COPD SARCOPENIA AND PATIENT OUTCOMES

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This symposium is intended for Healthcare Professional only

NUTRICIA
LIFE-TRANSFORMING NUTRITION

MALNUTRITION AFFECTS 1 IN 3 INPATIENTS WITH COPD AND 1 IN 5 OUTPATIENTS[1,2]

Malnutrition is[3]

A state in which deficiency of nutrients such as energy, protein, vitamins or minerals results in measurable adverse effects on body composition, function or clinical outcome

Malnutrition affects

35%
of inpatients with COPD[1]

Steer *et al,* 2010
N=608 patients admitting with AECOPD

21%
of outpatients with COPD[2]

Collins *et al,* 2010
N=425 outpatients screened

1. Steer J, *et al. Thorax* 2010;65(Suppl 4):A127. **2.** Collins PF, *et al. Clin Nutr.* 2015;5(Suppl 2):17. **3.** NICE. Nutrition support for adults: oral nutrition support, enteral tube feeding and parenteral nutrition (Clinical Guideline 32), 2006. nice.org.uk/guidance/cg32 [Accessed September 2017].

MALNUTRITION CAN BE IDENTIFIED BY UNINTENTIONAL WEIGHT LOSS AND LOW BMI

NICE (CG32) recognises malnutrition as any of the following:[1]

A body mass index (BMI) of less than 18.5 kg/m^2

Unintentional weight loss of greater than 10% within the last 3–6 months

A BMI of less than 20 kg/m^2 and unintentional weight loss of greater than 5% within the last 3–6 months

European Respiratory Society:

Unintentional weight loss >5% in 6 months, regardless of BMI = pre-cachexia[2]

1. NICE. Nutrition support for adults: oral nutrition support, enteral tube feeding and parenteral nutrition (Clinical Guideline 32), 2006. nice.org.uk/guidance/cg32 [Accessed September 2017]. **2.** Schols AM, *et al. Eur Respir J*. 2014;44:1504–20.

MEASURING BMI ALONE IS INSUFFICIENT TO IDENTIFY NUTRITIONAL RISK[1,2]

BMI

BMI is a standard measurement for nutritional risk in COPD patients **(NICE NG115)**[3]

BMI should be calculated in all patients with COPD[3]

Patients with low BMI (**<20 kg/m²**) should be given nutritional supplements and advised to take physical exercise[3]

Recent unplanned weight loss

Unintentional weight loss of **5-10%** indicates risk of malnutrition, regardless of BMI **(BAPEN, 2003)**[1]

Unintentional weight loss of **>5% during the last 6 months** is considered clinically significant in COPD patients **(ERS, 2014)**[2]

Low fat-free mass

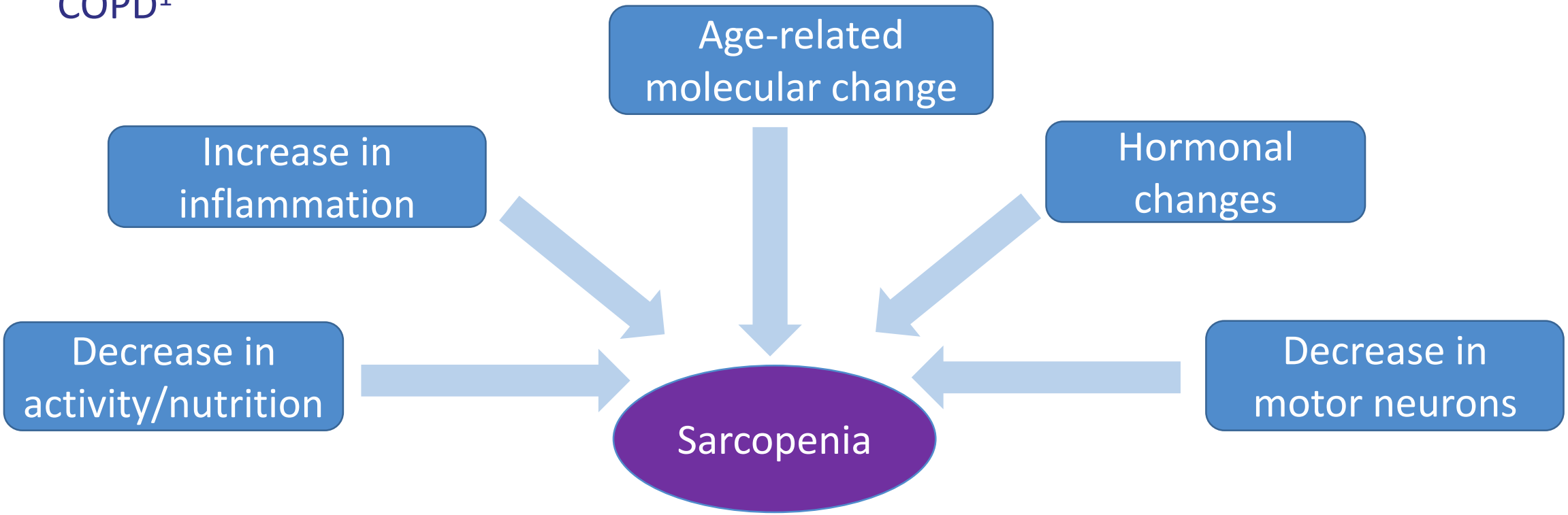
Low fat-free mass **(<10th percentile)**, independent of BMI and fat mass, is a strong predictor of mortality **(ERS, 2014)**[2]

Low BMI and particularly low fat-free mass is associated with worse outcomes in people with COPD **(GOLD, 2017)**[4]

1. Elia M (editor). The "MUST" report. Nutritional screening for adults: a multidisciplinary responsibility. BAPEN: Redditch, UK, 2003. **2.** Schols AM, *et al*. *Eur Respir J*. 2014;44:1504–20. **3.** NICE. Chronic obstructive pulmonary disease in over 16s: diagnosis and management (Clinical Guideline 101), 2010. nice.org.uk/guidance/cg101 [Accessed September 2017]. **4.** Global Strategy for the Diagnosis, Management and Prevention of COPD. Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2017. http://goldcopd.org [Accessed September 2017].

SARCOPENIA IS ACCELERATED IN OLDER ADULTS WITH COPD COMPARED TO HEALTHY OLDER ADULTS[1]

- Sarcopenia: progressive and generalised loss of skeletal muscle mass and strength[2]
- Sarcopenia is accelerated by as much as 30% in elderly patients with mild to moderate COPD[1]



1. Vermeeren MAP, *et al. Respiratory Medicine* 2006;100:1349-1355. 2. Santilli V, *et al. Clin Cases Miner Bone Metab* 2014;11(3):177-180.

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WEIGHT LOSS AND FAT-FREE MASS UNDERLINE TWO IMPORTANT "METABOLIC PHENOTYPES" THAT INDICATE NUTRITIONAL RISK IN COPD[1]

ERS: Metabolic COPD phenotypes and associated risks:[1]

Pre-cachexia

Unintentional weight loss >5% in 6 months

↓

Increased mortality risk

Cachexia

Unintentional weight loss >5% in 6 months and FFMI*<17 kg/m^2 (M) or 15 kg/m^2 (F)

↓

Increased mortality risk
Impaired physical performance

1. Schols AM, *et al*. *Eur Respir J*. 2014;44:1504–20.

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UNINTENTIONAL WEIGHT LOSS MAY BE MASKED BY NORMAL BMI

In a population of patients (N=94) admitted with (AECOPD):

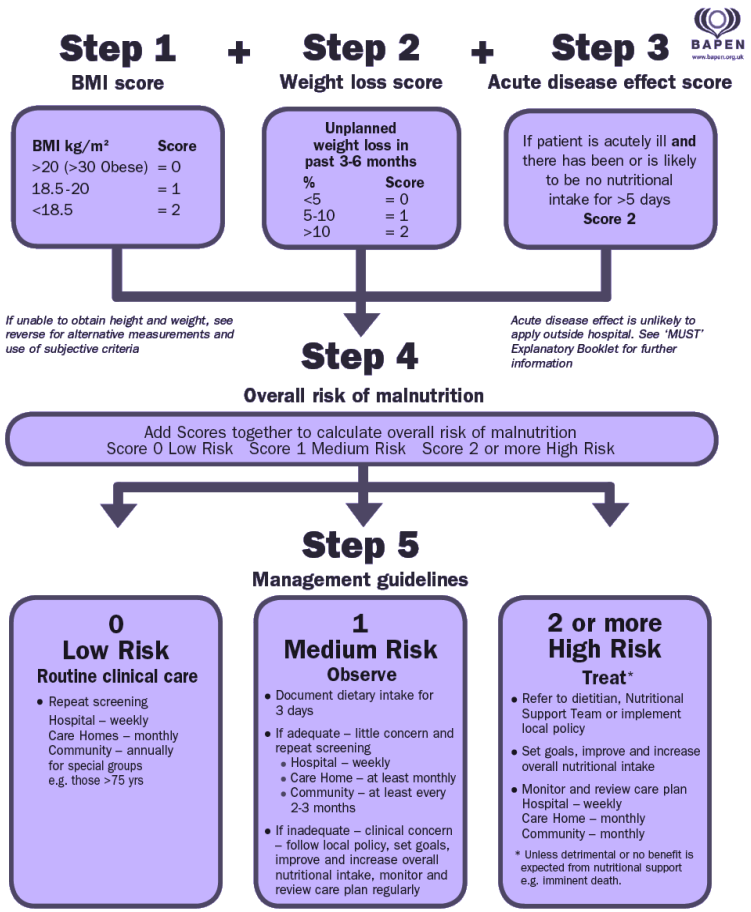
- **51% of the population were overweight or obese,** with an average BMI of 25.9[1]
- **When fat-free mass (FFM) was also considered:**
  - 23% were cachectic
  - 9% had muscle-atrophy
  - 6% were semi-starved

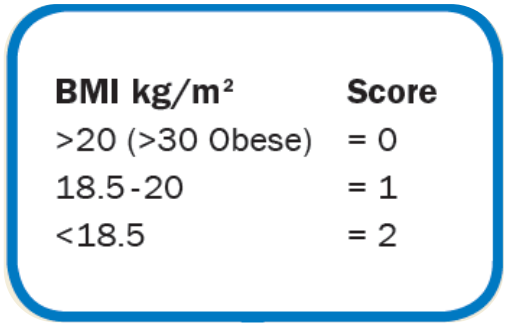
In a study of 83 patients consecutively hospitalised for AECOPD during one year:[2]

- **All patients had experienced significant unplanned weight loss**
  - 5.9 kg (men) vs 4.5 kg (women)
- **But average BMI was normal or near-normal**
  - 20.22 kg/m^2 (men) vs 19.38 kg/m^2 (women)

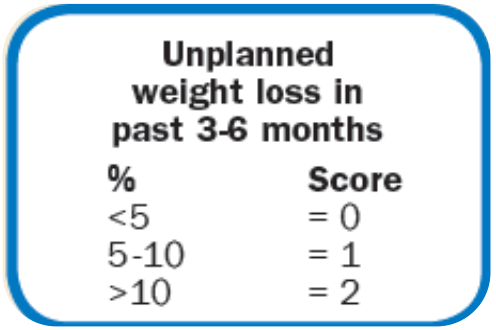
1. Horadagoda C, *et al*. *IMJ.* 2017;47(9):1057-63. **2.** Gupta B, *et al*. *J Clin Med Res.* 2010;2(2):68-74.

SCREENING FOR MALNUTRITION SHOULD INCLUDE BMI AND UNPLANNED WEIGHT LOSS[1]

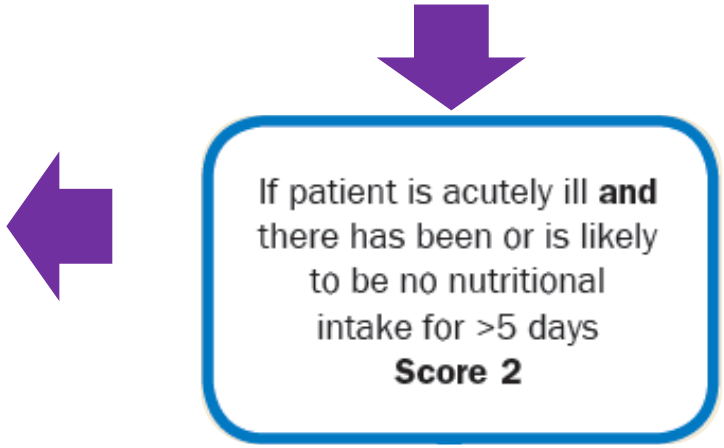




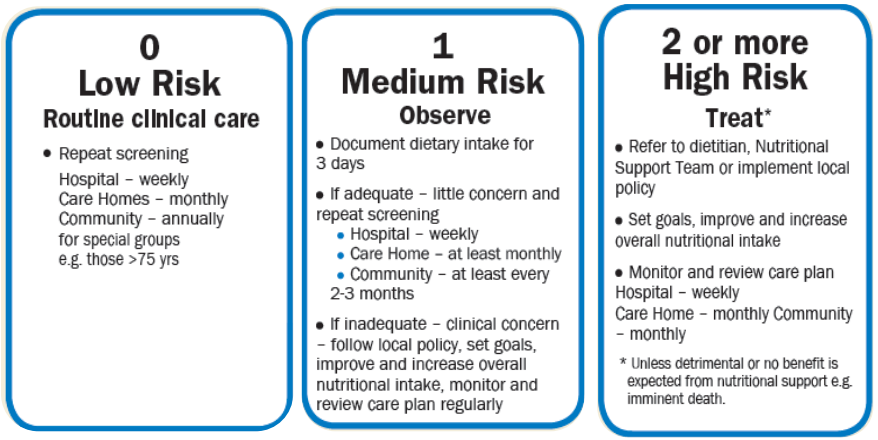
Step 1. Assign BMI score



Step 2. Assign weight loss score



Step 3. Assign acute disease score



Step 4. Add scores to reach a total score

1. BAPEN. MUST Toolkit. http://www.bapen.org.uk/pdfs/must/must_full.pdf [Accessed September 2017].

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MALNOURISHED PATIENTS WITH COPD HAVE LONGER HOSPITAL STAYS AND ALMOST THREE TIMES THE RISK OF DEATH[1]

An Australian study*[1] found, among 286 patients with COPD being admitted to hospital:

- Patients coded as malnourished** were almost 3 times more likely to die within 1 year of initial presentation, compared to their nourished counterparts[†]
- Malnourished patients had a length of stay almost twice the duration as nourished patients, at almost double the cost

Outcome	Malnourished (n = 47)	Nourished (n = 239)	
Mean LOS (days) Emergency admissions	11.57 SD 10.94	6.67 SD 10.21	95% CI 1.65–8.15 days; *p* = 0.003
Mortality at 1 year[††]	27.7%	12.1%	*p* = 0.006
Mortality at 2 years[††]	40.4%	18%	*p* =0.001

1. Hoong JM, *et al*. *Clinical Nutrition* 2017;36(4):1105-09.

MALNUTRITION AGGRAVATES THE DISABLING FEATURES OF COPD THAT IMPACT ON QUALITY OF LIFE[1-6]

Patients with COPD and low body weight have:

Reduced respiratory function[1-3]

- Greater gas trapping[1,3]
- Reduced diaphragmatic mass[3]
- Lower diffusing capacity[1,3]
- Increased exacerbation rate[4]

+

Decrease in fat-free mass[1,2,5,6]

- Muscle mass decrease is responsible for loss of strength, independence and increased falls[7]

↓

Reduced exercise tolerance[1-3,5,8]

- Walking distance[5,8]

+

Respiratory[2,3,6] and peripheral muscle weakness[1,8]

- Reduced PI max and PE max[8]

↓

Reduced health-related quality of life[1,2,5,8]

1. Collins PF, *et al. Respirology* 2013;18:616-629. **2.** Ferreira IM, *et al. Cochrane Database Syst Rev*. 2012;12:CD000998. **3.** Ezzell L & Jensen G. *Am J Clin Nutr.* 2000;72:141–146. **4.** Hallin R, *et al. Respir Med.* 2006;100:561–567. **5.** Goris A, *et al. Am J Respir Crit Care Med.* 1997:155:A498. **6.** Schols A *et al. Am Rev Resp Dis*. 1991;143(6):1248-1252. 7. Santilli V, et al. Clin Cases Miner Bone Metab 2014;11(3):177-180. 8. Singer J *et al. J Cardiopulm Rehabil Prev*. 2011; 31(2):111-119.

PATIENTS WITH COPD AND UNPLANNED WEIGHT LOSS ARE IN NEGATIVE ENERGY BALANCE

Disturbed energy balance

The disturbed energy balance results from a combination of internal and external factors:[1]

"INTERNAL"

↑ **Nutritional requirements** due to increased resting energy expenditure (REE) and altered metabolism[1-4]

"EXTERNAL"

↓ **Nutritional intake** caused by social, pharmacological, physical, & psychological factors[1,4-6]

1. Ezzell L & Jensen GL. *Am J Clin Nutr.* 2000;72:1415–6; **2.** Maltais F, *et al. Am J Respir Crit Care Med.* 2014;189(9):e15–e62. **3.** Kao CC, *et al. Metabolism.* 2011;60:1449–55. **4.** Vermeeren MA, *et al. Eur Respir J.* 1997;10:2264–69. **5.** Gandy J. Manual of Dietetic Practice. Wiley-Blackwell, 2014. **6.** Yilmaz D, *et al. Nutr J.* 2015;14:35.

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AGEING, DISEASE AND SOCIAL FACTORS CAN PREVENT PATIENTS FROM MEETING THEIR PROTEIN AND ENERGY REQUIREMENTS[1-3]

↓ Nutritional intake

Physical

- Dyspnoea
- Fatigue
- Dysphagia
- Early satiety
- Gas trapping
- Large residual lung volumes

Psychological

- Depression
- Anxiety
- Loneliness

Pharmacological

- Dry mouth
- Taste changes
- Oral thrush

Social

- Social isolation
- Unemployment
- Housebound

1. Vermeeren MA, *et al. Eur Respir J*. 1997;10:2264–9. **2.** Gandy J. Manual of Dietetic Practice. Wiley-Blackwell, 2014. **3.** Deutz N, *et al. Clin Nutr.* 2014;33:929–36.

PHYSICAL INACTIVITY (DECONDITIONING) AND NUTRITIONAL IMBALANCE ARE INVOLVED IN MUSCLE WASTING IN COPD[1,2]

Dysfunction in peripheral muscle

Muscle wasting is present in underweight patients with advanced disease, but also in 20–25% of normal weight individuals with moderate disease[3]

1. Maltais F, *et al. Am J Respir Crit Care Med*. 2014;189:e15–e62. **2.** Kim HC, *et al. Int J Chron Obstruct Pulmon Dis*. 2008;3:637–58. **3.** Schols AM & Gosker HR. *Curr Opin Support Palliative Care*. 2009;3:282-287.

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MUSCLE WASTING IN COPD IS ALSO A DIRECT RESULT OF CATABOLIC STIMULI

Dysfunction in peripheral muscle

Inflammatory response

Production of key cytokines triggers muscle proteolysis cascade

Induction of UbP (catabolic) system, apoptosis and macroautophagy[1,2]

Synthesis of acute phase proteins depletes amino acid pool, limiting muscle protein replenishment

Lower plasma levels of glutamate/BCAAs[3]

Oxidative stress: inflammatory-mediated ROS[1]

Proteolysis and increased expression of UbP components (muscle proteolysis cascade)[1,2]

Corticosteroids

Increased myostatin levels and reduced insulin-like growth factor-1 levels[1]

Low levels of growth factors and anabolic hormones, e.g. testosterone[1]

Reduced muscle protein synthesis and enhanced proteolysis

Hypoxemia

Activation of muscle degradation through hypoxia-inducible factor / von Hippel–Lindau signalling cascade[1]

Hypercapnia

Intracellular acidosis / alterations in contractile protein synthesis/degradation[1]

Muscle wasting

1. Maltais F, *et al. Am J Respir Crit Care Med*. 2014;189:e15–e62. **2.** Schols AM & Gosker HR. *Curr Opin Support Palliative Care*. 2009;3:282–7.
3. Hsieh MJ, *et al. J Formos Med Assoc*. 2016;115:595–601.

PEOPLE WITH COPD REQUIRE UP TO 50% MORE PROTEIN THAN THEIR HEALTHY COUNTERPARTS[1]

- Muscle protein is directly affected by protein intake in the diet[2-4] and muscle oxidative metabolism may be stimulated nutritionally[5]

	Healthy older adults	Older adults with acute/chronic illness	Infective Exacerbation of COPD (IECOPD)
Recommended protein intake (g/kg/day)	1.0-1.2	1.2-1.5	Up to 1.5
	European Society for Clinical Nutrition and Metabolism, 2014[1]		Vermeeren *et al.*,1997[2]

1. Deutz N, *et al. Clin Nutr.* 2014;33:929–36. **2.** Wolfe RR. *Clin Nutr.* 2008;27:675–84. **3.** Houston DK, *et al. Am J Clin Nutr.* 2008;87:150–5. **4.** Symons T *et al. Am J Clin Nutr* 2007;86:451–56. **5.** Schols AM, *et al. Chest.* 2013;144:1340–5. **6.** Bartali B, *et al J Gerontol A Biol Sci Med Sci.* 2006;61:589–93. **7.** Deutz N, *et al. Clin Nutr.*2014;33:929–36. **8.** Vermeeren MAP *et al Eur Respir J.* 1997;10:2264–9. **9.** Schols AM, et *al. Eur Respir J.* 2014;44:1504–20.

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THERE ARE MANY REASONS WHY OLDER ADULTS, PARTICULARLY THOSE WITH AN ILLNESS LIKE COPD, HAVE INCREASED PROTEIN NEEDS

- Protein intake in hospital and care home patients is often suboptimal[1]
- Frailty can be prevented or reversed by intervention with greater protein intake and exercise[2]

Rationale for +50% protein requirement in the unwell elderly:[2]

To offset the elevated metabolism caused by COPD

…and other stress factors associated with inflammatory conditions (e.g. oxidative stress)

To offset anabolic resistance of ageing

Resistance to the positive effects of dietary protein on muscle synthesis.

To offset the effects of muscle disuse and atrophy

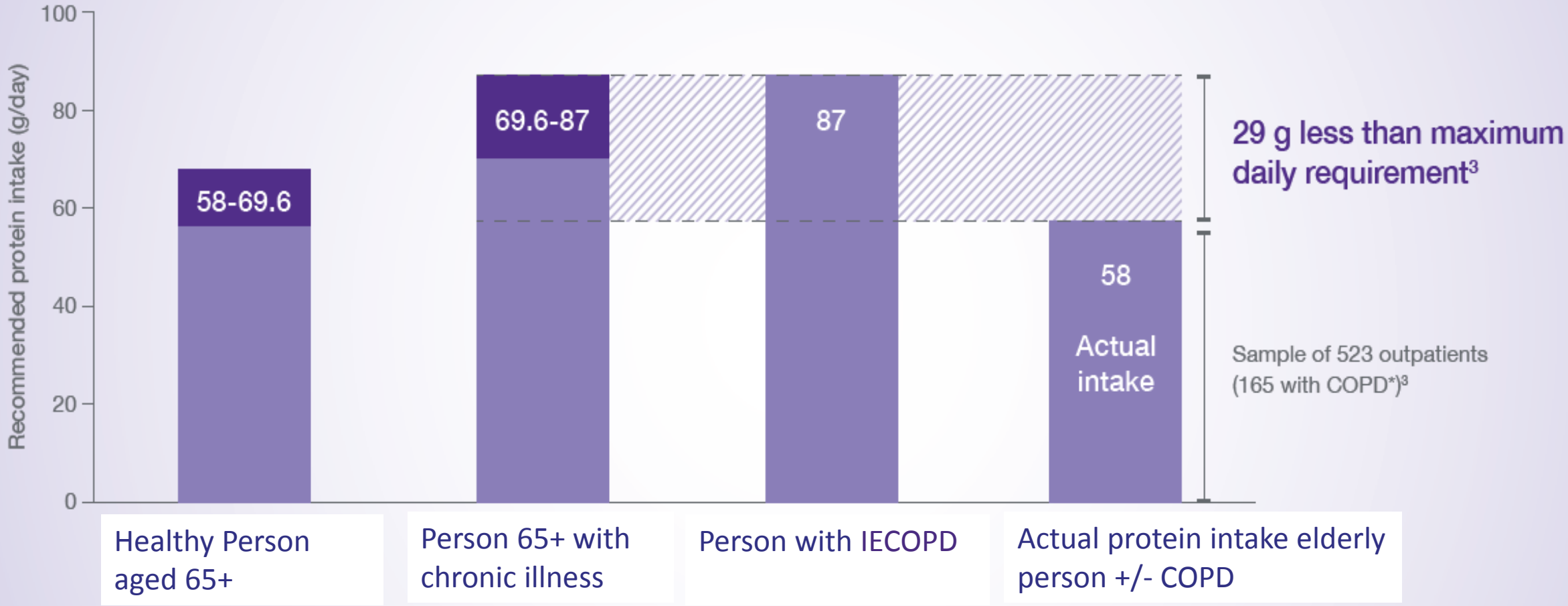
Bed rest and sedentary lifestyle lead to changes in protein synthesis and breakdown

ESPEN: "Good nutrition, especially adequate protein intake, helps limit and treat age-related declines in muscle mass, strength, and functional abilities. Nutrition in combination with exercise is considered optimal for maintaining muscle function"[2]

1. Bauer J, *et al. JAMDA* 2013;14: 542-49. 2. Deutz N, *et al. Clin Nutr.* 2014;33:929–36.

PATIENTS WITH COPD MAY NOT BE ABLE TO MEET THEIR RECOMMENDED PROTEIN REQUIREMENTS

Actual vs recommended protein intake (example: patient aged 65+ and weighing 58 kg)



1. Department of Health. Dietary Reference Values for Food Energy and Nutrients for the United Kingdom 41, HMSO, London, 1991. **2.** World Health Organization. Keep fit for life: Meeting the nutritional needs of older persons. http://apps.who.int/iris/bitstream/10665/42515/1/9241562102.pdf [Accessed September 2017]. **3.** Deutz NE, *et al. Clin Nutr*. 2014;33:9293–26. **4.** Vermeeren MAP, *et al. Eur Respir J* 1997;10:2264–69. **5.** Laudisio A, *et al. Arch Gerontol Geriat* 2016;64:75-81.

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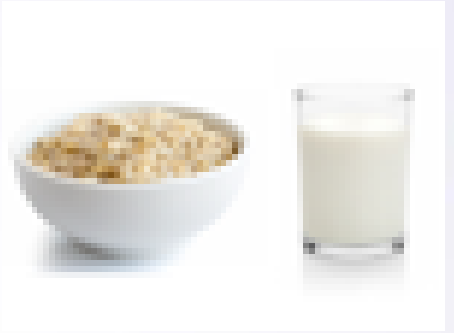
IS IT REALISTIC FOR COPD PATIENTS TO GET THE EXTRA PROTEIN THEY NEED FROM DIET ALONE?

Breakfast

1 Egg
6.3 g protein
1 Slice of toast
2.8 g protein



Bowl of porridge
5.3 g protein
Glass of milk
6.6 g protein

Lunch

Half a can of tuna
14.1 g protein

+

1 tin baked beans
10 g protein

Dinner

Chicken breast
29.5 g protein

Slice of bread
2.8 g protein
1 tbsp peanut butter
4.0 g protein

TOTAL
58 g
PROTEIN

Snack

Half glass of milk
3.3 g protein
2 x digestive biscuits
1.8 g protein

29 g more protein a day

TOTAL
87 g
PROTEIN

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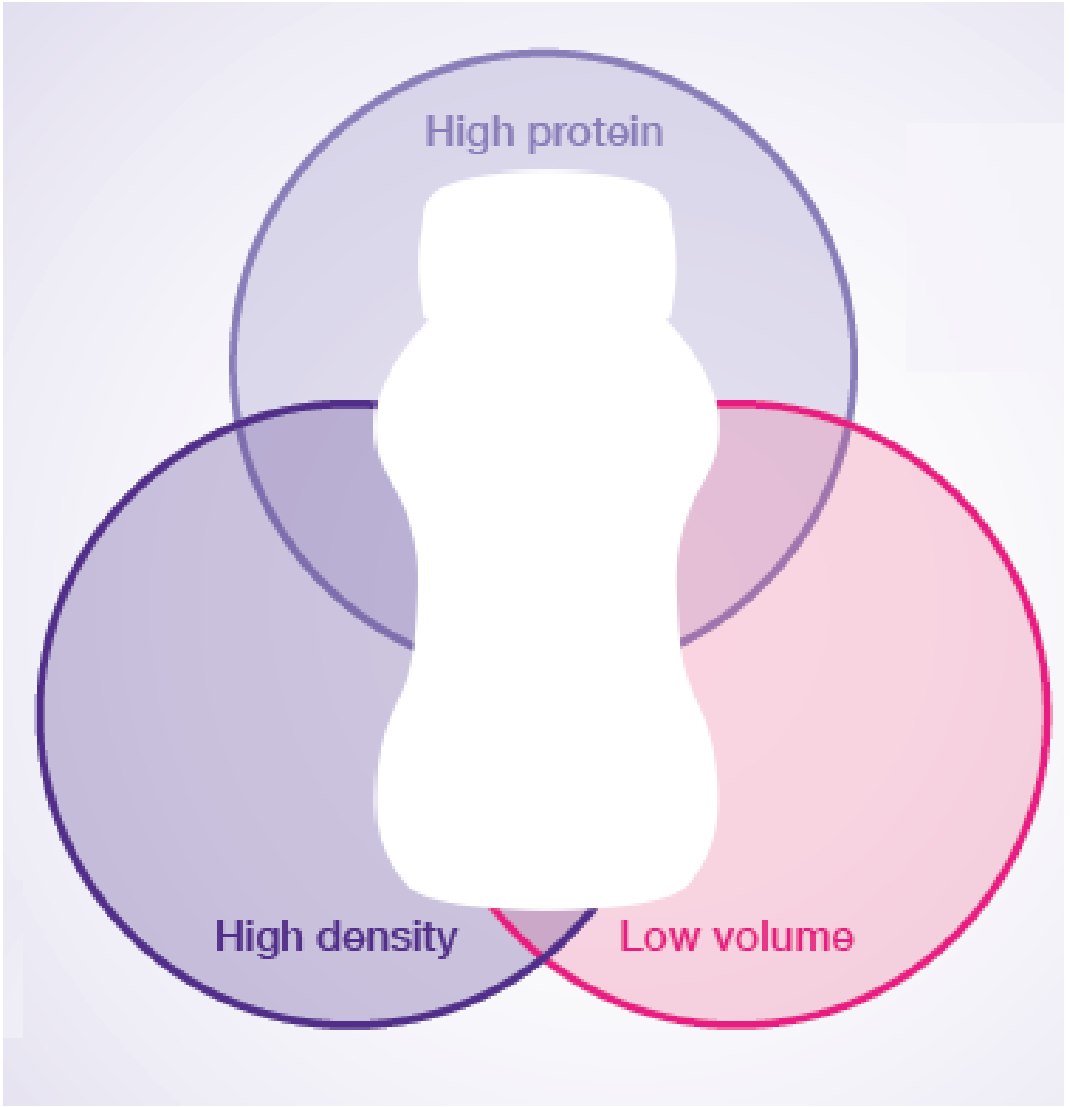
HIGH PROTEIN AND ENERGY DENSITY ARE KEY NEEDS FOR PATIENTS WITH COPD

- A high protein oral nutrition supplement (ONS) is one containing ≥20% of its energy from protein[1]
- An energy dense supplement is one containing is >2kcal/ml
- Low volume oral nutritional supplements (ONS) may make it easier to consume the energy levels they need[2,3]



1. Regulations (EC) No. 1924/2006, 2006. European Parliament and of the Council of 20 December 2006 on nutrition and health claims made on foods. OJEU. L12:3-18. 1. Hubbard GP, *et al. Clin Nutr*. 2012;31:293–312.
2. Hubbard GP, *et al. Proc Nutr Soc.* 2010;69(OCE2):E164.

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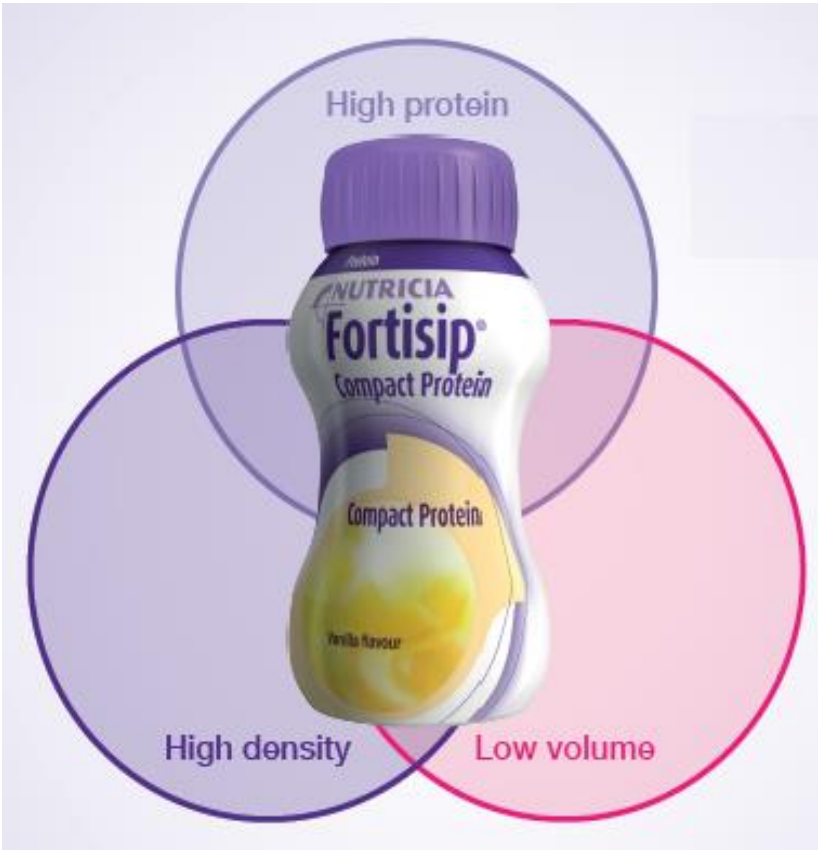
FORTISIP® COMPACT PROTEIN IS AN IDEAL HIGH PROTEIN, HIGH ENERGY, LOW VOLUME ONS

18g protein	300 kcal of energy	1.25ml bottle
24% of total energy Milk proteins (casein, whey) stimulate net whole body protein synthesis in undernourished COPD patients[2]	High calorie supplementation increased body weight, FFM, handgrip strength and exercise capacity in undernourished COPD patients[1]	The small volume of Fortisip® Compact Protein is designed to be manageable for patients and to impact less on their normal fluid and food intake

Essential amino acids may aid in the prevention and treatment of muscle wasting in COPD patients[2]

Recommended daily dose of 2 bottles per day provides:

- 36g protein
- 600kcal energy



1. Creutzberg, EF *et al. Nutrition* 2003;13:120-127. 2. Jonker R, *et al. Clin Nutr.* 2014;33:211-20. 3. Rawal G, Yadav S. *J Transl Int Med.* 2015:33(2)151-4. 4. Hsieh MJ, *et al. J Formos Med Assoc*. 2016;115:595-601.

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COMPARISON WITH MOST COMMONLY USED PRODUCTS

	1 serving (ready to drink)					1 serving (67 g powder reconstituted with 200 ml of milk)†	
	Fortisip® Compact Protein (Nutricia)	**Fresubin® Protein Energy** (Fresenius Kabi)	**Ensure® Plus Advance** (Abbott)	**Ensure® Compact** (Abbott)	**Altraplen® Compact** (Nualtra)	**Altraplen® Protein** (Nualtra)	**AYMES® Shake** (Aymes)
Energy (kcal/unit)	300	300	330	300	300	300	388
Energy (kcal/ml)	2.4	1.5	1.5	2.4	2.4	2.4	2.0
Volume (ml)/ presentation	125	200	220	125	125	200	256
% total energy from protein	24%	27%	24%	17%	16%	27%	14%
Protein (g/unit)	18	20	20	12.8	12	20	15.6
Protein (g/ml)	0.14	0.10	0.09	0.10	0.10	0.10	0.08

High energy

Low volume

High protein

†Details provided are for vanilla flavour. Product can also be reconstituted with whole milk.

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FORTISIP® COMPACT PROTEIN: PUTTING COST INTO CONTEXT

Cost of high protein, low volume, energy dense ONS	Cost of a hospital admission for COPD
£2.00 per unit[1] 2 x day = ~£120/month for 3 months	£1960 inpatient-only cost*[2]

By ensuring patients are assessed using a validated nutritional screening tool and ONS are only prescribed for those who are malnourished or at high risk of malnutrition, it is possible to ensure ONS are used both clinically and cost effectively (NICE, 2011[3])

. MIMS. Fortisip Bottle. http://www.mims.co.uk/drugs/nutrition/tube-and-sip-feeding/fortisip-compact-protein [Accessed September 2017]. **2.** NICE. National costing report: chronic obstructive pulmonary disease. 2011. www.nice.org.uk/guidance/cg101/resources/costing-report-134511805 [Accessed September 2017]. **3.** NICE Shared Learning Database. Clinical and cost effective prescribing of Oral Nutritional Supplements for Adults in the Community. https://www.nice.org.uk/sharedlearning/clinical-and-cost-effective-prescribing-of-oral-nutritional-supplements-for-adults-in-the-community [Accessed September 2017].

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SUMMARY

- ‘MUST’ is a validated five step tool used to identify and manage adults at risk of malnutrition
- ‘MUST’ uses BMI, unintentional weight loss and acute disease effect scores to calculate an overall malnutrition risk score
- Weight gains of ≥2 kg are associated with significant functional improvements and this is therefore recommended as a therapeutic target
- ONS contain energy, protein and micronutrients, can improve total nutritional intake with little suppression of voluntary food intake and are available in a variety of different styles and formats
- When choosing an ONS the healthcare professional should consider nutritional requirements, patients ability to tolerate volume, patients ability to take the ONS and patient preference