.
  • Subjective Global Assessment
  • The Academy of Nutrition and Dietetics/The American Society for Parenteral and Enteral Nutrition Malnutrition Consensus
  • GLIM: the Global Leadership Initiative in Malnutrition Malnutrition Consensus
Historical Look at Malnutrition

PERCENTAGE OF WEIGHT LOSS: BASIC INDICATOR OF SURGICAL RISK IN PATIENTS WITH CHRONIC PEPTIC ULCER

HIRAM O. STUDLEY

The Skeleton in the Hospital Closet

As awareness of the role of nutrition in recovery from disease increases, physicians are becoming alarmed by the frequency with which patients in our hospitals are being malnourished and even starved. One authority regards physician-induced malnutrition as one of the most serious nutritional problems of our time.

by CHARLES E. BUTTERWORTH, JR., M.D.

In recent years there has been growing concern over the rapidly increasing costs of hospitalization. In 1968, for example, short- and long-term hospital care costs were $10,793,600,000 in a total national health expenditure of $37,563,000,000, according to the Office of Research and Statistics of the Social Security Administration. Obese individuals are a case in point, and the inevitable consequences of the neglect of nutrition education in our medical schools. While the principles of good nutrition are practiced in some institutions and by some individuals, this seems to be the exception rather than the rule. It is, therefore, illusory for either the public or the medical fraternity to assume that good nutri-
Malnutrition Remains an Issue Today

Malnutrition continues to go unrecognized and untreated in many hospitalized patients.

“The key is to systematically identify patients who are malnourished or at risk and to promptly intervene.”
Malnutrition and Patient Outcomes

- Results from the Nutrition Day Survey 2010
- Study of 3122 participants from 56 hospitals in Australia and New Zealand
  Controlled for disease severity and non-nutritional factors
  - Phase 1: SGA and 24-h food intake
  - Phase 2: LOS, readmissions and in-hospital mortality at 90-d

Agarwal E et al, Clin Nutr 2013;32:737-45
Malnutrition and Impact on Patient Outcomes

• Despite having the same disease severity, malnourished patients had poorer outcomes
  • Significantly increased LOS (15d versus 10d)
  • Increased readmission rates (23% versus 18%)
  • 2X greater risk of 90d mortality

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Agarwal E et al, Clin Nutr 2013;32:737-45
Malnutrition in the ICU Impacts Outcomes

- Observational study in medical and surgical ICU’s
  - 2005 to 2011 (n=1361)
- RD malnutrition assessment
- Protein-energy malnutrition
  - 3.1 OR of 90-day mortality (95% CI, 1.89-4.92; p<0.001)

Havens JM. JPEN 2016; 42:156-163

<table>
<thead>
<tr>
<th>Variable</th>
<th>Malnutrition Absent</th>
<th>Nonspecific Malnutrition</th>
<th>Protein-Energy Malnutrition</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality rates, %</td>
<td>6.8</td>
<td>10.8</td>
<td>18.7</td>
<td>.001</td>
</tr>
<tr>
<td>In-hospital</td>
<td>13.1</td>
<td>18.6</td>
<td>31.8</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>90-day</td>
<td>25.6</td>
<td>29.3</td>
<td>48.6</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>365-day</td>
<td>18.7</td>
<td>17.8</td>
<td>28.7</td>
<td>.048</td>
</tr>
<tr>
<td>30-Day readmission rate, %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Malnutrition and Outcomes – Observational Data

<table>
<thead>
<tr>
<th>Author/Population</th>
<th>Study Design</th>
<th>Readmission</th>
<th>Mortality</th>
</tr>
</thead>
</table>
| Hiller
Hospitalized veterans (n=404) | Retrospective-case control | 30 day
31% vs 12%
3.4 times more likely to be readmitted | 90 day
32% vs 8%
5.5 times more likely to die |
| Mosquera*
GI surgical/oncology (n=490) | Retrospective review | Not significant | Not significant |
| Hudson
All hospitalized patients (n=3907) | Retrospective review | 30 day
40% vs 23%
2 times more likely to be readmitted | In-hospital
8% vs 5%
1.5 times more likely to die |
| Ceniccola
ICU patients (n=327) | Cross sectional | N/A | 2.37 times more likely to die |
| Hiura
Medical/surgical ICU patients (n=5605) | Retrospective cohort | N/A | 2.78 times more likely to die if severely malnourished |

Malnutrition Assessment Methodologies
Subjective Global Assessment

• Developed in the late 1980’s, this was a significant variation on the prevailing nutrition assessment methodology

What is Subjective Global Assessment of Nutritional Status?


From the Departments of Health Administration and Medicine, University of Toronto, the Department of Nutrition, Ryerson Polytechnical Institute, the Divisions of General Internal Medicine and Clinical Epidemiology and Gastroenterology, Toronto General Hospital, and the Division of Gastroenterology, Toronto Western Hospital, and St. Michael’s Hospital, Toronto, Canada
Subjective Global Assessment

• SGA provides a global overview of the patient with respect to nutrition

• Domains
  • Nutrient intake
  • Weight loss
  • Symptoms
  • Functional capacity
  • Metabolic requirement
  • Physical exam
Domains of SGA

**Nutrient Intake**
- Adequate: No change
- Inadequate: suboptimal solids, full fluids or minimal intake

**Weight Loss**
- <5%; between 5% and 10% or >10%
- Weight loss in the last two weeks

**Symptoms**
- Pain, anorexia, nausea, vomiting, diarrhea
- Dental issues, dysphagia, early satiety
Domains of SGA

- **Function**
  - No dysfunction
  - Reduced capacity: difficulty with activities of daily living; chair or bed-ridden

- **Metabolic**
  - High metabolic requirement
  - Yes or No

- **Physical Assessment**
  - Loss of body fat and muscle
  - Presence of edema
SGA Rating

- SGA: A
  - Well nourished
  - Normal

- SGA B
  - Mildly to moderately malnourished

- SGA: C
  - Severely malnourished
Malnutrition Assessment – Academy/ASPEN
Malnutrition Characteristics

Consensus Statement

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)

Jane V. White, PhD, RD, FADA¹; Peggi Guenter, PhD, RN²;
Gordon Jensen, MD, PhD, FASPEN³; Ainsley Malone, MS, RD, CNSC⁴;
Marsha Schofield, MS, RD⁵; the Academy Malnutrition Work Group;
the A.S.P.E.N. Malnutrition Task Force; and the A.S.P.E.N. Board of Directors

White J. JPEN 2012; 36:275-283
Etiology Based Malnutrition Definitions

Nutritional Risk Identified
- Compromised intake or loss of body mass

Inflammation Present? No / Yes

No
- Stavation-Related Malnutrition
  (cure chronic starvation, anorexia nervosa)

Yes
- Mild to Moderate Degree
- Chronic Disease-Related Malnutrition
  (organ failure, pancreatic cancer, rheumatoid arthritis, sarcopenic obesity)
- Marked Inflammatory Response
- Acute Disease or Injury-Related Malnutrition
  (major infection, burns, trauma, closed head injury)

Jensen GL. JPEN 2009;33:710
Academy/ASPEN Consensus Malnutrition Characteristics

The presence of **two or more** necessary for the diagnosis of malnutrition

- Unintentional weight loss
- Evidence of inadequate intake
- Loss of muscle mass
- Loss of subcutaneous fat
- Fluid accumulation
- Reduced hand grip strength

White JA. JPEN 2012; 36:275-283
# Severe Malnutrition in Adults

**For Example:**

ICD-10 Code E43

**Acute Illness/Injury**

<table>
<thead>
<tr>
<th>Weight Loss</th>
<th>&gt;2%/1 week</th>
<th>&gt;5%/1 month</th>
<th>&gt;7.5%/3 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Intake</td>
<td>≤ 50% for ≥ 5 days</td>
<td>≤75% for ≥ 1 month</td>
<td>≤ 50% for ≥ 1 month</td>
</tr>
<tr>
<td>Body Fat</td>
<td>Moderate Depletion</td>
<td>Severe Depletion</td>
<td>Severe Depletion</td>
</tr>
<tr>
<td>Muscle Mass</td>
<td>Moderate Depletion</td>
<td>Severe Depletion</td>
<td>Severe Depletion</td>
</tr>
<tr>
<td>Fluid Accumulation</td>
<td>Moderate → Severe</td>
<td>Severe</td>
<td>Severe</td>
</tr>
<tr>
<td>Grip Strength</td>
<td>Not Recommended in ICU</td>
<td>Reduced for Age/Gender</td>
<td>Reduced for Age/Gender</td>
</tr>
</tbody>
</table>

**Chronic Illness**

<table>
<thead>
<tr>
<th>Weight Loss</th>
<th>&gt;5%/1 month</th>
<th>&gt;7.5%/3 months</th>
<th>&gt;10%/6 months</th>
<th>&gt; 20%/1 year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Intake</td>
<td>≤ 50% for ≥ 1 month</td>
<td>≤75% for ≥ 1 month</td>
<td>≤ 50% for ≥ 1 month</td>
<td></td>
</tr>
<tr>
<td>Body Fat</td>
<td>Moderate Depletion</td>
<td>Severe Depletion</td>
<td>Severe Depletion</td>
<td></td>
</tr>
<tr>
<td>Muscle Mass</td>
<td>Moderate Depletion</td>
<td>Severe Depletion</td>
<td>Severe Depletion</td>
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<td>Moderate → Severe</td>
<td>Severe</td>
<td>Severe</td>
<td></td>
</tr>
<tr>
<td>Grip Strength</td>
<td>Not Recommended in ICU</td>
<td>Reduced for Age/Gender</td>
<td>Reduced for Age/Gender</td>
<td></td>
</tr>
</tbody>
</table>

**Social/Environmental**

<table>
<thead>
<tr>
<th>Weight Loss</th>
<th>&gt;5%/1 month</th>
<th>&gt;7.5%/3 months</th>
<th>&gt;10%/6 months</th>
<th>&gt; 20%/1 year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Intake</td>
<td>≤ 50% for ≥ 1 month</td>
<td>≤75% for ≥ 1 month</td>
<td>≤ 50% for ≥ 1 month</td>
<td></td>
</tr>
<tr>
<td>Body Fat</td>
<td>Moderate Depletion</td>
<td>Severe Depletion</td>
<td>Severe Depletion</td>
<td></td>
</tr>
<tr>
<td>Muscle Mass</td>
<td>Moderate Depletion</td>
<td>Severe Depletion</td>
<td>Severe Depletion</td>
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</tr>
<tr>
<td>Fluid Accumulation</td>
<td>Moderate → Severe</td>
<td>Severe</td>
<td>Severe</td>
<td></td>
</tr>
<tr>
<td>Grip Strength</td>
<td>Not Recommended in ICU</td>
<td>Reduced for Age/Gender</td>
<td>Reduced for Age/Gender</td>
<td></td>
</tr>
</tbody>
</table>

White J. J Acad Nutr Diet. 2012;112(5): 730-738
Non-Severe Malnutrition in Adults

<table>
<thead>
<tr>
<th>For Example: ICD-10 Code E44</th>
<th>Acute Illness/Injury</th>
<th>Chronic Illness</th>
<th>Social/Environmental</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weight Loss</strong></td>
<td>1-2%/1 week</td>
<td>5%/1 month</td>
<td>5%/1 month</td>
</tr>
<tr>
<td></td>
<td>5%/1 month</td>
<td>7.5%/3 months</td>
<td>7.5%/3 months</td>
</tr>
<tr>
<td></td>
<td>7.5%/3 months</td>
<td>10%/6 months</td>
<td>10%/6 months</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20%/1 year</td>
<td>20%/1 year</td>
</tr>
<tr>
<td><strong>Energy Intake</strong></td>
<td>&lt; 75% for &gt; 7 days</td>
<td>&lt; 75% for &gt; 1 month</td>
<td>&lt; 75% for &gt; 3 months</td>
</tr>
<tr>
<td><strong>Body Fat</strong></td>
<td>Mild Depletion</td>
<td>Mild Depletion</td>
<td>Mild Depletion</td>
</tr>
<tr>
<td><strong>Muscle Mass</strong></td>
<td>Mild Depletion</td>
<td>Mild Depletion</td>
<td>Mild Depletion</td>
</tr>
<tr>
<td><strong>Fluid Accumulation</strong></td>
<td>Mild</td>
<td>Mild</td>
<td>Mild</td>
</tr>
<tr>
<td><strong>Grip Strength</strong></td>
<td>Not Applicable</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

White J. J Acad Nutr Diet. 2012;112(5): 730-738
GLIM criteria for the diagnosis of malnutrition — A consensus report from the global clinical nutrition community

T. Cederholm a, b, 1, G.L. Jensen c, 1, M.I.T.D. Correa e, 2, M.C. Gonzalez f, R. Fukushima g, T. Higashihiguchi h, G. Baptista i, R. Barazzoni i, R. Blaauw i, A. Coats j, 2, A. Crivelli j, 2, D.C. Evans k, L. Gramlich l, V. Fuchs-Tarlovsky m, H. Keller n, L. Llido i, A. Malone n, 4, K.M. Mogensen j, 4, J.E. Morley o, M. Mucenski o, J. Nyuladi p, M. Pirlieh q, V. Pincasert q, M.A.E. de van der Schueren r, s, t, S. Silharm u, P. Singer v, w, x, K. Tappesden y, z, N. Velasco y, 1, D. Wauters y, z, P. Yamwong y, z, J. Xu y, z, A. Van Gossum 2, 1, C. Compher 2, 1, GLIM Core Leadership Committee, GIUM Working Group 2, 1
How Were the Criteria Selected?

| Table 1. Survey of Existing Approaches Used in Screening and Assessment of Malnutrition and Cachexia. |
|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| Etiologies                                      | Etiologies                                      | Etiologies                                      | Etiologies                                      | Etiologies                                      | Etiologies                                      | Etiologies                                      | Etiologies                                      | Etiologies                                      | Etiologies                                      | Etiologies                                      | Etiologies                                      |
| Reduced food intake                            | Disease burden/inflammation                     | Anorexia                                        | Weakness                                        | Signs/phenotype                                 | Weight loss                                     | Body mass index                                 | Lean/fat-free                                   | mass/muscle mass                                | Fat mass                                        | Fluid                                          | retention/ascites                               | Muscle function (e.g., grip strength)          | Biochemistry                                   
| X                                               | X                                               | X                                              | X                                              | X                                               | X                                               | X                                               | X                                               | X                                               | X                                               | X                                               | X                                               | X                                               | X                                               | X                                               |


GLIM Malnutrition Diagnosis Pathway

Step 1
• Screening of malnutrition risk using available standard validated tools

Step 2
• Nutritional assessment and severity classification
## GLIM Malnutrition Diagnosis

### Phenotypic Criteria

<table>
<thead>
<tr>
<th>Weight Loss (%)</th>
<th>&gt;5% within past 6 months</th>
<th>&gt;10% beyond 6 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Mass Index</td>
<td>&lt;20 if &gt; 70 years</td>
<td>&lt;20 if &gt;/= 70 years</td>
</tr>
<tr>
<td>Muscle Mass</td>
<td>Reduced</td>
<td></td>
</tr>
</tbody>
</table>

### Etiologic Criteria

<table>
<thead>
<tr>
<th>Food Intake or Assimilation</th>
<th>Ingestion &lt;=50% ER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Any reduction for &gt; 2 weeks</td>
</tr>
<tr>
<td></td>
<td>Any chronic GI condition that adversely impacts food assimilation or absorption</td>
</tr>
</tbody>
</table>

| Inflammation | Presence or acute disease/injury or chronic disease related |

### Malnutrition: One criterion from each category

**BMI: Worldwide**
- < 20 kg/m² if < 70 years
- < 22 kg/m² if ≥ 70 years

**BMI: Asian**
- < 18.5 kg/m² if < 70 years
- < 20 kg/m² if ≥ 70 years

ER – Estimated requirements
GI - Gastrointestinal
## GLIM Severity Thresholds

<table>
<thead>
<tr>
<th>Variable</th>
<th>Weight. Loss</th>
<th>BMI</th>
<th>Muscle Mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate threshold</td>
<td>5%-10% within 6 months</td>
<td>&lt;20 if &lt; 70 years</td>
<td>Mild to moderate deficit (assessed by validated method)</td>
</tr>
<tr>
<td></td>
<td>10%-20% beyond 6 months</td>
<td>&lt;22 if &gt;/= 70 years</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mild to moderate deficit (assessed by validated method)</td>
</tr>
<tr>
<td>Severe threshold</td>
<td>&gt;10% within 6 months</td>
<td>&lt;18.5 if &lt; 70 years</td>
<td>Severe (assessed by validated method)</td>
</tr>
<tr>
<td></td>
<td>&gt;20% beyond 6 months</td>
<td>&lt;22 if &gt;/= 70 years</td>
<td></td>
</tr>
</tbody>
</table>

*Note: BMI thresholds and methods for assessing muscle mass are specified for different age groups.*
Reduced Muscle Mass

- Current GLIM Body Composition Working Group
  - Practical measure for assessment
- DEXA
- Other body composition techniques
  - Bioelectrical impedance
  - CT scan
  - Ultrasound
- Anthropometry
  - Calf or arm muscle circumference
- Physical assessment - NFPE
Reduced Food Intake or Assimilation

- Consider GI symptoms that impact food intake or absorption
  - Dysphagia, nausea, vomiting, diarrhea, constipation or abdominal pain
- Presence of malabsorptive disorders
  - Intestinal failure (SBS)
  - Pancreatic insufficiency
  - Post operative bariatric surgery
- Other clinical situations
  - Esophageal strictures, gastroparesis, enterocutaneous fistula and intestinal pseudo-obstruction
Key Message Points with GLIM

• Adoption of a global consensus on criteria for malnutrition diagnosis
• Does not exclude the use of other nutritional assessment tools to guide individualized care and treatment
• Phenotypic and etiologic criteria were derived from commonly used screening and nutritional assessment tools
• Prospective or retrospective cohort studies to validate its relevance in clinical practice
Etiology and Variables
The Inflammatory Response - Acute

Acute Inflammatory Response → Release of Cytokines

- Release of Acute Phase Proteins
  - \( \uparrow \) Catabolism
  - \( \downarrow \) Synthesis

  - High CRP
  - \( \uparrow \) REE
  - Negative Nitrogen Balance
Chronic Disease – Mild to Moderate Inflammatory Response

- Cardiovascular disease
- Celiac disease
- Chronic pancreatitis
- Chronic obstructive pulmonary disease
- Congestive heart failure
- Cystic fibrosis
- Dementia
- Diabetes mellitus
- Inflammatory bowel disease

- Hematologic malignancies
- Metabolic syndrome
- Neuromuscular disease
- Obesity
- Organ failure/transplant (kidney, liver, heart, lung or gut)
- Pressure wounds
- Rheumatoid arthritis
- Solid tumors
Laboratory Parameters - Inflammation

- ↓’d serum albumin
- ↓’d serum transferrin
- ↓’d serum prealbumin
- Elevated C-reactive protein (↓’d in liver failure)
- Elevated blood glucose
- ↓’d or increased white blood cell count
- ↑’d percentage of neutrophils in the CBC
- ↓’d platelet count
- Marked negative nitrogen balance
Clinical Parameters - Inflammation

- Fever
- Hypothermia
- Presence of infection
- Urinary tract infection
- Pneumonia
- Blood stream infection
- Wound or incisional infection
- Abscess

Jevnn A. ASPEN. Adult Core Curriculum, 3rd ed 2017;185-212
Acute Disease/Injury – Severe Inflammatory Response

- Adult respiratory distress syndrome
- Closed head injury
- Critical illness
- Major abdominal surgery
- Major infection/sepsis
- Multi-trauma
- Systemic inflammatory response syndrome
- Severe burns
- Severe acute pancreatitis

Inadequate Energy Intake

• Diet Intake
  - Directly from patient and/or family
  - Diet history/24 hour recall/3 day recall
    • Less than half of your meals
    • Less than 75% of your meals

• Meal assessment – during hospitalization
  - Categorized by % - 100, 75, 50, 25, 0

• Nutrition intervention during hospital course

• Estimating requirements
  - Indirect calorimetry or predictive equations

• Compare actual intake with requirements
Unintentional Weight Loss

• Unintended weight loss is a well-validated indicator of malnutrition
• Frequent weighing is preferred standard
• Factors that interfere with weight accuracy
  – Underlying disease state
  – Fluid status
  – Equipment malfunction / human error
  – Errors in recall

Jevenn A. ASPEN. Adult Core Curriculum, 3rd ed 2017;185-212
Unintentional Weight Loss

- Usual weight should be used to determine percent of weight loss over time
- Bed scale vs. standing measurement
- Follow weight patterns
- Estimate dry weight (consider height, previous history, intake status)

Loss of Subcutaneous Fat and Muscle

**Tools to Assess Body Composition**

- Anthropometric Measurements
  - Skinfolds, circumference
- Bioelectrical impedance
- Dual-energy x-ray absorptiometry
- Physical Exam-
Nutrition-Focused Physical Exam

• Exam which uses physical assessment findings to help determine nutritional status and diagnose malnutrition
• Systematic approach (head-to-toe)
• Components
  – Observation and palpation techniques
  – Confer findings with patient
  – Opportunities to assess for macronutrient and micronutrient losses and deficiencies
• In the US, the NFPE is now a standard of practice for RDs
NFPE – Muscle and Fat Loss
Assessing Fluid Accumulation

- Chart review - disease process
- Intake/Output records
- Weight
- Physical exam - edema
- Ascites - check history, imaging studies
- Masks body compartment assessment (fat, muscle, weight)
- Use with caution when determining degree of malnutrition!
Functional Markers

• Hand-grip strength – validated proxy for lean body mass\(^1\)
• Independent predictor of poor nutrition status\(^2\)
• Consider non-malnutrition causes
  • neuromuscular diseases, medication, age-related, trauma, activity/immobility
• Correlate with other characteristics
• Overall energy, strength, endurance
• Ability to perform activities of daily living
• Ability to wean from mechanical ventilation

Why Not Serum Albumin/Visceral Proteins?

- Body down regulates albumin synthesis so that needed proteins for immune, clotting, and wound healing functions can be made
- Positive - antibodies, complement, C-reactive protein, and fibrinogen
- Negative - albumin, transferrin, prealbumin, retinol binding protein
- Malnourished individuals (pure semi-starvation) likely will exhibit normal visceral proteins (anorexia nervosa)
- Any degree of inflammation will down-regulate visceral protein synthesis

Jensen GL. JPEN 2009;33:710
Malnutrition Methodologies

SGA

GLIM

Academy
ASPEN
Importance of Diagnosing Malnutrition

- Malnutrition will always exist with presence of disease
- Bottom line to identify presence and degree of malnutrition
- Will guide intervention approaches
- Proper diagnosis is essential to reflect patient acuity
- Identify methodology that can work within your capacities
Thank You!

ainsleym@nutritioncare.org