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# CLINICAL NUTRITION HIGHLIGHTS

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# Hydration management in patients with dysphagia

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## Introduction

Dysphagia is broadly defined as difficulty swallowing. Difficulty with swallowing contributes to reduced dietary intake, and potentially dehydration and malnutrition. Hydration management can be a particularly challenging area for the management of persons with dysphagia. Commonly consumed drinks, such as water, tea, coffee, juice or milk, are fast-flowing liquids. They pose a challenge to safe swallowing where there has been neurological, anatomical, physiological or surgical alteration to the muscles, nerves and structures necessary for swallowing. Fast-flowing liquids can enter an airway that closes too slowly, insufficiently, or not at all. Aspiration occurs when material passes the level of the true vocal folds and enters the respiratory system. Pneumonia is a common sequelae, particularly for individuals who require assistance with feeding. In a cohort of older individuals hospitalized with pneumonia, those with dysphagia had higher pneumonia severity scores, and higher mortality at 30 days and 1-year post-admission.[1]

Adequate hydration is necessary for survival. Every cell, tissue and organ requires water to function. So how then to ensure that persons with dysphagia are adequately hydrated without exposing them to the risks of aspiration? Such is the conundrum that is faced on a daily basis from acute care to the community, and particularly for older individuals. This paper will address the prevalence of dysphagia and reasons why individuals with dysphagia are at higher risk for dehydration. Risk factors such as age, multiple co-morbidities, polypharmacy and inadequate access to nursing assistance will be reviewed. Consequences such as increased risk of falls and hospital admissions will be discussed. Finally, methods to improve fluid intake will be addressed. Treatment of dehydration is very effective. As such, dehydration is a preventable condition.

## Dysphagia prevalence

Estimating dysphagia prevalence is a challenging exercise. Dysphagia can be classified as oropharyngeal or esophageal in nature. Esophageal dysphagia relates to obstruction or motility issues of the esophagus. Prevalence figures for esophageal dysphagia are estimated at 6–9% of the general population.[2] Oropharyngeal dysphagia addresses issues relating to: chewing, oral containment and manipulation of food, liquid and medication; and bolus propulsion and transit through the pharynx to the esophagus. Prevalence studies for this group (coming from the United States of America, Australia and Spain) are more akin to putting puzzle pieces together as studies have grouped prevalence by way of: setting (acute hospital, aged care, community); condition (including stroke, brain injury, dementia, chronic obstructive pulmonary disease); and age (infants to elderly). Broadly, oropharyngeal dysphagia affects individuals at either end of the lifespan. The prevalence in hospitalized individuals older than 65 years is 10–30%.[3] In the acute care setting 0.35% of coded admissions[4] and 25–55% of identified admissions[1,5] are related to dysphagia. In the community, 11–16% of older individuals have dysphagia.[6,7] In aged care more than 50% of individuals present with oropharyngeal dysphagia.[8] By way of comparison, the World Health Organization reported that the global prevalence of diabetes in 2008 was 10% in adults aged 25 years or older.[9] Conditions associated with dysphagia include malnutrition, dehydration and death. Dysphagia prevalence and its consequences are not insignificant.

***Conditions associated with dysphagia include malnutrition, dehydration and death. Dysphagia prevalence and its consequences are not insignificant***

## Dehydration

Water is essential for biochemical reactions within cell fluids. It is also essential to extracellular fluids for transport and communication between cells and the environment for nutrients, metabolites, waste products, respiratory gases, hormones and heat. Water is also required for lubrication (eg, joints). In healthy individuals, food, liquids and metabolic activity provide hydration. Dehydration occurs when water losses exceed water gains.

There are three different types of dehydration – isotonic, hypotonic and hypertonic. It is important to distinguish them from one another, as the treatment for each differs.

- Isotonic dehydration occurs where there is a balanced loss of water and sodium.
- Hypertonic dehydration occurs when water loss is greater than sodium loss, eg, serum sodium level is >145 mmol/L and serum osmolality >300 mmol/kg.
- Hypotonic dehydration is the reverse, where sodium loss is greater than water loss, eg, serum sodium <135 mmol/L and serum osmolality <280 mmol/kg.[10]

A summary of the different types of dehydration and their potential causes are listed in Table 1. Individuals with dysphagia may suffer from any of these types of dehydration.

**Table 1. Definition of dehydration[10]**

| Isotonic | Hypertonic | Hypotonic |
|---|---|---|
| Loss of water = loss of sodium (balanced loss) | Water loss > sodium loss | Sodium loss > water loss |
| Can occur during:<br>• Complete fasting<br>• Vomiting<br>• Diarrhea | Can occur during fever: water loss through skin and lungs | Associated with excess use of diuretics causing excess loss of sodium |

Water is lost during the processes of cooling (sweat) and excretion (urine and feces), together with insensible losses associated with gradual movement of water across the epithelia of the skin and respiratory tract.[11] Consequently, fever, increased perspiration, and increased respiratory rate, events associated with an infection such as pneumonia, all increase insensible water losses.[12] Physiological changes associated with aging contribute to increased risk for dehydration. This includes changes in kidney function, thirst perception, body water content and homeostatic capacity.[13,14] Volkert found that one in seven individuals over the age of 65 years and one in four over 85 years consume less than the required amount of liquid per day.[13] Changes to vision, dexterity, hemiparesis or dyspraxia associated with stroke can affect a person's physical ability to see, decant and bring liquids to their mouth. Older individuals may also be concerned about incontinence and their ability to reach the toilet facilities in time. They may consciously limit water intake to reduce the likelihood of potential incontinence.

The prevalence of dehydration for individuals older than 60 years is noted to be 16% in a hospital setting[15] and 26–39% in long-term care settings.[16,17] Dehydration has been linked with mild cognitive impairment, irritability, restlessness and acute weight loss.[8,18] More seriously, when noted during hospital admission it has also been associated with increased mortality and morbidity.[15] It is also costly, with figures from 1991 showing 60% of hospitalized patients had dehydration at a cost of USD$446 million.[18] More recent data gathered from 1999 hospital discharge data showed an average length of stay of 4.6 days for treatment and total average hospital charge of US$7,442 per episode of care.[19]

The most commonly accepted formula for calculating dehydration is the body fluid loss by weight change as a percentage of total body weight.[15] It is significant when over 3% of body weight is lost. Vivanti et al. have shown that physical parameters indicative of mild dehydration include greater reduction in systolic blood pressure drop on standing, reduction in sternal skin turgor, increased tongue dryness, tongue furrows and dry oral mucosa, and lower body mass index (BMI) (20 versus 27 kg/m$^2$) in the population studied.[15] These physical symptoms provided more accurate indicators of change in hydration status than biochemical parameters. In a long-term care facility, Leibovitz found that four biochemical markers were more frequently observed in individuals with

**Table 2. Risk factors for dehydration[10,12,33]**

- Dysphagia
- Age >85 years
- Four or more chronic conditions
- Four or more medications
- Failure to eat or take medication
- Being bedridden
- Female gender
- < 3 hrs of daily nursing assistant care
- African-American heritage
- Diabetes
- Dementia
- Impaired visual acuity
- Impaired renal function
- Thickened fluids
- Use of certain medications:
  - Aspirin
  - Antidepressants
  - Non-steroidal anti-inflammatory drugs
  - Antihypertensives
  - Diuretics
- Confusion
- Leaving more than 25% of food uneaten at most meals
- Impaired communication, comprehension or cognition

*Severe dehydration risk (in addition to above):*

- Inability to feed oneself
- Impaired functional status

dehydration: above normal levels of blood urea nitrogen (BUN), BUN/creatinine serum ratio, urine/serum osmolality ratio and urine osmolality.[16] Low urine output (<800 mL/day) was also indicative of dehydration, although normal or high urine output did not necessarily equate with good hydration. In addition to orally fed individuals with dysphagia showing signs of dehydration, the investigators were surprised to find that individuals who were nasogastrically-fed also showed mild signs of dehydration. Dehydration in enterally-fed individuals has also been found by other investigators.[20] Risk factors for dehydration, particularly in older adults, are summarized in Table 2.

### *Consequences of dehydration*

Dehydration increases the risk of renal failure, falls, impaired mental status, constipation, urinary tract infection, medication toxicity, respiratory infection, decreased muscle strength and decubitus ulcers.[12] Postural hypotension may occur, again increasing falls risks and likelihood of hospital admission. Blood viscosity also increases as a consequence of dehydration. Thicker blood increases the risk of deep vein thrombosis, and cardiac and renal sequelae.

### *Dehydration and aging*

During the process of aging, changes occur in kidney function and thirst perception. There are physical changes to the kidneys such that between one third and one half of nephrons are lost, subsequently causing reduced function.[21] Some elderly individuals may experience high blood pressure. In order to manage hypertension, medications such as diuretics may be prescribed to enhance the excretion of sodium into the blood stream to correct the blood pressure. However, too much sodium excretion will cause hyponatremia (hypotonic dehydration). Hyponatremia is exacerbated by illness, low body weight and a low-sodium diet. Patients with hyponatremia are at a 4-fold increased risk of bone fracture after a fall and increased risk of osteoporosis at the hip (odds ratio 2.85; 95% CI 1.03–7.86; $P < 0.01$).[22,23] In addition, Rosner reported that patients who were hyponatremic for 3 months exhibited significant decreases in bone mineral density of 30% compared with controls. Cognitive dysfunction is also a concerning feature of hyponatremia.[22] Although some patients may be admitted with hyponatremia, others will go on to develop the condition or have it worsen on admission to hospital.[23] Hyponatremia is prevalent in hospitalized patients with congestive heart failure, cirrhosis and community-acquired pneumonia.[23]

Physiological deterioration of thirst perception is noted in the elderly. One study has shown that thirst perception is diminished in healthy elderly men, with a lack of thirst and discomfort when deprived of liquids for 24 hours. Following the deprivation trial, these elderly men showed a poor ability to rehydrate.[24] Thus, although the mouth may be dry, there may not be a sufficient physiological trigger to access liquids to rehydrate. Individuals with lesions or stroke affecting the hypothalamus also have decreased levels of thirst.[25] Cortical changes or altered physiologic sensitivity to osmotic load were hypothesized to be responsible for the changes in thirst perception associated with aging.

Total body water content decreases with age, and is about 4% lower in the elderly than younger adults.[25] With a reduced amount of total body water, there is a decreased threshold for water deprivation needed to change osmolality.[25]

With anatomical, physiological and neurological changes affecting the elderly person's ability to be adequately hydrated, constipation also becomes an issue. It is often thought that increasing dietary fiber and fluid intake will be sufficient to manage constipation symptoms. In a review of the constipation literature, Müller-Lissner et al. found that some, but not all, patients experienced relief with a fiber-rich diet, and that it is only in the presence of dehydration that constipation can successfully be treated by increasing fluid intake.[26]

## Dehydration and dysphagia

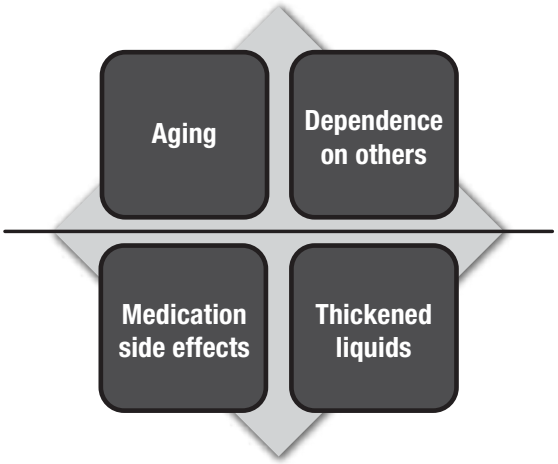
Hydration must be considered when providing fluids to individuals with dysphagia. Due to the swallowing disorder, the ability to manage regular fluids (eg, water, tea, coffee, juice, milk) is often compromised. In a large, well-designed, randomized controlled trial, Robbins et al. demonstrated that individuals receiving thickened fluids were more likely to be dehydrated than those receiving regular fluids.[27] This point is echoed by research conducted by Castellanos and colleagues.[28] Research has shown that only 33–43% of stroke patients with dysphagia meet their daily fluid requirements.[29,30]

***Only 33–43% of stroke patients with dysphagia meet daily fluid requirements***

## Challenges keeping individuals with dysphagia hydrated

There are four main challenges to keeping individuals with dysphagia hydrated. Firstly, dysphagia affects predominantly the very young and the very old. Issues associated with aging,

**Figure 1. Challenges to hydration for individuals with dysphagia**




such as reduced kidney function, reduced total body water and altered thirst perception, become amplified in older individuals with dysphagia. These have been expanded upon in the preceding section. Secondly, often as a result of another condition such as stroke, there is increased dependence on others, making it more difficult to access liquids. Thirdly, elderly individuals commonly use multiple medications. These medications can further challenge renal function or have the detrimental side effect of dry mouth. A dry mouth further exacerbates difficulty swallowing. Finally, the provision of thickened liquids, the treatment most commonly used for dysphagia, has been linked with dehydration. Each of these points is summarized in Figure 1 and will be expanded upon briefly below.

### *Dependence on others*

For individuals who have had a stroke, or the frail elderly, the ability to reach for or pour a drink can be frustratingly challenging. Thus, liquid may well be available, but simply out of reach. Indeed, in a study by Blower, 89% of patients in the population studied were unable to reach a drink and 45% were reluctant to ask for help from busy staff.[31] Fifty-two percent of patients surveyed from oncology, orthopedic and general medical wards were more thirsty than usual following their admission to hospital.[31]

***Patients are reluctant to ask busy staff for help to access a drink***

Post-stroke, some individuals may suffer from language and speech disturbances (aphasia or dysarthria), such that they are unable to communicate their thirst and need for fluids. For individuals with impulsivity or where safety is of concern, it is a necessity that others control the provision of liquids. However, in these circumstances staff must be vigilant to ensure that liquids are offered frequently to support hydration needs. It is acknowledged that this can be a challenge with staffing ratios.

### *Medication side effects – dry mouth and fluid/electrolyte imbalances*

Medications have been associated with changes to kidney function as noted above. However, polypharmacy can also result in dry mouth, or xerostomia. Medications such as tricyclic antidepressants, neuroleptics, diuretics, antiparkinsonian medication, anti-emetics, antihypertensives, antihistamines, cardiovascular agents, opioids, antipsychotics and muscle relaxants provide an extensive list of medications associated with xerostomia.[32] Many of these medications are also implicated in the development of hyponatremia. Thomson and colleagues conducted a longitudinal study of individuals over the age of 60 years tracked for between 5 and 11 years for medication use and prevalence of xerostomia.[33] They found that prevalence of medication use increased such that by 11 years, 94.8% of the cohort was taking at least one medication. There were increases in the prevalence and significant increases in severity of xerostomia. Furthermore they found that long-term use (>5 years) of daily aspirin and diuretics increased the odds of xerostomia by 4- and 6-times, respectively. Use of antihypertensives, non-steroidal anti-inflammatory drugs, and antidepressant medication was also associated with significant increases in xerostomia. Increased xerostomia severity was implicated for: antidepressants, narcotic analgesics, anti-asthma medication, anginals, anti-ulcer medication and the combination of thyroxine + diuretics.

Some medications directly affect fluid and electrolyte balance. For example, diuretics, vasodilators, $\beta_1$-blockers, aldosterone inhibitors, angiotensin-converting enzyme (ACE) inhibitors and angiotensin II inhibitors have all been implicated.[12] Changes in fluid and electrolyte balance may impair kidney function, or the medication may directly trigger anti-diuretic hormone secretion. Consequences of this, such as increased risk of falls and fractures, have been addressed above.

### *Effect of dry mouth on swallowing ability*

Saliva has multiple important functions. It keeps the mouth moist, protects the mucosal and dental surfaces, and importantly mixes with food during chewing. The unique properties of saliva are important for safe swallowing. The watery composition of saliva helps to moisten the bolus and makes chewing easier and more efficient. However, it is the salivary proteins, such as mucins, that help to bind the bolus and provide a slippery quality that assists with efficient transport through the oral and pharyngeal phases

of swallowing.[34] Hard and dry foods, in particular, require moisture to assist with their breakdown. Individuals with a dry mouth due to disease, or as a side effect of medication, will have more difficulty efficiently and safely breaking food particles down to a size and texture that is safe to swallow. Saliva also has a role in taste perception, providing a dispersing medium for tastants. It helps alter the temperature of food or liquid for oropharyngeal comfort during manipulation and swallowing. Taste perception and temperature regulation are important for acceptance of foods and liquids, and compliance with dietary recommendations.

### *Thickened liquids and dehydration*

Thickened liquids have been targeted as a contributor to dehydration. The concern is that thickening agents bind water molecules and make them unavailable for hydration. Sharpe et al. investigated the bioavailability of thick liquids using a range of thickening agents in both rats and humans.[35] In humans, blood and saliva sampling and whole body bioelectrical impedance measures were used to track the rate of intestinal absorption of water from thickened fluids. Pudding or spoon-thick liquids were chosen as it was hypothesized that the most significant effects would be observed with extremely thick liquids. Sharpe et al. found that in *all cases* water absorption exceeded 95% of the administered dose regardless of whether it was pure water or thickened water, and regardless of thickening agent.[35] Water was absorbed and equilibrated in body fluids within 60 minutes for all samples tested. Rats received a 10-fold higher dose of thickened fluids. Regardless of this increase, there were no significant differences in water absorption. In an independent single subject study Hill et al.[36] used water thickened with xanthan gum to pudding-thickness level using a stable, nonradioactive, nontoxic isotope technique and confirmed the findings of Sharpe et al.[35] that xanthan thickener does not affect the bioavailability of water.

***Xanthan thickener does not affect the bioavailability of water***

Consequently, it is not something inherent in the biochemical process of thickening agents that increases dehydration risk. Sharpe et al. put forward the following alternative suggestions: (a) the taste of thickened liquids is unpalatable and individuals do not drink sufficient thickened liquids for this purpose; (b) the thickened liquids may trigger gastric stretch receptors, essentially triggering a satiety response that limits the volume consumed.[35] There is widespread anecdotal clinical support for unpalatability of thickened liquids. Matta et al. noted flavor suppression in thickened beverages and the addition of unwanted and unexpected flavors, such as bitter, sour, metallic or astringent qualities.[37]

Interestingly, data from the obesity literature provides support also for satiety factors. Zijlstra and colleagues investigated the effect of viscosity of ad libitum food intake in healthy young volunteers.[38] Using a liquid, a semi-liquid and a semi-solid of the same palatability, macronutrient composition and energy density, they found significant differences in intake relative to viscosity. Specifically, they found that intake of liquid was 14% and 30% higher than semi-liquid and semi-solid intake, respectively. It may well be that a combination of taste and satiety factors affects sufficiency of intake for individuals with dysphagia. Thickened liquids are a necessity rather than a choice for swallowing safety and further efforts are required to improve intake.

## Increasing fluid intake to prevent dehydration

Determining the target amount of fluid intake to meet hydration requirements is not a simple task. Different formulas can result in differences of up to 700 mL/day.[12] Wotton et al., therefore, recommend that calculations should take into account initial and ongoing hydration needs, in addition to modifications based on co-morbidities.

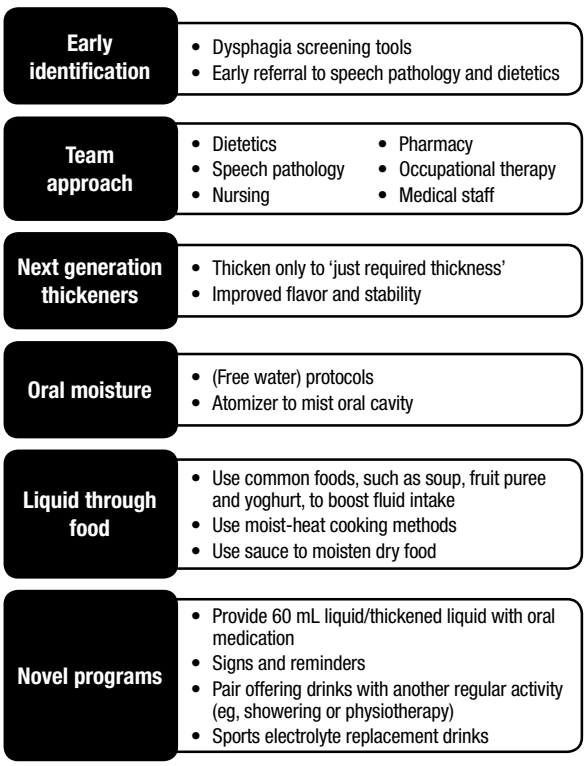
Poor oral intake is one of the greatest risk factors for dehydration. The recommended minimum total fluid intake is widely reported as 1,500–2,000 mL daily, coming from a combination of liquid and food sources. Fluid monitoring is a critical step to ensure adequate hydration. Without tracking fluid intake it is not possible to quickly and accurately determine whether intake is sufficient, or to determine why it may be insufficient. A range of fluids, including water, fruit and vegetable juice, milk, oral rehydration solutions, soup and decaffeinated beverages, should be offered, and thickened appropriately as required.

Steps to increase fluid intake and prevent dehydration are 6-fold:

1. Early identification programs are recommended;
2. A team approach to care is advocated;
3. Next generation thickeners are helping to improve safe liquid intake;
4. Hand in hand with next generation thickeners, oral moisture protocols are recommended to improve patient comfort;
5. Liquids can be provided though foods; and
6. A range of novel resources is available to reduce risk of developing dehydration.

These steps are briefly elaborated upon below and are summarized in Figure 2.

**Figure 2. Factors to increase fluid intake in individuals with dysphagia**




## *Early identification increases patient safety*

Early identification of dysphagia will also help to reduce dehydration risk. Consider a gentleman admitted to an emergency room with classic symptoms of stroke (right hemiplegia, dysarthria, aphasia and right facial droop). Some stroke guidelines require that patients are screened for dysphagia by trained personnel within 24 hours of admission and kept nil per os (NPO) until screened (Australian National Stroke Foundation).[39] If the gentleman's level of consciousness is fluctuating, he will not be suitable for oral intake. This means all foods, liquids and oral medications will be withheld. Once stabilized, the patient may still have to wait while transferred to a hospital ward. If his swallowing function is severely compromised, he may require non-oral nutrition. Prompt dysphagia screening can alert team members to the patient's needs early. Screening tools that then prompt referral to other team members will assist in faster identification and management of issues such as hydration and nutrition. Use of a validated screening tool for dysphagia is supported by the literature.[5,40,41]

## *A team approach*

A team approach to managing dehydration is required. For example, speech pathologists can assist by ensuring that where thickened liquids are required for swallow safety, the least amount of thickening agent to meet safety needs is used. There is a common thought that 'thicker is better'; however, risk of death from aspiration is higher for those aspirating thicker or more solid consistencies.[42] Vivanti et al. have shown that unless fluid-rich foods are provided, individuals needing honey- or pudding-thick thickened liquids are more likely to need enteral or parenteral nutrition support to meet daily fluid requirements.[20] Dietitians provide essential information on fluid balance and methods of increasing fluid intake via food or non-oral means. Prescription of supplements, particularly for protein, energy and micronutrients, is advocated. Occupational therapists provide valuable support to ensure that individuals can safely reach and successfully transport liquids to the mouth. Nursing staff are the 'eyes and ears' of the ward, monitoring fluid intake and providing hands-on assistance for those unable to feed themselves.

## *Next generation thickeners*

The science behind the development of thickeners continues at a rapid rate. Manufacturers have responded to scientific evidence and seek to improve the ease of use and palatability of their products. Pre-packaged thickened liquids are being used to provide consistency in thickened liquids. There are fewer errors from manual mixing resulting in wastage due to over- or under-thickening of liquids. In addition to increased patient safety, there are cost benefits to the practice with savings of 44–59%.[43] Health benefits are also noted as research has demonstrated significantly increased oral fluid intake on non-stroke wards where pre-thickened drinks were offered.[29]

However, there is also a quality of life benefit to being able to thicken personally-desired beverages as opposed to a forced choice option of pre-packaged drinks and flavors. Whelan found patients receiving pre-thickened drinks still requested hot beverages thickened with powder.[29] However, the type of thickening agent is important. Data from Payne et al. confirm earlier literature reports of instability in liquids thickened with starch thickeners.[44] They point out that the 'preparation history', such as speed of stirring and length of time stirring, increases the effects of thickening on standing. Tashiro et al. looked at a range of thickening agents and showed that xanthan gum provided predictable results with maximum flow velocity decreasing with increasing thickener concentration.[45] Clinically this means that liquids thickened with xanthan flow more slowly and with less propulsion. Where a person has dysphagia and has poor oral ability, the desired effect of thickened fluids is to have the bolus travel slowly and in a controlled fashion through the mouth and pharynx. The study of Tashiro et al. appears to support this effect with xanthan thickener.[45] Less xanthan gum is required for this effect than other thickening agents. Next generation thickeners have also improved flavor retention of the base liquid, and reduced the negative effects on flavor noted by Matta et al.[37]

### *Improving oral moisture – mouth wetting and 'free water' protocols*

Brunstrom et al. have shown that it is possible to be physiologically hydrated non-orally, and yet for feelings of thirst to remain.[46] Mouth wetting is an important requirement to satisfy the feeling of 'thirst'. This is thought to be a combination of increased oral moisture provided by the liquid and increase in saliva as *stimulated* by the liquid. Cold drinks increase saliva production and are thought to be more thirst quenching than warmer liquids. Thickened liquids, however, do not provide this 'mouth wetting' quality. One way to combat this issue is to use a water atomizer to mist the oral cavity for patients requiring thickened liquids. Misting the oral cavity covers a large surface area whilst providing very little thin fluid. Use of cold water in the atomizer may further improve oral pleasantness and decrease thirst sensation. Use of sterile water can allay concerns regarding infection.

Some individuals with dysphagia may be eligible to participate in 'free water' protocols. 'Free water' protocols have recently been provided with rigorous research support in the rehabilitation care setting.[47] Stringent requirements allow specially screened individuals to be provided thickened fluids at meals and for all medications, but allowed access to unthickened water. Only water is permitted as it is pH neutral and considered least damaging to lung tissue in the case of accidental aspiration. The provision of managed access to water aids compliance with thickened liquids. Oral hygiene is a key tenet of the protocol as it is recognized that bacteria, carried on food, liquid or saliva, is most likely to trigger development of aspiration pneumonia. Poor oral hygiene can result in the proliferation of pathogenic oral bacteria. Importantly, individuals who are able to participate in a free water protocol increase their daily fluid intake and quality of life scores compared with those who are only able to manage thickened liquids.[47]

### *Fluids provided through food*

Provision of small, frequent meals, such as five rather than three daily meals, has been found to increase fluid intake by more than 10% without increasing energy intake.[48] Vivanti et al. have shown that foods are a substantial source of hydration for individuals with dysphagia.[20] Thick nourishing soup, pureed fruit, yoghurt, and milk-based puddings were recommended to increase fluid intake using food as the carrier. These foods are commonly eaten by healthy individuals and as such may have more appeal to and acceptance by individuals with dysphagia.

### *Hydration programs and resources*

A range of straightforward strategies can help to improve hydration. Offering fluids at specific routine events, such as before or after showering or physiotherapy or with medication rounds, can improve fluid intake.[49] For example, the simple provision of fluids with medications increases hydration.[12] Providing 60 mL of liquid with medications boosts liquid intake whilst also assisting with medication passage through the esophagus and prevention of medication-induced esophagitis.[50] Teams could consider the adoption of 'happy hours' where freshly made fruit juices or milkshake drinks are provided to induce desire to drink. Use of symbols such as a water droplet logo on patient trays where fluid intake needs to be maximized can help staff identify those most in need of assistance to meet their daily fluid requirements.[49] Posters may assist with reminding elders to drink and to remind them that staff are happy to assist. Wotton et al. indicate that water in large plastic jugs that are only emptied daily takes on an unpleasant, plastic flavor.[12] The researchers recommend frequent replenishment of small water jugs to minimize tainting. Provision of sports electrolyte replacement drinks that are easily absorbed by the gut, as opposed to rehydration solutions, may also be more palatable and acceptable.[10]

## Summary

Dehydration is a significant problem for individuals with dysphagia that may result in many serious adverse, but avoidable, consequences. A team approach to maintaining adequate hydration is advocated. Thickened liquids do not alter bioavailability of water. Methods to improve intake of liquids need to be pursued. Practical application of techniques such as providing fluid-rich foods, the provision of water for those deemed suitable for free water protocols, and the administration of liquids thickened to 'just the required amount' help improve fluid intake in individuals with dysphagia. Consideration could also be given to using a water atomizer to mist the inside of the oral cavity after ingestion of thickened liquids to provide the mouth oral wetting, thereby reducing perception of thirst. For all individuals with dysphagia, a strict oral hygiene protocol is essential to reduce proliferation of oral bacteria that play a key role in the development of pneumonia.

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# Health economic perspective

## Dysphagia and dehydration – potential for high clinical and economic impact

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Dysphagia is recognized by health authorities and scientific societies as a risk factor for dehydration. Indeed, the National Guidelines Clearinghouse from the Agency for Healthcare Research and Quality (AHRQ)[1] highlight that dysphagia could be a limitation to oral intake and, as such, a risk factor for dehydration.

Teasell et al. (2010)[2] reported that the presence of dysphagia in stroke survivors has been associated with increased mortality and morbidities, such as malnutrition, dehydration and pulmonary compromise.[3-10] Dehydration may go unnoticed in this patient group because clinical symptoms such as cognitive impairment, confusion and predisposition to urinary tract infections are common in stroke patients.[10] A study by Whelan et al. (2001) found that the average total fluid intake of stroke patients met only 59% of their fluid requirements.[10] This sub-optimal intake is consistent with previous studies, suggesting that dysphagia predisposes patients to dehydration. In addition, Philip et al. (2000) highlighted that patients requiring thickened fluids are offered approximately 50% less fluids to drink than those able to consume normal fluids.[11] Reasons for this include less priority given by busy staff to offer fluid to patients, and a lack of understanding among family and staff that these patients require fluids with a thicker consistency.[12,13] Churchill et al. (2004) found that dysphagic patients had a higher risk of becoming dehydrated.[14] The odds ratio (OR) associated with dehydration was 4.2 (95% CI 2.1–8.3) among patients admitted for inpatient stroke rehabilitation.[14]

Based on the United States, (US) Health Care Utilization Program (HCUP) (2002), fluid and electrolyte disorders are the most common co-morbidities for patients younger than 18 years old; and the second most common co-morbidity for very old hospitalized patients aged 80 years and older.[15]

Altman et al. (2010) found that, among hospitalized patients diagnosed with dysphagia, the most common related co-morbid condition was fluid and electrolyte disorder, further referred to as dehydration.[16] Also noted in the study, 17.5% of dysphagic patients (from the National Health Discharge Survey [NHDS] 2005–2006) were dehydrated compared to 10.8% of non-dysphagic patients.[16]

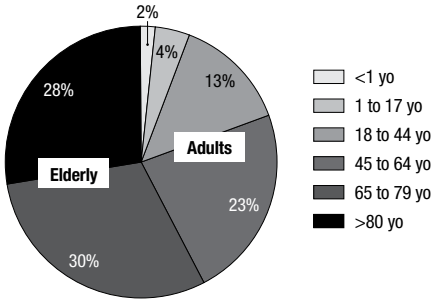
Dysphagic patients with dehydration had a median hospital length of stay (LOS) of 4.85 days versus 3.70 days for non-dysphagic patients with dehydration. This represents a difference of 1.15 days.[16]

| Hospitalized patients | Rate of dehydration (%) | Length of stay (days) |
|---|---|---|
| Dysphagia | 17.5 | 4.85 |
| Non-dysphagia | 10.8 | 3.70 |

According to the HCUP Factbook for the year 2002,[15] 592 million patients were discharged from the hospital with a primary diagnosis of fluid and electrolyte disorder. This included 30% of all patients who were 80 years or older.

The HCUP Factbook also highlights that fluid and electrolyte disorders are recorded as a co-morbidity in 1,312,000 patients aged 65 to 79 years discharged alive from hospitals annually, and in 1,219,000 discharges for those aged 80 years and older. Furthermore, fluid and electrolyte disorders led to 8,706,000 in-hospital deaths for patients aged 65 to 84 years and to 5,588,000 in-hospital deaths for those older than 85 years.[15]

**Percent hospitalizations with fluid and electrolyte disorders as primary diagnosis**




In 2002, fluid and electrolyte disorders as principal diagnosis was associated with a mean hospital LOS of 4.1 days and mean hospital charges of US$11,300 per patient. Sixty-six percent were admitted through the emergency room, and 2.9% died in-hospital.[16] In addition, fluid and electrolyte disorders is recognized by the US HCUP[15] as the fourth most frequent secondary diagnosis (hospitalization). Based on HCUP data, dehydration led to additional hospital charges of almost US$6.7 billion in 2002, of which more than US$2 billion were for patients older than 80 years. Altman et al. (2010)[16] found that among 271,983 hospitalized patients with dysphagia, 17.5% are diagnosed with fluid and electrolyte disorders. Based on the same fluid and electrolyte disorders mean charges of US$11,300 per patient (HCUP 2002), fluid and electrolyte disorders would lead to almost US$538 million spent every year among hospitalized patients with dysphagia.

In summary, dysphagia patients are at high risk of developing fluid and electrolyte disorders. These disorders impact clinical outcomes by increasing the risk of death and significantly add to the economic burden. Supporting dysphagia patients with early identification and appropriate food, fluid and nutritional products can help better meet patients' hydration needs and could potentially decrease the risk of complications and reduce healthcare costs.

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# CLINICAL NUTRITION ABSTRACTS

*CRITICAL CARE*

## New paradigm in nutrition support: Using evidence to drive practice

*Crit Care Nurs Q* 2012 Jul;35(3):255-267.
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Adequate nutrition support is a key component in achieving favorable outcomes for the critically ill patient. Significant evidence supports starting enteral nutrition rather than parenteral nutrition as early as possible after injury to promote positive outcomes. Evidence shows that enteral nutrition improves patient outcomes and decreases intensive care unit length of stay by improving splanchnic blood flow, moderating the metabolic response, sustaining gut integrity, and preventing bacterial translocation from the gut to the bloodstream. Implementing early enteral nutrition can be challenging. This article describes the rationale for early enteral nutrition, the evidence that favors enteral nutrition over parenteral nutrition, barriers to delivery of full enteral nutrition, and an evidence-based protocol developed at Harborview Medical Center to promote appropriate support. The role of the registered dietitian on the health care team in facilitating appropriate feeding is discussed. In addition, we will describe emerging nutrition therapies including the use of antioxidants, addition of the amino acid glutamine, use of immune-enhancing enteral formulas, and the potential role of probiotics that show promise in improving patient outcome.

## Nutrition and the open abdomen

*Nutr Clin Pract* 2012 Aug;27(4):499-506.
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Adequate nutrition support is critical in the management of patients with an open abdomen. Despite the literature supporting its use in trauma patients, provider concerns and clinical controversies remain regarding the early administration and long-term sequelae of enteral nutrition (EN) therapy in these patients. The purpose of this article is to review the clinical concepts behind the use of the open abdomen, as well as examine the altered nutrition requirements associated with the maintenance of a temporary laparostomy. The rationale for early EN is described, as well as the pros and cons surrounding the use of supplemental parenteral nutrition in those patients unable to meet nutrition goals enterally in a reasonable time frame. Finally, an open abdomen nutrition support algorithm is provided as part of the critical care plan in these patients who represent the sickest of surgical patients.

## Tolerance to enteral nutrition therapy in traumatic brain injury patients

*Brain Inj* 2012;26(9):1113-1117.
Pinto TF, Rocha R, Paula CA, de Jesus RP.
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OBJECTIVE: To evaluate the tolerance to enteral nutrition (EN) and the effects of pro-kinetic drugs in critical traumatic brain injury (TBI) patients. METHODS: Transversal observational study. A total of 32 out of 45 TBI patients of both genders receiving EN were evaluated in a trauma referral hospital intensive care unit (ICU). Data from each patient were collected for a period of 10 consecutive days after initiation of enteral feeding: gastric residue, presence of vomiting, abdominal distension, Glasgow coma scale and the use of pro-kinetic agents. RESULTS: In 20 of the 32 patients high levels of gastric residue were found. Of these 20 patients, half could not tolerate the diet within the first 72 hours following infusion. However, no association was found between disease severity and occurrence of gastrointestinal complications ($P > 0.05$). Feeding intolerance was observed in 75.0% ($n = 24$) of patients, even with the systematic use of metaclopramide from the outset of nutritional therapy. All patients with feeding intolerance who used erythromycin by nasogastric tube showed improvement. CONCLUSIONS: The high level of gastric residue was the most common feeding intolerance and the delivery of erythromycin by nasogastric tube seems to control gastrointestinal disorders in TBI patients.

## Optimizing nutrition in intensive care units: Empowering critical care nurses to be effective agents of change

*Am J Crit Care* 2012 May;21(3):186-194.
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Observational studies have consistently revealed wide variation in nutritional practices across intensive care units and indicated that the provision of adequate nutrition to critically ill patients is suboptimal. To date, the potential role of critical care nurses in implementing nutritional guideline recommendations and improving nutritional therapy has received little consideration. Factors that influence nurses' nutritional practices include the lack of guidelines or conflicting evidence-based recommendations pertaining to nurses' practice, strategies for implementing guidelines that are not tailored to barriers nurses face when feeding patients, strategies to communicate best evidence that do not capitalize on nurses' preference for seeking information through social interaction, prioritization of nutrition in initial and continuing nursing

The abstracts included in this section were selected from a search on clinical nutrition and related topics of the PubMed database of the United States National Library of Medicine. PubMed may be accessed via the National Library of Medicine Web site at www.nlm.nih.gov.

education, and a lack of interdisciplinary team collaboration in the intensive care unit when decisions on how to feed patients are made. Future research and quality improvement strategies are required to correct these deficits and successfully empower nurses to become nutritional champions at the bedside. Using nurses as agents of change will help standardize nutritional practices and ensure that critically ill patients are optimally fed.

## *DYSPHAGIA*

### Promoting safe swallowing when puree is swallowed without aspiration but thin liquid is aspirated: Nectar is enough

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The use of thickened liquids is a common compensatory strategy to improve swallow safety. The purpose of this study was to determine the optimal liquid viscosity to use to promote successful swallowing in a specific subset of dysphagic patients who swallow puree without aspiration but thin liquid with aspiration. A referral-based sample of 84 consecutive inpatients from a large, urban, tertiary-care teaching hospital who met the study criteria was analyzed prospectively. Inclusion criteria were no pre-existing dysphagia, a successful pharyngeal swallow without aspiration with puree consistency but pharyngeal dysphagia with aspiration of thin liquid consistency, and stable medical, surgical, and neurological status at the time of transnasal fiberoptic swallow testing and up to 24 h after recommendations for oral alimentation with a modified diet consisting of nectar-like and honey-like thickened liquids. Success with ingesting both nectar-like and honey-like thickened liquids and clinically evident aspiration events were recorded. Care providers were blinded to the study's purpose. All 84 patients were successfully ingesting nectar-like and honey-like thickened liquids at the time of swallow testing and up to 24 h after testing. A specific subset of dysphagic patients who swallowed puree without aspiration but aspirated thin liquid demonstrated 100% successful swallowing of both nectar-like and honey-like thickened liquids. Therefore, a nectar-like thickened liquid appears to be adequate to promote safe swallowing in these patients and, because of patient preference for the least thick liquid, may enhance compliance and potentially contribute to maintenance of adequate hydration requirements.

### Dysphagia, nutrition, and hydration in ischemic stroke patients at admission and discharge from acute care

*Dysphagia* 2012 Jun 9. [Epub ahead of print]
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Dysphagia may predispose stroke patients toward undernutrition and hydration. These comorbidities increase patient risks for reduced functional outcome and short-term mortality. Despite this impact, available information on relationships among dysphagia, nutrition, and hydration status in acute stroke is limited and conflicted. This study evaluated nutrition and hydration status in ischemic stroke patients with versus without clinically significant dysphagia at admission and at discharge from acute care. Sixty-seven patients admitted to the stroke unit in a tertiary-care hospital provided data for this study. On the day of hospital admission and upon discharge or at 7 days post-admission, serum biochemical measures were obtained for nutrition (prealbumin) and hydration status (BUN/Cr). Clinical evaluation for dysphagia, nutrition status, and stroke severity were completed an average of 1.4 days following hospital admission. Dysphagia was identified in 37% of the cohort. At admission 32% of patients demonstrated malnutrition based on prealbumin levels and 53% demonstrated evidence of dehydration based on BUN/Cr levels. No differences in nutrition status were attributed to dysphagia. Patients with dysphagia demonstrated significantly higher BUN/Cr levels (greater dehydration) than patients without dysphagia at admission and at discharge. Dehydration at both admission and discharge was associated with dysphagia, clinical nutrition status, and stroke severity. Results of this study support prior results indicating that dysphagia is not associated with poor nutrition status during the first week post stroke. Dehydration status is associated with dysphagia during this period. The results have implications for future confirmatory research and for clinical management of dysphagia in the acute stroke period.

## *GERIATRICS*

### Cost-effectiveness of nutritional intervention in elderly subjects after hip fracture

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Wyers CE, Reijven PL, Evers SM, Willems PC, Heyligers IC, Verburg AD, van Helden S, Dagnelie PC.
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Hip fracture patients can benefit from nutritional supplementation during their recovery. Up to now, cost-effectiveness evaluation of nutritional intervention in these patients has not been performed. Costs of nutritional intervention are relatively low as compared with medical costs. Cost-effectiveness evaluation shows that nutritional intervention is likely to be cost-effective. INTRODUCTION: Previous research on the effect of nutritional intervention on clinical outcome in hip fracture patients yielded contradictory results. Cost-effectiveness of nutritional intervention in these patients remains unknown. The aim of this study was to evaluate cost-effectiveness of nutritional intervention in elderly subjects after hip fracture from a societal perspective. METHODS: Open-label, multicenter randomized controlled

trial investigating cost-effectiveness of intensive nutritional intervention comprising regular dietetic counseling and oral nutritional supplementation for 3 months postoperatively. Patients allocated to the control group received care as usual. Costs, weight and quality of life were measured at baseline and at 3 and 6 months postoperatively. Incremental cost-effectiveness ratios (ICERs) were calculated for weight at 3 months and quality adjusted life years (QALYs) at 6 months postoperatively. RESULTS: Of 152 patients enrolled, 73 were randomized to the intervention group and 79 to the control group. Mean costs of the nutritional intervention was 613 Euro. Total costs and subcategories of costs were not significantly different between both groups. Based on bootstrapping of ICERs, the nutritional intervention was likely to be cost-effective for weight as outcome over the 3-month intervention period, regardless of nutritional status at baseline. With QALYs as outcome, the probability for the nutritional intervention being cost-effective was relatively low, except in subjects aged below 75 years. CONCLUSION: Intensive nutritional intervention in elderly hip fracture patients is likely to be cost-effective for weight but not for QALYs. Future cost-effectiveness studies should incorporate outcome measures appropriate for elderly patients, such as functional limitations and other relevant outcome parameters for elderly.

## Different components of nutritional status in older inpatients with cognitive impairment

*J Nutr Health Aging* 2012 May;16(5):468-471.
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OBJECTIVES: To evaluate different components of nutritional status in older patients with cognitive deficit, particularly in those with mild cognitive impairment (MCI). DESIGN: Cross-sectional study. SETTING AND PARTICIPANTS: 560 elderly subjects aged ≥ 65 years consecutively admitted to an acute Geriatric Unit of Apulia region of southern Italy. MEASUREMENTS: A standardized comprehensive geriatric assessment was used to evaluate medical, cognitive, affective and social aspects. Nutritional status was assessed using the Mini Nutritional Assessment (MNA). The cognitive function was categorized into three levels – MCI, dementia or normal cognition (NoCI) – according to the neuropsychological test score. RESULTS: Subjects with cognitive decline had significantly lower frequency of well-nourished (MCI = 10%, dementia = 8%, NoCI = 22%, $P < 0.05$) and higher frequency of malnourished (MCI = 47%, dementia = 62%, NoCI = 19%, $P < 0.001$) than patients with normal cognition. Similarly, MNA total score, MNA-3 and MNA-4 subscores were significantly lower in patients with MCI and dementia than patients with normal cognition ($P < 0.001$). CONCLUSIONS: These results suggest that cognitive decline may be associated with malnutrition in this sample of hospitalized older patients. Dietary habits (MNA-3) and subjective assessment of self-perceived quality of health and nutrition (MNA-4) are particularly poor also in patients with MCI and could be very important variables to be considered in the multidimensional evaluation of subjects with cognitive impairment.

## Nutritional supplementation during resistance training improved skeletal muscle mass in community-dwelling frail older adults

*J Frailty Aging* 2012;1(2):64-70.
Yamada M, Arai H, Yoshimura K, Kajiwara Y, Sonoda T, Nishiguchi S, Aoyama T.
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OBJECTIVE: Sarcopenia, the age-related loss of skeletal muscle mass, is highly prevalent in older adults. The aim of this study was to investigate the effects of the combination of resistance training and multinutrients supplementation (including vitamin D and protein) on muscle mass and physical performance in frail older adults. METHODS: This trial was conducted in Japanese frail older adults (n = 77), which underwent a standardized protocol of a 3-month physical exercise intervention. The sample population was divided into two groups, according to the adoption (S/Ex: n = 38) or not (Ex: n = 39) of the additional multinutrient supplementation. The outcome measures of interest for the present analyses were the skeletal muscle mass index (SMI) and several physical performance tests. RESULTS: Participants in S/Ex group had significant improvements for the outcome measures, including SMI and maximum walking time ($P < 0.05$), compared to those in Ex group. The prevalence of sarcopenia decreased from 65.7% to 42.9% in S/Ex group, while that in Ex group remained unchanged (68.6% to 68.6%) (relative risk = 1.60, 95% CI: 1.03–2.49). CONCLUSION: The results of this study suggest that the combination of resistance training and multinutritional supplementation may be more effective at improving muscle mass and walking speed than an intervention only based on resistance training.

## Clinical benefits of oral nutritional supplementation for elderly hip fracture patients: A single blind randomised controlled trial

*Age Ageing* 2012 Jun 8. [Epub ahead of print]
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BACKGROUND: Malnutrition is an important risk factor for poor outcome in patients recovering after hip fracture surgery. This study aimed to investigate the clinical, nutritional and rehabilitation effects of an oral nutritional supplementation (ONS) in an inpatient rehabilitation setting. METHODS: This was an observer-blinded randomized controlled trial of elderly post-surgical proximal femoral fracture patients. A ready-to-use oral liquid nutritional supplementation (18–24 g protein and 500 kcal per day) in addition to hospital diet was compared with hospital diet only. Both groups received usual rehabilitation therapy and oral calcium and vitamin D supplements. Outcomes were compared at discharge from rehabilitation and after 4 weeks of discharge. The primary outcome parameters were the serum albumin level, the body mass index (BMI), the functional independence measure (FIM) and the elderly

mobility scale (EMS). Secondary outcome parameters were frequency of complications, inpatient length of stay, mortality and acute hospital use within 6 months after discharge. RESULTS: A total of 126 patients were recruited, 65 in the supplementation arm and 61 in the control arm. There was a significant difference in change in BMI with a decrease of 0.25 and 0.03 kg/m$^2$ in the ONS group and 0.72 and 0.49 kg/m$^2$ in the control group at hospital discharge and follow-up, respectively (P = 0.012). The length of stay in rehabilitation ward was shortened by 3.80 (SE = 1.81, P = 0.04) days favoring the ONS group. The total number of infection episodes was also reduced significantly. No difference was observed in the rate of change of the serum albumin level, the FIM and the EMS. CONCLUSION: Clinical and nutritional benefits were seen in this trial but rehabilitation benefits could not be demonstrated.

## Protein supplementation increases muscle mass gain during prolonged resistance-type exercise training in frail elderly people: A randomized, double-blind, placebo-controlled trial

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Tieland M, Dirks ML, van der Zwaluw N, Verdijk LB, van de Rest O, de Groot LC, van Loon LJ.
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OBJECTIVES: Protein supplementation has been proposed as an effective dietary strategy to augment the skeletal muscle adaptive response to prolonged resistance-type exercise training in elderly people. Our objective was to assess the impact of protein supplementation on muscle mass, strength, and physical performance during prolonged resistance-type exercise training in frail elderly men and women. DESIGN/SETTING/PARTICIPANTS: A randomized, double-blind, placebo-controlled trial with two arms in parallel among 62 frail elderly subjects (78 ± 1 year). These elderly subjects participated in a progressive resistance-type exercise training program (two sessions per week for 24 weeks) during which they were supplemented twice daily with either protein (2 * 15 g) or a placebo. MEASUREMENTS: Lean body mass (DXA), strength (1-RM), and physical performance (SPPB) were assessed at baseline, and after 12 and 24 weeks of intervention. RESULTS: Lean body mass increased from 47.2 kg (95% CI, 43.5–50.9) to 48.5 kg (95% CI, 44.8–52.1) in the protein group and did not change in the placebo group (from 45.7 kg, 95% CI, 42.1–49.2 to 45.4 kg, 95% CI, 41.8–48.9) following the intervention (P value for treatment × time interaction = 0.006). Strength and physical performance improved significantly in both groups (P = 0.000) with no interaction effect of dietary protein supplementation. CONCLUSIONS: Prolonged resistance-type exercise training represents an effective strategy to improve strength and physical performance in frail elderly people. Dietary protein supplementation is required to allow muscle mass gain during exercise training in frail elderly people. Trial Registration: Clinicaltrials.gov identifier: NCT01110369.

## Malnutrition screening and early nutrition intervention in hospitalised patients in acute aged care: A randomised controlled trial

*J Nutr Health Aging* 2012;16(6):562-568.
Holyday M, Daniells S, Bare M, Caplan GA, Petocz P, Bolin T.
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OBJECTIVES: High rates of malnutrition have been reported in the older hospitalized patient population. This is recognised to impact on patient outcomes and health costs. This study aimed to assess the impact of nutrition screening and intervention on these parameters. DESIGN: Randomized controlled prospective study. SETTING: The study was performed in the acute geriatric medicine wards of the Prince of Wales Hospital, Sydney, Australia. PARTICIPANTS: All patients admitted to these wards under a geriatrician with an expected length of stay of at least 72 hours were considered for the study. INTERVENTION: Patients were screened on admission for malnutrition using the Mini Nutritional Assessment (MNA) tool and randomly assigned to control or intervention groups. Intervention patients were immediately commenced on a malnutrition care plan (MCP). Control patients were only commenced on an MCP if referred by clinical staff. MEASUREMENTS: Length of stay (LOS), weight change and frequency of readmission to hospital were compared between the groups. RESULTS: 143 patients were screened. 119 were identified as malnourished (MN) or at risk of malnutrition (AR). Overall LOS was not different between the two groups (control vs intervention: 13.4 ± 1.3 days vs 12.5 ± 1.2 days, P = 0.64). However there was a significant decrease in LOS in the MN (control vs intervention: 19.5 ± 3 days vs 10.6 ± 1.6 days, P = 0.013) and a trend to reduced readmissions. There was no difference in weight change over admission between the groups. Without screening, clinical staff identified only a small proportion of malnourished patients (35% of MN and 20% of AR). CONCLUSIONS: Malnutrition in the older hospital population is common. Malnutrition screening on hospital admission facilitated targeted nutrition intervention, however length of stay and re-presentations were only reduced in older malnourished patients with an MNA score less than 17.

## Frailty and nutrition: What we have learned from research and clinical practice on the Mini Nutritional Assessment

*J Frailty Aging* 2012;1(2):52-55.
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In this short communication, we review the relationship between frailty and malnutrition risk in the elderly. Frailty is a term used for elderly at increased risk of adverse outcomes, including disability, falls, hospitalization, need for long-term care, and mortality. The Mini Nutritional Assessment (MNA) was designed and validated in a series of studies to assess nutritional status of elderly, as integral part of the comprehensive geriatric assessment, with a 2-steps screening process; when the MNA-SF classify a person at risk, the full MNA should be completed. The MNA and MNA-SF are sensitive, specific,

and accurate in identifying nutrition risk. Increased risk of malnutrition, a common condition in the elderly, is closely associated with many potential contributors of frailty. The maintenance of optimal physical and cognitive performances depends on the early screening of critical conditions to develop preventive targeted interventions; the MNA supports such preventive action.

## *IMMUNONUTRITION*

### A meta-analysis of the effect of combinations of immune modulating nutrients on outcome in patients undergoing major open gastrointestinal surgery

*Ann Surg* 2012 Jun;255(6):1060-1068.
Marimuthu K, Varadhan KK, Ljungqvist O, Lobo DN.
Division of Gastrointestinal Surgery, Nottingham Digestive Diseases Centre National Institute for Health Research Biomedical Research Unit, Nottingham University Hospitals, Queen's Medical Centre, Nottingham, United Kingdom.

BACKGROUND: Immune modulating nutrition (IMN) has been shown to reduce complications after major surgery, but strong evidence to recommend its routine use is still lacking. OBJECTIVE: The aim of this meta-analysis was to evaluate the impact of IMN combinations on postoperative infectious and noninfectious complications, length of hospital stay, and mortality in patients undergoing major open gastrointestinal surgery. METHODS: Randomized controlled trials published between January 1980 and February 2011 comparing isocaloric and isonitrogenous enteral IMN combinations with standard diet in patients undergoing major open gastrointestinal surgery were included. The quality of evidence and strength of recommendation for each postoperative outcome were assessed using the GRADE approach and the outcome measures were analyzed with RevMan 5.1 software (Cochrane Collaboration, Copenhagen, Denmark). RESULTS: Twenty-six randomized controlled trials enrolling 2,496 patients (1,252 IMN and 1,244 control) were included. The meta-analysis suggests strong evidence in support of decrease in the incidence of postoperative infectious [risk ratio (RR) (95% confidence interval [CI]): 0.64 (0.55, 0.74)] and length of hospital stay [mean difference (95% CI): -1.88 (-2.91, -0.84 days)] in those receiving IMN. Even though significant benefit was observed for noninfectious complications [RR (95% CI): 0.82 (0.71, 0.95)], the quality of evidence was low. There was no statistically significant benefit on mortality [RR (95% CI): 0.83 (0.49, 1.41)]. CONCLUSIONS: IMN is beneficial in reducing postoperative infectious and noninfectious complications and shortening hospital stay in patients undergoing major open gastrointestinal surgery.

### Compliance with and effects of preoperative immunonutrition in patients undergoing pancreaticoduodenectomy

*J Hepatobiliary Pancreat Sci* 2012 May;19(3):249-258.
Shirakawa H, Kinoshita T, Gotohda N, Takahashi S, Nakagohri T, Konishi M.
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BACKGROUND/PURPOSE: This study was conducted to ascertain the feasibility and effectiveness of preoperative enteral immunonutrition using an immune-enhanced formula (Impact) in patients undergoing pancreaticoduodenectomy. METHODS: Twenty-five patients undergoing an elective pancreaticoduodenectomy were asked to ingest Impact for 5 days (750 mL/d) prior to surgery in addition to their normal diets. We retrospectively compared the early postoperative outcomes of the Impact group (n = 18), which consisted of patients who fully complied with the study protocol, and a control group (n = 13), which consisted of patients who had not ingested Impact prior to surgery. RESULTS: Overall, 82.6% of the patients complied with the preoperative oral ingestion of Impact; all but four patients tolerated a daily intake of 750 mL. While the clinical backgrounds of the Impact and control groups were not significantly different, the frequency of incisional wound infection was lower (0 vs 30.8%, P = 0.012) and the change in systemic severity as evaluated using the acute physiology and chronic health evaluation (APACHE)-II scoring system was milder (P = 0.033) in the Impact group than in the control group. CONCLUSION: The preoperative oral ingestion of Impact was well tolerated and appeared to be effective for preventing incisional wound infection and reducing the response to surgical stress in patients undergoing a pancreaticoduodenectomy.

### Optimal timing for the initiation of enteral and parenteral nutrition in critical medical and surgical conditions

*Nutrition* 2012 Sep;28(9):840-843.
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The early provision of nutrients as part of specialized therapy for critically ill patients admitted for critical medical and surgical conditions is recommended by various international guidelines. Enteral nutrition is the first option and should be initiated 24–48 h after admission to an intensive care unit. Even after gastrointestinal anastomosis, early oral or enteral feeding is not only safe but also associated with enhanced recovery and fewer complications. Recent studies showed that the use of an enteral diet or parenteral nutrition that contains immune nutrients enhances the recovery of critically ill patients. Although the precise caloric target remains controversial, the general consensus advocates the avoidance of prolonged hypocaloric or hypercaloric feeding. However, there is still debate about the timing of the initiation of parenteral nutrition when enteral nutrition either is impossible or does not meet the nutritional goals. Although controversy remains, two recent studies showed that when enteral feeding is not feasible the early initiation of parenteral nutrition was not associated with palpable benefit.

### Immunonutrition before and during radiochemotherapy: Improvement of inflammatory parameters in head and neck cancer patients

*Support Care Cancer* 2012 Mar 28. [Epub ahead of print]
Machon C, Thezenas S, Dupuy AM, Assenat E, Michel F, Mas E, Senesse P, Cristol JP.
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PURPOSE: Inflammatory, angiogenic and oxidative stress markers have been explored in head and neck squamous cell carcinoma (HNSCC) patients before and during radiochemotherapy. Furthermore, the effects of an oral supplementation containing amino acids, ω-3 fatty acids, ribonucleic acids, vitamins, and antioxidants on biological markers and acute toxicities were investigated. METHODS: Thirty-one patients with non-metastatic stage III or IV HNSCC treated with concomitant radiochemotherapy were recruited. A nutritional support (Oral Impact®) was given during 5 days before each cycle of chemotherapy. Biological samples were collected at baseline, after 5 days of oral supplementation and before the last cycle of chemotherapy. Acute phase proteins levels, proteomic cytokines determination and urinary isoprostanes levels were used as inflammatory and oxidative stress biomarkers. Toxicities were followed up during radiochemotherapy. RESULTS: At baseline, median levels of inflammatory (CRP 9.8 mg/L [0.8–130.1], IL-6 4.2 pg/mL [0.7–126.5]), pro-angiogenic (VEGF 229.5 pg/mL [13.1–595.9]) and pro-oxidative stress (urinary isoprostanes 118 pmol/mmol creatinine [51–299]) markers were increased. Decrease in CRP (P = 0.002) and α-1 acid glycoprotein (P = 0.020) levels were observed after 5 days of oral supplementation. During radiochemotherapy, no significant variation of inflammatory markers was reported, and a low incidence of severe acute mucositis was noted. CONCLUSIONS: Stage III or IV HNSCC patients are characterised by a pro-inflammatory, pro-angiogenic and pro-oxidative status. Nutritional support could improve this inflammatory state and could prevent severe acute mucositis.

## *MEDICAL NUTRITION THERAPY*

### Nutritional support in chronic obstructive pulmonary disease: A systematic review and meta-analysis

*Am J Clin Nutr* 2012 Jun;95(6):1385-1395.
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BACKGROUND: The efficacy of nutritional support in the management of malnutrition in chronic obstructive pulmonary disease (COPD) is controversial. Previous meta-analyses, based on only cross-sectional analysis at the end of intervention trials, found no evidence of improved outcomes. OBJECTIVE: The objective was to conduct a meta-analysis of randomized controlled trials (RCTs) to clarify the efficacy of nutritional support in improving intake, anthropometric measures, and grip strength in stable COPD. DESIGN: Literature databases were searched to identify RCTs comparing nutritional support with controls in stable COPD. RESULTS: Thirteen RCTs (n = 439) of nutritional support [dietary advice (1 RCT), oral nutritional supplements (ONS; 11 RCTs), and enteral tube feeding (1 RCT)] with a control comparison were identified. An analysis of the changes induced by nutritional support and those obtained only at the end of the intervention showed significantly greater increases in mean total protein and energy intakes with nutritional support of 14.8 g and 236 kcal daily. Meta-analyses also showed greater mean (± SE) improvements in favor of nutritional support for body weight (1.94 ± 0.26 kg, P < 0.001; 11 studies, n = 308) and grip strength (5.3%, P < 0.050; 4 studies, n = 156), which was not shown by ANOVA at the end of the intervention, largely because of bias associated with baseline imbalance between groups. CONCLUSION: This systematic review and meta-analysis showed that nutritional support, mainly in the form of ONS, improves total intake, anthropometric measures, and grip strength in COPD. These results contrast with the results of previous analyses that were based on only cross-sectional measures at the end of intervention trials.

### Consensus statement: Academy of Nutrition and Dietetics and American Society for Parenteral and Enteral Nutrition: Characteristics recommended for the identification and documentation of adult malnutrition (undernutrition)

*JPEN J Parenter Enteral Nutr* 2012 May;36(3):275-283.
White JV, Guenter P, Jensen G, Malone A, Schofield M; Academy Malnutrition Work Group; A.S.P.E.N. Malnutrition Task Force; A.S.P.E.N. Board of Directors.
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The Academy of Nutrition and Dietetics (Academy) and the American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.) recommend that a standardized set of diagnostic characteristics be used to identify and document adult malnutrition in routine clinical practice. An etiologically-based diagnostic nomenclature that incorporates a current understanding of the role of the inflammatory response on malnutrition's incidence, progression, and resolution is proposed. Universal use of a single set of diagnostic characteristics will facilitate malnutrition's recognition, contribute to more valid estimates of its prevalence and incidence, guide interventions, and influence expected outcomes. This standardized approach will also help to more accurately predict the human and financial burdens and costs associated with malnutrition's prevention and treatment and further ensure the provision of high-quality, cost-effective nutrition care.

### International consensus guidelines for nutrition therapy in pancreatitis

*JPEN J Parenter Enteral Nutr* 2012 May;36(3):284-291.
Mirtallo JM, Forbes A, McClave SA, Jensen GL, Waitzberg DL, Davies AR; International Consensus Guideline Committee Pancreatitis Task Force.
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Guidelines for nutrition support in pancreatitis have been inconsistently adapted to clinical practice. The International Consensus Guideline Committee (ICGC) established a pancreatitis task force to review published guidelines for pancreatitis in nutrition support. A PubMed search using the terms pancreatitis, acute pancreatitis, chronic pancreatitis, nutrition support, parenteral nutrition, enteral nutrition, and guidelines was conducted for the period from January 1999 to May 2011. Eleven guidelines were identified for review. The ICGC used the following process to develop unified guideline statements: summarize the strength of evidence

(grading) of the guidelines; establish level of evidence for ICGC statements as high, intermediate, and low; assign published guideline levels of evidence; and define an ICGC grading system. International Pancreatitis Guideline Grades were established as follows: platinum-high level of evidence and consistent agreement among the guidelines; gold-acceptable level of evidence and no conflicting statements in guidelines; and silver-single existing guideline statement with no conflict in other guidelines. Eighteen ICGC statements were derived from the 11 published pancreatitis guidelines. Uniform agreement from widely disparate groups (United States, Europe, Japan and China) resulted in 4 platinum-level guideline statements for nutrition in pancreatitis: nutrition support therapy (NST) is generally not needed for mild to moderate disease, NST is needed for severe disease, enteral nutrition (EN) is preferred over parenteral nutrition (PN), and use PN when EN is contraindicated or not feasible. This methodology provides a template for future ICGC nutrition guideline development.

## *PEDIATRICS*

### Nutritional practices and their relationship to clinical outcomes in critically ill children – An international multicenter cohort study

*Crit Care Med* 2012 Jul;40(7):2204-2211.
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OBJECTIVES: To examine factors influencing the adequacy of energy and protein intake in the pediatric intensive care unit and to describe their relationship to clinical outcomes in mechanically ventilated children. DESIGN, SETTING, PATIENTS: We conducted an international prospective cohort study of consecutive children (ages 1 month to 18 years) requiring mechanical ventilation longer than 48 hours in the pediatric intensive care unit. Nutritional practices were recorded during the pediatric intensive care unit stay for a maximum of 10 days, and patients were followed up for 60 days or until hospital discharge. Multivariate analysis, accounting for pediatric intensive care unit clustering and important confounding variables, was used to examine the impact of nutritional variables and pediatric intensive care unit characteristics on 60-day mortality and the prevalence of acquired infections. MAIN RESULTS: Thirty-one pediatric intensive care units in academic hospitals in eight countries participated in this study. Five hundred patients with mean (SD) age 4.5 (5.1) yrs were enrolled and included in the analysis. Mortality at 60 days was 8.4%, and 107 of 500 (22%) patients acquired at least one infection during their pediatric intensive care unit stay. Over 30% of patients had severe malnutrition on admission, with body mass index z-score > 2 (13.2%) or < -2 (17.1%) on admission. Mean prescribed goals for daily energy and protein intake were 64 kcals/kg and 1.7 g/kg respectively. Enteral nutrition was used in 67% of the patients and was initiated within 48 hrs of admission in the majority of patients. Enteral nutrition was subsequently interrupted on average for at least 2 days in 357 of 500 (71%) patients. Mean (SD) percentage daily nutritional intake (enteral nutrition) compared to prescribed goals was 38% for energy and 43% (44) for protein. A higher percentage of goal energy intake via enteral nutrition route was significantly associated with lower 60-day mortality (odds ratio for increasing energy intake from 33.3% to 66.6% is 0.27 [0.11, 0.67], P = 0.002). Mortality was higher in patients who received parenteral nutrition (odds ratio 2.61 [1.3, 5.3], P = 0.008). Patients admitted to units that utilized a feeding protocol had a lower prevalence of acquired infections (odds ratio 0.18 [0.05, 0.64], P = 0.008), and this association was independent of the amount of energy or protein intake. CONCLUSIONS: Nutrition delivery is generally inadequate in mechanically ventilated children across the world. Intake of a higher percentage of prescribed dietary energy goal via enteral route was associated with improved 60-day survival; conversely, parenteral nutrition use was associated with higher mortality. Pediatric intensive care units that utilized protocols for the initiation and advancement of enteral nutrient intake had a lower prevalence of acquired infections. Optimizing nutrition therapy is a potential avenue for improving clinical outcomes in critically ill children.

### Malnutrition screening tools for hospitalized children

*Curr Opin Clin Nutr Metab Care* 2012 May;15(3):303-309.
Hartman C, Shamir R, Hecht C, Koletzko B.
Institute of Gastroenterology, Nutrition and Liver Diseases, Sackler Faculty of Medicine, Tel-Aviv University, Schneider Children's Medical Center of Israel, Clalit Health Services, Petach Tikva, Israel.

PURPOSE OF REVIEW: Malnutrition is highly prevalent in hospitalized children and has been associated with relevant clinical outcomes. The scope of this review is to describe the five screening tools and the recent European Society for Parenteral and Enteral Nutrition (ESPEN) research project aimed at establishing agreed, evidence-based criteria for malnutrition and screening tools for its diagnosis in hospitalized children. RECENT FINDINGS: Five nutrition screening tools have recently been developed to identify the risk of malnutrition in hospitalized children. These tools have been tested to a limited extent by their authors in the original published studies but have not been validated by other independent studies. So far, such screening tools have not been established widely as part of standard pediatric care. SUMMARY: Although nutrition screening and assessment are recommended by European Society for Parenteral and Enteral Nutrition and the European Society for Pediatric Gastroenterology Hepatology and Nutrition and are often accepted to be required by healthcare facilities, there is no standardized approach to nutritional screening for pediatric inpatients. The near future will provide us with comparative data on the existing tools which may contribute to delineating a standard for useful nutrition screening in pediatrics.

*Highlights of*

# Clinical Nutrition Week

*21–24 January 2012 • Orlando, Florida, USA*

## A.S.P.E.N. President's address – Parenteral nutrition (PN) evidence and safety: Can PN outcomes be improved?

J Mirtallo (Columbus, OH, USA)

Although parenteral nutrition (PN) is a complex therapy with a much narrower risk/benefit ratio than enteral nutrition (EN), its use is growing, as evidenced by a 2.6-fold increase in patients discharged from the hospital on PN over the 18 years to 2010.[1] However, concern still lingers about its safety. Analyzing data on PN, including published evidence or science, patient statistics and care processes, may help practitioners improve outcomes with PN.

The gold standard for evidence supporting PN practice is the randomized controlled trial (RCT). However, significant gaps in the science of PN still exist, as evidenced by differences in practice guidelines and recommendations. Flaws in study design or the statistical analysis of studies on which guidelines are based may account for the differences and may affect PN outcomes.[2,3]

Practitioners should consider a population's characteristics when translating information into clinical practice. Unfortunately, demographic information about PN patients is scarce outside of research settings, making it difficult to evaluate and improve outcomes. SUSTAIN™, a new national patient registry for nutrition care sponsored by the American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.), will provide critical demographic data to measure PN-associated outcomes.

By nature, the provision of PN is multidisciplinary, complex and prone to error.[4,5] Information gathered during the care process or from sentinel events and error reporting is important to identify safety issues and pinpoint areas that need improvement, even though such data may not be conducive to RCTs.

Recently, A.S.P.E.N. hosted a summit on recurrent drug shortages, endorsed by the Institute for Safe Medication Practices. The summit addressed safety issues caused by confusion in the prescribing process, the use of less desirable or unfamiliar products, and circumvented safety checks. To deal with inadequate supply, organizations have reduced doses and prioritized patients to receive limited drugs, practices that may result in suboptimal therapy or nutrient deficiencies.

To address issues in PN safety, A.S.P.E.N. is providing education on safe PN, testifying before Congress on drug shortage issues, creating a PN safety task force, establishing a malnutrition committee and supporting the work of NutritionDay and the European fight against malnutrition.[6]

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## Gone fishin' – The truth about omega-3s in critical care nutrition: Interactive panel discussion

P Marick (Norfolk, VA, USA)
A Pontes-Arruda (Fortaleza, Ceará, Brazil)
T Rice (Nashville, TN, USA)
D Heyland (Kingston, ON, Canada)

Fish oils exert a protective effect in critical illness by altering cell membrane and function, influencing genes, and producing protectins and resolvins that decrease inflammation.[1] A recent systematic review concluded that fish oils are the only dietary supplement in Western medicine that show a therapeutic effect.[2] However, results of their use in clinical trials yield divergent results.

The INTERSEPT study evaluated the effect of fish oils in patients with early sepsis and organ failure on reducing the progression of the disease to severe sepsis. Results showed prophylactic administration of fish oils and other pharmaconutrients was associated with less severe sepsis, septic shock and multi-organ failure, and shorter duration of mechanical ventilation and stays in the intensive care unit (ICU) and hospital.[3]

On the other hand, the OMEGA study of eicosapentaenoic acid (EPA), gamma-linolenic acid (GLA) and antioxidants in patients with acute lung injury failed

to show a positive effect on reducing ventilator-free days or other clinical outcomes, and the study was stopped for perceived futility.[4] In a recent phase II study, Stapleton reported bolus dosing of pure fish oil had no effect on biomarkers of pulmonary or systemic inflammation in patients with acute lung injury.[5]

Marked differences in the results from clinical studies may be due to differences in study design or to inadequate protein and calorie content of the study diets. In the OMEGA study, subjects on control diets received significantly more protein than those on study diets (20 g versus 3.6 g), which may have favorably influenced outcomes in the control group. The OMEGA study delivered nutrition by bolus, which may have affected the rate of incorporation of fish oil into the cell and blunted the modulation of the inflammatory response. The OMEGA study also used trophic feedings for the first 5 days, which could have led to the fish oil supplements being oxidized for calories instead of being incorporated into cell membranes.[6]

Given the evidence that increased protein and calorie intake is associated with improved clinical outcomes in critically ill patients,[7] future studies on the role of fish oil as an immune-modulating nutrient in critical illness should ensure adequate protein and calorie intake.

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## Nestlé symposium – Nutrition emergency in the ICU: Challenges and solutions


J Saavedra (Baltimore, MD, USA)
K Miller (Louisville, KY, USA)
B Taylor (St Louis, MO, USA)
S McClave (Louisville, KY, USA)


Gut dysfunction is multidimensional and may present along a continuum from graduated dysfunction – with compromised ability to maintain normal motility, digestion, absorption and/or barrier function – to complete gut failure. Lack of luminal nutrients and altered microbiota are nutrition-related factors that predispose patients to gut dysfunction.

Due to the growing complexity of nutrition support therapy in the ICU, optimal feeding in the ICU requires a team effort and having the expertise, strategies, and protocols in place to act quickly. Dr Miller introduced the mnemonic "CAN WE FEED?" to address the what, when and how of successful early EN:

C – Co-morbidities assessed by critical illness severity screens
A – Age
N – Nutrition risk screening by NRS-2002 tool[1]
W – Wait for resuscitation before beginning EN
E – Energy needs assessed by equations or indirect calorimetry
F – Formula as per need for standard, anti-inflammatory, arginine-supplemented, or malassimilation formula
E – Enteral access depending on tolerance and how long the patient will need EN
E – Efficacy monitored
D – Determine tolerance[2]

Proven solutions to feeding challenges in ICU include volume-based feeding protocols,[3] nutrition bundles, a bottom-up protocol and the presence of the ICU dietitian.[4] To be positioned as champions for optimal nutrition, dietitians need to understand the whole of ICU patient care, incorporate physical assessment with nutrition assessment, develop evidence-informed protocols,[5] and learn to place feeding tubes.[6]

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## Late breaking studies in clinical nutrition


M Casaer (Leuven, Belgium)
M Berger (Lausanne, Switzerland)
D Heyland (Kingston, ON, Canada)
A Pontes-Arruda (Fortaleza, Ceará, Brazil)


The Early Parenteral Nutrition Completing Enteral Nutrition in Adult Critically Ill Patients (EPaNIC) study compared early versus late initiation of PN to supplement insufficient EN.[1] Late initiation was associated with fewer complications, faster recovery, and reduced healthcare utilization and costs. Rates of ICU and hospital deaths and survival at 90 days were similar for both groups. Results suggest that withholding PN during the first week of critical illness is superior to initiation of PN when nutritional goals are not met by EN alone.[1]

Dr Berger reported on an unpublished, multicenter trial that studied the effect of supplemental PN on preventing the deleterious effects of high cumulative energy deficits. Patients on EN who did not achieve goal rate by day 3 were started on PN. The supplemental PN group had fewer infections, days on antibiotics and of ventilator-dependence, and required no more insulin than the control group. ICU length of stay was not affected and hypoglycemia was rare. Berger concluded that starting supplemental PN no earlier than day 4 and covering energy needs is better than allowing large energy deficits to develop in ICU patients.

Dr Heyland presented preliminary results from an intervention study on the effect of a new nurse-driven feeding protocol on achieving EN feeding goal. The Enhanced Protein-Energy Provision via the Enteral Route in Critically Ill Patients (PEP-uP) protocol emphasizes the 24-hour feeding volume[2,3]; tailors feeding models to the patient's

hemodynamic stability[4]; tolerates higher gastric residual volumes; and provides semi-elemental formulas, pro-motility agents and protein supplements at onset of feedings.

Compared with the control group, patients on the PEP-uP protocol started feedings earlier, received more calories and protein, and were more likely to achieve calorie goals. The more aggressive feeding protocol was well accepted by nursing staff, and complications did not increase significantly.

The INTERSEPT Study investigated the effect of EPA and GLA on reducing the progression of systemic inflammatory response syndrome (SIRS) to sepsis or septic shock. Patients received either EN with EPA, GLA and antioxidants or an iso-caloric, iso-nitrogenous control diet for 7 days. Patients receiving the study diet were less likely to develop severe sepsis and/or septic shock or cardiovascular and respiratory failure, and had fewer ventilator-dependent, ICU and hospital days. EPA/GLA may have a role in the early stages of sepsis by slowing the progression of sepsis-related organ dysfunction.[5]

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## Management of short bowel syndrome


K Iyer (New York, NY, USA)
K Tappendon (Urbana, IL, USA)
M De La Cuerda (Madrid, Spain)


Management of short bowel syndrome (SBS) and intestinal failure focuses on optimizing residual intestinal function to reduce dependence on PN.[1] Nutritional interventions include a high-calorie, low-fat diet with medium-chain triglyceride (MCT) oil and soluble fibers; restricting oxalates when the colon is present; frequent small meals; limiting simple sugars; individualized lactose restriction; and calcium 1,500 mg/d. Medical therapy includes anti-motility agents and anti-secretory agents (octreotide).[2] The use of growth hormone is controversial and limited in clinical practice because of the transient nature of any beneficial effects and the potential for adverse effects.[3]

Emerging strategies to enhance intestinal adaptation promise to reduce PN in individuals with intestinal failure. Short-chain fatty acids, especially butyrate, enhance intestinal adaptation. A recent animal study evaluated the effect of supplementing partial EN with short-chain fructo-oligosaccharides (FOS) as an alternate method of delivering butyrate to PN-dependent subjects. Supplementation with short-chain FOS, a prebiotic source that is rapidly fermented to butyrate, stimulated increases in intestinal mass, mucosal weight, DNA quantity, and transport of glucose and glutamine.[4]

Glucagon-like peptide 2 (GLP-2) improves intestinal absorption and nutritional status in SBS patients with impaired postprandial GLP-2 secretion due to loss of the terminal ileum and colon.[5] In a recent Phase III study of 83 patients, teduglutide (ALX-0600), a GLP-2 analog, was shown to be safe and well tolerated.[6] Teduglutide restored intestinal functional and structural integrity and reduced PN dependency.

Prognostic factors for intestinal failure after resection depend on the type and extent of resection, age, length of time from resection and adaptation. While 30–70% of patients will be weaned from PN in the long-term, patients with liver failure have a mortality rate greater than 90% and thus are candidates for life-saving liver transplant.

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## Dudrick research symposium – Omega-3 fatty acids: History, metabolism, and function


S Innis (Vancouver, BC, CA)
N Salem (Columbia, MD, USA)
A Simpoulos (Washington, DC, USA)


Omega-3 fatty acids (ω-3 FA) play a central role in maintaining optimal health throughout life. Recent work suggests they are critical to hepatic metabolic development in the newborn and facilitate adaptation from in utero nutrition to the postnatal high-fat milk diet. As part of the adaptation at birth, docosahexaenoic acid (DHA) increases fatty acid oxidation and directs glucose and amino acids to anabolic pathways.[1,2]

DHA plays an important role in neural function throughout life. Decreases in plasma DHA are associated with cognitive decline in the elderly. The MIDAS study investigated the effect of DHA supplementation on improving cognitive function in healthy older adults with age-related cognitive decline. Subjects who received 900 mg/d DHA for 24 weeks had improved learning and memory function, suggesting that DHA is a safe, beneficial supplement that supports cognitive health with aging.[3]

However, another clinical trial of DHA supplementation (2 g/d) in individuals with mild to moderate Alzheimer's disease failed to show a decrease in the rate of cognitive and functional decline. These findings suggest intervention with DHA might be more effective if initiated earlier in the course of the disease in patients who do not have overt dementia.[4]

Changing the ratio of ω-6:ω-3 FA in the Western diet may be beneficial in the treatment of cardiovascular disease, cancer, and inflammatory and autoimmune diseases.

However, the optimal ratio may vary with the disease being treated, and the therapeutic dose of ω-3 FA may depend on the person's genetic predisposition.[5]

Recommendations to increase ω-3 FA intake should focus on protein sources, rather than dietary fat, because DHA and EPA are naturally present in high protein foods.[6]

Even with no other changes in the diet, DHA supplementation can improve DHA status. Supplementation with ALA and EPA are not as effective, because the rate of DHA synthesis from ALA and EPA is very slow. Preformed DHA leads to much higher DHA content in brain and other organs.[7]

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## A.S.P.E.N. – FELANPE session – Nutritional therapy in the critically ill surgical patient: Topics of interest


J Diaz-Pizarro (Mexico City, Mexico)
J Velasquez (Valencia City, Venezuela)
C Cukier (São Paulo, Brazil)


Strong evidence supports the use of early EN in patients with severe acute pancreatitis (SAP) to modulate the stress response, promote more rapid resolution of the disease process, maintain the gut barrier and reduce morbidity and mortality.[1,2] When PN is indicated, initiation should be delayed for 5 days after the peak in inflammation to reduce complications and promote faster recovery.[3] Both nasogastric and nasojejunal feeding appear to be safe in SAP.[4]

Most patients with SAP tolerate both semi-elemental and polymeric formulas very well.[5] Currently there is insufficient evidence to recommend immuno-enhanced nutrition for patients with SAP. Although early work suggested probiotics were beneficial in SAP,[6] a subsequent large RCT concluded probiotics do not reduce infections and increased risk of mortality in SAP.[7]

Appropriate nutritional therapy during sepsis and severe infection helps to modulate the inflammatory response, maintain immune and mucosal barrier function, and blunt muscle catabolism. Early EN is the preferred route of nutritional support in sepsis[8] to maintain the gut barrier and prevent late nosocomial infections.[9] Even patients with open peritoneal cavities benefit from EN.[10] Glutamine supplementation in sepsis may attenuate the inflammatory response and improve tissue metabolic function.[11] Early and continued selenium supplementation of 1,000 µg/d reduces mortality in patients with severe sepsis or septic shock.[12]

The addition of fish oil to parenteral lipids may mitigate the immunosuppressive effect of long-chain fatty acids used in traditional parenteral lipids and improve outcomes. Fish oils support intrinsic immune function and modify inflammatory cytokine concentrations.[13,14] They also modify protein synthesis and downregulate protein degradation in sepsis.[15] Clinical trials with fish oil-based PN lipids in patients with sepsis are associated with a tendency towards shorter length of hospital stay[14] and suggest they are probably safe in critically ill septic patients.[16]

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## Roundtable: How parents can cope when a child has a new gastrostomy tube


G Rempel (Winnipeg, MB, Canada)


Gastrostomy tubes (GT) are often required to safely provide nutrition in children with feeding disorders. Yet, parents are conflicted about the risks, complications and benefits of GT, viewing feeding by mouth as an enjoyable activity and important social process, but also a struggle.[1] Parents perceive that GT feeding represents a loss of normality, a sign of disability, and a disruption of maternal nurturing and bonding.[2]

A clinical pathway for children and families with new GT supports parents by providing more information about caring for GT feedings, opportunities to communicate with other families experiencing the same issues, and emotional support for their decision-making.

A family-centered feeding plan incorporates an understanding of the family's needs, wants and fears related to GT feeding, and information the family needs to make decisions without coercion.[3]

Almost all parents report a significant improvement in their child's health after GT initiation and a significant reduction in time spent feeding. Children experience statistically significant and clinically important increases in weight gain and subcutaneous fat deposition.[4] Other advantages of GT feeding may include easier medication administration, better seizure and constipation control, and decreased parental stress.

Disadvantages of GT feeding include the need for surgical placement, potential complications (migration of tube, dislodgement of tube, skin irritation), increased regurgitation, and parenteral loss of feeding skills. Parents

need information on the reason for the GT placement, tube choice and procedures, complications, impact on quality of life, care and cost.

According to Dr Rempel (Clinical Nutrition Week 2012, 23 January 2012), parents felt better supported after implementation of the clinical pathway, and emergency room visits for the children decreased significantly.

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## Rhoads Research Lecture – Improving patient care with practice-based research

R Dickerson (Memphis, TN, USA)

Practice-based research (PBR) in nutrition support is a valuable tool to generate and share knowledge about issues that arise from clinical practice. Given that the primary intent of PBR is to solve a clinical dilemma or problem seen in daily practice, results are usually immediately applicable to day-to-day clinical practice. Clinically relevant PBR extends the impact of improvements in patient care efforts beyond one's individual practice setting.

The most common source of ideas for PBR is observations from clinical practice. For example, patients with traumatic brain injury (TBI) have a higher incidence of gastric feeding intolerance than those without TBI, an observation that was the basis for a retrospective analysis on the use of prokinetic agents in TBI. Results indicated a combination of metoclopramide with erythromycin was the preferred first-line therapy for TBI patients with gastric feeding intolerance.[1] Lack of published data on the clinical relevance of the interaction of levothyroxine and continuous EN led to a study that linked the interaction with hypothyroidism and resulted in the recommendation for weekly thyroid function monitoring in patients receiving levothyroxine concurrently with continuous EN.[2]

The landmark early PBR on high protein, hypocaloric feedings for obese subjects was inspired by work on the influence of protein and caloric intake on nitrogen balance and body composition.[3] A more recent PBR study built on earlier work on intensive insulin therapy (IIT) in critically ill patients. The study evaluated the effect of tight glycemic control in renal failure patients receiving specialized nutritional support and found these patients were more likely to develop hypoglycemia while receiving IIT than patients without renal failure.[4]

Busy clinicians cite common barriers to conducting PBR: lack of formal research training; inadequate facilities, equipment or funding; an insufficient patient population; and lack of available mentors. For many practitioners, the most challenging barrier is inadequate time.

Overcoming fear of conducting PBR requires a positive attitude and a strong commitment to incorporating research into everyday practice and sharing knowledge gained.

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## Underfeeding the ICU patient

A Malone (Columbus, OH, USA)
N Mehta (Boston, MA, USA)
J Mechanick (New York, NY, USA)
S McClave (Louisville, KY, USA)

Nearly a quarter of hospitalized patients receive clear liquids or no diet for prolonged periods.[1] Permissive underfeeding may benefit some patients, especially the critically ill, but current evidence varies depending on the mode of feeding (PN versus EN), the patient's risk level (moderate versus high), and whether or not the patient is obese.

In obese critically ill patients, permissive underfeeding that provides 2.5 g protein/kg/d supports the maintenance of lean body mass[2] and is at least as effective as eucaloric feedings. Permissive underfeeding decreases risks associated with underlying co-morbidities (hyperglycemia, delayed ventilator weaning and worsening hepatic function). Resultant weight loss also favorably alters gut flora[3] and makes it easier to care for obese critically ill patients.

A recent meta-analysis demonstrated that supplemental PN in surgical patients may reduce infectious complications and the length of hospitalization.[4] Permissive underfeeding in this population avoids overfeeding, increases insulin sensitivity, modulates metabolic responses, and reduces energy expenditure.

Permissive feeding in the non-obese critically ill patient on EN is controversial. The study by Arabi et al that reported permissive underfeeding (60–70%) in critically ill patients was associated with lower mortality rates than target feeding (90–100%).[5] However, the study did not account for oral intake. When days of observation after progression to oral intake were excluded from the analysis, results show a significant benefit to increased caloric intake,[6] which is consistent with evidence that a caloric deficit of as little as 4,000 calories has adverse effects.[7]

Subset analysis of the recent EPaNIC study[8] suggests moderate-risk patients who received early PN had worse outcomes (more infections and fewer discharged alive) than high-risk patients. These findings emphasize the need to consider the differing risk/benefit ratios for parenteral versus enteral calories when determining whether supplemental PN is indicated.[9]

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## *Clostridium difficile:* An organism with a new virulence

C Edmiston (Milwaukee, WI, USA)
T Canada (Houston, TX, USA)

Managing *Clostridium difficile* infection (CDI) has become more daunting over the past decade because of alarming increases in CDI incidence and severity both in the hospital and in the community.[1] The pathogenesis of CDI requires disruption of the normal colonic microflora by antimicrobials or other agents; ingestion of a toxigenic strain of *C difficile*; and the presence of either severe underlying disease, advanced age, prolonged hospitalization, acid neutralizing drugs, or manipulation of the gastrointestinal tract (eg, by feeding tubes or motility altering drugs).[2] *C difficile* spores can survive in the environment for years, such as on surfaces, and are not susceptible to antibacterial hand foams.

Efforts to reduce patient exposure to *C difficile* center on keeping patients out of the hospital; infection control and isolation methods, including gloves, proper hand washing, use of disposable personal equipment, and barrier precautions; and environmental cleaning and disinfection.[3]

Once patients are exposed to the pathogen, reducing the risk of CDI focuses on antimicrobial stewardship to promote judicious use of antimicrobials[4] and restore normal gut flora. Nearly all classes of antimicrobial have the potential to disrupt indigenous intestinal microflora, thereby allowing *C difficile* spores to grow and produce toxin. Extended courses of antibiotics and the prolonged time needed to restore normal intestinal microflora after antimicrobial therapy make treatment even more challenging.

Many medications beyond antimicrobials have the potential to alter normal gastrointestinal flora. Gastric acid suppressant agents, chemotherapeutic agents, opioids, immunosuppressants, loperamide, and statins may predispose a patient to CDI or prolong the illness.[5]

Future prevention strategies for CDI are likely to invoke: 1) use of better diagnostics that correctly distinguish those patients who do and do not require isolation and treatment; and 2) other modalities that reduce recurrent and primary CDI, such as vaccines, passive antibodies (immunoglobulin G) and biologics to bolster immunity.[6]

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## Surgical nutrition: Challenges and pitfalls

F Moore (Gainesville, FL, USA)
P Wischmeyer (Aurora, CO, USA)
R Martindale (Portland, OR, USA)
W Chwals (Boston, MA, USA)

Malnutrition in surgical patients is an emergency. Compared with medical patients, surgical patients start nutrition later and consequently receive less of their prescribed calories (46% versus 56%), according to a large international survey of ICUs.[1]

The current challenge in surgical nutrition is to meet the needs of critically ill ICU patients who initially survive severe sepsis, but often succumb to subsequent infections and organ failure. A new paradigm, defined as persistent inflammatory/immunosuppressive catabolic syndrome (PICS), characterizes a condition often seen after a hospital stay of longer than 14 days, which is associated with elevated C-reactive protein levels, T cell counts greater than 800 cells/mm$^3$, and weight loss. PICS can linger up to 12 months following critical illness in the ICU and can result in loss of lean body mass from inflammation, poor wound healing, apoptosis and death.[2,3]

Caused by sepsis-induced alterations in myeloid-derived suppressor cells (MDSC),[4] PICS leads to increased susceptibility to secondary nosocomial infections and late mortality in sepsis.[5] Nutrition-related therapy includes early enteral glutamine during treatment of shock, immune-enhancing diets after shock resolves, short-term PN if not resolved, early mobility and anabolic agents (eg, propranolol, oxandrolone, IIT).

In pediatric surgical patients, overfeeding is a potential hazard particularly in younger children. Overfeeding by as little as 50% above the measured energy expenditure can significantly increase morbidity and mortality.[6] A child's energy needs decrease after surgery due to growth inhibition, decreased insensible losses and inactivity. Indirect calorimetry remains the only accurate method to assess energy requirements in the pediatric surgical patient.[7] While IIT may reduce morbidity and mortality in adults, it risks hypoglycemia in critically ill children.

Current guidelines for adult surgical patients concur on most topics, including early EN, the preference for EN, the benefits of fish oils, supplemental antioxidants, use of glutamine, small bowel versus gastric feeding, and use of arginine in surgery patients. Differences exist in the use of indirect calorimetry versus predictive equations, prokinetics in the ICU, arginine in the medical ICU and gastric residuals.[8] Most of the differences are due to significant differences in the study populations, so updated guidelines will focus on specific groups in the ICU.

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***The views expressed in this newsletter are of the presenters and participants, <u>not</u> the Nestlé Nutrition Institute.***

# Conference Calendar 2012

*September 2012*

## 34th ESPEN Congress

*8–11 September 2012*
*Barcelona, Spain*

*Organizer:*
The European Society for Clinical Nutrition and Metabolism

Web site: www.espen.org

## 8th Congress of the EUGMS

*26–28 September 2012*
*Brussels, Belgium*

*Organizer:*
European Union Geriatric Medicine Society (EUGMS)

Web site: www.eugmsbrussels2012.org

## ACS 98th Annual Clinical Congress

*29 September – 4 October 2012*
*Chicago, Illinois, USA*

*Organizer:*
American College of Surgeons (ACS)

Web site: www.facs.org

*October 2012*

## Food and Nutrition Conference and Expo 2012 (FNCE 2012)

*6–9 October 2012*
*Philadelphia, Pennsylvania, USA*

*Organizer:*
Academy of Nutrition and Dietetics

Web site: www.eatright.org/fnce/

## ESICM LIVES 2012 Annual Congress

*13–17 October 2012*
*Lisbon, Portugal*

*Organizer:*
The European Society of Intensive Care Medicine (ESICM)

Web site: www.esicm.org/data/modulegestionde-contenu/pagesgenerees/07-congresses/0a-annual-congress/105.asp

## NASPGHAN Annual Meeting and Postgraduate Course

*18–21 October 2012*
*Salt Lake City, Utah, USA*

*Organizer:*
North American Society for Pediatric Gastroenterology, Hepatology and Nutrition (NASPGHAN)

Web site: http://www.naspghan.org

## 2012 AAP National Conference and Exhibition

*20–23 October 2012*
*New Orleans, Louisiana, USA*

*Organizer:*
American Academy of Pediatrics (AAP)

Web site: www.aapexperience.org

## 2nd ESSD Congress

*25–27 October 2012*
*Barcelona, Spain*

*Organizer:*
The European Society for Swallowing Disorders (ESSD)

Web site: www.essd2012.org

*November 2012*

## The 2012 Annual Meeting of the American College of Allergy, Asthma & Immunology

*8–13 November 2012*
*Anaheim, California, USA*

*Organizer:*
American College of Allergy, Asthma & Immunology (ACAAI)

Web site: www.acaai.org/annual_meeting/Pages/default.aspx

## 2012 ASHA Convention

*15–17 November 2012*
*Atlanta, Georgia, USA*

*Organizer:*
American Speech-Language-Hearing Association (ASHA)

Web site: www.asha.org/events/convention

## GSA 65th Annual Scientific Meeting

*14–18 November 2012*
*San Diego, California, USA*

*Organizer:*
The Gerontological Society of America (GSA)

Web site: www.geron.org/annual-meeting

## 4th World Congress of Pediatric Gastroenterology, Hepatology and Nutrition (WCPGHAN)

*14–18 November 2012*
*Taipei, Taiwan*

*Organizers:*
Federation of International Societies of Pediatric Gastroenterology, Hepatology and Nutrition

Asian Pan-Pacific Society of Pediatric Gastroenterology, Hepatology and Nutrition

Taiwan Society of Pediatric Gastroenterology, Hepatology and Nutrition

Web site: www.wcpghan2012.com

# EAT-10

**A Validated Dysphagia Screening Tool**

# 75% of dysphagia sufferers are undiagnosed[1]

## What is the EAT-10?

It is a screening tool to help identify swallowing difficulties. It is:

- **FAST:**
  10 simple questions.
  Takes less than 4 minutes[2]
- **FLEXIBLE:**
  Can be clinician[2]-administered or self[3]-administered
- **CLINICALLY VALIDATED:**
  Demonstrated ability to detect dysphagia risk[2,3]

**Use the EAT-10 to identify people at risk for dysphagia early**

## Who are at-risk groups to target for screening?

Screening is recommended in persons with...

- Cough related to pneumonia[4]
- Cough related to bronchitis[4]
- Cerebrovascular disease (stroke)[4]
- Head and neck cancer[4]
- Head trauma[4]
- Parkinson's disease[4]
- Alzheimer's disease[4]

**Scan with your smart phone and start using the EAT-10 today!**

Alternatively visit http://www.nestlenutrition-institute.org/PracticalTools/Documents/test1.pdf


**Screen and intervene.**
**Nutrition can make a difference.**


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