



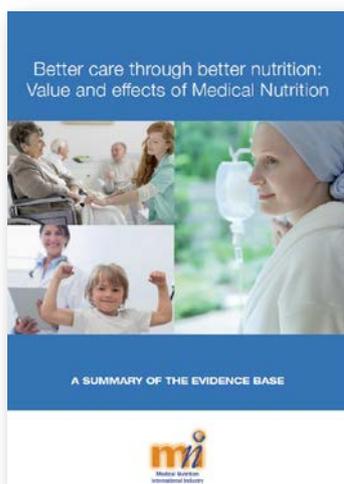
Better care through better nutrition: Value and effects of Medical Nutrition

A summary of the evidence base

Medical Nutrition International Industry (MNI)



Updated and expanded dossier on Medical Nutrition



The Burden of malnutrition

- What is malnutrition and how it is identified
- Prevalence of malnutrition
- Benefits of screening for malnutrition
- Causes, and clinical and economic consequences of malnutrition

Management of malnutrition: The role of Medical Nutrition

- What is Medical Nutrition?
- Benefits of Medical Nutrition: nutritional, functional, clinical and economic
 - Oral nutritional supplements (ONS)
 - Enteral tube feeding (ETF)
 - Parenteral Nutrition (PN)
- Recommendations for action



What is malnutrition and how is it identified?

“A state resulting from lack of intake or uptake of nutrition that leads to altered body composition (decreased fat free mass) and body cell mass leading to diminished physical and mental function and impaired clinical outcome from disease”^{1,2}.

- ‘Malnutrition’ includes both over-nutrition (overweight and obesity) as well as under-nutrition but here ‘malnutrition’ is used synonymously with under-nutrition and nutritional risk

Nutritional screening identifies individuals who:

- are ‘at-risk’ across the spectrum of nutritional status
- are at risk of adverse outcome and who
- may benefit clinically from nutritional support

Practical, validated tools are available to screen for risk of malnutrition

However, lack of routine use means the diagnosis of malnutrition is often missed



1. Van Bokhorst-de van der Schueren MAE et al. *Basics in Clinical Nutrition*. Prague 2011.

2. Cederholm et al. *Clin Nutr* 2017; 36:49-64.

The ‘hidden’ problem of malnutrition affects all age groups in all care settings



“Malnutrition is Europe’s hidden major health problem...repeatedly reported from every kind of care situation”¹



Hospitals

About **1 in 4 patients in hospital** are at risk of malnutrition²⁻⁸



Community

Around **1 in 3 older people living independently** at risk⁹



Care homes

More than **1 in 3 people** in care homes at risk^{1,9,10-12}



An estimated 33 million people in Europe are at risk of malnutrition¹

Almost 1 in 5 children admitted to hospital are at risk¹³

1. Ljungqvist O & de Man F. *Nutr Hosp* 2009; 24(3):368-370. 2. Russell C & Elia M. *Reddlich, BAPEN*. 2008. 3. Russell C & Elia M. *Reddlich, BAPEN*. 2009. 4. Russell C & Elia M. *Reddlich, BAPEN*. 2011. 5. Russell C & Elia M. *Reddlich, BAPEN*. 2012. 6. Meijers JM et al. *Br J Nutr* 2009; 101(3):417-423. 7. Inobendorf R et al. *Clin Nutr* 2010; 29(1):38-41. 8. Schindler K et al. *Clin Nutr* 2010; 29(5):552-559. 9. Kaiser MJ et al. *J Am Geriatr Soc* 2010; 58(9):1734-1738. 10. Suominen MH et al. *Eur J Clin Nutr* 2009; 63(2):292-296. 11. Lelovics Z et al. *Arch Gerontol Geriatr* 2009; 49(1):190-196. 12. Parsons EL et al. *Proc Nutr Soc* 2010; 69:E197. 13. Joosten KF et al. *Arch Dis Child* 2010; 85(2):141-145.



The causes and consequences of malnutrition

- The **causes** of malnutrition are multi-factorial:
 - Patient-related factors resulting from disease and disability contribute to low food intake
 - Organisational factors such as lack of training or clear responsibilities are also involved
- A multi-stakeholder approach is needed to identify and implement effective solutions
- The adverse **consequences** of malnutrition are far-reaching



Malnutrition is associated with:

Increased complications
Greater risk of infections
Poor quality of life
Increased mortality
Suboptimal growth and development in children
Increased healthcare resource use and higher costs

Economic consequences of malnutrition



Costs of malnutrition

	Country	Costs of malnutrition	Note
	England ¹	£19.6 billion	Public expenditure on malnutrition in 2011-12
	Germany ²	€9 billion	Additional costs due to malnutrition across all care sectors in 2003
	The Netherlands ³	€1.9 billion	Additional costs due to malnutrition in 2011
	Republic of Ireland ⁴	€1.4 billion	Public expenditure on malnutrition in 2007
	Croatia ⁵	€97.4 million	Cost of malnutrition for selected diagnoses in 2012

Malnutrition in Europe costs healthcare systems an estimated €170 billion per year⁶

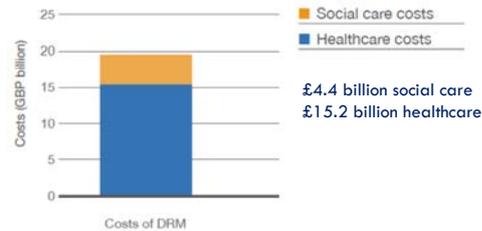


1. Eila M. Reddich, BAPEN, 2015. 2. Cepton, Munich, 2007. 3. Freyer K et al. Clin Nutr 2013; 32(1): 136-41. 4. Rice N & Normand C. Pub Health Nutr. 2012; 15(10): 1966-72. 5. Berkovic et al. Clin Nutr 2014; 33(4): 689-93. 6. Ljungqvist O, de Man F. Nutr Hosp 2009; 24:368-70



Malnutrition increases health and social care costs in England

The public health and social care expenditure associated with malnutrition in adults and children in England identified using the 'MUST' was estimated to be **£19.6 billion**¹



This represents 15% of the total expenditure on health and social care

The economic costs of malnutrition far exceed the costs of treating overweight and obesity and related morbidity^{1,2}

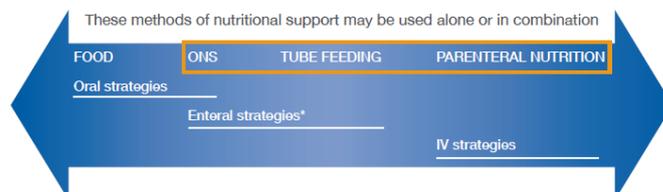


1. Ellis M. BAPEN 2015. 2. Morgan E, Dent M. The National Obesity Observatory, Oxford 2010

Management of malnutrition



- **Early identification** is key to effective management of malnutrition
 - **Screening** using validated tools should be routine practice
- **A range of strategies** can be used to manage malnutrition, e.g. dietary advice, oral nutritional supplements (ONS), enteral tube feeding (ETF) or parenteral nutrition (intravenous nutrition) (PN)



- The strategies shown in the orange area are known as **'Medical Nutrition'**

What is Medical Nutrition and when is it used?

Medical nutrition products are specific nutritional compositions for disease intervention that effectively contribute to the therapeutic regimen by improving a patient's general condition

ONS	<ul style="list-style-type: none"> Inability to meet nutritional requirements from normal food and patient identified as at risk of malnutrition or malnourished When nutritional requirements are increased due to disease/medical condition and unable to be met by normal food. 	<p>ONS, ETF and PN can be used as either a sole source of nutrition or to supplement nutrient intake; they are complementary strategies that can be used in combination to meet patients' needs</p>
ETF	<ul style="list-style-type: none"> Inability to take any oral intake or it is unsafe to do so When oral intake from food and ONS cannot alone achieve the patient's nutritional requirements 	
PN	<ul style="list-style-type: none"> Failure of the gastrointestinal (GI) tract When intake from oral and enteral routes cannot alone achieve the patient's nutrient targets defined in their nutritional care plan 	

Benefits of Medical Nutrition – Key points

- Medical nutrition provides an **evidence-based, effective solution** to tackling malnutrition in patients who are unable to consume enough food safely **to sustain life or optimise health**
- Medical nutrition has proven **nutritional, functional, clinical and economic benefits** for patients with a variety of conditions in different healthcare settings
- Reductions in the use of healthcare resources** associated with the use of medical nutrition (ONS, ETF and PN) offer potential cost savings for healthcare systems and budgets

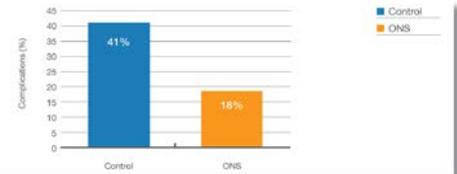




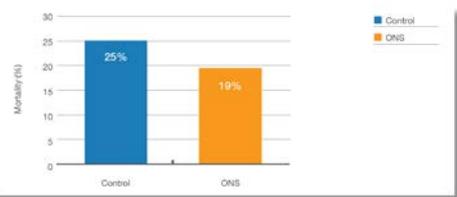
Benefits of Oral Nutritional Supplements (ONS)

Proven nutritional benefits	ONS increase total energy intake without decreasing food intake and lead to weight gain and prevention of weight loss in patients who are malnourished or 'at-risk' of malnutrition in hospital and in community settings ¹⁻⁴
Proven functional benefits	ONS have proven functional benefits such as improvements in activity, quality of life and independence measures, particularly in older malnourished patients in the community ⁵⁻¹¹
Proven clinical benefits	ONS have proven clinical benefits; ONS use is consistently linked to lower mortality and complication rates for malnourished patients when compared to standard care ^{1-4, 12,13}

56% lower complication rates in supplemented versus control patients in hospital¹



24% lower mortality in supplemented versus control patients¹

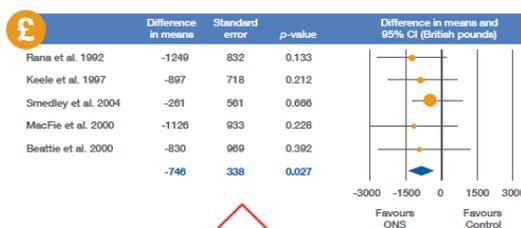


1. Stratton RJ et al. Wallingford: CABI Publishing; 2003. 2. National Institute for Health and Clinical Excellence (NICE). CG32. 2006. London. 3. Mine AC et al. Cochrane Database Syst Rev 2009;(2):CD005288. 4. Cawood A et al. Ageing Res Rev 2012; 11(2):278-296. 5. McMurdo ME et al. J Am Geriatr Soc 2009; 57(12):2239-2245. 6. Norman K et al. Clin Nutr 2008; 27(1):48-56. 7. Rabault N et al. Neurology 2008; 71(23):1856-1861. 8. Carballo B et al. J Am Geriatr Soc 2007; 55(12):2030-2034. 9. Persson M et al. Clin Nutr 2007; 26(2):216-224. 10. Parsons EL et al. Clin Nutr 2011; 6(Suppl 1):31. 11. Stange I et al. Clin Nutr 2011; 6(Suppl 1):128. 12. Avenell A & Handoll HH. Cochrane Database Syst Rev 2006;(4):CD001880. 13. Stratton RJ et al. Ageing Res Rev 2005; 4(3):422-450.

Financial Benefits of Oral Nutritional Supplements (ONS) in hospitals



- ONS can reduce the cost of overall hospital care by (12%) vs routine care¹
- Meta-analyses of studies in abdominal surgical patients show significant cost savings:¹



Mean cost saving of £746 (€1,076) per patient*



Mean cost saving of 13.5%**

1. Elia M et al. Clin Nutr 2016; 35(2): 370-80. *GBP (£) (2003 prices) vs £346, P=0.026; P = 0%. **vs 6.1%, P=0.026; P = 0%.

Enteral Tube Feeding - Benefits and Indications

Enteral tube feeding (ETF) is a **life-saving technique** frequently used in patients of all age groups with a wide variety of conditions across all healthcare settings e.g. hospitals, nursing homes and in patients living in their own homes. It can be used as a sole source of nutrition or supplementary to oral intake

Indications for ETF as sole source of nutrition

Inability to take any oral intake or it is unsafe to do so:

- Dysphagia due to neurological conditions such as stroke, brain injury, progressive degenerative neurological disease, severe developmental delay in children
- Upper gastrointestinal obstruction e.g. head & neck cancer
- Post-operatively when oral intake is contra-indicated
- Unconscious patients in the intensive care unit

Indications for Supplementary ETF

When intake from oral food/fluids and ONS cannot achieve the patient's nutritional requirements:

- Dysphagia
- Gastrointestinal disease
- Cancers
- Malabsorption syndromes
- Increased nutritional requirements e.g. cystic fibrosis
- Physiological anorexia

The use of Enteral Tube Feeding

- Enteral tube feeding is frequently used in both hospitals and the community and in both adults and children
- It may be used for short periods of time or longer term in people with chronic/degenerative conditions
- The prevalence of ETF in the community is growing:

Country	Growth in enteral tube feeding in Community
UK¹	5% increase in the number of new HETF registrations in 2010 compared to 2009
Spain²	8 x increase in the number of patients registered between 1997 and 2006
Italy³	prevalence of HETF in 2012 increased by a factor of 1.62 compared to 2005
Taiwan⁴	The incidence of PEG insertion (≥ 65 years) increased from 97 to 190/million of population from 2005 to 2010

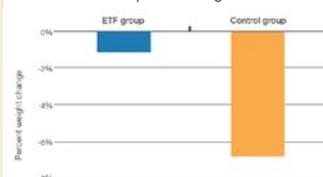
HETF Home Enteral Tube Feeding; PEG Percutaneous endoscopic gastrostomy.
1. Smith T et al. BAPEN. 2011. ISBN: 978-1-899467-76-1. 2. Cuenda C et al. Nutr Hosp. 2009; 24(3):347-53. 3. Piroli L. BMC Nutrition. 2017; 3(1):6. 4. Chang WK et al. Medicine (Baltimore). 2016; 95(24):e3910



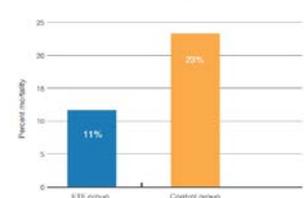
Benefits of Enteral Tube Feeding

Proven nutritional benefits	Systematic reviews show that ETF can: Substantially increase nutritional intake in hospital patients ¹ Improve or maintain nutritional intake in patients in the community ¹ Systematic reviews show that ETF is associated with improved body weight and lean tissue mass in patients in the community and attenuating loss of body weight and lean tissue mass in hospital patients ¹ .
Proven functional benefits	ETF can improve functional outcomes in patient groups (depending on the patient group and care setting) ¹ Meta analysis showed that early vs delayed ETF in patients with traumatic brain injury significantly reduced the rate of poor functional outcome ²
Proven clinical benefits	ETF is associated with reductions in mortality and complications in hospital patients ¹ .

Attenuation of weight loss with ETF in the hospital setting¹



Lower mortality rates with ETF compared with routine clinical care¹



1. Stratton RJ et al. Disease-related malnutrition: an evidence based approach to treatment. Wallingford: CAB International; 2003. 2. Wang X et al. PLoS One. 2013; 8(3):e58838.



Enteral Tube feeding and mortality

- Early enteral nutrition (EEN) is associated with **lower mortality** in critically ill patients in multiple meta-analyses:

Author (year)	Patient group	EEN definition	Meta- analysis outcomes
McClave et al 2016 ¹	NR	NR	▼Mortality in EEN vs. withholding early EN (delayed EN or standard therapy)
Li et al 2014 ²	Acute pancreatitis	Within 24 hrs of admission	▼Mortality in EEN vs.TPN or delayed EN
Li et al 2013 ³	Acute pancreatitis	Within 48 hrs of admission	▼Mortality in EEN
Wang et al 2013 ⁴	Traumatic brain injury	Within 72 hrs of admission/ within 7 days post injury	▼Mortality rate in EEN vs. delayed feeding
Doig et al 2011 ⁵	Adult trauma patients in ITU	Within 24 hours of injury	▼Mortality in EEN

1.McClave SA et al. JPEN. 2016; 40(2):159-211. 2. Li X et al. Med Sci Monit. 2014; 20:2327-35. 3. Li JY et al. PLoS One. 2013; 8(6):e64926. 4. Wang X et al. PLoS One. 2013; 8(3):e58838. 5. Doig GS et al. Injury. 2011; 42(1):50-6.



Benefits of Parenteral Nutrition

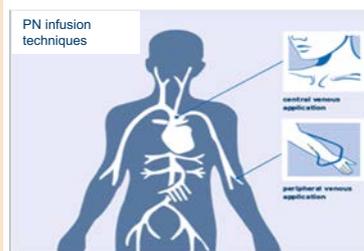
- Parenteral nutrition (PN) is a **life-sustaining therapy** for adults and children when oral and enteral nutrition are contraindicated or inadequate.
- PN has **transformed the prognosis for many patients with previously fatal conditions**, and is considered one of the most important advances in therapeutics over the last four decades¹.

Indications for Total PN (TPN)

- Failure of the gastrointestinal (GI) tract due to:
- Short-bowel syndrome
 - Severe gut dysfunction
 - Mesenteric vascular insufficiency
 - Bowel obstruction
 - GI bleeding
 - Severe diarrhoea
 - High-output fistula
 - Sepsis
 - Severe burns, trauma, or pancreatitis

Indications for Supplementary PN (SPN)

When intake from oral and enteral routes cannot alone achieve the patient's nutrient targets defined in their nutritional care plan



1. Kolezko B et al. J Pediatr Gastroenterol Nutr. 2005; 41: S1-S4.



Parenteral Nutrition indicated in a wide range of patients

Critically ill patients	Guidelines agree that in critically ill patients who are malnourished or at nutritional risk, total PN should be started within 24–48 hours of ICU admission if ETF is not feasible or is contraindicated ^{1,2} . Whilst there is no consensus on when to start supplemental PN in the ICU, many experts suggest timely initiation where nutritional intake from other routes is inadequate ^{1,2,3}
Patients undergoing surgery	PN is an important modality to maintain nutrition status and prevent postoperative complications when nutritional targets cannot be met with oral and/or enteral nutrition ^{2,4,5}
Patients with cancer	PN is indicated in cancer patients who are malnourished or at nutritional risk during active cancer treatment (surgery, chemotherapy, and/or radiotherapy) and in certain patients with incurable cancer, to preserve nutritional status and QOL when oral intake or EN are insufficient to meet nutritional needs ^{6,7} .
Children	PN is one of the most important advances in paediatric therapeutics over the last four decades and is life-saving in children who cannot be fed adequately by the oral or enteral route.

1. Singer P et al. Clin Nutr 2009; 28(4): 387-400. 2. McClave SA et al. JPEN J Parenter Enteral Nutr 2016; 40(2): 159-211. 3. Singer P et al. Intensive Care Med 2014; 40(2): 252-5. 4. Weimann A et al. Clin Nutr 2017; 36(3): 623-50. 5. Chambrier C and Sztark F. J Visc Surg 2012; 149(S): e325-36. 6. Arends J et al. Clin Nutr 2017; 36(1):11-48. 7. August DA et al. A.S.P.E.N. JPEN J Parenter Enteral Nutr 2009; 33(5): 472-500.



Benefits of Parenteral Nutrition

Nutritional benefits	Timely provision of PN in critically ill and surgical patients (when ETF inadequate or contraindicated) <ul style="list-style-type: none"> improves energy and protein provision, enabling more patients to meet their nutritional targets¹⁻⁶. preserves nutritional status and prevents skeletal muscle wasting and fat loss⁶⁻⁹.
Functional benefits	Supplementing ETF with PN to achieve target caloric intake leads to functional benefits in hospital patients undergoing surgery for oesophageal cancer (physical functioning and energy/fatigue scores) ⁷
Clinical benefits	Higher protein and energy intake from PN and/or ETF in critically ill patients is associated with significant reductions in-hospital and 60-day mortality rates and shorter time to discharge alive ¹⁰⁻¹² . Perioperative PN is also associated with a reduction in major and infectious complications following surgery in patients who are malnourished or cannot be fed via the oral or enteral routes ¹³⁻¹⁵



Home PN is the cornerstone of treatment for adults and children with chronic intestinal failure and is considered the best option for improving quality of life in children with conditions that require long-term PN, and their families¹⁶

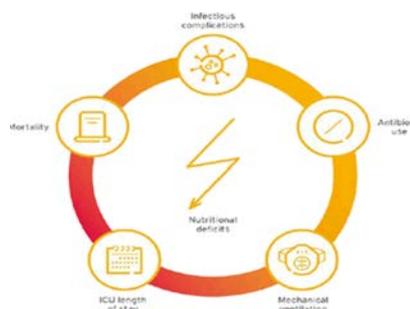
1. Heidegger CP et al. *Lancet* 2013; 381(9864): 385-93. 2. Vallejo KP et al. *Crit Care* 2017; 21(1): 227. 3. Prebat P et al. *Ann Med Surg (Lond)* 2016; 6: 68-73. 4. Kutsogiannis J et al. *Crit Care Med* 2011; 39(12): 2691-9. 5. Cahill NE et al. *JPEN J Parenter Enteral Nutr* 2011; 35(2): 160-8. 6. Doig GS et al. *JAMA* 2013; 309(20): 2130-8. 7. Wu W et al. *JPEN J Parenter Enteral Nutr* 2017; 41(7): 1146-54. 8. Bauer P et al. *Intensive Care Med* 2000; 26(7): 893-900. 9. Ryan AM et al. *Clin Nutr* 2007; 26(6): 718-27. 10. Compher C et al. *Crit Care Med* 2017; 45(2): 156-63. 11. Nicolo M et al. *JPEN J Parenter Enteral Nutr* 2016; 40(1): 45-51. 12. Alberta C et al. *Intensive Care Med* 2009; 35(10): 1726-37. 13. Burden S et al. *Cochrane Database Syst Rev* 2012; 11: CD009879. 14. Heyland DK et al. *Can J Surg* 2001; 44(2): 102-11. 15. Wejs TJ et al. *Ann Thorac Surg* 2017; 104(2): 477-84. 16. Kolosicko B et al. *J Pediatr Gastroenterol Nutr* 2005; 41 Suppl 2: S1-87

Cost benefits of PN



PN is associated with **cost benefits**:

- Cost-minimization analysis showed that timely use of PN **reduced the requirement for mechanical ventilation** resulting in significantly and meaningfully **reduced total cost** of acute hospital care by US\$3,150 per patient with short-term relative contraindication to EN¹.
- Timely use of supplemental parenteral nutrition (ETF + PN) has also demonstrated **cost-effectiveness** in patients who are not able to achieve at least 60% of their target energy intake by day 3 of admission to ICU, through a **reduction in the incidence of hospital-acquired infections**².

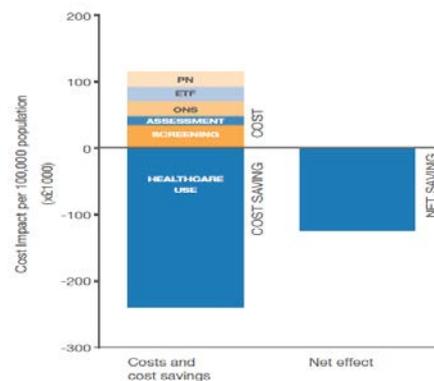


1. Doig GS and Simpson F. *Clinicoecon Outcomes Res* 2013; 5: 369-79. 2. Pradelli L, Graf S, Pichard C, et al. *Clin Nutr* 2018; Apr;37(2):573-579



Economic benefits of implementing guidelines on nutritional support including ONS, ETF and PN in adults

Implementing guidelines on nutritional support **including screening, assessment, ONS, ETF and PN** ultimately saves rather than costs money €134,000 - €486,000 (£119,000 – £432,000 per 100,000 depending on the model used)¹



1. Elia M. Malnutrition Action Group of BAPEN and the National Institute for Research Southampton Biomedical Research Centre; 2015



Recommendations for action

Identifying Malnutrition	<ul style="list-style-type: none"> National nutrition policy addressing under-nutrition as well as obesity/overweight Routine screening for vulnerable groups built into national nutrition policies Validated screening tools routinely used Appropriate equipment (weighing scales, stadiometers) available Agreement about who is responsible for performing screening Evidence-based guidance (including nutritional care plans) used to take action following screening and for monitoring 	Consequences	<ul style="list-style-type: none"> Awareness raised about the negative consequences of malnutrition for patients, healthcare providers and for society Evidence based screening programmes used to ensure malnutrition is identified early and appropriate action taken
Prevalence	<ul style="list-style-type: none"> Commitment made to systematically measure the prevalence of malnutrition A common approach taken to measuring and documenting malnutrition and risk of malnutrition, enabling comparisons to be made 	Benefits of Medical Nutrition	<ul style="list-style-type: none"> A wealth of evidence is available that demonstrates the benefits of Medical Nutrition. This should be translated into practice to ensure that patients who need nutritional intervention receive it in a timely and appropriate manner
Causes	<ul style="list-style-type: none"> Evidence based approaches for nutritional care plans should be used taking account of causes 	Guidance	<ul style="list-style-type: none"> Guidance on managing malnourished patients or patients at risk of malnutrition should reflect current evidence and should provide clear and practical advice about how and when to use different forms of nutritional intervention, including ONS, ETF and PN
		Good Practice	<ul style="list-style-type: none"> Examples of good practice should be shared widely to facilitate the implementation of nutritional guidelines and ensure best use of resources.

Recommendations for action



Fundamental prerequisites for success

- There must be **multi-stakeholder involvement** at all levels
- **Awareness, training and education** are central to success
- **Audit and quality improvement activities** should be included in any initiative that strives to tackle malnutrition
- **Good practice** should be routinely **shared**



Note



- This presentation is based on a report synthesising relevant information on the rationale for and value of Medical Nutrition to provide stakeholders with an up-to-date and practical summary of the evidence base. The full report can be downloaded from <http://medicalnutritionindustry.com/>
- The report is an updated and expanded version of previous reports prepared in 2009, 2010 and 2012. It draws on the key elements of a comprehensive systematic review of the scientific evidence base for the management of disease-related malnutrition.¹ Using a pragmatic approach to identify relevant additional publications,² this document builds on the systematic review by adding data on the prevalence, causes and consequences of malnutrition and the nutritional, functional, clinical and economic benefits of medical nutrition. In the 2018 update data from key systematic reviews on the benefits of ETF have been added along with information about the increasing use of ETF to manage malnutrition across health-care settings. The 2018 update also includes a description of the indications for PN and its use in different countries, together with a summary of studies supporting the nutritional, functional, and economic benefits of PN, identified from a pragmatic review of the literature. Furthermore, the report includes a unique collation of relevant guidelines relating to medical nutrition (ONS, ETF and PN), as well as examples of good practice.
- We recognize there are gaps - either real gaps or due to difficult accessibility of documentation. We hope this will be the starting point to encourage further documentation and sharing of information. Therefore, this report represents work in progress as unpublished data may not be included, trials are ongoing and further guidelines and good practice may be in development

Stratton RJ, Green CJ, Eila M. Disease-related malnutrition: an evidence based approach to treatment. Wallingford: CAB International; 2003. ¹Section 1 mainly based on publications up to May 2012 as per previous version. Sections 2-4 mainly based on publications up to May 2016.