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Review

Evidence-Based Recommendations for Addressing Malnutrition in Health Care: An Updated Strategy From the feedM.E. Global Study Group

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A B S T R A C T

The prevalence of malnutrition ranges up to 50% among patients in hospitals worldwide, and disease-related malnutrition is all too common in long-term and other health care settings as well. Regrettably, the numbers have not improved over the past decade. The consequences of malnutrition are serious, including increased complications (pressure ulcers, infections, falls), longer hospital stays, more frequent readmissions, increased costs of care, and higher risk of mortality. Yet disease-related malnutrition still goes unrecognized and undertreated. To help improve nutrition care around the world, the feedM.E. (Medical Education) Global Study Group, including members from Asia, Europe, the Middle East, and North and South America, defines a Nutrition Care Pathway that is simple and can be tailored for use in varied health care settings. The Pathway recommends *screen, intervene, and supervene*: screen patients' nutrition status on admission or initiation of care, intervene promptly when needed, and supervene or follow-up routinely with adjustment and reinforcement of nutrition care plans. This article is a call-to-action for health caregivers worldwide to increase attention to nutrition care.

Around the world, disease-related malnutrition is common and costly, especially among people who are older.[1–10] Hospitalization itself is often associated with patients' risks for worsening nutritional status, which can in turn lead to delayed recovery and functional decline.[6,11–14] Although multiple clinical guidelines specify care processes,[15–18] malnutrition is still overlooked and undertreated. Attention to nutrition during a stay in a hospital or long-term care facility is vital to quality care; postdischarge nutrition planning and follow-up care are likewise essential.[18–22] Indeed, results of an ever-growing number of studies have shown that optimal nutrition care can improve patients' clinical outcomes and cut health care costs.[4,23–29] Nevertheless, barriers, such as lack of awareness, time, money, and training, have prevented nutrition from being optimally utilized in health care.[30,31]

feedM.E. is a malnutrition awareness and medical education (M.E.) program developed by international leaders who are committed to increasing recognition of nutrition's role in improving health outcomes around the world. The feedM.E. Global Study Group includes nutrition leaders from Asia, Europe, the Middle East, and North and South America. Together we add our support to an international "call to action" for preventing and treating malnutrition in health care.[21,32–37] The group conducted the current literature review on the state of malnutrition and of nutrition care around the world. It includes meta-analyses, prospective and retrospective trials, and published nutrition care guidelines.

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In this article, we propose a simple and efficient Nutrition Care Pathway that can be used for patients at risk of malnutrition in the community, monitored during hospitalization, and followed in long-term care, or in postdischarge care in the community. We advise "screen, intervene, and supervene" as a new mantra for nutrition care.

Malnutrition Is Common and Costly

Malnutrition associated with illness or injury is usually seen as a shortfall of protein and energy intake relative to needs. By the time a person is admitted to a hospital, he or she will usually have little or no appetite and will have lost weight already.[1,38] In fact, results of a recent hospital survey showed that more than 40% of patients lost weight in the 3 months before entering the hospital, and 50% had reduced food intake the week before admission.[1] For patients admitted to hospitals worldwide, malnutrition prevalence is estimated to be as high as 50%; actual prevalence depends on the malnutrition criteria used and on the population of patients served.[2–9] Worse still, hospitalization itself is a risk factor for declining nutritional status. Traditional preparation for surgery, missed mealtimes due to medical procedures, and nil per os (nothing by mouth) orders all add up to problems of nutrient deficit and weight loss.[11] Surprisingly, the malnutrition prevalence numbers are similar in hospitals of both emerging and industrialized nations, and these numbers have not changed much over the past decade.[35,39–42] Anyone who is sick or injured is at risk of malnutrition as a result of increased nutrition requirements with inflammation; older people are particularly vulnerable to disease-related malnutrition.[10]

Malnutrition Leads to Poor Clinical Outcomes and Higher Costs of Care

During and after hospitalization, the health and financial tolls of malnutrition are high. Results of numerous clinical studies show that hospitalized patients who are malnourished are at a distinctly higher risk for complications—especially pressure ulcers, infections, and falls (Table 1). Patients hospitalized in Asia,[4] in Europe and the United Kingdom,[1,43] and in North[44] and South America[45] were at higher risk of dying if malnourished. Costs were also higher when extra care and longer stays were needed to treat health complications, as supported by studies from Singapore, Brazil, and The Netherlands (Table 1).

Malnutrition Is Often Unrecognized and Undertreated

The traditional recommendations of nutrition screening, assessment, and intervention are sometimes overlooked or inadequate. In a European-wide survey of hospital nutrition care (1217 units, 325 hospitals, 25 countries, >21,000 patients), only half of the units reported routine use of nutrition screening.[51] Even when energy intake was assessed and an energy goal was specified, about half of the patients consumed less than their energy goal; or they self-reported inadequate food intake.[8,51] According to the British Nutrition Foundation, more than 60% of hospital patients experienced a decline in nutritional status during their stay in the hospital.[12]

Nutrition Care Improves Clinical Outcomes and Lowers Health Care Costs

Nutrition guidelines worldwide advise nutritional intervention for patients who cannot meet nutrient needs with a diet of regular food. Nutrition interventions, including oral nutrition supplements (ONS) and enteral and parenteral nutrition, had significant clinical and economic benefits across patient groups and in different settings, as shown by results of randomized, controlled trials (RCTs), prospective studies, and meta-analyses. Health benefits of nutrition intervention include improved nutrition status, muscle mass, strength, or performance; fewer health complications; improved quality of life; and

Table 1
Worldwide Examples of Health and Economic Impacts of Malnutrition

Impact	Study	Description	Results
Complications	Fry 2010[46]	US epidemiologic analysis of 887,189 surgery cases from 1368 hospitals	Malnourished surgery patients were 4 times more likely to develop pressure ulcers, 2 times more likely to have surgical-site infections, and 5 times more likely to get catheter-associated urinary tract infections during hospitalization when compared with similar but adequately nourished patients.
	Bauer 2007[47]	Observational study of 49 Australian patients who experienced falls during hospitalization	Nearly half (45%) of all patients who fell while hospitalized were malnourished.
	Schneider 2004[48]	Observational study of 630 patients who were evaluated for nutrition risk in a French hospital	Severely malnourished patients were 5 times more likely than nourished patients to get hospital-acquired infections.
	Lee 2003[49]	Prospective observational study of 161 patients admitted to the intensive care unit of a South Korean hospital	The probability of first nosocomial infection in severely malnourished patients was 2.4 times higher than in moderately malnourished or well-nourished patients.
Death	Lim 2012[4]	Prospective cohort study (with case-matched control) of 818 patients admitted to a Singapore hospital	Mortality rates were higher in malnourished patients at 1, 2, and 3 years. Malnutrition was a significant predictor of mortality (adjusted hazard ratio = 4.4; 95% Confidence Interval [CI] 3.3–6.0; $P < .001$).
	Correia 2003[45]	Retrospective cohort study of 709 patients in 25 Brazilian hospitals	Mortality in the malnourished patients was 12.4% vs 4.7% in the well- nourished group (Relative Risk [RR] = 2.63).
Length of stay	Lim 2012[4]	Prospective cohort study (with case-matched control) of 818 patients admitted to a Singapore hospital	Malnourished patients (29%) had longer hospital stays (6.9 ± 7.3 days vs 4.6 ± 5.6 days; $P < .001$) compared to well-nourished patients.
	Correia 2003[45]	Retrospective cohort study of 709 patients in 25 Brazilian hospitals	Malnourished patients stayed in the hospital for 16.7 ± 24.5 days vs 10.1 ± 11.7 days for the nourished.
Readmission	Lim 2012[4]	Prospective cohort study (with case-matched control) of 818 patients admitted to a Singapore hospitals	Malnourished patients (29%) were more likely to be readmitted within 15 days (adjusted RR = 1.9; 95% CI 1.1–3.2; $P = .025$).
Cost of care	Freijer 2013[50]	Cost-of-illness analysis	The total additional costs of managing adult patients with disease-related malnutrition were estimated to be €1.9 billion in 2011, which equals 2.1% of the total Dutch national health expenditure and 4.9% of the total costs of the health care sectors analyzed in this study.
	Correia 2003[45]	Retrospective cohort study of 709 patients in 25 Brazilian hospitals	Hospital costs in malnourished patients were increased up to 308.9%.

Table 2
Impact of Nutrition Intervention on Patient Outcomes

Benefit	Study	Description	Results
Nutritional status	Cawood 2012[24]	Meta-analysis of 4 randomized controlled trials (RCTs) (n = 118; 1 RCT in hospital and 3 RCTs in community patients)	High-protein oral nutrition supplements (ONS) use improved patients' total protein and energy intake compared with nonsupplemented controls in all but 1 trial, and significantly so on meta-analysis. Intervention also improved mid-arm muscle circumference (mean difference 0.47 cm [95% confidence interval (CI) 0.30–0.64]; $P < .05$).
Strength	Cawood 2012[24]	Meta-analysis of 4 RCTs (n = 219; community patients with chronic obstructive pulmonary disease, gastrointestinal (GI) disease, and hip fracture)	High-protein ONS significantly improved handgrip strength compared with the controls (1.76 kg [95% CI 0.36–3.17]; $P = .014$ random-effects model).
Complications	Cawood 2012[24]	Meta-analysis of 3 RCTs (n = 932; hospitalized patients with hip fracture, leg and pressure ulcers, and acute illness)	High-protein ONS significantly reduced the incidence of complications compared with controls.
	Milne 2009[25]	Meta-analysis of 24 trials (n = 6225) in older people treated with ONS compared with usual care; also reported a subgroup analysis of patients with hip fracture (6 trials, n = 298)	There was a reduction in complications in people treated with ONS (relative risk [RR] 0.86; 95% CI 0.75–0.99), including those with hip fractures (RR 0.60; 95% CI 0.40–0.91).
	Stratton 2005[23]	Meta-analysis of 4 RCTs with ONS vs routine care in patients at risk of pressure ulcers (4 RCTs, n = 1224, elderly, postsurgical, chronically hospitalized patients)	ONS use (250–500 kcal, 2–26 weeks) was associated with a significantly lower incidence of pressure ulcer development (odds ratio 0.75; 95% CI 0.62–0.89).
Quality of life	Starke 2011[55]	RCT of patients at risk of malnutrition who received individualized nutrition support or standard hospital care	Patients who got individualized nutrition support had significantly higher scores on the Quality of Life (QoL) Short Form-36 function summary scale compared with those who received standard care (37% vs 32%; $P = .03$).
	Norman 2008[53]	RCT of 3-month posthospital nutrition intervention in malnourished GI patients who received ONS + dietary counseling (n = 38) or counseling alone (n = 42)	All 8 scales of the QoL improved in patients who received ONS in addition to dietary counseling compared with only 3 scales in patients who received dietary counseling alone.
Mortality	Milne 2009[25]	Meta-analysis of 50 RCTs comparing patients with or without ONS; subgroup analysis of trials with older adults who met criteria of "undernourished"	No mortality benefits for ONS when all 50 trials were combined, but mortality results were statistically significant or approaching statistical significance in undernourished adults (RR 0.79; 95% CI 0.64–0.97).
	Barr 2004[52]	Prospective sequential study design in critically ill patients in the intensive care unit before and after implementing a nutrition management protocol (n = 200)	Risk of death was 56% lower in patients who received enteral nutrition (hazard ratio, 0.44; 95% CI, 0.24–0.80; $P = .007$).

reduced risk of mortality (Table 2).[23–25,52–57] Economic benefits include reduced length of stay, fewer hospital readmissions, and lowered cost of care (Table 3).[24,26,55,58–60]

Nutrition Care Pathway

To provide best-practice nutrition care, it is essential that caregivers appreciate the current definition of malnutrition. Malnutrition has been newly defined as 3 clinical syndromes, which are characterized by underlying illness or injury and varying degrees of inflammation.[61] The three syndromes are (1) *starvation-related malnutrition*, a form of malnutrition without inflammation; (2) *chronic disease-related malnutrition*, which is nutritional inadequacy associated with chronic conditions that impose sustained inflammation of a mild-to-moderate degree; and (3) *acute disease-* or *injury-related malnutrition*, which is undernutrition related to conditions that

Table 3
Impact of Nutrition Intervention on Economic Outcomes

Benefit	Study	Description	Results
Length of stay	Philipson 2013[26]	Retrospective data analysis with a propensity-matched patient episodes (n = 1.2 million) of patients with or without oral nutrition supplements (ONS) during hospitalization	ONS patients had shorter length of stay (LOS) by 2.3 days (from 10.9 to 8.6 days or 21% shorter; 95% confidence interval [CI] of −2.42 to −2.16).
	Cawood 2012[24]	Meta-analysis of high-protein ONS versus controls in 9 randomized controlled trials (RCTs) of patients with hip fracture and acutely ill patients (n = 1227) and across hospital and community (7 RCTs)	There was significant reduction in LOS of ONS patients versus controls (−3.77 [95% CI −7.37 to −0.17] days; $P = .040$ random-effects model).
	Lee 2012[59]	Retrospective observational comparison of records for hospitalized older patients (n = 37) who did or did not receive dietitian-recommended nutrition plan	Older adult patients who did not receive a dietitian-recommended plan had a mean LOS of 26.4 ± 15.5 days, which was two-thirds longer (15.8 ± 6.9 days) than those who received the feeding recommended by the dietitian ($P = .0074$).
Readmission	Stratton 2013[60]	Meta-analysis of 6 RCTs (n = 852), including mostly people ≥65 years; compared readmission data on people who received ONS vs people who received routine care	ONS use significantly lowered the likelihood of hospital readmission (odds ratio [OR] 0.59; 95% CI 0.43–0.80; $P = .001$).
	Cawood 2012[24]	Meta-analysis of readmission data from 2 RCTs in acutely ill patients with a wide variety of conditions and in patients with gastrointestinal disease (n = 546)	Patients given high-protein ONS had a significantly reduced hospital readmissions compared with controls (OR 0.59 [95% CI 0.41–0.84] days; $P = .004$; random-effects model).
	Starke 2011[55]	RCT of patients defined as at risk of malnutrition, individualized nutrition support (n = 66) vs standard hospital care (n = 66)	Significantly fewer readmissions (17/64 vs 28/61; $P = .027$) in patients with nutrition support compared with those who got standard hospital care.
Cost of care	Philipson 2013[26]	Retrospective data analysis with propensity-matched patient episodes (n = 1.2 million) of patients with or without ONS during hospitalization	ONS patients had a decreased episode cost of $4734 (95% CI −$4754 to −$4714), from $21,950 to $17,216 (21.6% decline) compared with matched patients who did not receive ONS.

elicit marked inflammatory responses. Many chronic conditions (such as kidney disease, cancer, heart failure, or rheumatoid arthritis) have inflammation as a disease component, thus increasing the risk of malnutrition,[62,63] even among patients who are overweight or obese.[64] Most severe acute health crises (such as severe infection, surgery, burn injury, or sepsis) have marked inflammation, which contributes to and perpetuates the risk of severe malnutrition.[62,63] In particular, sarcopenia (loss of muscle mass with low strength or performance) is caused and worsened by injury, illness, and inactivity during hospitalization.[65–67]

Taking these malnutrition syndromes into account, the feedM.E. Group now introduces "screen, intervene, and supervene" as a guide for delivering prompt and complete nutrition care (Figure 1). When the "screen" step shows that underlying illnesses, injuries, or symptoms are likely to cause malnutrition or its risk, we advise caregivers to consider immediate nutrition care with dietary advice to "intervene" by way of increasing energy and protein intake with dietary fortification or use of oral nutrition supplementation. Such early attention to nutrition (in patients capable of oral feeding) is expected to help prevent or lessen the impact of malnutrition. For those whose screening results suggest malnutrition or risk of malnutrition, we next advise implementation of the complete Nutrition Care Pathway, which includes advanced strategies for diagnosis of malnutrition and its causes, in turn leading to further "intervene and supervene" steps.

Nutrition Care Pathway: Screen for Malnutrition Risk

Screening patients for malnutrition on admission to the hospital is a new standard of care, and routine screening is likewise appropriate in rehabilitation facilities, long-term care centers, and community health care settings. To ascertain malnutrition risk, we recommend nutrition screening that pairs (1) the 2 Malnutrition Screening Tool (MST) questions[68,69] with (2) a quick clinical judgment about whether the patient's illness or injury carries risk for malnutrition (Figure 1).[61–63] The 2 MSTs questions ask the patient about recent weight loss and appetite loss as a way to recognize symptoms of risk for malnutrition.[68,69] MST is both sensitive and specific, even in older people.[68,70,71] Alternatively, the Simplified Nutritional Appetite Questionnaire (SNAQ) is a validated, efficient tool for use with

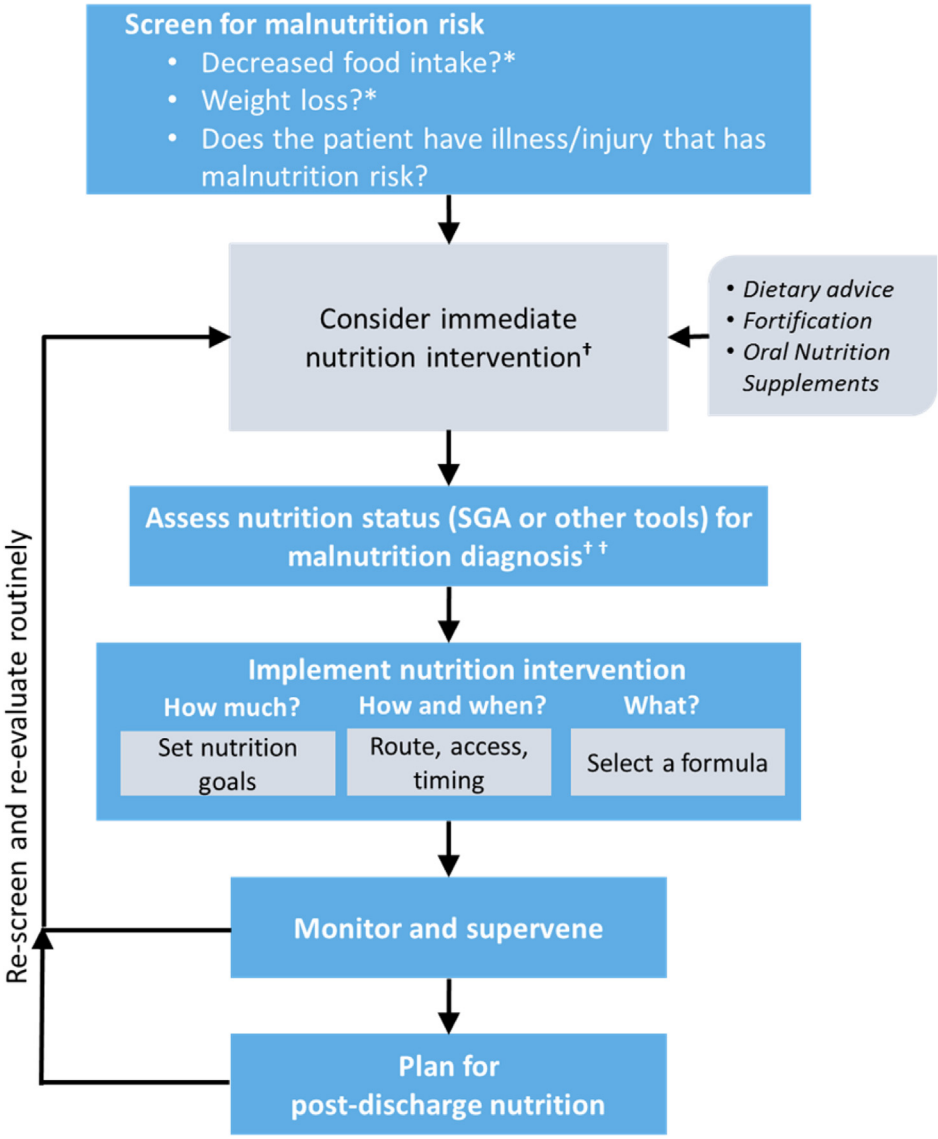

Fig. 1. The Nutrition Care pathway. *Ferguson et al.[68] †For individuals capable of oral intake. ††Detsky et al.[74]

long-term care and community populations.[71–73] Next the clinician makes a quick judgment about the patient's condition and its likelihood to cause or worsen malnutrition. Many chronic diseases (eg kidney disease, cancer, heart failure) and acute conditions (eg infection, surgery, burn, sepsis, or trauma) carry risk for malnutrition. This step of the screen raises awareness of potential risk for malnutrition. If nutrition screening identifies high risk of malnutrition, consider immediate intervention with nutrition advice for increasing or optimizing oral feeding, or oral nutrition supplementation.

Nutrition Care Pathway: Intervene

The intervention portion of the Nutrition Care Pathway includes assessment of nutrition status, malnutrition diagnosis, and implementation of treatment.

Assessment and Diagnosis

For nutrition assessment, the Subjective Global Assessment is widely used for most adults,[74] and the Mini-Nutritional Assessment is used for older persons.[75,76] Such assessment, conducted by a qualified and trained clinician (dietitian, nutrition specialist, physician, or nurse), determines the extent of nutritional shortfall. Following assessment, the clinician creates an individualized plan that specifies how, what, and how much to feed.[7] Guidelines support prompt intervention (ie targeted nutrition therapy within 24 to 48 hours of admission).[15–17] Any underlying causes of malnutrition identified during screening or assessment (eg chronic disease, oral or swallowing problems, depression) also should be treated.[7,77,78]

To facilitate malnutrition diagnosis and help standardize malnutrition care, experts from the American Society for Parenteral and Enteral Nutrition and the Academy of Nutrition and Dietetics defined specific criteria for malnutrition diagnosis.[79]

Implementation of Treatment

This step involves decisions about how much to feed, how and when to feed, and what to feed.

How much to feed

It is first necessary to estimate energy and protein needs and to establish target goals for each patient.[16,17] Adult energy requirements depend on needs for basal metabolism, physical activity, and metabolic stresses of different disease conditions.[80] These requirements may be calculated by predictive equations or measured by indirect calorimetry; predictive equations are less accurate for individual patients, whereas indirect calorimetry requires specialized equipment. The easiest method to estimate energy needs is to use the simple predictive formula that determines daily calorie requirements by multiplying the patient's actual body weight (in kg) by 25 to 30 kcal (Table 4).[17] Ideal or adjusted body weight is used for estimating needs of obese and emaciated adults.

Adults with critical illness are at particular risk of sarcopenia, as are those who are of older age.[65–67,81,82] In a patient who is critically ill, muscle loss occurs early and rapidly. A recent study showed a 17% loss in muscle mass in 10 days in the intensive care unit.[83] Protein is an essential nutrient for maintaining muscle synthesis and preventing its degradation. The recommendation for usual adult dietary protein intake is 0.8 g protein per kilogram body weight per day.[84] Protein targets for adults with disease or injury are in the range of 1.0 to 2.0 g/kg body weight per day.[17,85] To maintain lean body mass and function, adults older than 65 years have higher needs than do younger adults (≥1.0 g protein per kilogram body weight per day).[85,86] In patients with burns or multitrauma, protein need may be as high as 2.0 g/kg body weight per day.[17,85]

Table 4
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 body weight/day*
• Guidelines for dietary protein needs: 1.0 to 2.0 g or more of protein/kg body weight/day†

*Target is based on metabolic stress of disease, physical activity, and actual nutritional status.

†Target is set according to age, illness or injury severity, and actual nutritional status; due to high risk for refeeding syndrome, advance nutrition levels cautiously for individuals who are severely malnourished or starved.

How and when to feed

Choosing the appropriate form of nutrition therapy is stepwise and systematic.[19] Enteral nutrition, 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.[87] Oral feeding with diet enrichment or with ONS is the primary and first choice for a vast majority of patients.[19] When oral food and ONS are impossible or inadequate, nutrition can be given as enteral tube feeds. When the gastrointestinal tract is so compromised that calorie and protein requirements cannot be fully met by enteral feeding, parenteral nutrition can be used either alone or in combination with enteral nutrition.

Guidelines support prompt intervention, that is, individualized nutrition therapy within 24 to 48 hours of admission.[7,16,17,88] As a notable exception, a patient near the end of life can be kept comfortable without provision of food or oral/enteral nutrition, if this strategy is mutually agreeable to patient/family and caregivers.[89]

What to feed

Many hospitalized individuals are able to eat food, but their appetite is limited by illness. In such cases, experts recommend foods with energy-rich additives (eg maltodextrin, protein fortification), eating smaller but more frequent meals or high-energy snacks between meals, or using ONS.[7]

Standard commercially prepared enteral formulas are 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.[90] Specialized commercially prepared formulas meet basic needs but also meet disease- or condition-specific needs, including 1.0 to 2.0 kcal/mL; some are formulated and flavored for use as ONS or enteral tube feeds, and others are intended only for enteral tube feeds.[91]

Nutrition Care Pathway: Supervene

Nutrition care does not end when a patient is released from the hospital or other care center. The final step of the Nutrition Care Pathway is to supervene and follow-up, with continuing attention to meeting nutrition needs. In fact, poor nutritional status on discharge predicts hospital readmission within 30 days.[92] New focus on postdischarge nutrition planning[18] is expected to help lower costly hospital readmissions,[20] improve quality of life for patients,[53,55] and in some cases even reduce risk of death.[25] Effective nutrition care necessitates a postdischarge nutrition plan, and use of follow-up measures to ensure that the plan is implemented. Results of a systematic review of 6 RCTs (surgical and medical patients of older age) showed that postdischarge nutrition care with use of ONS had a positive effect

on nutritional intake (energy) and nutritional status (weight) in all trials.[93] The feedM.E. Global Group thus recommends continued efforts to prevent and treat malnutrition for patients who have been discharged from the hospital into long-term care centers or into the community.

Call to Action

Attention to nutrition is fundamental to good clinical practice. Nutrition care improves patient outcomes and reduces health care costs. We, the members of the feedM.E. Global Group on Nutrition in Healthcare, call health care providers worldwide to action with "screen, intervene, and supervene." The proposed Nutrition Care Pathway recommends *screen always, intervene promptly when needed*, and *supervene routinely*. Most patients can be treated effectively by following simple and logical practices, as we have emphasized in this article. We note that most hospital patients would benefit from simple nutrition interventions: food enrichment and ONS.

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