Original Investigation

Malnutrition and Pressure Injury Risk in Vulnerable Populations: Application of the 2019 International Clinical Practice Guideline

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ABSTRACT

Nutrition plays a vital role in promoting skin integrity and supporting tissue repair in the presence of chronic wounds such as pressure injuries (PIs). Individuals who are malnourished are at greater risk of polymorbid conditions, adverse clinical outcomes, longer hospital lengths of stay, PI development, and mortality, and incur increased healthcare costs compared with patients who are adequately nourished. In addition, some patient populations tend to be more vulnerable to PI formation, such as neonates, patients with obesity, older adults, and individuals who are critically ill. Accordingly, this article aims to review the latest nutrition care recommendations for the prevention and treatment of PIs, including those recommendations tailored to special populations. A secondary objective is to translate nutrition recommendations into actionable steps for the healthcare professional to implement as part of a patient plan of care.

Implementing an evidence-based plan of care built around individualized nutrition interventions is an essential step supporting skin integrity for these populations. The 2019 *Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline* (CPG) affirms that meeting nutrient requirements is essential for growth, development, maintenance, and repair of body tissues. Many macronutrients and micronutrients work synergistically to heal PIs. Registered dietitian nutritionists play an important role in helping patients identify the most nutrient dense foods, protein supplements, and oral nutrition supplements to meet their unique requirements.

KEYWORDS: clinical practice guideline, nutrition, older adult, pressure injury, special populations

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INTRODUCTION

Nutrition plays a vital role in promoting skin integrity and supporting tissue repair in the presence of pressure injuries (PIs). Providing sufficient calories to optimize energy intake and adequate nutrients for individuals at risk of or with malnutrition is essential. For individuals at risk of or with a PI, meeting nutrition requirements is foundational to good health.

Accordingly, the European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, and Pan Pacific Pressure Injury Alliance have developed nutrition recommendations to guide the care of individuals at risk of or with a PI.[1] Patient populations such as older adults, neonates, patients with obesity, and those who are critically ill are vulnerable to PI formation. Implementing an evidence-based plan of care built around individualized nutrition interventions is an essential step supporting skin integrity.

This article aims to review the latest nutrition care recommendations for the prevention and treatment of PIs, including those recommendations tailored to special populations. A secondary objective is to translate nutrition recommendations into actionable steps for the healthcare professional to implement as part of a patient plan of care.

MALNUTRITION AND PI DEVELOPMENT IN VULNERABLE POPULATIONS

Individuals who are malnourished are at greater risk of polymorbid conditions, adverse clinical outcomes, longer hospital lengths of stay, PI, and mortality, and incur increased healthcare costs compared with patients who are adequately nourished.[2–5] Researchers estimate that hospital costs may be 100% higher for patients who are malnourished versus adequately nourished.[6]

Those patient populations who tend to be more vulnerable to PI formation have numerous intrinsic and extrinsic

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risk factors that predispose them to PI formation, including malnutrition.[7–11] This is not surprising because malnutrition affects tissue tolerance.[12] Normally, the skin requires adequate nutrients to sustain itself but in the presence of protein-calorie malnutrition (PCM), among other factors, the skin's resilience is diminished, often leading to PI formation.[13,14]

The impaired wound healing that results from severe malnutrition is part of a cascade of pathophysiologic events that creates a downward clinical spiral. The chronicity of the wound affects the metabolic pathways of many nutrients, resulting in impaired wound healing. Simply adding one amino acid or one vitamin is not a viable solution to promote wound healing. Multiple interventions are needed at strategic intervals to address both malnutrition and wound healing.[15]

Special Group: Neonates

The aim of nutrition support in neonates is to promote growth and development. The high nutritive demands of extremely preterm infants (<28 weeks' gestation) support doubling their weight by 30 weeks' gestational age. This growth rate requires a high intake of energy, protein, and other nutrients. Extremely low-birth-weight infants are born with low stores of iron, zinc, calcium, and vitamins. They have minimal to no subcutaneous tissue present at birth.[16,17] Electrolyte, fluid, and glucose imbalance is common in the first few days of life. To combat this imbalance, parenteral nutrition should be implemented within 24 hours following birth.[16] Underdevelopment of the skin and underlying tissue structures at birth translate into minimal tissue tolerance for external pressure forces.

Appropriate protein and amino acid replacement protocols are needed for neonates. Protein intake for a neonate ranges from 1.5 to 3.5 g/kg per day to maintain a nitrogen balance necessary for growth.[16] Adamkin[18] reported that extremely low-birth-weight infants receiving amino acids for protein synthesis and sufficient calories for growth within the first week of life had better outcomes related to bronchopulmonary dysplasia, late-onset sepsis, hospital stays, neurodevelopmental impairment, cognition, and death compared with infants who received significantly fewer calories and less protein.[18–20] However, it is uncertain whether an increase in protein and calories will assist in PI prevention. That said, the increase in nutrition would assist in skin and structural development, ultimately decreasing cell deformation and supporting PI prevention.[21]

Special Group: Older Adults

On the other end of the age spectrum, older adults experience malnutrition in settings such as hospitals and long-term care.[11,12,22–26] Factors affecting the nutrition status of older adults include declining appetite, weight loss, chronic diseases, polypharmacy, feeding dependency, loss of taste and smell, and impaired dentition.[7] Unfortunately, malnutrition only adds to the plight of older adults who are already predisposed to poor functional outcomes and quality of life, as well as increased hospital lengths of stay, morbidity, and mortality.[8,27–30] The additional burden of a PI only adds to the complexity of their care.

Research and nutrition guidelines have discussed the link between malnutrition in the older adult and PI formation and/or its impact on PI healing. Providers should implement measures for accurate assessment and evaluations to avoid or promptly recognize malnutrition in the older adult. Nutrition interventions should be timely and accommodate considerations, such as food preferences, diet liberalization, tolerance, and feeding route, as well as appropriate supplementation.[7,12,25,26,31–35]

Special Group: Individuals with Obesity

In previous years, obesity (overnutrition) was simply defined as a condition occurring when too many calories were consumed, often empty calories.[23,32] However, more recent literature defines obesity as a complex condition,[36] disease,[37] and state[38] associated with metabolic disorders.[39] Its classification as a condition, state, or disease seems to be linked to the severity of obesity and associated sequelae. An adult with overweight or obesity may be at risk of malnutrition during severe acute illness or major traumatic event because calories consumed may not be adequate.[40] The degrees of obesity are subdivided by the body mass index (BMI) into classes: class 1, BMI of 30 to 35 kg/m^2; class 2, BMI of 35 to 40 kg/m^2; and class 3, BMI of 40 kg/m^2 or higher.[41] Class 3 obesity may also be categorized as "extreme," "severe," or "morbid" obesity.[35] It is known that obesity is a low-grade chronic inflammatory state[36,37] that can lead to an array of metabolic disorders and increased susceptibility to immobility; it has also been linked to PI formation.[9,42]

Malnutrition can impact tissue tolerance via malfunctions of the body systems and vascular flow, but the added complications of the obesity spectrum compound the situation.[38,39] Obesity can be synonymous with a lack of nutrition support for critical body functions, and this relationship is what can potentiate PI formation and poor wound healing.[12,38,39] It is considered a multimorbid factor for the critically ill[43] and older adult[42] populations who are already at risk of PI formation.

Sarcopenic obesity is a multifactorial condition that is the result of aging, sedentary lifestyle, and unhealthy diets concurrent with insulin resistance, inflammation, and oxidative stress. Individuals with sarcopenic obesity experience reduced muscle mass and function with an increase in fat mass.[44–46] Sarcopenic obesity must be identified and treated to promote wound healing.

Special Group: ICU Patients

In recent years, there has been increased interest in the impact of nutrition and nutrition intake during critical illness. A recent systematic review reported a high prevalence of malnutrition among ICU patients, ranging from 38% to 78%, with associated negative sequelae including morbidity and mortality, longer hospital length of stay, ICU readmission, and serious adverse events such as hospital-acquired PIs.[47–50] In particular, PIs are a concern in this population, which has the highest incidence of any setting, ranging from 12% to 24.5%.[51]

In the critically ill, nutrition needs are poorly understood and vary based on the phase of illness.[52] Severe PCM can result from impaired intake, as well the hypercatabolic/hypermetabolic response to injury or severe illness.[53] In a hypermetabolic state, calorie utilization escalates, pulling from glycogen stores and then from visceral stores to meet end-organ energy needs. In addition, the activation of tissue proteins from the inflammatory and immune responses contributes to anorexia, muscle wasting, decreased nitrogen retention, and impaired albumin synthesis.

Accurately measuring nutrition status in the critically ill presents an additional challenge to clinicians. Nutrition screening tools such as the NUTRIC (Nutrition Risk in Critically Ill) are specifically tailored to this population.[54] This validated tool takes into consideration the unique clinical characteristics of critically ill patients that alter their response to nutrition interventions.[55,56] However, the association between NUTRIC scores and PI development has not been studied to date and may be worthy of future investigation.

The 2019 *Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline* (CPG) affirms that meeting nutrient requirements is essential for growth, development, maintenance, and repair of body tissues.[1] Both inadequate nutrition intake and undernutrition have been associated with PI development.[1] In the critical care population, feeding problems can arise from prolonged NPO status, enteral feeding holds during weaning from mechanical ventilation, the provision of bedside care (eg, repositioning, incontinence care), bedside procedures such as line placement that require the head of the bed to be flat, and holds for perceived intolerance to enteral feeding formulas.[57–62]

Overall, the impact of nutrition on PI prevention and treatment in critical care has been understudied, with sparse evidence to support or refute its role in PI development, prevention, and treatment. In older studies regarding this population, the number of days without nutrition (>3 days) and BMI were predictive of PI development.[63,64] More recent empirical investigations examining PI risk factors in the critically ill identified PCM and hypoalbuminemia to be significant predictors of PI development.[65–69] Although albumin and prealbumin are not reliable nutrition indicators, anasarca (a clinical finding related to PCM) and hypoalbuminemia contribute to impaired nutrient delivery and waste removal from the tissues and skin, which impacts perfusion and results in compromised tissue tolerance that may potentiate PI development.[70] Few studies have examined the impact of nutrition interventions on PI prevention in this population. Bourdel-Marchasson and colleagues[71] reported that in older critically ill patients who could consume an oral diet, the use of a standard diet plus two oral nutrition supplements (ONSs) compared with standard diet alone resulted in the development of fewer PIs. Theilla and colleagues[72] found a reduction in the development of PIs in 100 mechanically ventilated patients with acute lung injury when an enteral formula enriched with micronutrients, eicosapentaenoic acid, and α-linolenic acid was administered compared with a control formula without these nutrition components. In one study that evaluated the impact of nutrition on PI healing in critical care patients, the introduction of a feeding formula enriched with fish oil significantly decreased the progression of stage 2 or more severe PIs compared with those patients given an isocaloric control formula.[72]

The need persists to strengthen the empirical evidence surrounding the impact of nutrition on PIs in the critically ill population. A better understanding of the nutrition risk factors that play a role in PI development as well as intervention studies that examine the effect of nutrition intake and supplementation on PIs development, prevention, and healing may contribute to overall improved outcomes in this vulnerable subset of hospitalized patients.

RECOMMENDATIONS FOR PRACTICE

The CPG provides specific and general nutrition recommendations (Table 1). Clinical managers and healthcare administrators are responsible for incorporating these recommendations into their current healthcare systems and clinical pathways. Begin the process by comparing current practices with the CPG recommendations for nutrition screening, assessment, care plans, and interventions. Overarching considerations include the following:

- What is current practice?
- Are these practices evidence-based?
- What should be different?

Table 2 includes selected questions to consider in updating policies, protocols, and clinical pathways.[73] This information is intended as a starting point for critical evaluations of current practice and is not meant to be exhaustive.

To identify patients who will benefit from an in-depth nutrition assessment, a nutrition screen should be conducted on all patients admitted or readmitted to a healthcare setting in accordance with facility policies and regulatory guidelines. The nutrition screen should be completed by any member of the interdisciplinary team who has been

Table 1. CLINICAL PRACTICE GUIDELINE NUTRITION RECOMMENDATIONS AND GOOD PRACTICE STATEMENTS

Recommendation	SoE	SoR	GPS
Consider the impact of impaired nutrition status on the risk of PIs.	SoE = C	SoR = ↑	—
Conduct nutritional screening for individuals at risk of a PI.	SoE = B1	SoR = ↑↑	—
Conduct a comprehensive nutrition assessment for adults at risk of a PI who are screened to be at risk of malnutrition and for all adults with a PI.	SoE = B2	SoR = ↑↑	—
Develop and implement an individualized nutrition care plan for individuals with, or at risk of, a PI who are malnourished or who are at risk of malnutrition.	SoE = B2	SoR = ↑↑	—
Optimize energy intake for individuals at risk of PIs who are malnourished or at risk of malnutrition.	SoE = B2	SoR = ↑	—
Adjust protein intake for individuals at risk of PIs who are malnourished or at risk of malnutrition.	—	—	yes
Provide 30-35 kcal/kg body weight per day for adults with a PI who are malnourished or at risk of malnutrition.	SoE = B1	SoR = ↑	—
Provide 1.25-1.5 g protein/kg body weight per day for adults with a PI who are malnourished or at risk of malnutrition.	SoE = B1	SoR = ↑↑	—
Offer high-calorie, high-protein fortified foods and/or nutrition supplements in addition to the usual diet for adults who are at risk of developing a PI and who are also malnourished or at risk of malnutrition, if nutrition requirements cannot be achieved by normal dietary intake.	SoE = C	SoR = ↑	—
Offer high-calorie, high-protein nutrition supplements in addition to the usual diet for adults with a PI who are malnourished or at risk of malnutrition, if nutrition requirements cannot be achieved by normal dietary intake.	SoE = B1	SoR = ↑↑	—
Provide high-calorie, high-protein, arginine, zinc, and antioxidant oral nutrition supplements or enteral formula for adults with a stage 2 or greater PI who are malnourished or at risk of malnutrition.	SoE = B1	SoR = ↑	—
Discuss the benefits and harms of enteral or parenteral feeding to support overall health in light of preferences and goals of care with individuals at risk of PIs who cannot meet their nutrition requirements through oral intake despite nutrition interventions.	—	—	yes
Discuss the benefits and harms of enteral or parenteral feeding to support PI treatment in light of preferences and goals of care for individuals with PIs who cannot meet their nutrition requirements through oral intake despite nutrition interventions.	SoE = B1	SoR = ↑	—
Provide and encourage adequate water/fluid intake for hydration for an individual with or at risk of pressure injury, when compatible with goals of care and clinical conditions.	—	—	yes
Conduct age-appropriate nutrition screening and assessment for neonates and children at risk of PIs.	—	—	yes
For neonates and children with or at risk of PIs who have inadequate oral intake, consider fortified foods, age-appropriate nutrition supplements, or enteral or parenteral support.	—	—	yes
Provide PI education, skills training, and psychosocial support to individuals with or at risk of PIs.	SoE = C	SoR = ↑	—

Abbreviations: GPS, good practice statement; PI, pressure injury, SoE, strength of evidence; SoR, strength of recommendation.
Note: For more details regarding an interpretation of the evidence and recommendations, use the following link to download the free e-version of the Quick Reference Guide for free: www.internationalguideline.com/static/pdfs/Quick_Reference_Guide-10Mar2019.pdf.
Reference: European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel and Pan Pacific Pressure Injury Alliance. Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline. The International Guideline. Haesler E, ed. EPUAP/NPIAP/PPPIA; 2019.

trained and deemed competent to do so. The screening tool should be valid and reliable for the intended population.[5,74] Examples of valid and reliable tools that are sensitive indicators of risk for developing PI include the Mini Nutritional Assessment and Malnutrition Universal Screening Tool.[75,76]

Individuals at risk of or with malnutrition as well as patients with a PI should be referred to a registered dietitian nutritionist (RDN) to conduct an in-depth nutrition assessment.[40,77] The RDN should review the patient's food and fluid intake history, evaluate anthropometric measurements and weight history, review biochemical data and tests performed, and conduct a nutrition-focused physical examination.[5]

Once the patient's nutrition diagnosis has been identified, an individualized care plan should be developed and communicated to all members of the interprofessional team. Interventions to correct nutrition and hydration deficits must be evidence-based and in accordance with the patients' goals.[78] The care plan should be adjusted each time the patient's condition changes.[79]

It is important to boost the calorie and protein intake of individuals at risk of or with malnutrition. Research has demonstrated that ONSs improve the caloric intake of individuals at risk of malnutrition.[80] It is good practice to provide additional protein at meals to individuals with acute and chronic conditions and older adults with malnutrition identified at risk of PI.[1] Determination of calorie and protein needs should take into account the patient's underlying medical conditions. Research suggests that the protein intake for older adults should be 1 to 1.5 g/kg body weight per day.[35,81] There are a number of guidelines that define calorie and protein recommendations for populations at risk of a PI (Table 3).

Individuals with a PI who are malnourished or at risk of malnutrition should receive 30 to 35 kcal/kg body weight and 1.25 to 1.5 g protein/kg body weight per day. When the patient's intake is not adequate to meet his/her nutrition needs, interventions such as the use of enhanced/fortified foods and ONSs should be implemented.[1] The use of a high-calorie, high-protein ONS containing immune-

Table 2. SELECTED QUESTIONS TO CONSIDER

Nutrition Screen	Nutrition Assessment	Nutrition Care Plan	Nutrition Interventions
• Is the tool validated? • Is there a validated tool that better meets your needs? • What percentage of patients have a screening tool completed on admission? • Is the score and interpretation of the score populated in the EHR? • Are the scores consistent with other PI screening tools with nutrition components? • Is the process sustainable?	• Are standards of care for practice of dietetics being followed? • What criteria trigger a consult for assessment by RDN? • Does the EHR populate useful data, eg, calculate body mass index? • Are the most current criteria to identify malnutrition used? • Is the process sustainable?	• Are care plans written according to unit policies? • Are care plans based on protocols? Have protocols been updated with the 2019 CPG? • How often are care plans updated? • Are care plan goals and interventions communicated to healthcare team? • Is the process sustainable?	• Are nutrition interventions based on protocols? Have protocols been updated with 2019 CPG? • Does your formulary include an ONS containing immune-modulating nutrients as described in the CPG? • Are clinical outcomes tied to nutrition interventions? • How often are interventions updated? • Is the process sustainable?

Abbreviations: CPG, Clinical Practice Guideline; EHR, electronic health record; ONS, oral nutrition supplement (immune-modulating nutrients include arginine, other nucleotides, vitamins E and C, selenium, and/or beta-carotene); RDN, registered dietitian nutritionist.

Reference: Litchford MD. Nutrition & Pressure Injuries: Putting the Guideline into Practice. Greensboro, NC: CASE Software & Books; 2020.

modulating nutrients (immune-ONS; ie, arginine, zinc, and antioxidants) has been associated with increased PI healing.[82] Individuals who cannot meet their nutrient needs with dietary intake should be provided two servings of nutrient dense ONS (1.5–2.4 kcal/mL) between meals for at least 4 weeks.[1] For individuals with a stage 2 (or greater) PI who cannot meet their nutrition needs with a regular diet, high-protein ONSs containing arginine, zinc, and antioxidants should be provided.[1] Although the supporting research does not address deep-tissue or unstageable PIs, it is reasonable to conclude that individuals with these injuries have significant damage to the skin and underlying tissues and could benefit from a high-energy, high-protein ONS containing arginine, zinc, and antioxidants. Practitioners should determine the appropriateness of immune-ONS using best clinical judgment. See Table 4 for an example of an ONS regimen.

Food should be the first intervention, incorporating preferred foods and beverages to address weight loss and malnutrition. This is an effective intervention that tends to be more enjoyable for patients because of the increased variety, flavor, and caregiver ability to match the patient's ethnic and normal eating patterns. See Table 5 for a comparison of foods usually found in facilities' nourishment rooms.

Optimize Protein and Energy Intake

Many macronutrients and micronutrients work synergistically to heal a PI. The CPG recommends specific ranges for energy and protein intake because of their importance in the synthesis of new tissues required for wound healing. Meeting energy and protein needs can be achieved with food if the patient can and is willing to consume the quantities required. Illness and declining functional status may limit the total volume of foods and liquids consumed. Use of high-quality protein supplements; high-calorie, high-protein ONSs; enteral feeds; and parenteral nutrition are options to meet increased nutrient needs for wound healing. These products can be incorporated into an individual's diet if required as part of the goals of care.

Dietary sources of protein, carbohydrate, and fats are not nutritionally equivalent. Incorporate high-quality complex carbohydrates, healthy fats including omega-3 fats, and complete sources of dietary protein. Complete sources of protein contain all the indispensable amino acids (IDAAs) in amounts needed to meet the reference pattern. In addition, Recommended Dietary Allowances (RDAs) are published for each IDAA.

When recommending dietary sources of protein, the RDN should focus on providing the amino acids most likely to be low in the diet, that is, methionine, cysteine, lysine, threonine, and tryptophan.[83] To optimize muscle protein synthesis, provide 2.5 to 3 g of leucine three times per day to stimulate anabolic signaling and initiate the protein synthesis pathways.[84–88] β-Hydroxy β-methylbutyrate is a metabolite of leucine that also stimulates protein synthesis pathways and decreases protein degradation. Sources of dietary protein that provide the highest levels of key IDAAs include whey protein isolate, milk protein isolate, milk, eggs, beef, chicken, and fish.[73,89–92]

Another option to meet increased energy and protein requirements are ONSs. Studies have demonstrated that two servings of immune ONS used for a minimum of 4 weeks promote wound healing of stages 2, 3, and 4 PIs.[82,93] Table 6 illustrates the difference in standard ONSs and the immune-ONS by RDA and upper tolerable limits. Note that the increased levels of ascorbic acid, vitamin E, zinc, copper, manganese, and selenium are greater than the RDA but below the upper tolerable level. There is no "magic nutrient" that triggers complete wound healing. These additional nutrients work synergistically to promote healing.

Table 3. PROTEIN AND CALORIE RECOMMENDATIONS FOR POPULATIONS AT RISK OF PI

Guideline	Population	Energy Recommendation	Protein Recommendation
Trans-Tasman Pressure Injury (2011)	Adults with PIs at moderate to high risk of delayed healing	30–35 kcal/kg BW per day	1.25–1.5 g/kg BW per day
PROT-AGE Study Group (2013)	Older adults with kidney disease at risk of protein-energy wasting	30–35 kcal/kg BW per day	
	Older adults with acute or chronic disease		1.2–1.5 g/kg BW per day
	Older adults with severe injury or disease	Use indirect calorimetry to estimate energy needs; if unavailable, use an appropriate predictive equation. For critically ill individuals with obesity, refer to the ASPEN standards	2.0 g/kg BW per day
ASPEN (2016 and 2017)	Critically ill adults	Use indirect calorimetry to estimate energy needs; if unavailable, use an appropriate predictive equation or weight-based formula: 25–30 kcal/kg BW per day	1.2 g/kg BW per day
	Critically ill individuals with obesity	Use indirect calorimetry to estimate energy needs, if unavailable, use weight-based equation: BMI 30-50 kg/m^2: 11–14 kcal/kg BW per day, BMI over 50 kg/m^2: 22–25 kcal/kg BW per day	BMI 30–40 kg/m^2: 2.0 g/kg ideal BW/d; BMI over 40 kg/m^2: 2.5 g/kg BW per day
ESPEN (2018)	Critically ill adults	Use indirect calorimetry to estimate energy needs; if unavailable, use weight-based equation of 25 kcal/kg BW per day increasing to target	1.3 g/kg BW per day achieved progressively
	Older adults	30 kcal/kg BW per day, individually adjusted based on nutrition assessment	1.3 g/kg BW per day achieved progressively
Society for Sarcopenia, Cachexia and Wasting Disease (2010)	Older adults		1–1.5 g/kg BW per day

Abbreviations: ASPEN, American Society for Parenteral and Enteral Nutrition; BMI, body mass index; BW, body weight; ESPEN, European Society for Parenteral and Enteral Nutrition; PI, pressure injury.

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For individuals with or at risk of PI, it is important to encourage adequate water/fluid intake, when compatible within goals of care and clinical conditions.[1] In healthy individuals, water/fluid intake should be approximately 30 mL/kg body weight per day or 1 mL/kcal per day.[1]

The RDN plays an important role in helping patients identify the most nutrient-dense foods, protein supplements, and ONSs to meet their unique requirements. If nutrient requirements cannot be met with food, fortifiers, and ONSs, the RDN may recommend enteral and parenteral feeding.

Table 4. SAMPLE SUPPLEMENTATION REGIMEN

Nutrient	Stage 1 PI	Stages 2, 3, and 4; Deep-Tissue; and Unstageable PIs
Calories	30–35 kcal/kg BW/d	30–35 kcal/kg BW per day
Protein	1.25–1.5 g/kg BW per day	1.25–1.5 g/kg BW per day
Arginine	No	Yes
Zinc	No	Yes
Antioxidants	No	Yes

Abbreviation: PIs, pressure injuries.
Note: The 2019 International Clinical Practice Guideline recommends oral nutrition supplements containing arginine and micronutrients starting with stage 2 PIs.

NUTRITION SUPPORT FOR PATIENTS WITH COVID-19

In light of the COVID-19 pandemic, nutrition support for patients with COVID-19 both in the hospital and at home needs to be evaluated based on the Society of Critical Care Medicine (SCCM) nutrition guidelines as well as the CPG.

Early results reported by Li and colleagues[94] suggested that there is a very high prevalence of malnutrition in

Table 5. WHICH IS THE BETTER CHOICE TO OFFER YOUR PATIENT WITH DECREASED INTAKE?

Food Item	Portion Size	Protein, g/Portion
Commercial shake	6–17 oz	7–30
Sandwich	2 oz meat	14
Milk	8 oz	8
Cheese sticks	1 oz	6
Ice cream	3 fl oz	2
Juice	6 oz	0
Graham crackers	2 packs	0.5
Saltines	3 packs	1
Oral nutrition supplement	8 oz	8–30

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Reference: US Department of Agriculture. FoodData Central database. https://fdc.nal.usda.gov. Last accessed November 14, 2021.

patients with COVID-19 admitted to the hospital. In their study of 182 older patients, 52.7% were malnourished, and 27.5% were at risk of malnutrition.[94] Older age, polymorbidity, and the ICU stay itself are all factors likely associated with the incidence and risk of malnutrition in this population.[43,78,95] That is, patients with COVID-19 who require hospitalization are typically older, have comorbidities, and are at risk of malnutrition and sarcopenia at the time of hospital admission. These patients may present with an asymptomatic form of the disease and/or have either one or multiple comorbidities such as obesity, diabetes, chronic obstructive pulmonary disease, hypertension, and so on that require hospitalization, assisted ventilation, and supportive care in the ICU.[96] In a recent meta-analysis, it was reported that in patients with COVID-19 and comorbidities, approximately 20% needed hospitalization in the medical ICU.[97] In addition to mechanical ventilation, patients may need renal and/or cardiac support.[97]

During the initial phase of infection, patients with COVID-19 admitted to the hospital who require mechanical ventilation can be in a state of hyperinflammation (linked to an overproduction of early response proinflammatory cytokines), the "cytokine storm syndrome,"[98] which can lead to vascular hyperpermeability, multiorgan failure, and death. The use of mechanical ventilation, the hyperinflammatory state, and prolonged ICU and hospital stay further increase the risk of malnutrition in these patients and are all significant risk factors for the development of PIs if left untreated.[99]

Since the start of the pandemic, several publications have addressed the nutrition needs of the patient with COVID-19. Based on these reports and others, nutrition and critical care societies in Europe (European Society for Parenteral and Enteral Nutrition [ESPEN]) and North America (American Society of Parenteral and Enteral Nutrition [ASPEN]) and the SCCM have published guidelines for feeding these patients.[100,101] On hospital admission, patients should first be assessed for risk of malnutrition using a validated screening tool such as the Malnutrition Universal Screening Tool. It is recommended that nutrition therapy should begin within 24 to 36 hours of an ICU admission or within 12 hours of being placed on mechanical ventilation. It is ideal for the patient to consume food orally; enteral nutrition or parenteral nutrition should be considered on a case-by-case basis, especially in patients with gastrointestinal tolerance issues. All of the guidelines suggest that at least 70% of energy expenditure should be delivered during the early acute phase, followed by 80% to 100% of energy needs as tolerated.[100,101]

Because of the intense hypercatabolic response associated with COVID-19, high levels of protein should be delivered. The ASPEN and SCCM guidelines suggest that 1.2 to 2.0 g protein/kg of actual body weight be delivered per day,

Table 6. STANDARD VERSUS IMMUNE SPECIALTY ORAL NUTRITION SUPPLEMENTS

Nutrient	Nutrients Treatment/400 mL	Nutrients Control/400 mL	Difference	Required Dietary Allowance/Adequate Intake[a]	Upper Limit
Kcal	504	508	0		
Protein, g (milk protein)	40	40	0		
Arginine, g	6	—	+6		
Ascorbic acid, mg	500	76	+424	75/90	2,000
Vitamin E, mg	76	9.2	+66.8	15	1,000
Zinc, mg	18	9.2	+8.8	7-13	40
Copper, µg	2,700	1,352	+1348	900	10,000
Manganese, mg	5.2	2.52	+2.68	1.8/2.3[a]	11
Selenium, µg	128	44	+84	55	400

[a]Recommended dietary allowance: average daily level of intake sufficient to meet the nutrient requirements of nearly all (97%-98%) healthy people. Adequate intake: established when evidence is insufficient to develop a recommended dietary allowance and is set at a level assumed to ensure nutritional adequacy.
© Mary Litchford.
Reference: Cereda E, Klersy C, Serioli M, Crespi A, D'Andrea F, OligoElement Sore Trial Study Group. A nutritional formula enriched with arginine, zinc, and antioxidants for the healing of pressure ulcers: a randomized trial. Ann Intern Med 2015;162(3):167-74.

whereas the ESPEN guidelines recommend 1.3 g protein/kg of actual body weight per day.[100,101] These guidelines are in line with the CPG, which recommends 1.25 to 1.5 g protein/kg body weight daily for adults at risk of a PI and malnutrition. For patients with an existing PI and at risk of malnutrition, 1.25 to 1.5 g/kg body is recommended.[1]

In the early acute phase of COVID-19, patients on a mechanical ventilator should be fed a standard high-protein (≥20% protein) polymeric isosmotic enteral formula. The addition of fiber may be considered as the patient's overall status improves. However, if there is significant gastrointestinal intolerance, then providers should consider a fiber-free formula.[101]

Although it is important to deliver adequate levels of macronutrients to the COVID-19 patient to help treat or avoid malnutrition and the development of a PI, it is also important that a patient receive sufficient vitamins and minerals. The ESPEN guidelines suggest that daily allowances for trace elements and vitamins be provided to patients with COVID-19 who are malnourished.[100] In addition to providing high calories and high amounts of protein, the CPG suggests that supplemental arginine, zinc, and antioxidants be given to those persons who have developed a stage 2 or greater PI who are malnourished or at risk of malnutrition.[1] Further, ESPEN guidelines recommend that in polymorbid medical inpatients (such as those with COVID-19) who develop a PI, specific amino acids (arginine and glutamine) and the leucine metabolite β-hydroxy β-methylbutyrate be added to oral or enteral feeds to accelerate PI healing.[95]

While in the hospital, patients should be monitored daily for signs of malnutrition and PIs. However, there are no recommendations for the discharged patient who is required to socially distance and/or isolate himself/herself. Weight loss has been reported in recovering patients who also frequently present with cardiovascular, neurologic, and respiratory deficiencies. These patients may also develop a PI while hospitalized. These deficiencies make postdischarge nutrition care an important aspect of the patient's overall recovery plan.[102]

According to a report from the AARP Foundation and the United Health Foundation, the current pandemic has caused a significant epidemic of loneliness and social isolation among older adults.[103] According to one survey, two-thirds of adults report social isolation, and 66% say their anxiety levels have increased.[104] Older adults living at home with minimal social contact are especially vulnerable because loneliness and social isolation have a negative impact on mental and physical health.[105] These findings are attributable in part to the impact COVID-19 has on eating behaviors and the lack of physical activity. Loneliness and social isolation are associated with reduced appetite, poor food intake, lack of physical activity, and a greater risk of malnutrition among older adults.[106–109] In addition, socially isolated adults tend to eat fewer vegetables and fruits, eat smaller incomplete meals, and increase their alcohol consumption.[107,110,111] All of these factors significantly increase the risk of the isolated person developing a PI.[1]

The Canadian Malnutrition Task Force reports that once a patient has been discharged, he/she may feel too tired or weak to eat.[112] In addition, it is possible that patients may be eating less and drinking less than normal after hospitalization. To prevent further muscle loss, it is important to eat foods that are high in protein, include whole grains, and to eat fruits and vegetables at each meal. Patients are encouraged to keep track of what they are actually eating and drinking at each meal.[112] If food intake is not sufficient, they should consume an ONS to help meet their individual nutrition needs.[100]

QUALITY IMPROVEMENT

The quality improvement process and indicators are used by healthcare organizations to measure and improve care

Table 7. NUTRITION QUALITY INDICATOR

Process Indicator: Every individual at risk of a PI receives nutrition screening, and when applicable, a comprehensive assessment is conducted, and a care plan is documented.

Description	The percentage of individuals at increased risk of PIs who receive nutrition screening and, if required, a comprehensive nutrition assessment and plan
Numerator	The number of individuals at increased risk of a PI who received nutrition screening (and assessment and a treatment plan as required)
Denominator	Number of individuals at increased risk of a PI
Inclusion criteria	Individuals at increased risk of PI
Source	Medical records
Measurement level	Patient
Rationale	Nutrition screening for those at risk of PIs results in faster identification of individual with or at risk of malnutrition who require comprehensive assessment. Nutrition assessment is associated with more rapid implementation of nutrition interventions and reduction in PI rates/increased PI healing

Abbreviation: PI, pressure injury.
Reference: European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, Pan Pacific Pressure Injury Alliance. Prevention and Treatment of Pressure Ulcers/Injuries: Quick Reference Guide. Haesler E, ed. EPUAP/NPIAP/PPPIA; 2019.

provided to their patients. The CPG provides examples of quality indicators to help healthcare providers monitor the progress toward implementation and sustainability of their PI prevention and treatment program. The nutrition indicator outlined in the CPG can be used as a standalone indicator or as part of the quality improvement program of the facility (Table 7).[1]

CONCLUSIONS

Nutrition assessment and intervention are often overlooked but are critical in the prevention and treatment of PIs. This article highlighted the importance of proper and thorough nutrition assessment and intervention especially for certain vulnerable populations who are at risk of or may have a PI. The recommendations include those put forth by the recently published CPG, which are based on the latest evidence available and designed to assist the clinician in successfully managing and supporting skin integrity of the high-risk patient. ●

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