



# Clinical Handbook With Practice Tools



Feed Patients Right.  
Feed Patients Now.





## feedM.E.: MALNUTRITION AWARENESS AND EDUCATION

The content in this handbook and practice tools has been reviewed and endorsed by international nutrition experts and groups. Together we are committed to increasing awareness of nutrition in healthcare and taking action against malnutrition.

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## INTRODUCTION: WHAT IS feedM.E.?

**feedM.E.** is a malnutrition awareness and medical education program developed as a call to action for improved identification and treatment of malnutrition in hospital settings and in the community. To ensure that the **feedM.E.** program is up-to-date and relevant to contemporary care around the world, materials have been developed, reviewed, and edited by an international team of nutrition experts.

The **feedM.E.** Handbook is for educators and clinicians who are responsible for care of patients in intensive care units (ICUs), in hospital wards, and in the community. It is intended as the bridge from nutrition guidelines and policies to everyday practice. In this Handbook, we provide tools to promote good nutrition care, and we offer strategies for benchmarking and fine-tuning nutrition practices.

To get started, we recommend a logical and stepwise approach to quality improvement in hospital and community nutrition:<sup>1, 2</sup>

- Build a culture that values nutrition as part of overall care.
- Implement nutrition education and training programs as a way to update your clinical nutrition practices.
- Know evidence-based nutrition guidelines and create nutrition policies and protocols that reflect these guidelines.
- Benchmark nutrition practices at your care site to help determine what changes are needed.
- Take action against malnutrition. Incorporate nutrition screening and assessment into routine practice at your clinic or hospital; intervene with nutrition therapy when needed.
- Conduct routine institutional reassessments in order to measure progress toward goals for improved nutrition care.

**This Handbook is a companion piece to Abbott Nutrition's feedM.E. monograph and slidesets.**

To obtain copies of the monograph, talk to your Abbott Nutrition representative. Likewise, ask your Abbott Nutrition representative about a lecture-based program on **feedM.E.** Nutrition. Programs are available for hospital administrators, clinical executives, and bedside clinicians.



# 1 BUILD A CULTURE THAT VALUES NUTRITION CARE

## Mission Nutrition

Healthcare administrators, clinical leaders and educators, and bedside clinicians all need to know and believe in the importance of nutrition in healthcare. As a first step, create a culture that values nutrition by making good nutrition a part of each healthcare system's mission and goals (**Figure 1.1**).<sup>2</sup>

To build a culture of nutrition value, healthcare professionals must first understand evidence-based nutrition guidelines.

## Policies and Protocols

Hospital leaders can develop their own policies and protocols to reflect nutrition practice guidelines, or they may prefer to adopt or adapt ready-made protocols and practice algorithms, such as those we offer in this **feedM.E.** Clinical Handbook.

## Training and Reinforcement

As a next step, staff training and education programs are essential to translate policies and guidelines to everyday practice.<sup>3</sup> Many teaching-learning models are possible to meet the unique needs and resources of each hospital.

Hospital nutritional programs can be formal or informal, such as:

- Grand rounds presentations
- In-service training classes
- Bedside instruction for small groups
- One-on-one training sessions
- Workshops
- Computer-based learning modules
- Visual reminders such as posters and checklists



**Figure 1.1** Create an Institutional Culture that Values Nutrition Care.



Some hospital educators develop their own nutrition education programs to meet local needs and cultures, while others prefer ready-to-use materials. We offer various resources for either strategy:

- Abbott Nutrition **feedM.E.** resources include this monograph, a practical handbook, and 3 slidesets for presentations targeted to hospital administrators, clinical leaders and educators, and bedside clinicians.
- Abbott Total Nutrition Therapy (TNT) courses are available as Abbott-sponsored 1 or 2-day programs on nutrition for (1) adult in- and outpatients, (2) critical care patients, (3) geriatric in-and outpatients, and (4) pediatric in- and outpatients.
- The Abbott Nutrition Health Institute website (<http://anhi.org/>) is a rich source of information on malnutrition and its costs, including videotaped lectures from international conferences and medical education courses for credit.
- The American Society for Parenteral and Enteral Nutrition has recently published The A.S.P.E.N. Adult Nutrition Support Curriculum (2nd Edition).<sup>4</sup>
- The European Society for Clinical Nutrition and Metabolism (ESPEN) has a similar resource, Basics in Clinical Nutrition (4th Edition).<sup>5</sup>
- A U.S. critical care nurse educator team described materials used and outcomes of critical care nutrition education in their hospital system.<sup>6</sup>
- A Canadian dietitian and colleagues reported how they designed and implemented a program to improve malnutrition diagnosis and intervention in hospitals across Canada.<sup>7</sup>

**Contact your local Abbott representative to learn more about courses developed by Abbott Nutrition:**

- **feedM.E.** lecture programs are targeted to hospital administrators, clinical leaders and educators, and bedside clinicians (30- to 60-minute presentations). The slide presentations review why and how to implement evidence-based nutrition practices.
- Total Nutrition Therapy (TNT) courses for adult, critical care, geriatric and pediatric nutrition (1 or 2-day training courses)

To sustain good nutrition and keep practices current, it is important to reinforce messages and refresh training routinely, and to make changes as needed.<sup>3</sup> It is likewise important to encourage ongoing and open discussions about nutrition care.<sup>3</sup> Identifying knowledgeable and enthusiastic nutrition leaders (i.e., nutrition “champions”) is one way to deliver and reinforce nutrition goals and messages. Nutrition champions are dietitians, nurses, and physicians who facilitate, model, and continually reinforce best-practice nutrition in hospitals and other healthcare settings.<sup>7, 8</sup> These individuals may instruct in large-scale educational programs, or they may conduct one-on-one or small-group training sessions.



## 2 KNOW DEFINITIONS AND GUIDELINES

In today's practice of medicine, treatments are based on evidence of best outcomes. With hundreds of new articles on nutrition science and clinical outcomes published in the medical literature each year, it is difficult for practitioners to keep up with all the latest evidence. However, nutrition experts worldwide regularly review the evidence and publish guidelines to help clinicians implement the best nutritional practices for patients in the hospital and beyond (**Table 2.1**). While nutrition practitioners often base interventions on their clinical experience, they also look to their local protocols for best practices, which are in turn informed by national guidelines.<sup>9</sup>

### Review of English-language Nutrition Guidelines

The following list includes English-language guidelines and recommendations now available:

- Terminology and definitions for malnutrition and nutrition care<sup>10-12</sup>
- Screening and assessment of nutritional status for hospitalized patients<sup>13-15</sup>
- Best enteral nutrition practices for hospitalized patients<sup>5, 10, 16, 17</sup>
- Enteral nutrition therapy for patients who are critically ill<sup>18-21</sup>
- Appropriate use of parenteral nutrition<sup>22, 23</sup>
- Nutrition for patients with special health considerations,<sup>5</sup> including pulmonary, liver, and renal disease,<sup>24-26</sup> acute pancreatitis,<sup>27, 28</sup> and cancer<sup>29</sup>

**Table 2.1** Guidelines and Practice Recommendations from Europe and North America

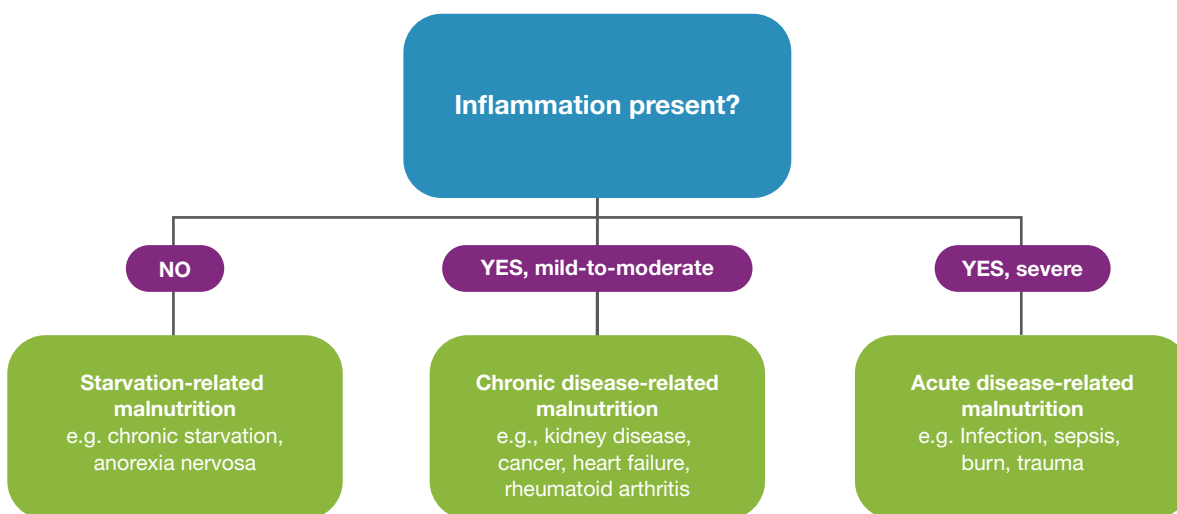
Guidelines	Where to Find Them
<b>Academy of Nutrition and Dietetics</b>	<a href="http://www.eatright.org/HealthProfessionals/">http://www.eatright.org/HealthProfessionals/</a>
<b>American Society for Enteral and Parenteral Nutrition (A.S.P.E.N.)</b>	<a href="http://www.nutritioncare.org/Library.aspx">http://www.nutritioncare.org/Library.aspx</a>
<b>Canadian Critical Care Nutrition</b>	<a href="http://criticalcarenutrition.com/">http://criticalcarenutrition.com/</a>
<b>European Society for Clinical Nutrition and Metabolism (ESPEN)</b>	<a href="http://www.espen.org/espenguidelines.html">http://www.espen.org/espenguidelines.html</a>





## Definition of Malnutrition

Malnutrition results when nutrient intake is disproportionate with nutrient needs; the reasons for this disproportion vary widely. As a result, malnutrition has been newly defined as 3 different clinical syndromes, which are characterized according to underlying illness/injury and varying degrees of inflammation.<sup>30</sup> The 3 syndromes are: (1) starvation-related malnutrition, i.e., a form of malnutrition without inflammation; (2) chronic disease-related malnutrition, i.e., nutritional inadequacy associated with chronic conditions that impose sustained inflammation of a mild-to-moderate degree; and (3) acute disease- or injury-related malnutrition, i.e., under-nutrition related to conditions that elicit marked inflammatory responses (**Figure 2.1**). Many chronic conditions (such as kidney disease, cancer, heart failure, or rheumatoid arthritis) have inflammation as a disease component, thus increasing risk of malnutrition.<sup>31, 32</sup> Most severe acute health crises (such as severe infection, surgery, burn injury, or sepsis) have marked inflammation, which contributes to risk of severe malnutrition.<sup>31, 32</sup>



**Figure 2.1** Three Malnutrition Syndromes and Examples of Underlying Causes

## Summary of Nutrition Updates

Like all aspects of medicine, nutrition practices change over time. The greatest impetus for change is the accumulation of new evidence from clinical study results. For example, we highlight 12 hospital nutrition practices that have been recommended as new standards for tube feeding in the last decade (**Table 2.2**).



**Table 2.2** Some Expert-Recommended and Evidence-based Nutrition Practices for Hospitalized Patients

Issue or Condition	Practice Recommendation
<b>Enteral vs Parenteral Nutrition</b>	Guidelines universally recommend enteral over parenteral feeding for most hospitalized adult patients who cannot consume food orally. <sup>18, 19, 21</sup>
<b>Bowel Sounds</b>	Absence of bowel sounds is no longer considered a contraindication to enteral nutrition. <sup>16, 33</sup>
<b>Contraindication to Enteral Feeding</b>	Parenteral nutrition is indicated for patients with severe gastrointestinal malfunction, such as for those with perforation, small bowel ileus, bowel ischemia, mechanical bowel obstruction, small bowel fistulae (prior to repair), or severe short bowel syndrome (< 100 cm). <sup>16, 33</sup>
<b>Early Enteral Nutrition</b>	<i>Early</i> enteral feeding is now a standard of care. <sup>16, 33</sup> When enteral nutrition is needed, start within 24-48 hours of arrival in the ICU or post-operatively.
<b>Enteral Formula Strength</b>	Feed full-strength formula. Although formula dilution was previously believed to improve tolerance, the practice may actually increase risk of contamination, which can lead to symptoms of intolerance. <sup>10</sup>
<b>Enteral Formula Type</b>	Consider the needs of each patient when selecting a feeding formula; commercial formulas are now available at varying calorie and protein densities, with or without fiber, with disease-specific ingredients (e.g., diabetes, renal disease, or cancer) or with immune-modulating and tolerance-promoting ingredients. <sup>*34</sup>
<b>Hang Time</b>	Replace non-sterile formula in an open feeding system every 4 hours, sterile formula in an open feeding system every 8 hours, and sterile formula in a closed feeding system at 24-48 hour intervals (per manufacturer's guidelines). <sup>10, 35-37</sup>
<b>Interruptions in Feeding</b>	Minimize feeding interruptions. <sup>*6</sup> Stop enteral nutrition immediately before minor procedures, and restart within 1 hour after procedure. <sup>*6</sup>
<b>Positioning During Enteral Feeding</b>	Guidelines recommend elevating the head of the patient's bed to a 30-45° angle during feedings. This simple practice is associated with decreased reflux of gastric contents and reduced incidence of aspiration pneumonia. An unstable spine or hemodynamic instability contraindicates head-of-bed elevation. <sup>10</sup>
<b>Prokinetic Agents</b>	For a critically ill patient who experiences symptoms of feeding intolerance (e.g., vomiting), use a prokinetic agent. <sup>18, 21</sup>
<b>Probiotics</b>	In the latest update of guidelines for critically ill patients, probiotic use was associated with reduced risk for infections, including ventilator-associated pneumonia. <sup>38</sup>
<b>Small Bowel (Versus Gastric) Placement of Feeding Tube</b>	Feeding tube placement in the small bowel is recommended for patients at risk of aspiration. <sup>21</sup>

\* Expert Opinion



### 3 BENCHMARK CURRENT NUTRITION PRACTICE

Does your hospital have room for improvement? Despite the availability of expert guidelines, new nutrition recommendations are not always incorporated into practice promptly.<sup>8</sup> If you suspect that your clinic, hospital, or intensive care unit (ICU) needs to improve or update nutrition practices, audit actual practice or test caregiver knowledge. Relevant data are essential to support a plan to update nutrition care.

#### Conduct a Survey in Your Hospital Ward or ICU

Below we list some possible topics for review and audit. Audit one or more of these practices, or develop your own study parameters.

##### *Patients Admitted to Hospital Wards*

- Do we have specific nutrition policies? If so, how often are they reviewed and updated?
- Do we have nutrition protocols?
- What % of patients undergo nutrition screening within the first 24 hours of admission?
- When screening is done, what % of patients are malnourished or at risk of malnutrition? Of these, what % are given oral supplements?
- What is the mean length of stay (LOS) for common diagnoses in specific hospital wards?
- Does our hospital have a formal process for communicating a post-discharge nutrition care plan?

##### *Patients Admitted to the Intensive Care Unit (ICU)*

- How and when do we assess the nutritional status of ICU patients?
- Do we have nutrition protocols? If so, how often are they reviewed and updated?
- What % of ICU patient days involve enteral feeding, parenteral feeding, both, or neither?
- What is our ICU process for communicating nutritional care plans for patients who are discharged to home?
- What are the mean lengths of stay (LOS) for common diagnoses in our ICU?
- What are our pre- and post-surgery nutrition care policies?
- How do we set energy and protein targets for malnourished or at-nutritional-risk patients?



## Participate in an International Survey

### *NutritionDay*

NutritionDay is a 1-day cross-sectional audit of food intake by patients in hospitals and nursing homes; surveys are conducted once per year.<sup>39, 40</sup> This program was developed to help hospitals improve how they identify patients at malnutrition risk and to improve nutrition care for all patients. Initially, care of European hospital patients was surveyed; over time, the nutritionDay survey has expanded to hospital, nursing home, and intensive care units throughout the world. After 6 years of surveys, more than 100,000 patients from 3,000 sites are now in the database.

Facilities participating in the nutritionDay survey use standardized protocols to collect data on nutrition care provided, which can in turn be related to patient outcomes such as length-of-stay, hospital acquired infections, complication rates, and readmission rates. Visit <http://www.nutritionday.org/> to get more information and to register as a participating site.

### *Critical Care Nutrition Survey*

Canada's Clinical Evaluation Research Unit in Ontario is dedicated to improving nutritional therapies in the critically ill through knowledge generation, synthesis, and translation. Every other year, the group conducts a worldwide survey of nutritional care in the ICU.<sup>41</sup> Three international surveys have now been completed and the 2013 survey is underway; the 2011 survey included a total of nearly 4,000 patients in 221 ICUs of 21 countries. This ongoing quality improvement (QI) initiative allows participating ICUs to benchmark their nutrition practices and compare their record within and across different countries.

#### **NutritionDay Survey**

Visit <http://www.nutritionday.org/> for more information and to register as a participating site. This worldwide survey is conducted annually.

#### **Canadian Survey of ICU Nutrition**

Visit <http://criticalcarenutrition.com/> for more information and to register as a participating site in the next survey. A survey was conducted in 2013; the next survey is planned for 2015.

## Test Caregiver Knowledge

For targeted nutrition evaluation programs, you may want to survey health professionals' knowledge. For example, we provide a sample test that could be used to assess ICU nurses' knowledge of current best-practices for nutrition and feeding (**Table 3.1**).



**Table 3.1.** Sample Test for Baseline Evaluation of Nurses' Knowledge of Nutrition in the ICU<sup>6</sup>

Issue or Condition	
<p><b>1. Guidelines universally recommend enteral tube-feeding over parenteral feeding for:</b></p> <ul style="list-style-type: none"><li>a. All hospitalized patients over 65 years old</li><li>b. All ICU patients</li><li>c. Most ICU patients who cannot eat regular food</li><li>d. All nursing home residents who are bedridden</li></ul>	<p><b>7. A recent meta-analysis of clinical trial results has shown that _____ contribute(s) to lowered risk of infection in critically ill patients.</b></p> <ul style="list-style-type: none"><li>a. Zinc</li><li>b. Probiotics</li><li>c. Fish oil</li><li>d. Arginine</li></ul>
<p><b>2. Use of parenteral nutrition is appropriate for critically ill patients with:</b></p> <ul style="list-style-type: none"><li>a. Bowel perforation (prior to repair)</li><li>b. Bowel fistulae</li><li>c. Bowel obstruction</li><li>d. Any of the conditions listed above</li></ul>	<p><b>8. To lessen symptoms of intolerance when a critically ill patient is fed enterally (e.g., vomiting):</b></p> <ul style="list-style-type: none"><li>a. Give a prokinetic agent</li><li>b. Flush feeding tube with sterile saline</li><li>c. Discontinue enteral feeding</li><li>d. Decrease tube feeding rate by 25 mL/h</li></ul>
<p><b>3. As a standard of care, enteral feeding should be started within _____ hours of arrival in the ICU (unless the patient has a condition that contraindicates enteral feeding or is able to eat regular food).</b></p> <ul style="list-style-type: none"><li>a. 0-5</li><li>b. 12</li><li>c. 24-48</li><li>d. 72</li></ul>	<p><b>9. Lack of bowel sounds:</b></p> <ul style="list-style-type: none"><li>a. Suggests that the bowel is ischemic</li><li>b. Is diagnostic for bowel obstruction</li><li>c. Indicates that parenteral feeding is needed</li><li>d. Is not a contraindication to enteral feeding</li></ul>
<p><b>4. On initiation, enteral nutrition formula should be fed at:</b></p> <ul style="list-style-type: none"><li>a. Quarter strength</li><li>b. Third strength</li><li>c. Half strength</li><li>d. Full strength</li></ul>	<p><b>10. For patients who are malnourished or at risk of malnutrition, nutrition intervention results in:</b></p> <ul style="list-style-type: none"><li>a. Lower rates of pressure ulcers and other complications</li><li>b. Fewer hospital readmissions</li><li>c. Shorter hospital stays</li><li>d. All of the above</li></ul>
<p><b>5. A non-sterile feed in an open system (e.g., blenderized food) has a maximum hang time of:</b></p> <ul style="list-style-type: none"><li>a. 2 hours</li><li>b. 4 hours</li><li>c. 8 hours</li><li>d. 16 hours</li></ul>	<p><b>11. Malnutrition is now recognized as 3 different clinical syndromes, which differ according to disease- or injury-related inflammation present.</b></p> <p>True or False?</p>
<p><b>6. The minimum angle for head-of-bed elevation to help prevent aspiration pneumonia during enteral feeding is:</b></p> <ul style="list-style-type: none"><li>a. 15°</li><li>b. 30°</li><li>c. 45°</li><li>d. 60°</li></ul>	

**Answer key:** 1c; 2d; 3c; 4d; 5b; 6b; 7b; 8a; 9d; 10d; 11 True.





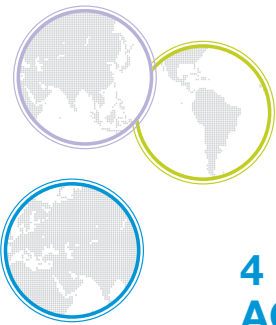
## Benchmarking, Reassessment and Quality Improvement

Benchmarking studies establish baseline conditions regarding how nutrition care in a hospital ward or ICU measures up to what is recommended by evidence-based nutrition guidelines and to what is important to hospital leaders. Educational programs and training courses for physicians and nurses are then used to move practice in the desired direction. Follow-up studies assess the uptake of new nutrition practices, measure changes in patient outcomes, and monitor how changes are affecting costs of care.

The process of planning for improvement, implementing change, and measuring outcomes is called *quality improvement*. Quality improvement is a continuous process that employs a series of improvement cycles. The following table provides recent references relevant to quality improvement of nutritional practices in hospital settings. Some papers are about strategies to change nutritional practices and others provide examples of results obtained when researchers used specific strategies to implement changes (**Table 3.2**).

**Table 3.2** *Quality Improvement of Nutritional Practices in Hospital Settings*

Reference	Highlights
<b>Brantley, S<sup>2</sup></b>	Implementing guidelines into practice, including sample strategies for implementing specific practices
<b>Bourgault, A et al.<sup>6</sup></b>	How a U.S. hospital system updated enteral nutrition practice for critically ill patients; reviews guidelines and expert recommendations, addresses nurses' training; provides sample tools used in the hospital
<b>Cangelosi, M et al.<sup>42</sup></b>	A compilation of studies and meta-analysis of results from studies comparing enteral and parenteral nutrition (patient outcomes and costs)
<b>Sinuff, T et al.<sup>43</sup></b>	A multi-center Canadian study on the use of audit and feedback to improve nutrition practices in ICU units
<b>Sriram, K et al.<sup>44</sup></b>	Restructuring of the nutritional support team improved the proper utilization of PN and decreased inappropriate use of PN in a public teaching hospital in the U.S.
<b>Van Heukelom, H et al.<sup>7</sup></b>	A dietitian-driven program, the Nutrition Care Plan is used to increase the accuracy of nutrition diagnosis in a Canadian health care system



## 4 'SCREEN AND INTERVENE' TO TAKE ACTION AGAINST MALNUTRITION

Screening for malnutrition risk is a new standard of care for patients admitted to the hospital; screening is recommended by both the American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.) and the European Society for Clinical Nutrition and Metabolism (ESPEN).<sup>15, 45</sup>

### Screen for Malnutrition Risk

The updated definition of malnutrition, which takes into account whether or not inflammation is present, necessitates a new approach to identifying patients at risk; it is now important to determine whether a patient has an illness or injury that increases risk of malnutrition.<sup>30-32</sup> We recommend a Screen for Malnutrition Risk (**Table 4.1, Figure 4.1**) that pairs (1) a quick clinical judgment about whether the patient's illness or injury carries risk for malnutrition<sup>30-32</sup> with (2) the two Malnutrition Screening Tool (MST) questions.<sup>46, 47</sup>

In the first step, the clinician makes a quick judgment about the patient's condition and its likelihood to cause or worsen malnutrition. Many chronic diseases (such as kidney disease, cancer, heart failure, or rheumatoid arthritis) and acute conditions (such as infection, surgery, burn, sepsis, or trauma) are characterized by inflammation and thus carry risk for malnutrition. This initial step raises awareness to potential risk for malnutrition.

As a next step, we recommend the two Malnutrition Screening Tool (MST) questions, which query the patient about recent weight loss and appetite loss as a way to recognize symptoms of risk for malnutrition. The MST score provides a quick estimate of the severity of malnutrition risk.<sup>46, 47</sup> MST is both sensitive and specific.<sup>46, 48</sup>

**Table 4.1.** *The Screen for Malnutrition Risk Guides Immediate and Subsequent Nutrition Care*

#### Screen for Malnutrition Risk for Hospitalized Patients

1. Does the patient have an inflammatory illness or injury that can increase risk for malnutrition?
2. (For the patient) Have you been eating poorly because of a decreased appetite?\*
3. (For the patient) Have you lost weight recently without trying?\*

*If indicated, intervene with prompt oral feeding or ONS to lessen malnutrition risk.*

\*MST questions<sup>46, 47</sup>

*Screen and intervene* is a new paradigm for nutrition care. That is, when underlying illness, injury, or symptoms indicate malnutrition risk, consider immediate oral feeding or oral nutrition supplementation as a way to prevent or lessen the impact of malnutrition in all patients capable of oral feeding. As a notable exception, if the patient is near end-of-life, he or she can be kept comfortable without provision of food.<sup>49</sup>



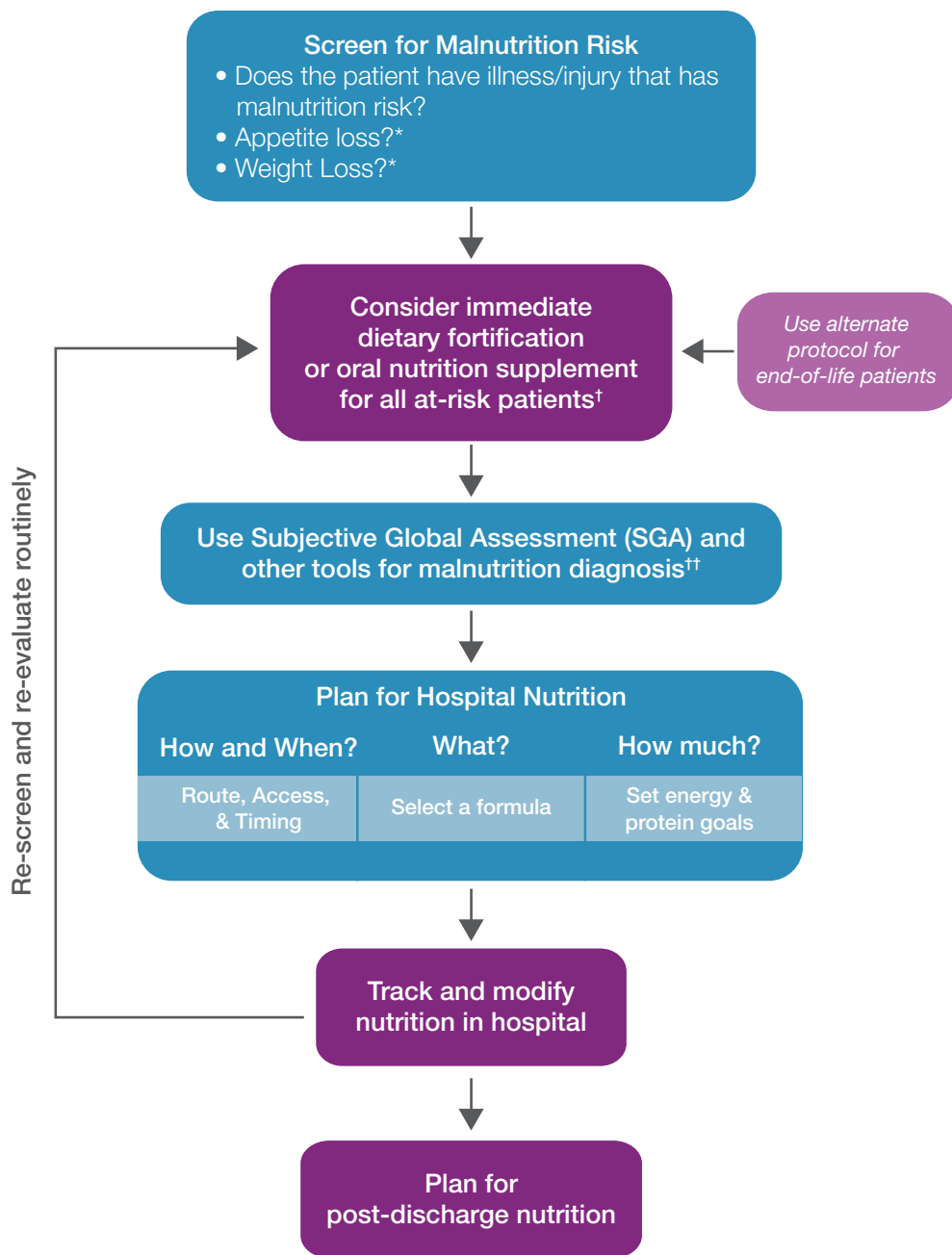


### Alternative Tools to Screen for Malnutrition Risk

There are many tools available to help identify malnutrition, and different tools are optimized for certain settings (outpatient, hospital, geriatric practice), and are also used according to regional or local preferences. We recommend the MST for its simplicity, but other validated tools are available (**Table 4.2**). Ideally, each health care group can select a tool that meets the needs of the local setting, and then use it routinely and consistently (see Handbook Appendix for screening tools).

**Table 4.2.** Malnutrition Screening Tools

Name	Description	Parameters Used
<b>Malnutrition Screening Tool (MST)</b> <sup>46</sup>	MST is a simple and quick-to-administer 2-question tool that is now used in healthcare settings worldwide. This tool is recommended by FeedM.E. nutrition experts.	Appetite and unintentional weight loss
<b>Malnutrition Universal Screening Tool (MUST)</b> <sup>50</sup>	Developed by an Advisory Group of the British Association of Parenteral and Enteral Nutrition for screening in the community, MUST is widely used in the UK and Europe.	Body mass index (BMI), change in body weight, presence of acute disease
<b>Nutritional Risk Screening-2002 (NRS-2002)</b> <sup>15</sup>	Developed by ESPEN, this is often used in European hospital settings.	Weight loss, BMI, food intake and disease diagnosis
<b>Mini Nutritional Assessment-Short Form (MNA-SF)</b> <sup>51-53</sup>	Another reliable, reproducible assessment tool specifically validated for use with older people in multiple settings. The short form (MNA-SF) can be used as a screening tool, while the full MNA serves as an assessment tool.	Diet history, weight loss, BMI, disease state, neuropsychological problems



**Figure 4.1.** Nutrition Care Pathway for Hospitalized Patients

\*For information on nutrition screening with the MST see: Ferguson M, et al. *Nutr.* 1999;15:458-464.<sup>46</sup>

†This advice is for patients who are able to consume food orally.

††For information on nutrition assessment and malnutrition diagnosis see: Detsky AS, et al. *JPEN* 1987;11:8-13.<sup>54</sup>; Jensen GL, et al. *JPEN* 2012;36:267-274.<sup>32</sup>; White J, et al. *JPEN* 2012;36:275-283 and *J Acad Nutr. Diet* 2012;112:730-738.<sup>12, 31</sup>



## The Nutrition Care Pathway for Basic Nutrition Needs

When the Screen for Malnutrition Risk identifies a person as malnourished or at-risk-of malnutrition, follow the full Nutrition Care Pathway (**Figure 4.1**). As the next step, a nutrition assessment is used to define specific nutrition needs.

For nutrition assessment, the Subjective Global Assessment (SGA) is widely used for most adults,<sup>54</sup> and the Mini-Nutritional Assessment (MNA) is used for older persons.<sup>51, 52</sup> Such assessments, conducted by a qualified and trained clinician (dietitian, nutrition specialist, physician, or nurse), determine the extent of nutritional shortfall (see Handbook Appendix for SGA and MNA tools).

Following assessment, the clinician creates an individualized plan that specifies how, when, what, and how much to feed.<sup>53</sup> Guidelines support prompt intervention, i.e., targeted nutrition therapy within 24 to 48 hours of admission.<sup>19, 21, 55</sup>

To facilitate malnutrition diagnosis and help standardize malnutrition care, experts from A.S.P.E.N. and the Academy of Nutrition and Dietetics (AND) have defined specific criteria for malnutrition diagnosis.<sup>12, 31</sup> The six measures used to determine malnutrition severity are (1) energy intake, (2) weight change with interpretation, (3) body fat, (4) muscle mass, (5) fluid accumulation, and (6) grip strength. These groups have also worked to clarify coding for malnutrition. ICD-9/ICD-10 malnutrition codes for mild-to-moderate and severe malnutrition are 263 and 262, respectively.<sup>31</sup>

### Assessment Tools

Subjective Global Assessment (> 18 years)  
Mini-Nutritional Assessment (> 65 years)

### ICD-9/ICD-10 Malnutrition Codes

Mild-to-moderate	263
Severe	262

## Other Tests and Tools to Determine Effects and Severity of Malnutrition

Low body weight or body mass index (BMI) and recent weight loss are signs of malnutrition or risk for malnutrition. Measurements of muscle strength, physical function, and certain serum proteins are used to characterize the causes, consequences, or severity of malnutrition.

**Muscle measures.** A shortfall of protein intake relative to needs results in loss of muscle strength and/or function, i.e., sarcopenia.<sup>56</sup> Muscle strength is estimated by determining handgrip strength; low muscle strength is associated with older age and with the presence of disease. Performance or muscle function can be measured as usual gait speed or by tests such as timed get-up-and-go (TGUG) and short physical performance battery (SPPB).<sup>56</sup>

**Laboratory tests.** Additional information from laboratory blood chemistry testing can help identify malnutrition type, severity, and response to treatment (**Table 4.3**).<sup>45, 57</sup> A low level of serum transthyretin (also called prealbumin) indicates the presence of inflammation, which increases risk of malnutrition. Since transthyretin's half-life is relatively short (2-4 days), dropping transthyretin levels on repeat testing suggest rising risk for malnutrition, while increasing transthyretin levels suggest declining malnutrition risk, e.g., in response to disease and nutrition treatment.

C-reactive protein (CRP) serves as a marker of inflammation, which is often a contributing factor in disease-related malnutrition. When signs of malnutrition are present and CRP is elevated ( $\geq 1.0$  mg/dL or  $> 10$  mg/L), disease-related malnutrition is likely (as with chronic or acute inflammatory diseases), while malnutrition signs along with low CRP (CRP  $< 1.0$  mg/dL) suggest starvation only (e.g., anorexia nervosa).



**Table 4.3.** Laboratory Tests as Indicators of Malnutrition Risk\*

Laboratory Measure	Normal Values
Transthyretin (prealbumin)	15-36 mg/dL
C-reactive protein	< 1.0 mg/dL

\*Although various laboratory tests have been suggested as potential markers for inflammation, specific inflammatory markers have not yet been validated for diagnosis of malnutrition.<sup>31</sup>

## Intervene With Basic Nutrition Care

**How to feed.** Choosing the appropriate form of nutrition therapy is stepwise and systematic.<sup>58</sup> Enteral nutrition (EN), feeding by way of the gastrointestinal system, includes providing regular food, adding oral nutritional supplements to the diet, or delivering formulas by tube feeding via nasogastric, nasoenteral, or percutaneous tubes.<sup>11</sup>

- Oral feeding with diet enrichment or with oral nutrition supplements (ONS) is the primary and first line of defense for a vast majority of patients.<sup>58</sup>
- When oral food and ONS are impossible or inadequate, nutrition is given as enteral tube feeds (Handbook Section 5, Advanced Nutrition Care).
- When the gastrointestinal tract is compromised, parenteral nutrition is used either alone or in combination with enteral nutrition (Handbook Section 5, Advanced Nutrition Care).

**When to feed.** Guidelines support prompt intervention, i.e., individualized nutrition therapy within 24-48 hours of admission.<sup>15, 30,53,55</sup> As a strategy to promote feeding to target levels, experts also suggest minimizing feeding interruptions for medical procedures.<sup>6</sup>

**What to feed.** Many hospitalized individuals are able to eat food, but their appetite is limited. In such cases, experts recommend foods with energy-rich additives (maltodextrin, protein fortification), eating smaller but more frequent meals or high-energy snacks between meals, or using oral nutrition supplements (ONS).<sup>53</sup>

Standard commercially-prepared nutrition formulas are generally complete and balanced and contain an energy level of 1.0 kcal/mL, thus meeting the needs of many sick or injured patients who cannot get adequate nutrition with a diet of regular food.<sup>59</sup> Specialized commercially-prepared formulas meet basic needs but also meet disease- or condition-specific needs; some are formulated and flavored for use as ONS, and others are appropriate as enteral tube feeds (**Table 4.4**).<sup>34</sup>



**Table 4.4** Examples of Enteral Formula Features for Specific Health Conditions

Disease Condition	Special Nutritional Ingredients and Composition
<b>Volume-Restricted (e.g., with heart failure)</b>	Calorically-dense, i.e., high energy and/or high protein <sup>60</sup> for patients sensitive to fluid volume
<b>Glucose Intolerance, Diabetes</b>	Specific ingredients minimize post-feeding blood glucose rises, i.e., slowly-absorbed carbohydrates and fats <sup>61, 62</sup>
<b>Chronic Kidney Disease Pre-Dialysis</b>	Low protein, low phosphorus to spare clearance burden on the kidneys before dialysis begins <sup>63, 64</sup>
<b>Chronic Kidney Disease with Dialysis</b>	Low phosphorus to spare clearance burden on kidneys and high protein to compensate dialysis-related losses <sup>26, 63</sup>
<b>Cancer</b>	High protein to maintain or restore lean body mass, anti-inflammatory omega-3 fatty acids, <sup>63</sup> and antioxidants <sup>64</sup>

**How much to feed.** Clinicians estimate energy and protein needs and establish a target energy goal for each patient.<sup>19, 21</sup> Adult energy requirements depend on needs for basal metabolism, physical activity, and metabolic stresses of different disease conditions.<sup>65</sup> The easiest method to estimate energy needs is to use the simple predictive formula that determines daily calorie requirements by multiplying the patient's body weight (BW, in kg) by 25 to 30 kcal, i.e., 25-30 kcal/kg BW/day (**Table 4.5**).<sup>21</sup>

Sarcopenia, i.e., loss of muscle mass with low strength or performance, is caused and worsened by injury, illness, and inactivity during hospitalization. Adults who are sick or injured are at risk of sarcopenia, as are those who are of older age.<sup>56, 66</sup> Protein is an essential nutrient for maintaining muscle protein synthesis and preventing its breakdown. Dietary protein intake thus requires special attention during and after hospitalization. The usual recommendation for adult dietary protein intake is 0.8g protein/kg BW/day.<sup>67</sup> Protein targets for adults with disease or injury vary widely according to severity of the condition (1.0 to 2.0 g/kg actual body weight per day).<sup>21, 68</sup> To maintain lean body mass and function, adults older than 65 years have higher needs than do younger adults ( $\geq 1$  g protein/kg BW/day).<sup>68</sup> In patients who are obese (body mass index > 30), protein need is  $\geq 2.0$  g/kg body weight per day (ideal body weight is used for obese adult estimates).<sup>21, 68</sup>

**Adults who are sick or injured are at risk of sarcopenia, as are those who are of older age.**

**For these adults, adequate dietary protein is essential to help maintain muscle protein synthesis and to lessen harmful breakdown.**





**Table 4.5** *How Much to Feed*

Estimating Daily Energy and Protein Targets for Patients Recovering From Illness or Injury
Simple formula for estimating energy requirement: 25 to 30 kcal/kg BW/day*
Guidelines for dietary protein needs: 1.0 to 2.0 or more g protein/kg BW/day†

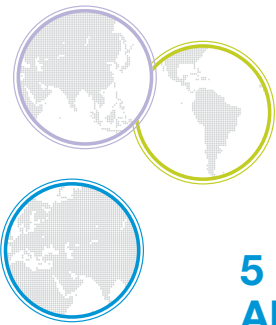
\*Recommendation based on metabolic stress of disease, physical activity, and actual nutritional status

†Recommendation determined by age, illness or injury severity, and actual nutritional status

### *In-Hospital Tracking and Post-Discharge Nutrition Planning*

Individuals receiving nutrition therapy should also be monitored regularly to ensure feeding tolerance and adequate supplies of energy with sufficient protein. For a patient who is initially well-nourished, rescreening should occur at regularly determined intervals, especially when his or her clinical status changes.<sup>13</sup>

Nutrition care does not end when a patient is released from the hospital; follow-up with continued care in the community is important. Poor nutritional status on discharge, with weight loss and low serum albumin levels as biomarkers, has been recognized as a predictor of hospital readmission within 30 days.<sup>69</sup> New focus on post-discharge nutrition planning<sup>70</sup> is expected to help lower costly hospital readmissions,<sup>71</sup> improve quality of life for patients,<sup>72, 73</sup> and in some cases even reduce risk of death.<sup>74</sup> Effective nutrition care calls for a post-discharge nutrition plan along with follow-up to ensure that the plan is implemented.



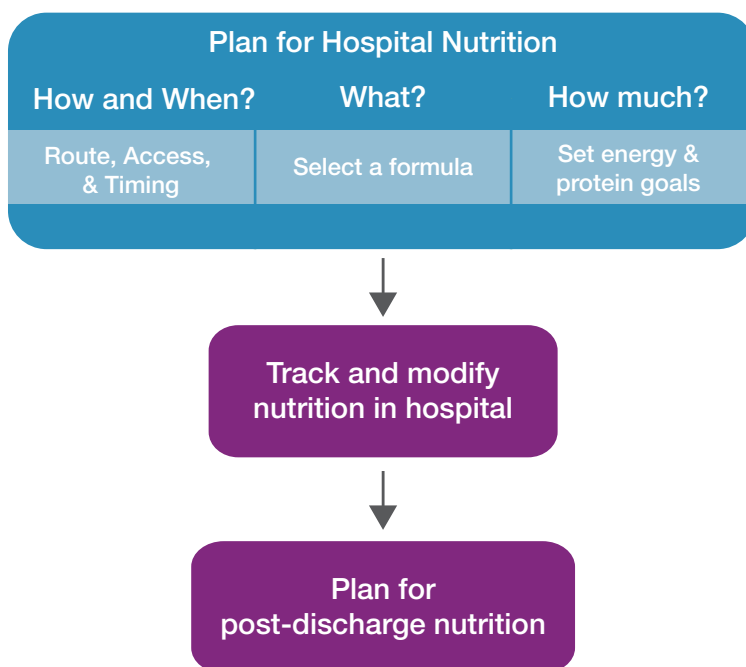
## 5 USE PROTOCOLS AND PRACTICE ALGORITHMS FOR ADVANCED NUTRITION CARE

When a hospitalized patient cannot consume enough fortified foods or oral nutrition supplements (ONS) to meet nutrient needs, advanced nutrition intervention is essential. For these patients, nutrition can be tube-fed by either the enteral or parenteral route (enteral nutrition, EN; parenteral nutrition, PN). Nutrition decisions for these people, usually the very sickest, can be complex. It is important to consider the individual's general health and medical issues (underlying disease, comorbidities, mental status, expected prognosis), as well as relevant ethical issues (personal wishes, stage of terminal illness).<sup>53</sup>

This section of the **feedM.E.** Handbook will focus on recommendations for feeding critically ill or injured patients with complex nutritional needs. We offer decision tools, practice protocols, and care algorithms to help incorporate nutrition recommendations into practice. These protocols are intended to guide safe and effective tube feeding.

### Who, How, What, and How Much to Feed

In this section, we review the critical choices necessary to provide appropriate nutrition support, which include deciding whether the patient should receive EN or PN; determining feeding route and access; choosing which formula to feed; and setting protein and energy goals to target (**Figure 5.1**).



**Figure 5.1** Most Critically Ill Patients Require Nutrition Support, and Decisions on the Nutrition Care Pathway Will Determine How to Provide Support, and What/How Much to Feed.



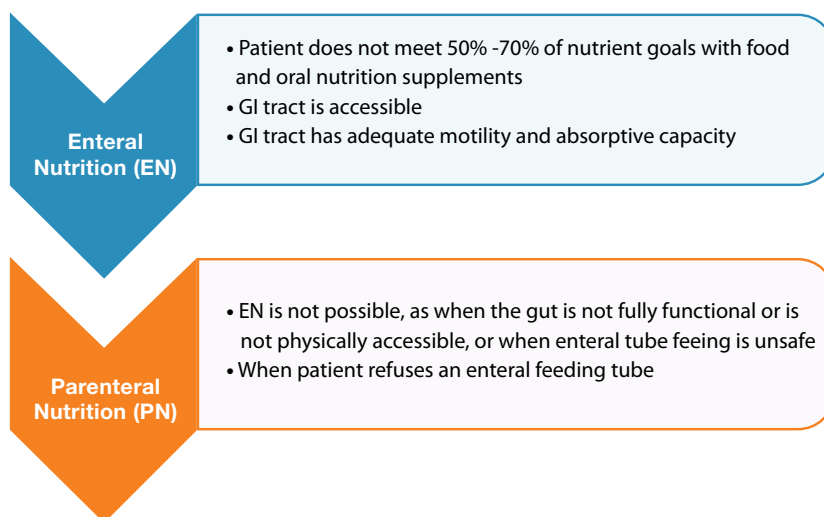


## Who Should Receive Enteral Versus Parenteral Nutrition?

For those who have failed to respond to oral feeding alone or are likely to fail, enteral or parenteral nutrition is needed either as a sole source of nutrition or as a supplement to oral feeding (**Figure 5.2**). Tube-fed nutrition can be given for a short-term or long-term interval depending on the patient's underlying medical problem.

**Enteral tube feeding.** Practice guidelines in Europe, Canada, and the U.S. endorse enteral tube feeding for patients who are critically ill and hemodynamically stable.<sup>18, 19, 21</sup> In fact, EN is preferred over PN for most intensive care unit (ICU) patients. This evidence-based practice is supported by numerous clinical trials involving a variety of critically ill patient populations, including those with trauma, burns, head injury, major surgery, and acute pancreatitis. For critically ill patients who are candidates for enteral feeding, early initiation (within 24 to 48 hours of arrival in the ICU) has become a recommended standard of care. Experts identify these early hours as a window of opportunity to provide nutrition that maintains gut barrier function and supports immune responses.<sup>19, 21</sup>

**Indications:** Enteral nutrition is indicated when a patient cannot eat or is unable to consume adequate oral nutrition to meet nutrition needs; for EN, the GI tract must be accessible and functional with adequate motility and absorptive capacity.<sup>16, 33</sup>



**Figure 5.2** Indications for Tube-Fed Nutrition Therapy<sup>33</sup>

Contraindications: EN may be contraindicated and PN necessary in patients with a perforated bowel (prior to repair); bowel obstruction; severe short bowel syndrome (< 100 cm); inability to adequately propel and absorb bowel contents; uncontrolled vomiting and diarrhea; intermittent bowel ischemia; and severe hemodynamic instability.<sup>16, 18, 33</sup>

Generally, the absence of bowel sounds is no longer considered an absolute contraindication to EN,<sup>21</sup> and new evidence in patients with hemodynamic instability points to improved survival in those given EN in the first 48 hours.<sup>75</sup>

Many conditions complicate feeding decisions; evidence-based guidance helps healthcare professionals choose between EN and PN (**Table 5.1**).



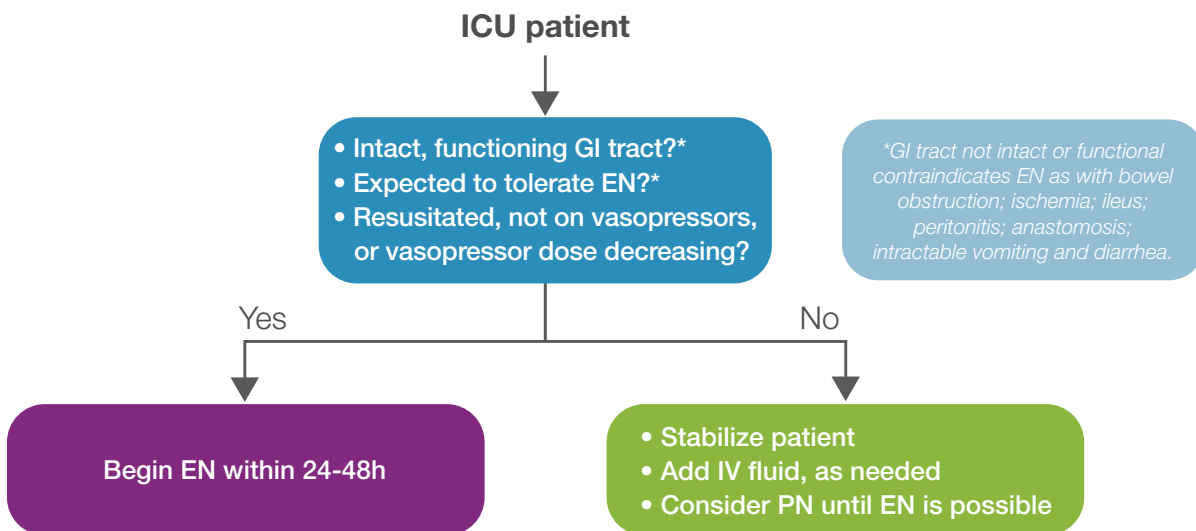
**Table 5.1** *Is Enteral Nutrition Possible, Safe, & Effective for My Patient? When Is Enteral Nutrition Contraindicated?*<sup>16, 33</sup>

Does the patient have..	Comments
<b>...a condition in which the gut is not fully functional or accessible?</b>	
• Perforated bowel	<b>Contraindication to EN; use PN until perforation is repaired, then consider EN</b>
• Severe short bowel syndrome (<100 cm)	<b>Absolute contraindication to EN; use PN</b>
• Mechanical bowel obstruction or bowel not physically accessible	<b>Contraindication to EN; use PN until problem is corrected</b> <sup>16, 18</sup>
• Bowel ischemia	<b>Contraindication to EN prior to repair</b> <sup>16, 18</sup>
• Absence of bowel sounds, flatus, or stool passage	Bowel sounds are no longer considered necessary to begin using the gut in ICU patients, nor is passage of flatus or stool. <sup>16, 21</sup>
• Ileus (limited GI motility)	The impact of ileus on function can vary in different sections of the GI tract; e.g., post-surgical ileus appears to affect the stomach and colon more than the small intestine; <sup>16</sup> thus, post-pyloric feeding may be tolerated in this case. If EN is not tolerated, PN may be necessary.
• High gastric residual volume (GRV)	The definition of "high GRV" (for withholding EN) varies with different guidelines; <sup>18, 21</sup> follow local protocols and use clinical judgment. Promotility agents can be used to help reduce gastric residual volumes. Consider accepting gastric residual volumes up to 500mL, but monitor for aspiration risk. <sup>18, 34</sup>
• Poor GI absorption	Consider a small peptide feeding formula to help overcome absorption problems. <sup>75</sup>
<b>...a condition in which tube feeding EN may not be safe?</b>	
• Hemodynamic instability	Severe hemodynamic instability, such as in patients who are receiving escalating doses of vasopressors, is a contraindication to EN. <sup>21, 34</sup> New evidence suggests that EN can reduce mortality in patients with hemodynamic instability (when EN is started in the first 48h). <sup>75</sup> Results of an observational study showed that the sickest patients, i.e., those on multiple vasopressors, were most likely to benefit.
• Limitation to maintaining head of bed (HOB) elevation of 30 to 45° angle	With conditions such as spinal injury or hemodynamic instability, HOB elevation may not be possible. <sup>6, 10, 18</sup> Lack of HOB elevation is otherwise unsafe because it increases risk of reflux and of aspiration pneumonia. <sup>18</sup>
• Pancreatitis	For patients who have uncomplicated pancreatitis and require nutrition support, "EN should be considered the standard of care." <sup>77</sup> EN is associated with multiple advantages for such patients. <sup>77, 78</sup>
<b>...a condition in which tube feeding EN may not be effective?</b>	
• Uncontrolled vomiting	Uncontrolled vomiting limits use of EN, as it increases risk for aspiration and presents challenges in tube placement and maintenance of tube position. In some cases, EN feeding can be managed. Consider small bowel feeding or use of prokinetic agents. <sup>18, 76</sup>
• Uncontrolled diarrhea	Uncontrolled diarrhea limits the effectiveness of EN. To control diarrhea, consider and treat the underlying cause, i.e., infection, inflammation, impaction, medication. Depending on the cause of diarrhea, an EN formula with added fiber or one that is less concentrated may be tolerated. When diarrhea is not due to infection, consider using an anti-diarrheal agent. <sup>76</sup>
• Fistula with output	A high-output, mid-gut fistulae is a contraindication to EN prior to its repair. Patients with more proximal or distal fistulae, with low-to-moderate output, may tolerate EN with close monitoring. <sup>16</sup>



**Parenteral nutrition.** Nutrition guidelines around the world do not agree on when PN should be started in patients who are not candidates for EN but are otherwise well nourished.<sup>18, 19, 21</sup> ICU patients who need PN represent a range of different and complicated conditions; under such circumstances, feeding decisions are usually made on a case-by-case basis.

For malnourished ICU patients, U.S. and European experts agree that PN should be initiated within 24 hours of admission (**Figure 5.3**).<sup>19, 21</sup>



**Figure 5.3** Is My Critically Ill Patient a Candidate for EN or PN? <sup>34, 79, 80</sup>

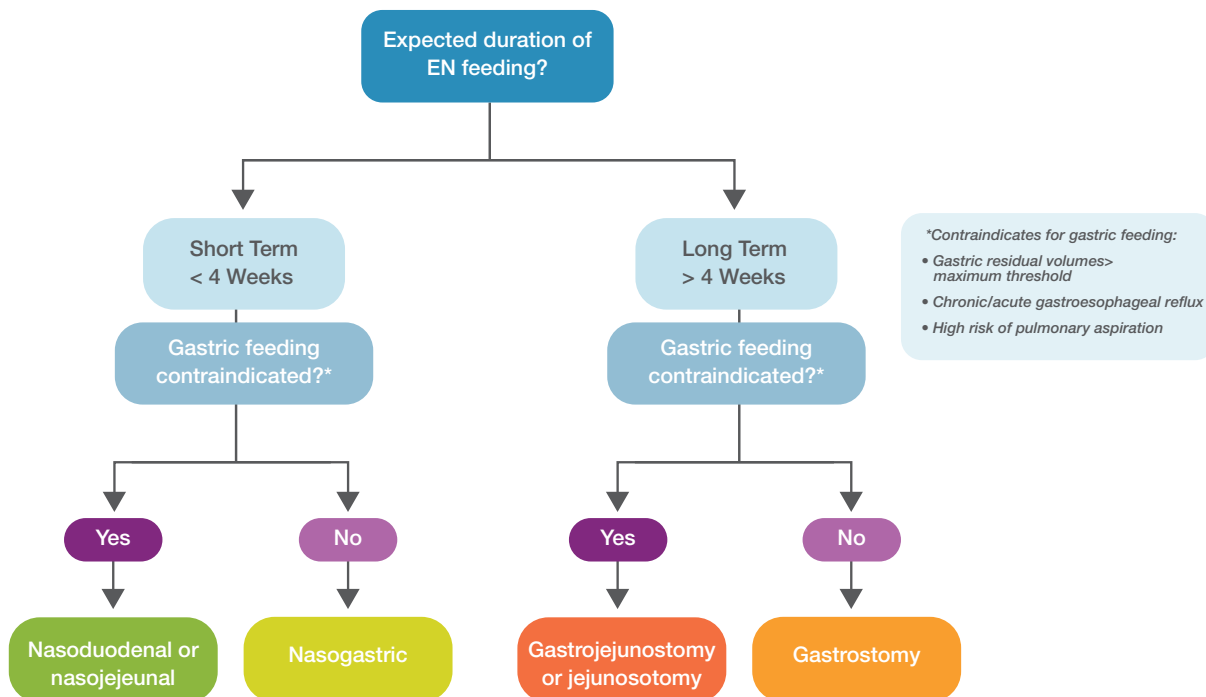
The presence of extreme hemodynamic instability (rising lactate levels or escalating vasopressor requirements) generally rules out EN for hospitalized patients (**Figure 5.3**). Recent evidence suggests that early EN feeding in some vasopressor-dependent ICU patients can improve survival.<sup>75</sup> However, critically ill patients who are on vasodepressors should be carefully monitored if fed enterally because they are at risk for developing gastric intolerance (e.g., abdominal distension, rising lactate levels).<sup>81</sup>

### How to Feed: Choosing a Route for Enteral Feeding

Enteral feeding routes can access the gut in different ways, i.e., by way of a nasal tube to the stomach or intestine, or by direct access to the stomach or intestine. Selection of the optimal route will take into account the patient's health status, his or her gastrointestinal (GI) anatomy and function, and the expected length of therapy.<sup>35</sup> In general, the solution should be delivered as high up in the GI tract as possible, while ensuring maximum absorption.<sup>59</sup> The nasal route is best for short-term use, i.e., less than four weeks. For those patients at risk of aspiration, small bowel routes are a better choice.<sup>35</sup> When it is expected that nutrition therapy will last for more than four weeks, access points to the stomach (gastrostomy) or small bowel (jejunostomy) are necessary (**Figure 5.4**).



Choosing the site where the feeding tube should terminate depends in part on the function of the patient's stomach. The advantages of stomach feeding include the similarity to normal nutrition and the relative ease of tube placement. Stomach placement also allows the feeding formula to be delivered continuously or intermittently, as the patient's tolerance allows. Placement in the small bowel can avoid problems in the stomach (gastric outlet obstruction, fistula), high risk of aspiration, or issues related to pancreatitis.<sup>35</sup> Small bowel feedings are best tolerated when feeding is given continuously rather than as a bolus.<sup>82</sup>

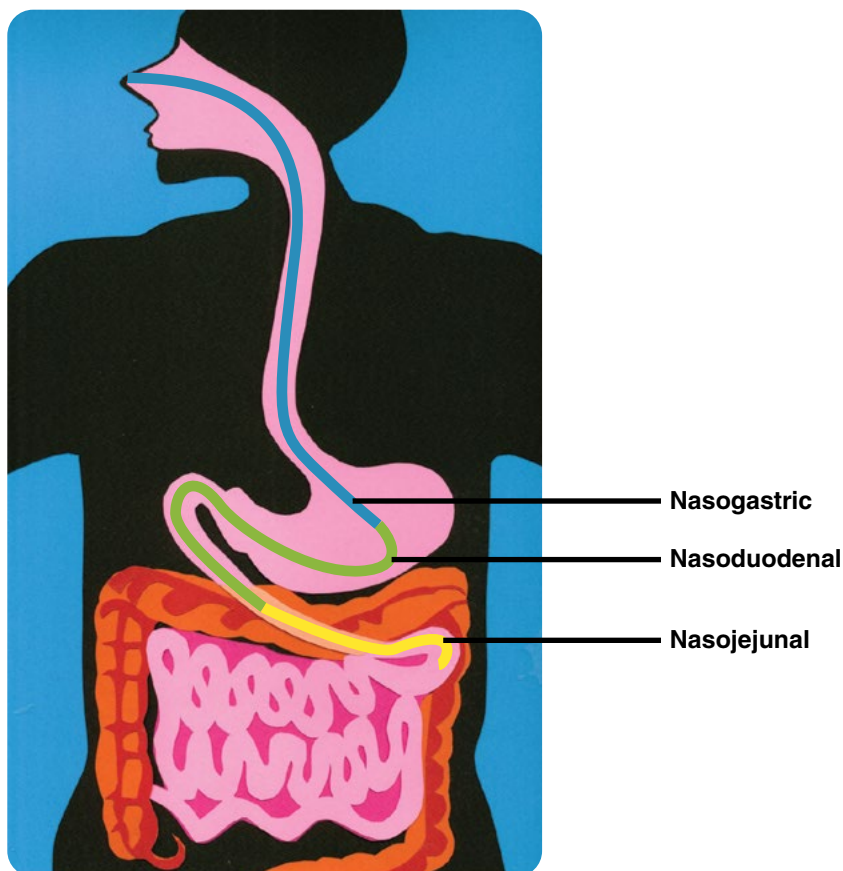


**Figure 5.4** Selecting an enteral feeding device depends on patient condition and anticipated length of feeding duration (adapted from A.S.P.E.N EN Handbook).<sup>35, 79</sup>

### Transnasal Access for Enteral Feeding

Candidates for GI access by way of the nose (transnasal, i.e., nasogastric, nasoduodenal or nasojejunal; **Figure 5.5**) are those patients who need only short-term feeding support and those with:<sup>82</sup>

- Disorders of the pharynx or esophagus
- Neurological or psychological disorders
- Certain GI disorders
- Short bowel
- Burns
- Chemotherapy or radiotherapy ongoing



**Figure 5.5** Enteral Access Routes<sup>83</sup>

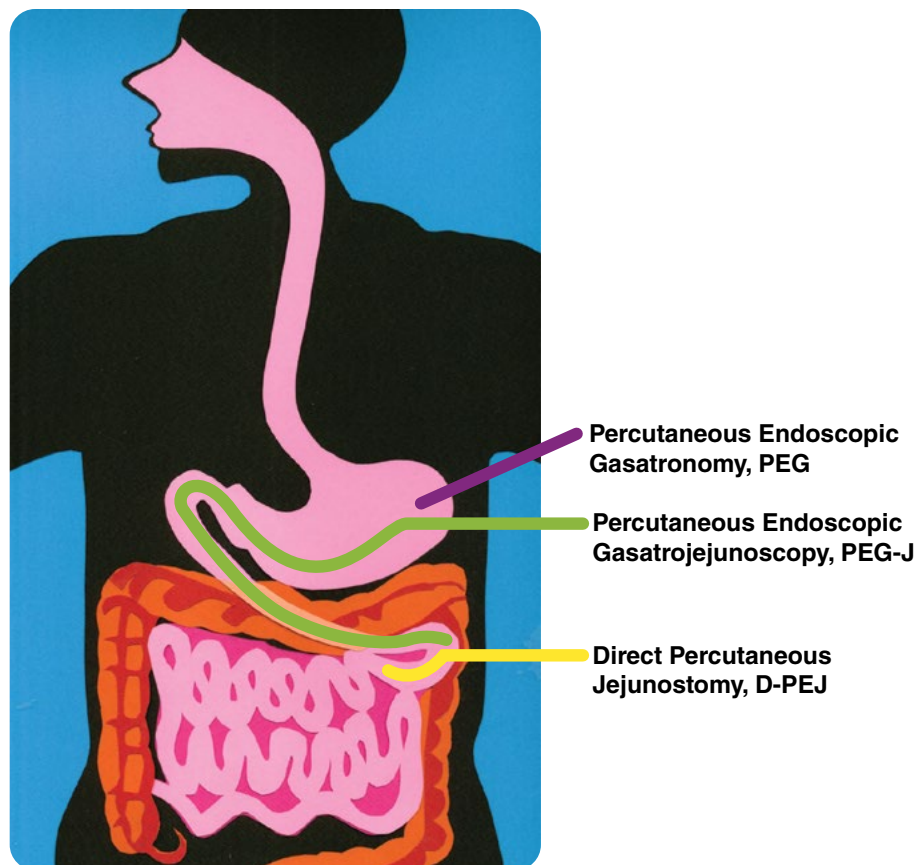
### *Direct Access for Enteral Feeding*

When enteral nutrition will be needed for more than 4 weeks, a feeding tube placed directly into the stomach or small bowel is an appropriate choice. Gastrostomy tubes enter the body through the wall and feed directly to the stomach, while jejunostomy tubes enter the small bowel and feed to the jejunum **(Figure 5.6)**.

Direct access to the stomach or small bowel is indicated for:<sup>35, 84</sup>

- Patients with swallowing difficulties; neoplasms of the upper GI tract, or those with multiple traumas
- Patients on long-term ventilation
- The post-operative period for surgery of the mouth or pharynx

Direct access to the stomach or small bowel can be achieved in the endoscopic suite, or at bedside using an endoscope with sedation and anesthesia. Surgical placement is appropriate when endoscopy is not possible, or when the patient will already be undergoing surgery for other reasons.<sup>16</sup> Complications of gastrostomy and jejunostomy feeding tubes include wound complications, tube dislodgement, missed placement, intra-abdominal leakage of feedings, aspiration, and cardiopulmonary complications.<sup>85</sup>



**Figure 5.6** Endoscopic Access Routes for Enteral Feeding<sup>83</sup>

Some of the more commonly used endoscopic placement methods are:<sup>35</sup>

- **PEG = Percutaneous Endoscopic Gastrostomy.** An endoscope is inserted into the mouth and down the esophagus. Guided by the endoscopic interior view and by the endoscope's light aimed at the abdominal wall, the point of closest contact is located, i.e., the point of greatest light translucence on the exterior abdominal wall. A very small incision is made through the abdominal wall and into the stomach, and a guide wire is run through the incision and upward through the stomach and mouth. A feeding tube is then drawn down the guide wire into the stomach, exiting the abdomen at the incision.
- **PEG-J = Percutaneous Endoscopic Gastrojejunostomy.** Like the PEG, the PEG-J is an endoscopic procedure. One end of the feeding tube is guided out through the stomach wall and the other is guided downward (via endoscope) into the jejunum for small bowel feeding.
- **D-PEJ is a Direct Percutaneous Jejunostomy.** Guided by an endoscope inserted in the mouth and down the GI tract, a tube is placed directly into the jejunum through a small incision in the abdominal wall, without accessing the stomach. Proper placement of this tube is more difficult than a standard PEG.



All contraindications to enteral nutrition apply here, as well as issues specific to endoscopic placement, including:

- Issues preventing an endoscopic procedure, such as obstructions in the pharynx, esophagus or elsewhere in the GI tract; severe clotting disorders; and the inability to see the endoscope light through the abdominal wall (e.g., with obesity)<sup>84</sup>
- Peritonitis<sup>85</sup>
- Ethical issues relating to limited life expectancy and psychologically-based eating disorders<sup>35</sup>
- Massive ascites, peritoneal dialysis, severe portal hypertension, morbid obesity, or severely enlarged liver may prevent PEG-based feeding in some, but not all, instances<sup>84, 85</sup>

### *Surgical Access for Enteral Feeding*

When endoscopic placement of a tube to the stomach or small bowel is not possible, surgery may be needed. Most often, however, feeding tubes are placed surgically when a surgical procedure for trauma or GI disease is already underway.<sup>84</sup> Laparoscopic placement should be considered when endoscopic methods are not possible, and other surgery is not necessary. Though complications of surgical techniques are similar to those of endoscopic techniques, surgical methods have a low but real risk of mortality and morbidity.<sup>84, 85</sup>

**NCJ = Needle catheter jejunostomy.** This placement of a feeding tube through the abdominal wall and into the jejunum is relatively simple to perform after major surgery or with laparoscopy. A needle catheter is used to puncture the abdominal wall, and is threaded into a submucosal channel in the jejunum, and then into the jejunum. The catheter is then introduced through the needle and to the small bowel, and secured with sutures. Additional sutures are used to secure the intestinal loop to the abdominal wall and secure the catheter at its exit point, reducing the risk of complications.<sup>86</sup>



### How to Feed: Device and Regimen

Next select a delivery system (device and regimen) based on the patient's needs and feeding tube location (**Table 5.2 and Table 5.3**).

**Table 5.2** Choose the Regimen for Delivering Enteral Formula: Continuous, Intermittent, or Bolus Feeding

Delivery Regimen	Continuous	Intermittent	Bolus
<b>Description</b>	Feeding delivered at a slow and continuous rate <sup>10</sup>	Feeding occurs periodically over a 24h period, <sup>87-89</sup> e.g., 2-3 hours of feeding followed by 2 hours of rest <sup>59</sup>	Feeding all at once, mimicking a normal meal, e.g., about 15 minutes 3 to 8 times per day <sup>10</sup>
<b>Achieve using:</b>	Pump	Pump or gravity <sup>36</sup>	Gravity or syringe <sup>10</sup>
<b>Typically delivered to:</b>	Small bowel (or stomach in critically ill patients) <sup>10</sup>	Small bowel or stomach	Stomach only, as small bowel lacks reservoir capacity <sup>87-89</sup>
<b>Advantages</b>	<ul style="list-style-type: none"> <li>• Slow and continuous rate can enhance GI tolerance<sup>36</sup></li> <li>• Allows for controlled formula delivery to patients with volume sensitivity, e.g., those with congestive heart failure</li> </ul>	Patients have extended feeding breaks	Mimics normal meal
<b>Preferred for:</b>	<ul style="list-style-type: none"> <li>• Critically ill<sup>9</sup></li> <li>• Risk of reflux</li> <li>• History of aspiration pneumonia</li> <li>• Small bowel feeding</li> <li>• Those intolerant of intermittent/bolus feeding</li> </ul>	Mobile patients <sup>91</sup>	





**Table 5.3** Decide Whether to Deliver Formula by Pump or Gravity

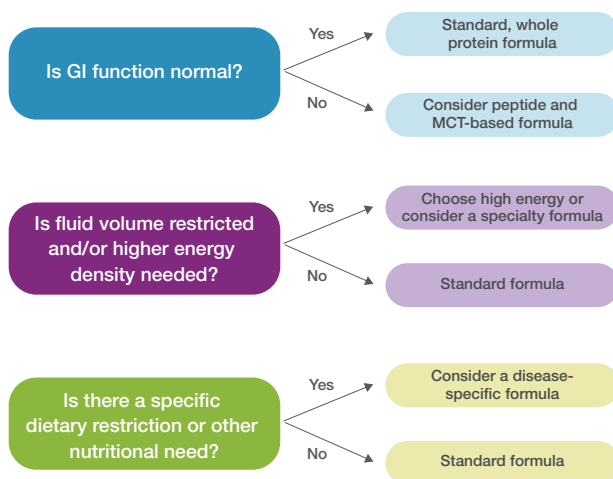
Delivery Device	Pump	Gravity
<b>Preferred for:</b>	<ul style="list-style-type: none"> <li>• Small bowel feedings<sup>1</sup></li> <li>• Patients with:<sup>87, 88</sup> <ul style="list-style-type: none"> <li>- Severe reflux</li> <li>- Risk of aspiration pneumonia</li> <li>- Severe diarrhea</li> </ul> </li> </ul>	Stable Patients
<b>Advantages/Disadvantages</b>	<ul style="list-style-type: none"> <li>• Can deliver precise and consistent amounts to patient with volume sensitivity<sup>90</sup></li> <li>• Can deliver slow and continuously amounts over many hours to enhance GI tolerance<sup>90</sup></li> <li>• Pump feeding results in lower rates of vomiting, aspiration pneumonia and severe diarrhea<sup>10</sup></li> <li>• May not be available or feasible in some settings</li> </ul>	<ul style="list-style-type: none"> <li>• Commonly available</li> <li>• Appropriate for bolus stomach feeding<sup>90</sup></li> <li>• Delivery rates are less reliable than pumps<sup>59</sup></li> <li>• Intended flow rate can be altered when patient changes position<sup>59</sup></li> </ul>

### When to Feed

Guidelines support prompt intervention, i.e., individualized nutrition therapy within 24-48 hours of admission.<sup>15, 30,53,55</sup>

### What and How Much to Feed: Choosing an Enteral Formula and Protein/Energy Targets

Sterile liquid enteral nutrition products or powder products reconstituted with clean water are now recognized as safe and consistent. A simplified decision tree provides guidance for formula selection for most patients **(Figure 5.7)**.



**Figure 5.7** Individual Patient Needs Will Determine the Most Suitable Enteral Feeding<sup>59</sup>

Abbreviation: Medium chain triglyceride, MCT



While standard enteral formulas are able to meet the basic macro-and micronutrient needs of patients, various therapeutic enteral formulas can be used to meet basic needs and also deliver specific pharmaconutrients that can lessen hyperinflammatory responses, enhance the immune responses to infection, or improve gastrointestinal tolerance. Therapeutic formulas contain specific pharmaconutrients, i.e. arginine, antioxidants, certain  $\omega$ -3 and  $\omega$ -6 fatty acids, hydrolyzed proteins, and medium-chain triglycerides. Each of these ingredients is recognized to have functional properties. When combined in special formulas, they can improve patient outcomes;<sup>34</sup> certain diseases are associated with special nutrition needs (**Table 5.4**).

**Table 5.4** Patients with Different Critical Care Conditions Have Special and Varying Nutrient Needs

Condition	Special Formula Characteristics
<b>SIRS/sepsis or ALI/ARDS</b>	Anti-inflammatory fats (omega-3s) <sup>63</sup>
<b>Surgery, Trauma, Burns</b>	Arginine, glutamine, anti-inflammatory fats (omega-3s) <sup>63</sup>
<b>GI Intolerance or Malabsorption</b>	Hydrolyzed proteins, medium-chain triglycerides, prebiotics <sup>21,34</sup>

SIRS= Systemic inflammatory response syndrome; ALI= Acute lung injury; ARDS= Acute respiratory distress syndrome

Tube feeding solutions have sometimes been prepared by “blenderizing” regular foods.<sup>5</sup> While such blenderized feeds were believed to be naturally healthy and economical, study results have shown that neither belief was true. Results have unfailingly demonstrated unsafe levels of bacterial contamination in blenderized mixtures.<sup>37, 92, 93</sup> In addition, it is difficult to prepare blenderized foods with batch-to-batch consistency of nutrient contents, and it is likewise difficult to achieve consistent viscosity. Due to higher risk for contamination, blenderized foods are neither recommended nor widely used in current nutrition practice.

To determine how much to feed, ICU clinicians calculate or estimate energy/protein needs, then establish a target feeding goal for each patient.<sup>19, 21</sup> Adult energy requirements depend on needs for basal metabolism, physical activity, and metabolic stresses of illness or injury.<sup>65</sup> Requirements can be calculated by predictive equations or they can be measured by indirect calorimetry. Predictive equations are less accurate for individual patients, while indirect calorimetry requires use of specialized equipment.<sup>21</sup> When predictive equations are used, correction factors are needed to adjust estimates upward to accommodate higher energy needs due to inflammatory stress (**Table 5.5**).

**Due to higher risk for contamination, blenderized foods are neither recommended nor widely used for tube feeding in current nutrition practice.**



**Table 5.5** How Much to Feed Patients With Critical Illness or Injury: Energy

Estimating Daily Energy Targets for Patients Recovering From Illness or Injury	
For ICU patients, measure daily energy requirements by indirect calorimetry or calculate with predictive equation <sup>21</sup>	
Correction factors based on inflammatory stress <sup>94</sup>	
Stress Condition	Correction Factor
Trauma	1.4 = skeletal or blunt trauma 1.6 = head injury with steroid therapy
Surgery	1.2 = minor surgery
Sepsis	1.6 = major sepsis
Burns	2.1 = major burns

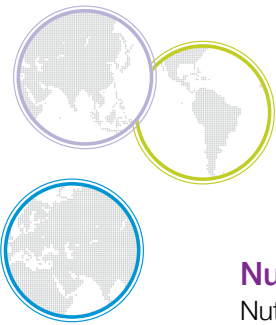
Protein needs likewise increase with severe illness or injury; some patients require up to 2.0 grams of protein per kg of body weight per day (**Table 5.6**). In a patient who is critically ill, muscle loss can exceed 1.4 kg per day; within 2 weeks, a patient can lose up to half the muscle mass he or she had on admission.<sup>66</sup> Protein is an essential nutrient for maintaining muscle synthesis and for preventing its degradation. Dietary protein intake thus requires special attention during and after hospitalization. Protein targets for adults with disease or injury are in the range of 1.0 to 2.0 g/kg actual body weight per day.<sup>68, 95</sup> To maintain lean body mass and function, adults older than 65 years have higher needs than do younger adults ( $\geq 1$  g protein/kg BW/day).<sup>68</sup> In burn or multi-trauma patients, protein needs are greater than 2.0 g/kg body weight per day.<sup>21, 68</sup>

**Table 5.6** How Much to Feed Patients With Critical Illness or Injury: Protein

Estimating Daily Protein Targets for Patients Recovering From Illness or Injury
Guidelines for dietary protein: <b>1.0 to 2.0 or more g protein/kg BW/day</b> <sup>†</sup>
Older patients with acute and/or chronic disease: <b>1.2 to 1.5 g/kg BW/day</b> <sup>†68</sup>
Older patients with severe illness and/or marked malnutrition: <b>as much as 2.0 g/kg BW/day</b> <sup>†68</sup>
Patients with severe burn injury: <b>as much as 2.0 g/kg BW/day</b> <sup>†21</sup>

†Recommendation determined by age, severity of illness or injury, and actual nutritional status

BW=body weight



## Nutrition Orders

Nutrition guidelines and best practices can be embedded into a nutrition orders form, as shown in the example below (**Figure 5.8**). The requirements in a nutrition checklist must be adapted to local patient population and available resources.

**Figure 5.8** Sample Orders for Enteral Tube-Feeding (TF) in Adults: To Be Tailored for Each Hospital

1.	<input type="checkbox"/> Physician authorizes dietitian to initiate, advance, and monitor TF in consultation with physician. <input type="checkbox"/> Physician to select feeding schedule as ordered below.
2.	<b>TUBE FEEDING TYPE: Choose one of the following.</b> <input type="checkbox"/> NG <input type="checkbox"/> ND <input type="checkbox"/> NJ <input type="checkbox"/> PEG <input type="checkbox"/> PEG-J <input type="checkbox"/> D-PEJ <input type="checkbox"/> Other:
3.	<b>TUBE FEEDING FORMULA: Choose one of the following.</b> <input type="checkbox"/> Standard with fiber <input type="checkbox"/> Standard, no fiber <input type="checkbox"/> Diabetes <input type="checkbox"/> Pulmonary <input type="checkbox"/> Anti-inflammatory <input type="checkbox"/> Immune-modulating <input type="checkbox"/> Renal (pre-dialysis) <input type="checkbox"/> Renal (dialysis) <input type="checkbox"/> Peptide-based <input type="checkbox"/> High energy/protein <input type="checkbox"/> Other:
4.	<b>TUBE FEEDING SCHEDULE: HOB elevated to <math>\geq 30^\circ</math>, unless contraindicated.</b> <b>Choose one of the following.</b> <input type="checkbox"/> <b>Continuous tube feeding</b> (Rate=total volume divided by 24 hours). Start TF full strength at 25 mL/h; increase ___mL every 4h until goal of 75mL/h is reached. <input type="checkbox"/> <b>Intermittent tube feeding as alternating ___h feeding and ___h rest.</b> Start TF full strength at 25 mL/h; increase ___mL every feeding until goal rate is met. Max rate recommended is 150 mL/h. Feed day/night/both (circle choice). <input type="checkbox"/> <b>Bolus tube feeding (by gravity). Max recommended rate is 500 mL/bolus.</b> Start full strength at 120 mL per bolus. Advance by ___mL per feeding until goal is reached. Bolus goal volume= ___mL/bolus at (frequency) ___ (time) <input type="checkbox"/> ___24h or <input type="checkbox"/> from ___ to ___
5.	<b>TUBE FEEDING FLUSHES:</b> <input type="checkbox"/> ___mL sterile water every ___h or <input type="checkbox"/> BID/ <input type="checkbox"/> TID/ <input type="checkbox"/> QID
6.	<b>TUBE OCCLUSION TREATMENT:</b> <input type="checkbox"/> Enzyme treatment as _____
7.	<b>CHECK GASTRIC RESIDUAL VOLUME. No check needed if feeding by small bowel tube.</b> If GRV > ___mL more than 2 consecutive hours, hold tube feeding and contact physician <input type="checkbox"/> anytime day or night <input type="checkbox"/> only between these hours _____
8.	<b>BOWEL MANAGEMENT</b> <input type="checkbox"/> Senna 187 mg by feeding tube PRN <input type="checkbox"/> Docusate sodium 100 mg by feeding tube BID PRN <input type="checkbox"/> Milk of magnesia 30 mL daily PRN                      Other: _____
9.	<b>LAB ORDERS:</b> <input type="checkbox"/> Comprehensive metabolic panel <input type="checkbox"/> Phosphorus <input type="checkbox"/> Magnesium <input type="checkbox"/> Prealbumin/transferrin
10.	<b>Other:</b>  <b>Physician's signature:</b>  <b>Date:</b> <b>Time:</b>

Abbreviations: NG, nasogastric; ND, nasoduodenal; NJ: nasojejunal; PEG, percutaneous endoscopic gastrostomy; PEG-J, percutaneous endoscopic gastric-jejunostomy; D-PEJ, Direct percutaneous endoscopic jejunostomy; BID, twice daily; TID, three-times daily; QID, four-times daily; GRV, gastric residual volume; PRN, pro re nata, when necessary



### Key Principles for Advanced Nutrition Care

- For hospitalized patients who cannot meet their nutrition needs by oral intake, start enteral nutrition promptly. Guidelines suggest starting early feeding of critically ill patients, i.e., within the first 24 to 48 hours following admission; advance to target level within 48 to 72 hours, as tolerated. EN can sometimes be started at the target feeding rate.<sup>10, 18, 19, 21</sup>
- Parenteral nutrition remains a life-saving therapy for patients who do not have a functional or accessible gut or for whom it would be unsafe to use enteral feeding.
- For all hospitalized patients, monitor nutrition status and track response to intervention. Adjust the plan to accommodate worsening or improving status. Plan for nutrition care on transition from ICU to ward, and from ward to long-term care or home care.



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## APPENDIX OF PRACTICE TOOLS

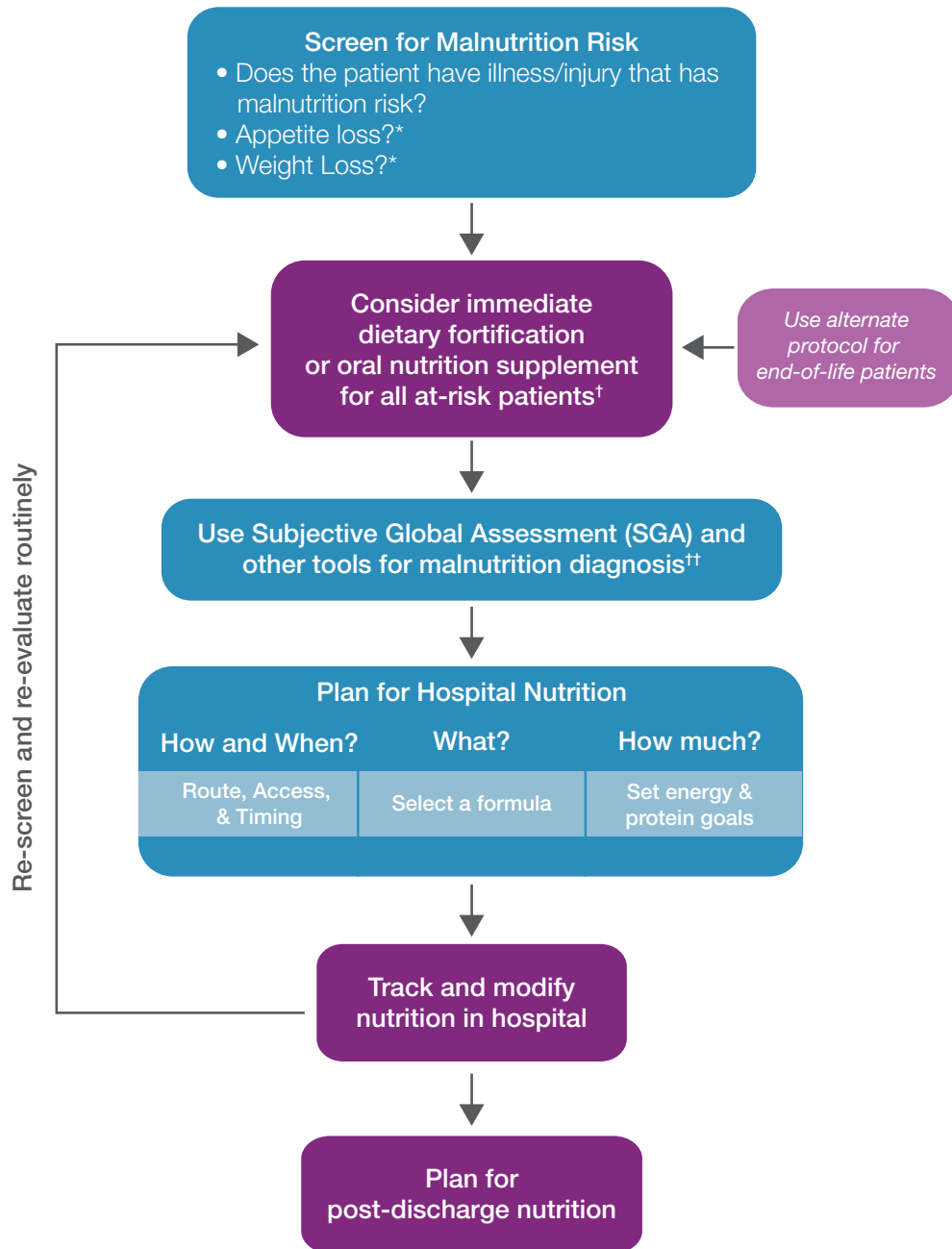
*This appendix provides a set of tools, algorithms, and checklists to help clinicians build their own programs for hospital nutrition care. All are hyperlinked for downloading, so they can be readily used in practice.*

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## feedM.E. NUTRITION CARE PATHWAY



**Figure 4.1.** Nutrition Care Pathway for Hospitalized Patients

\*For information on nutrition screening with the MST. see: Ferguson M, et al. *Nutr.* 1999;15:458-464.<sup>1</sup>

†This advice is for patients who are able to consume food orally.

††For information on nutrition assessment and malnutrition diagnosis. see: Detsky AS, et al. *JPEN* 1987;11:8-13.<sup>2</sup>;

Jensen GL, et al. *JPEN* 2012;36:267-274.<sup>3</sup>; White J, et al. *JPEN* 2012;36:275-283 and *J Acad Nutr. Diet* 2012;112:730-738.<sup>4,5</sup>



# TOOLS TO IDENTIFY MALNUTRITION AND RISK

## Body Mass Index (BMI) Calculator

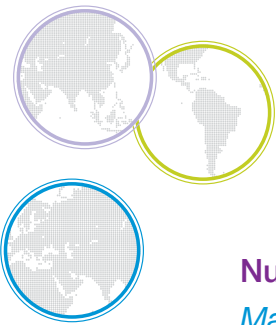
To determine BMI, enter height and weight data in English (inches and pounds) or metric units (centimeters and kilograms).

Height (inches): \_\_\_\_\_ Weight (pounds): \_\_\_\_\_

Height (centimeters): \_\_\_\_\_ Weight (kilograms): \_\_\_\_\_

BMI = \_\_\_\_\_

WEIGHT	lbs	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215		
	kgs	45.5	47.7	50.0	52.3	54.5	56.8	59.1	61.4	63.6	65.9	68.2	70.5	72.7	75.0	77.3	79.5	81.8	84.1	86.4	88.6	90.9	93.2	95.5	97.7		
HEIGHT																											
	inches	cm																									
5'0"	152.4	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42		
5'1"	154.9	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	36	37	38	39	40		
5'2"	157.4	18	19	20	21	22	22	23	24	25	26	27	28	29	30	31	32	33	33	34	35	36	37	38	39		
5'3"	160.0	17	18	19	20	21	22	23	24	24	25	26	27	28	29	30	31	32	32	33	34	35	36	37	38		
5'4"	162.5	17	18	18	19	20	21	22	23	24	24	25	26	27	28	29	30	31	31	32	33	34	35	36	37		
5'5"	165.1	16	17	18	19	20	20	21	22	23	24	25	25	26	27	28	29	30	30	31	32	33	34	35	35		
5'6"	167.6	16	17	17	18	19	20	21	21	22	23	24	25	25	26	27	28	29	29	30	31	32	33	34	34		
5'7"	170.1	15	16	17	18	18	19	20	21	22	22	23	24	25	25	26	27	28	29	29	30	31	32	33	33		
5'8"	172.7	15	16	16	17	18	19	19	20	21	22	22	23	24	25	25	26	27	28	28	29	30	31	32	32		
5'9"	175.2	14	15	16	17	17	18	19	20	20	21	22	22	23	24	25	25	26	27	28	28	29	30	31	31		
5'10"	177.8	14	15	15	16	17	18	18	19	20	20	21	22	23	23	24	25	25	26	27	28	28	29	30	30		
5'11"	180.3	14	14	15	16	16	17	18	18	19	20	21	21	22	23	23	24	25	25	26	27	28	28	29	30		
6'0"	182.8	13	14	14	15	16	17	17	18	19	19	20	21	21	22	23	23	24	25	25	26	27	27	28	29		
6'1"	185.4	13	13	14	15	15	16	17	17	18	19	19	20	21	21	22	23	23	24	25	25	26	27	27	28		
6'2"	187.9	12	13	14	14	15	16	16	17	18	18	19	19	20	21	21	22	23	23	24	25	25	26	27	27		
6'3"	190.5	12	13	13	14	15	15	16	16	17	18	18	19	20	20	21	21	22	23	23	24	25	25	26	26		
6'4"	193.0	12	12	13	14	14	15	15	16	17	17	18	18	19	20	20	21	22	22	23	23	24	25	25	26		



## Nutrition Screening Tools

### Malnutrition Screening Tool (MST) in English Units

Ferguson 1999<sup>1</sup>

<b>1. Have you lost weight recently without trying?</b>	<b>No</b>	<b>0</b>
	<b>Unsure</b>	<b>2</b>
<b>If yes, how much weight have you lost?</b>	<b>2-13 lb</b>	<b>1</b>
	<b>14-23 lb</b>	<b>2</b>
	<b>24-33lb</b>	<b>3</b>
	<b>&gt; 33 lb</b>	<b>4</b>
	<b>Unsure</b>	<b>2</b>
<b>2. Have you been eating poorly because of a decreased appetite?</b>	<b>No</b>	<b>0</b>
	<b>Yes</b>	<b>1</b>
<b>TOTAL MST SCORE</b>		

### Malnutrition Screening Tool (MST) in Metric Units

Ferguson 1999<sup>1</sup>

<b>1. Have you lost weight recently without trying?</b>	<b>No</b>	<b>0</b>
	<b>Unsure</b>	<b>2</b>
<b>If yes, how much weight have you lost?</b>	<b>1-5 kg</b>	<b>1</b>
	<b>6-10 kg</b>	<b>2</b>
	<b>11-15 kg</b>	<b>3</b>
	<b>&gt; 15 kg</b>	<b>4</b>
	<b>Unsure</b>	<b>2</b>
<b>2. Have you been eating poorly because of a decreased appetite?</b>	<b>No</b>	<b>0</b>
	<b>Yes</b>	<b>1</b>
<b>TOTAL MST SCORE</b>		

### Risk of Malnutrition Based on MST Score

Ferguson 1999<sup>1</sup>

	<b>MST Score</b>	<b>Status</b>	<b>Action</b>
<b>Eating well with no recent weight loss</b>	0-1	Low Risk	Rescreen weekly while in hospital
<b>Eating poorly or recent weight loss</b>	2-3	Medium Risk	Recommend nutrition supplement; dietitian consult within 48-72h
<b>Eating poorly and recent weight loss</b>	4-5	High Risk	Recommend nutrition supplement; dietitian consult within 24h





## Nutritional Risk Screening (NRS-2002)

The NRS-2002 nutrition screening tool was developed and validated by the European Society of Clinical Nutrition and Metabolism (ESPEN); it is intended for adults in the community or in the hospital.<sup>6</sup>

### Part 1 NRS Initial Screening\*

	YES	NO
<b>1. Is BMI &lt; 20.5?</b> <b>2. Has the patient lost weight within the last 3 months?</b> <b>3. Has the patient had a reduced dietary intake in the last week?</b> <b>4. Is the patient severely ill, e.g., in intensive therapy?</b>		
<p>*If the answer is 'YES' to any question, proceed to Part 2 Final Screening.            If the answer is 'NO' to all questions, re-screen the patient at weekly intervals. If the patient is scheduled for major surgery, use a preventive nutritional care plan to avert nutritional risk.</p>		

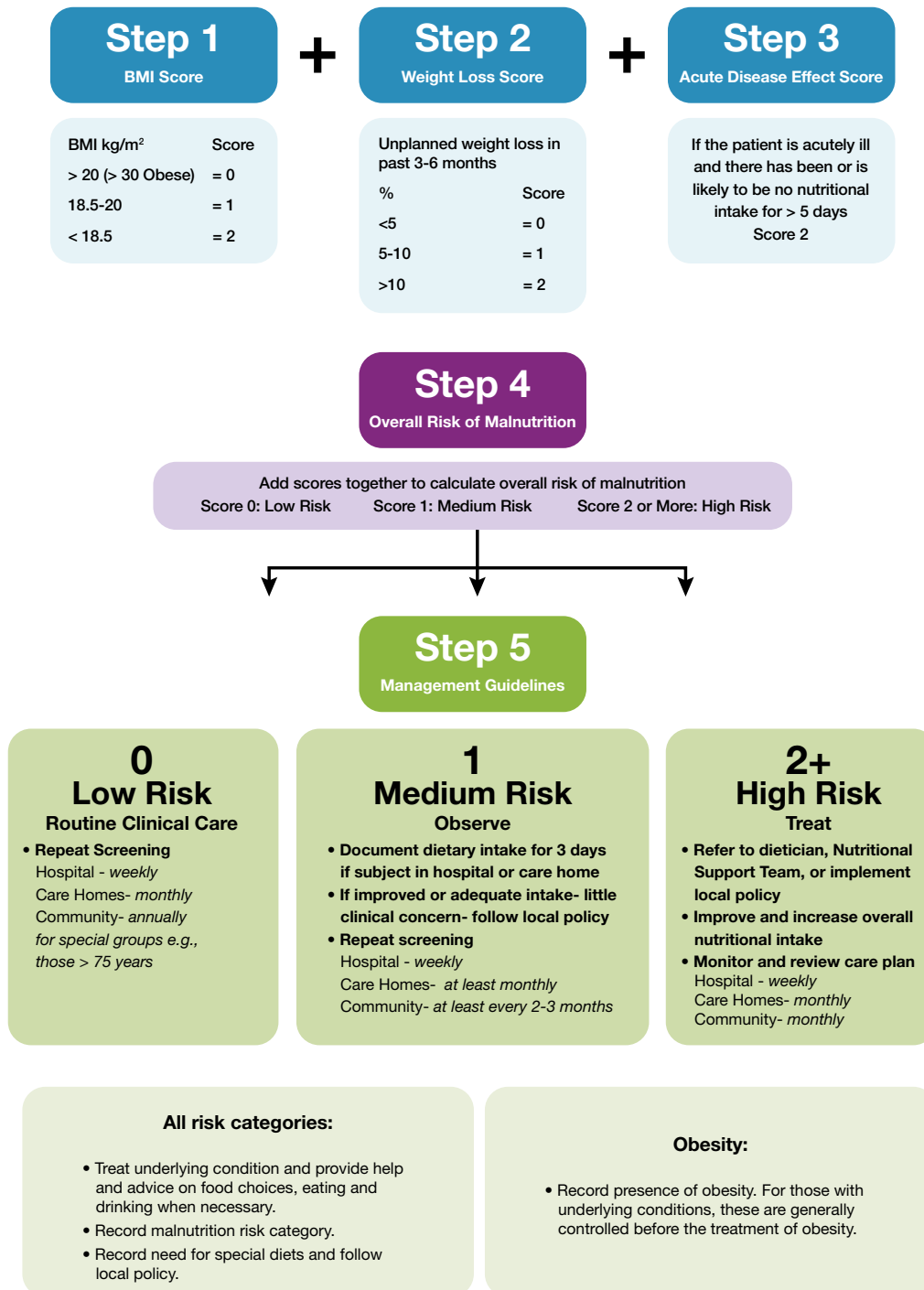
### Part 2 NRS Final Screening\*

Severity of nutritional status impairment		Severity of disease or injury	
Normal nutritional status	Score 0	No disease or injury	Score 0
Wt loss > 5% in 3 months or Food intake below 50-75% of normal requirement in preceding week	Mild Score 1	Hip fracture Chronic patient with acute complication, e.g., cirrhosis, COPD, chronic hemodialysis, diabetes, oncology	Mild Score 1
Wt loss > 5% in 2 months or BMI 18.5-20.5 + impaired general condition or Food intake 25-60% of normal requirement in preceding week	Moderate Score 2	Major abdominal surgery, stroke, severe pneumonia, hematologic malignancy	Moderate Score 2
Wt loss > 5% in 1 month (> 15% in 3 months) or BMI < 18.5 + impaired general condition or Food intake 0-25% of normal requirement in preceding week	Severe Score 3	Head injury, bone marrow transplantation, intensive care patients (APACHE > 10)	Severe Score 3
<b>Scores for nutrition, disease severity</b>			
<b>Total score = nutrition + disease severity score</b>			
<b>If ≥ 70 years old, add 1 to total score</b>			
<p><b>Score ≥ 3: the patient is nutritionally at- risk, and a nutritional plan is initiated.</b>  <b>Score &lt; 3:</b> re-screen the patient at weekly intervals; if the patient is scheduled for major surgery, use a preventive nutritional care plan to avert nutritional risk.</p>			



## Malnutrition Universal Screening Tool

The MUST is a tool used to screen adults for malnutrition risk, including those in the community, in a care home, or in the hospital. It was developed and validated by the British Association for Parenteral and Enteral Nutrition (BAPEN).<sup>7</sup>





## Nutrition Assessment Tools

### *Subjective Global Assessment*

The Subjective Global Assessment (SGA) is a clinical technique used to assess nutritional status of hospitalized patients on the basis of a history and physical examination.<sup>2</sup> The history section covers weight loss, nutritional intake, and gastrointestinal symptoms, while the physical examination section assesses loss of subcutaneous fat tissue and muscle wasting at different sites.

#### **A. History Section**

##### ***Weight Loss***

- The patient's weight loss over the past 6 months (and the past 2 weeks) is evaluated. The 2-week assessment is used to fine-tune the 6-month assessment. Actual weights are preferable if available.
- Weight loss over the last 6 months is rated as:
  - severe if >10%
  - mild-to-moderate if 5 to 10%
  - normal if <5%
- Weight loss over the past 2 weeks is rated as:
  - Normal, if weight is stable
  - Severe, if weight is increasing or decreasing

##### ***Food Intake***

- Rate the patient's food intake: lower scores indicate decreased intake over a longer period of time and greater changes in food type.

##### ***Gastrointestinal Symptoms***

- Looks at gastrointestinal symptoms that have persisted over the past 2 weeks. The more severe the symptoms, the lower the rating.

#### **B. Physical Examination**

##### ***Loss of Subcutaneous Fat***

- Subcutaneous fat can be evaluated by examining:
  - Fat pads under the eyes; these should show a slight bulge in a well-nourished individual, but will be "hollow" in a malnourished patient.
  - Adipose tissue above the triceps and biceps. By pinching the adipose tissue over the tricep and bicep muscles, the thickness of the skinfold is used to rate the patient's nutritional status.



### ***Loss of Muscle***

- The following sites can be utilized for assessment of the patient's muscle mass; the overall rating for muscle loss is based on assessment of these sites.
  - temporalis muscle
  - prominence of the clavicle, contour of the shoulders
  - visibility of the scapula and ribs
  - protrusion of the interosseous muscle between thumb and forefinger
  - amount of quadricep and calf muscle mass.

### **C. Overall SGA Rating**

Use the scoring sheet that follows to help compile a rating based on the Subjective Global assessment.

The overall SGA rating is not simply a numerical score, and one of its strengths is that it can accommodate and incorporate an examiner's clinical judgment. If the patient deteriorates or improves, the examiner may apply different weights to each section to reflect these changes.

## Subjective Global Assessment Scoring Sheet

Patient Name: \_\_\_\_\_ Patient ID: \_\_\_\_\_ Date: \_\_\_\_\_

1. History		Severe	Mild-Moderate	Normal				
Weight Changes		Rating						
Over the past 6 months	Over the past 2 weeks	1	2	3	4	5	6	7
___ < 5% weight change (or gain)	___ Increasing weight							
___ 5-10% weight loss	___ Stable weight							
___ > 10% weight loss	___ Ongoing weight loss							
Food Intake		Rating						
Overall:	___ usual intake	1	2	3	4	5	6	7
	___ < usual and decreasing							
	Duration: ___ weeks							
Type of Change	___ suboptimal solids ___ full liquid intake							
	___ hypocaloric fluids ___ unable to rest							
GI Symptoms		Rating						
	___ none	1	2	3	4	5	6	7
	___ anorexia							
	___ nausea							
	___ vomiting							
	___ diarrhea							
	Duration: ___ weeks							

2. Physical Examination		Severe	Mild-Moderate	Normal				
		Rating						
1. Loss of subcutaneous fat		1	2	3	4	5	6	7
2. Muscle wasting								

2. Overall SGA Classification		Final Rating
A. Normal or well nourished Rating of 6 to 7 in most categories or significant and sustained improvement		
B. Mild to moderately malnourished 3 to 5 rating indicated in most categories		
C. Severely malnourished 1 to 2 rating in most categories		

From Abbott Nutrition Canada ([www.CKDNutrition.ca](http://www.CKDNutrition.ca))





### MNA for Individuals 65 Years and Older

The Mini Nutritional Assessment (MNA) is available in a short form recommended for use as a screen for malnutrition risk. In full-length format, MNA can be used for assessment.

**Mini Nutritional Assessment**  
 For more information on the Mini Nutritional Assessment Tool, go to [www.mna.elderly.com](http://www.mna.elderly.com).

### Serum Biochemistry Measures

Clinical judgment is important to nutritional evaluations, but some physicians look to objective laboratory measures that can complement subjective nutritional assessments.<sup>10, 11</sup> The half-life of each serum biochemical marker determines whether it is best used as a diagnostic (long half-life) or as a measure to track response to treatment and recovery (short half-life).<sup>12</sup>

Serum Measure	Normal Range	Half Life	Comments
<b>Albumin</b>	3.4-5.0 g/dL	20 days	Values below the normal range indicate poor nutritional status and may suggest poor prognosis.
<b>Transferrin</b>	Males: 215-365 mg/dL Females: 250-380 mg/dL	8 days	Values below the normal range indicate poor nutritional status.
<b>Transthyretin (prealbumin)</b>	15-36 mg/dL	1-2 days	Values below the normal range indicate poor nutritional status; rising levels over time indicate response to treatment and recovery.
<b>C-reactive protein</b>	< 1.0 mg/dL	18 hours	Values above the normal range indicate inflammation, as associated with disease, which may negatively affect nutritional status.



## HOW TO FEED

### Enteral Nutrition (EN) Versus Parenteral Nutrition (PN) Feeding

Does the patient have..	Comments
<b>...a condition in which the gut is not fully functional or accessible?</b>	
• Perforated bowel	<b>Contraindication to EN; use PN until perforation is repaired, then consider EN</b>
• Severe short bowel syndrome (<100 cm)	<b>Absolute contraindication to EN; use PN</b>
• Mechanical bowel obstruction or bowel not physically accessible	<b>Contraindication to EN; use PN until problem is corrected</b> <sup>13,14</sup>
• Bowel ischemia	<b>Contraindication to EN prior to repair</b> <sup>13,14</sup>
• Absence of bowel sounds, flatus, or stool passage	Bowel sounds are no longer considered necessary to begin using the gut in ICU patients, nor is passage of flatus or stool. <sup>14,15</sup>
• Ileus (limited GI motility)	The impact of ileus on function can vary in different sections of the GI tract; e.g., post-surgical ileus appears to affect the stomach and colon more than the small intestine; <sup>14</sup> thus, post-pyloric feeding may be tolerated in this case. If EN is not tolerated, PN may be necessary.
• High gastric residual volume (GRV)	The definition of "high GRV" (for withholding EN) varies with different guidelines; <sup>13,15</sup> follow local protocols and use clinical judgment. Promotility agents can be used to help reduce gastric residual volumes. Consider accepting gastric residual volumes up to 500mL, but monitor for aspiration risk. <sup>13, 15</sup>
• Poor GI absorption	Consider a small peptide feeding formula to help overcome absorption problems. <sup>17</sup>
<b>...a condition in which tube feeding EN may not be safe?</b>	
• Hemodynamic instability	Severe hemodynamic instability, such as in patients who are receiving escalating doses of vasopressors, is a contraindication to EN. <sup>15,16</sup> New evidence suggests that EN can reduce mortality in patients with hemodynamic instability (when EN is started in the first 48h). <sup>16</sup> Results of an observational study showed that the sickest patients, i.e., those on multiple vasopressors, were most likely to benefit.
• Limitation to maintaining head of bed (HOB) elevation of 30 to 45° angle	With conditions such as spinal injury or hemodynamic instability, HOB elevation may not be possible. <sup>13,19,20</sup> Lack of HOB elevation is otherwise unsafe because it increases risk of reflux and of aspiration pneumonia. <sup>13</sup>
• Pancreatitis	For patients who have uncomplicated pancreatitis and require nutrition support, "EN should be considered the standard of care." <sup>21</sup> EN is associated with multiple advantages for such patients. <sup>21,22</sup>
<b>...a condition in which tube feeding EN may not be effective?</b>	
• Uncontrolled vomiting	Uncontrolled vomiting limits use of EN, as it increases risk for aspiration and presents challenges in tube placement and maintenance of tube position. In some cases, EN feeding can be managed. Consider small bowel feeding in conjunction or use of prokinetic agents. <sup>13,17</sup>
• Uncontrolled diarrhea	Uncontrolled diarrhea limits the effectiveness of EN. To control diarrhea, consider and treat the underlying cause, i.e., infection, inflammation, impaction, medication. Depending on the cause of diarrhea, an EN formula with added fiber or one that is less concentrated may be tolerated. When diarrhea is not due to infection, consider using an anti-diarrheal agent. <sup>17</sup>
• Fistula with output	A high-output, mid-gut fistulae is a contraindication to EN prior to its repair. Patients with more proximal or distal fistulae, with low-to-moderate output, may tolerate EN with close monitoring. <sup>14</sup>





## Route, Access, and Regimen

### Enteral Route: Nasal Access or Direct Access to Stomach or Small Bowel

Decision points	Nasal access*	Direct access†
<b>Expected duration of feeding</b>	Less than 4 weeks	4 weeks or longer
<b>Indications (diseases or disorders)</b>	Disorders of the pharynx or esophagus Neurological or psychological disorders Certain GI disorders Short bowel Burns	Swallowing difficulties Upper GI tract disrupted by tumor or trauma Severe GI dysfunction Poor stomach emptying Severe nausea, uncontrolled vomiting, or gastric dilation
<b>Other indications</b>	Ongoing chemo- or radiotherapy	Long-term ventilation required For post-operative recovery following mouth or pharynx surgery

\* Nasal tubes enter through the nose and feed to the stomach (nasogastric) or small bowel (nasoduodenal, nasojejunal).

† Direct access tubes enter through the abdominal wall and feed directly to the stomach (gastrostomy) or small bowel (jejunostomy); a direct access tube entering the stomach can also be used to feed to the jejunum (gastro-jejunostomy).

### Feeding Regimen: Pump or Gravity for Enteral Feeding

	Who?	Why?	Why not?
<b>Pump</b>	For small bowel feedings <sup>19</sup> Patients with severe reflux, risk of aspiration, severe diarrhea <sup>23, 24</sup>	Precise and consistent delivery rates, which can benefit patients with volume sensitivity <sup>25</sup> Enhanced GI tolerance with slow, continuous feeding; <sup>25</sup> lower rates of vomiting, aspiration, and severe diarrhea <sup>19</sup>	Not yet available in your hospital setting
<b>Gravity</b>	Stable patients who can tolerate intermittent or bolus feedings to the stomach <sup>25</sup>	Widely available	Delivery rates are less reliable with gravity feeding than with pumps <sup>26</sup> Intended flow rate may be altered if patient changes position in bed <sup>26</sup>



## Feeding Regimen: Continuous, Intermittent, or Bolus delivery of Enteral Formula

Feeding Regimen*	How	Where	Who	Why
Continuous	Pump	Small bowel or stomach	Critically ill patients <sup>27</sup> Patients at risk of reflux or aspiration <sup>27</sup> Individuals intolerant of intermittent or bolus feedings <sup>27</sup>	Continuous, slow rate enhances GI tolerance <sup>25</sup>
Intermittent	Pump or gravity <sup>27</sup>	Small bowel or stomach	Patients who are mobile <sup>28</sup> or have other reasons for non-continuous feeding	Slowed feeding rate is possible even when a pump is unavailable
Bolus	Gravity or syringe <sup>19</sup>	Stomach only, as small bowel lacks reservoir capacity <sup>23, 24, 29</sup>	Patients who need or prefer extended breaks from feeding	Mimics normal meals; does not require a pump

\*Continuous feeding delivers formula at a nonstop slow rate to achieve daily nutrition targets.<sup>19</sup> Intermittent feedings are given periodically over time (e.g., 2-3 hours of feeding followed by 2 hours of rest),<sup>23, 24, 26, 29</sup> and bolus feedings are given all at once but with feedings multiple times a day, (e.g., full bolus in 15 minutes, with 3 to 8 such feedings per day).<sup>19</sup>

## HOW MUCH TO FEED: SETTING ENERGY AND PROTEIN TARGETS

Clinicians estimate energy and protein needs and establish a target energy goal for each patient.<sup>15, 30</sup> Adult energy requirements depend on needs for basal metabolism, physical activity, and metabolic stresses of different disease conditions.<sup>31</sup> The easiest method to estimate energy needs is to use the simple predictive formula that determines daily calorie requirements by multiplying the patient's body weight (BW, in kg) by 25 to 30 kcal, i.e., 25-30 kcal/kg BW/day.<sup>15</sup>

### Simple Formula to Estimate Daily Energy Needs

Estimating daily energy targets for patients recovering from illness or injury

Simple formula for estimating energy requirement: 25 to 30 kcal/kg BW/day\*

\*Recommendation based on metabolic stress of disease, physical activity, and actual nutritional status

Alternative methods for estimating energy needs are also available. Indirect calorimetry requires specialty equipment and a trained operator,<sup>31</sup> while the Harris-Benedict equation takes sex, gender, weight, height, and age into account.<sup>31, 32</sup> In turn, an estimate obtained with the Harris-Benedict equation can be further individualized by correcting for activity level and for severity of disease- or injury-related metabolic stress.





## Other Methods to Estimate Daily Energy Needs

Method of estimating energy need	Inputs	Comments
Indirect calorimetry <sup>31</sup>	Requires specialty equipment and a trained operator	An accurate measurement of individual energy needs that requires access to a ventilation hood, respiration chamber, pumps and measurement instruments that allows measurement of the patient's volume and concentration of oxygen/carbon dioxide. These values are converted to energy needs using a general formula.
Harris-Benedict equation <sup>31,32</sup>	Sex, weight, height, and age	<p>A common and widely accepted predictive equation to determine daily caloric needs due to resting energy expenditure (REE).</p> <p>By gender, the equations are:</p> <ul style="list-style-type: none"> <li>• Adult male daily REE (in calories) = <math>66.5 + (13.8 \times \text{weight in kg}) + (5.0 \times \text{height in cm}) - (6.8 \times \text{age in years})</math></li> <li>• Adult female daily REE = <math>655.1 + (9.6 \times \text{weight in kg}) + (1.8 \times \text{height in cm}) - (4.7 \times \text{age in years})</math></li> </ul> <p>The results are further refined by multiplying by factors that correct for higher metabolic needs due to activity and to the stress of illness or injury.</p>

Use the Table Below to Personalize Harris-Benedict REE Results in Order to Correct for Physical Activity and Inflammation<sup>33</sup>

Select an activity and a stress factor	Correction factor
<b>Activity factor:</b>	1.2 = confined to bed 1.3 = out of bed
<b>Stress Factor:</b>	
<b>Trauma</b>	1.35 = skeletal 1.6 = head injury with steroid therapy 1.35 = blunt
<b>Surgery</b>	1.1 = minor 1.2 = major
<b>Infection</b>	1.2 = mild 1.5 = moderate 1.8 = severe
<b>Burns</b>	1.5 = 40% of body surface area 1.95 = 100% of body surface area



Protein is an essential nutrient for maintaining muscle protein synthesis and preventing its breakdown, especially in individuals with illness or injury. Dietary protein intake thus requires special attention during and after hospitalization. The usual recommendation for dietary protein intake by a healthy adult is 0.8g protein/kg BW/day.<sup>34</sup> Protein targets for adults with disease or injury vary widely according to severity of the condition (1.0 to 2.0 g/kg actual body weight per day).<sup>15, 35</sup> To maintain lean body mass and function, adults older than 65 years have higher needs than do younger adults ( $\geq 1$  g protein/kg BW/day).<sup>35</sup> In patients who are obese (body mass index  $> 30$ ), protein need is  $\geq 2.0$  g/kg body weight per day (ideal body weight is used for obese adult estimates).<sup>15, 35</sup>

### How Much Protein to Feed Patients With Illness or Injury

Estimating daily protein targets for patients recovering from illness or injury
<b>Guidelines for dietary protein: 1.0 to 2.0 or more g protein/kg BW/day†</b>
<b>Older patients with acute and/or chronic disease: 1.2 to 1.5 g/kg BW/day<sup>†35</sup></b>
<b>Older patients with severe illness and/or marked malnutrition: as much as 2.0 g/kg BW/day<sup>†35</sup></b>
<b>Patients with severe burn injury: as much as 2.0 g/kg BW/day<sup>†15</sup></b>

†Recommendation determined by age, severity of illness or injury, and actual nutritional status

BW=body weight

## WHAT TO FEED: CHOOSING THE BEST ENTERAL FORMULA FOR A PATIENT

**Feeding Formula: Patients with Different Disease Conditions Have Varying Nutritional Needs, Which Can Be Met with Specialty Nutritional Formulas**

Disease condition	Special nutritional needs
Fluid volume-restricted (e.g., with heart failure)	Calorically-dense, high energy, and/or high protein <sup>36</sup>
Diabetes	Ingredients that help minimize post-feeding blood glucose rises <sup>37,38</sup>
Chronic kidney disease pre-dialysis	Low protein, low phosphorus <sup>39</sup> to lessen burden on the kidneys
Chronic kidney disease with dialysis	High protein <sup>39</sup> to compensate for protein losses due to dialysis; low phosphorus <sup>39</sup> to lessen burden on the kidneys
Cancer	High protein, inflammation-modulating, and antioxidant ingredients <sup>40</sup>
SIRS/sepsis or ALI/ARDS	Inflammation-modulating ingredients <sup>39</sup>
Surgery, trauma, burns	Immune-modulating ingredients <sup>39</sup>
GI intolerance or malabsorption	Tolerance-promoting ingredients such as medium-chain triglycerides and small peptides <sup>15, 41</sup>

SIRS= Systemic inflammatory response syndrome; ALI= Acute lung injury; ARDS= Acute respiratory distress syndrome







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