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THE 'MUST' EXPLANATORY BOOKLET

A Guide to the
'Malnutrition Universal Screening Tool' ('MUST')
for Adults

MAG

Malnutrition Action Group
A Standing Committee of BAPEN

Edited on behalf of MAG by
Vera Todorovic, Christine Russell and Marinos Elia

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The 'MUST' Explanatory Booklet has been designed to explain the need for nutritional screening and how to undertake screening using the 'Malnutrition Universal Screening Tool' ('MUST'). It can also be used for training purposes.

The Booklet is part of the 'MUST' toolkit (see http://www.bapen.org.uk/musttoolkit.html) which also includes

- The 'Malnutrition Universal Screening Tool' ('MUST')
- *The 'MUST' Report*
- The 'MUST' calculator
- e-learning modules on nutritional screening using 'MUST'
- The 'MUST' App

For further information on any aspect of the 'MUST', care plan, or references, please see the full guideline document *The 'MUST' Report.*

This Explanatory Booklet, 'MUST' and the Executive Summary of *The 'MUST' Report* are available to download from the BAPEN website www.bapen.org.uk.

Printed copies of all 'MUST' materials are available to purchase from the BAPEN office

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Details of other BAPEN publications can be found at www.bapen.org.uk

'MUST' is supported by the British Dietetic Association, The Royal College of Nursing, the Registered Nursing Home Association and the Royal College of Physicians

The British Association for Parenteral and Enteral Nutrition (BAPEN)

BAPEN is a multi-professional association and registered charity established in 1992. Its membership is drawn from doctors, dietitians, nurses, patients, pharmacists and from the health policy, industry, public health and research sectors.

- BAPEN works to achieve its mission by raising awareness of the prevalence and impact of malnutrition, raising standards in nutritional care and developing appropriate pathways to prevent malnutrition.

- BAPEN researches and publishes the evidence on malnutrition, and provides tools, guidance, educational resources and events for all health and care professionals to support the implementation of nutritional care across all settings and according to individual need.

- BAPEN works in partnership with its membership, its core specialist groups and external stakeholders to embed excellent nutritional care into the policy, processes and practices of all health and care settings.

- The Malnutrition Action Group (MAG) is a Standing Committee of BAPEN.

For membership details, contact the BAPEN office or log on to the BAPEN website **www.bapen.org.uk**

The 'MUST' Explanatory Booklet

Contents

1. Background

Purpose

The 'Malnutrition Universal Screening Tool' ('MUST') has been designed to help identify adults who are underweight and at risk of malnutrition, as well as those who are obese. It has not been designed to detect deficiencies in or excessive intakes of vitamins and minerals.

Definition of malnutrition

There is no universally accepted definition of malnutrition but the following is increasingly being used:

Malnutrition is a state of nutrition in which a deficiency or excess (or imbalance) of energy, protein, and other nutrients causes measurable adverse effects on tissue/body form (body shape, size and composition) and function, and clinical outcome[1]

Although the term malnutrition can refer to both under and overnutrition it is used here to refer to undernutrition. A BMI >30kg/m^{2} is used to indicate very overweight (obese) individuals.

Malnutrition and public health

It has been estimated that at any one time more than 3 million people in the UK are at risk of malnutrition[2] and, yet it continues to be an under-recognised and under-treated problem. Furthermore, the public health expenditure on disease-related malnutrition in the UK in 2007 was calculated to be in excess of £13 billion per annum, about 80% of which was in England[2]. This is a heavy burden and cost to bear not only for individuals, but for health and social care services, and society as a whole.

Table 1 summarises the prevalence of malnutrition (medium and high risk according to 'MUST' combined) on admission to care settings across the UK which highlights the size of the problem. Figures are taken from BAPEN's Nutrition Screening Week surveys undertaken in 2007, 2008 and 2010.[3-5]

Table 1 Summary of malnutrition risk (medium plus high risk according to 'MUST') on admission to care taken from BAPEN Nutrition Screening Week data [3-5]

Care setting	Malnutrition risk (medium and high risk combined)	Data source
Hospital	% at risk of malnutrition	
	28%	NSW 2007, 2008
	34%	NSW 2010
Care Homes*	30%	NSW 2007
	42%	NSW 2008
	37%	NSW 2010
Mental Health Units	19%	NSW 2007
	20%	NSW 2008
	18%	NSW 2010

* Figures are for residents admitted to care homes within past 6 months

Data from studies in outpatient clinics suggests that 16-21% patients are at risk of malnutrition (medium and high risk) with those at risk experiencing significantly more hospital admissions and significantly longer length of hospital stay.[6-8]

A small number of surveys to estimate the risk of malnutrition have been carried out on people living in sheltered housing accommodation in the UK. Data from these studies suggest that 10-14% are at risk of malnutrition (medium and high risk according to 'MUST' combined).[9-11]

At any given point in time, the vast majority (93%) of people at risk of malnutrition are living in the community, 5% are in care homes and 2% are in hospital.[2]

The most vulnerable nutritionally at risk groups include those with chronic diseases, the elderly, those recently discharged from hospital, and those who are poor or socially isolated.[2]

Table 2 Consequences of malnutrition

Malnutrition is frequently undetected and untreated causing a wide range of adverse consequences.[2]

Effect	Consequence
Impaired immune response	Impaired ability to fight infection
Reduced muscle strength and fatigue	Inactivity, and reduced ability to work, shop, cook and self-care. Poor muscle function may result in falls, and in the case of poor respiratory muscle function result in poor cough pressure – delaying expectoration and recovery from chest infection
Inactivity	In bed-bound patients, this may result in pressure ulcers and venous blood clots, which can break loose and embolise
Loss of temperature regulation	Hypothermia
Impaired wound healing	Increased wound-related complications, such as infections and un-united fractures
Impaired ability to regulate salt and fluid	Predisposes to over-hydration, or dehydration
Impaired ability to regulate periods	Impaired reproductive function
Impaired foetal and infant programming	Malnutrition during pregnancy predisposes to common chronic diseases, such as cardiovascular disease, stroke and diabetes (in adulthood)
Growth failure	Stunting, delayed sexual development, reduced muscle mass and strength
Impaired psycho-social function	Even when uncomplicated by disease, malnutrition causes apathy, depression, introversion, self-neglect, hypochondriasis, loss of libido and deterioration in social interactions (including mother-child bonding)

(adapted from Combating Malnutrition: Recommendations for Action. BAPEN 2009[2])

These adverse effects of malnutrition increase costs to the Health and Social care services throughout the UK and the community as a whole.

In the community, elderly individuals identified as at risk of malnutrition with 'MUST' are more likely to be admitted to hospital and to visit their GP more frequently[12]. Underweight individuals (BMI <20 kg/m^2) have also been shown to consume more healthcare resources than those with a BMI between 20 and 25 kg/m^2, having more prescriptions (9%), more GP visits (6%) and more hospital admissions (25%).[13]

In *hospital*, patients at risk of malnutrition stay in hospital significantly longer than those who are not malnourished and are more likely to be discharged to health care destinations other than home.[14,15]

Evaluation and review

The 'Malnutrition Universal Screening Tool' ('MUST') has been evaluated in hospital wards, outpatient clinics, general practice, the community and in care homes. Using the 'MUST' to categorise patients for their risk of malnutrition was found to be easy, rapid, reproducible, and internally consistent. 'MUST' can be used in patients in whom height and weight are not obtainable, as a range of alternative measures and subjective criteria are provided.

Positive results have been described for patients self-screening with 'MUST' with screening results comparable to those of health professionals.[16]

The evidence base for 'MUST' is summarised in The 'MUST' Report, copies of which are available from the BAPEN Office.

The 'MUST' was developed in 2003 by the multidisciplinary Malnutrition Advisory Group (MAG), a Standing Committee of the British Association for Parenteral and Enteral Nutrition (BAPEN). The development of 'MUST' was independently reviewed by members of the Royal College of Physicians, Royal College of General Practitioners, Royal College of Obstetricians and Gynaecologists, Royal College of Nursing, British Dietetic Association and many other organisations, independent clinicians and healthcare practitioners.

The 'MUST' continues to be supported by MAG (now called the Malnutrition Action Group) and educational resources and other tools have been developed to aid it's implementation.

Staff who undertake nutritional screening using 'MUST' should be appropriately trained to ensure that they are competent to do so.

Information on BAPEN's E-learning resources on using 'MUST' in hospital and community settings is available at www.bapen.org.uk

'MUST' is the most widely used nutritional screening tool in the UK.[5] It is also commonly used in other countries worldwide.

'MUST' is reviewed on an annual basis.

2. Nutritional screening and care planning with the 'MUST'

Nutritional screening

This is the first step in identifying subjects who may be at nutritional risk or potentially at risk, and who may benefit from appropriate nutritional intervention. It is a rapid, simple and general procedure used by nursing, medical, or other staff on first contact with the subject so that clear guidelines for action can be implemented and appropriate nutritional advice provided. Some subjects may just need help and advice with eating and drinking; others may need to be referred for more expert advice.

Screening may need to be repeated regularly as a subject's clinical condition and nutritional problems can change. It is particularly important to re-assess subjects identified at risk as they move through care settings.

It is always better to prevent or detect problems early by screening than discover serious problems later

How to screen using the 'MUST'

There are five steps to follow:

Steps 1 and 2 – Gather nutritional measurements (height, weight, BMI, recent unplanned weight loss). *If it is not possible to obtain height and weight, use alternative measurements (see pp. 10-15).*

Step 3 – Consider the effect of acute disease.

Step 4 – Determine the overall risk score or category of malnutrition. *If neither BMI nor weight loss can be established, assess overall risk subjectively using 'Other criteria' (see page 7).*

Step 5 – Using the management guidelines and/or local policy, form an appropriate care plan. *See example on pages 8-9 for care planning considerations and page 19 on the 'MUST' flowchart.*

Steps 1 – 5

Step 1: Body mass index (BMI) (kg/m²)

- BMI gives a rapid interpretation of chronic protein-energy status based on an individual's height and weight.

- Take the subject's height and weight to calculate BMI, or use the BMI chart (see pp. 20-21 for the 'MUST' BMI chart) to establish the subject's BMI score.

- If weight and height are not available, self reported height or weight, if realistic and reliable, may be appropriate. Alternative measurements and observations can also be used (see pp.10-15).

If unobtainable, subjective criteria (see page 7) should be used to give an overall clinical impression of the subject's nutritional risk category.

Step 2: Weight loss

- Unplanned weight loss over 3 – 6 months is a more acute risk factor for malnutrition than BMI.

- To establish the subject's weight loss score, ask if there has been any weight loss in the last 3 – 6 months, and if so how much (or look in their medical records).

- Deduct current weight from previous weight to calculate amount of weight lost. Use weight loss tables (see page 22) to establish weight loss score.

- If the subject has not lost weight (or has gained weight) score 0.

Table 3   Weight loss score

Score	Unplanned weight loss in past 3 – 6 months (% body weight)	Significance
2	>10	Clinically significant
1	5 – 10	More than normal intra-individual variation - early indicator of increased risk of undernutrition
0	<5	Within 'normal' intra- individual variation

Step 3: Acute disease can affect risk of malnutrition

- If the subject is currently affected by an acute patho-physiological or psychological condition, **and** there has been no nutritional intake or likelihood of no intake for more than 5 days, they are likely to be at nutritional risk. Such patients include those who are critically ill, those who have swallowing difficulties (e.g. after stroke), or head injuries or are undergoing gastrointestinal surgery.

This is unlikely to occur in the community or in patients attending outpatient clinics.

Add 2 to the score

Step 4: Overall risk of malnutrition

Establish overall risk of malnutrition after considering all relevant factors. Add scores together from Steps 1, 2 and 3 to calculate overall risk of malnutrition.

0 = low risk 1 = medium risk 2 or more = high risk

If neither BMI nor weight loss can be established, assess overall risk category using the 'Subjective criteria' in the box below.

Subjective criteria

If height, weight or BMI cannot be obtained, the following criteria which relate to them can help form a clinical impression of an individual's overall nutritional risk category. The factors listed below can either contribute to or influence the risk of malnutrition.

Please note, these criteria should be used collectively not separately as alternatives to Steps 1 and 2 of 'MUST' and are not designed to assign an actual score. Mid upper arm circumference (MUAC) may be used to estimate BMI category (see page 16) in order to support your overall impression of the subject's nutritional risk.

BMI
- Clinical impression - thin, acceptable weight, overweight. Obvious wasting (very thin) and obesity (very overweight) can be noted.

Weight loss
- Clothes and/or jewellery have become loose fitting.

- History of decreased food intake, reduced appetite or dysphagia (swallowing problems) over 3 – 6 months and underlying disease or psychosocial/ physical disabilities likely to cause weight loss.

Acute disease
- Acutely ill **and** no nutritional intake or likelihood of no intake for more than 5 days.

> *Estimate a malnutrition risk category (low, medium or high) based on your overall evaluation.*

Step 5: Management guidelines

Setting an appropriate care plan

- Record subject's overall risk score, agree and document a care plan and any advice given.

- Subjects in high or medium risk categories typically require some form of intervention as suggested in the box below. For an example of management guidelines, see the 'MUST' flowchart on page 19.

Table 4   Overall 'MUST' score and suggested management guidelines

'MUST' score (BMI + weight loss + acute disease effect)	Overall risk of malnutrition	Action
2 or more	High	**Treat** - unless detrimental or no benefit from nutritional support expected e.g. imminent death.
1	Medium	**Observe** - or treat if approaching high risk or if rapid clinical deterioration anticipated.
0	Low	**Routine care** - unless major clinical deterioration expected
In obese subjects, underlying acute conditions are generally controlled before treating obesity		

The care plan

1. Set aims and objectives of treatment.
2. Treat any underlying conditions.
3. Treat malnutrition with food and/or oral nutritional supplements (ONS). Subjects who are unable to meet their nutritional requirements orally may require artificial nutritional support e.g. enteral or parenteral nutrition. None of these methods are exclusive and combinations of any or all may be needed. If subjects are overweight or obese, follow local guidelines for weight management.
4. Monitor and review nutritional intervention and care plan.
5. Reassess subjects identified at nutritional risk as they move through care settings.

Oral nutritional interventions

Food and fluid
Consider the following:
- Provide help and advice on food choices, eating and drinking.
- Ensure tasty, attractive food of good nutritional value during and between meals. It is important to ensure that the full range of nutrients (including macro and micro nutrients) are provided during the day.
- Ensure provision of adequate fluids
- Offer assistance with shopping, cooking and eating where appropriate.
- Provide a pleasant environment in which to eat - in hospital, at home, in dining clubs or via other organisations.

Oral nutritional supplements
Consider the following:
- Use ONS if it is not possible to meet nutritional requirements from food. Typically an additional daily intake of 250-600 kcal can be of value. Intake of ONS can be improved by varying the texture and flavours offered. The use of energy and protein dense ONS should be considered for patients who are unable to consume the volume of a standard ONS.
- Dietary advice and counselling should be given when recommending ONS.

Artificial nutritional support (enteral and parenteral nutrition)

If required, follow local policy.

Monitoring

All subjects identified as being at risk of malnutrition should be monitored on a regular basis to ensure that their care plan continues to meet their needs.

3. Taking measurements for use with the 'MUST'

Measuring height and weight

Height

- Use a height stick (stadiometer) where possible. Make sure it is correctly positioned against the wall.
- Ask subject to remove shoes and to stand upright, feet flat, heels against the height stick or wall (if height stick not used).
- Make sure the subject is looking straight ahead and lower the head plate until it gently touches the top of the head.
- Read and document height.

Weight

- Use clinical scales wherever possible.[17] Make sure they have been regularly checked for accuracy and ensure that they read zero without the subject standing on them.
- Weigh subject in light clothing and without shoes.

Calculation of body mass index (BMI)

Actual BMI can be calculated using the following equation:

$$BMI = \frac{Weight\ (kg)}{Height\ (m)^2}$$

The BMI score can be obtained using the BMI chart provided (see pp. 20-21).

Alternative measurements

Height

- If height cannot be measured, use recently documented or self-reported height (if reliable and realistic).
- If height cannot be measured or the subject does not know or is unable to report their height, the following alternative measurements can be used to calculate height.

(i) Length of forearm (ulna)

- Ask subject to bend an arm (left side if possible), palm across chest, fingers pointing to opposite shoulder.

- Using a tape measure, measure the length in centimetres (cm) to the nearest 0.5 cm between the point of the elbow (olecranon) and the mid-point of the prominent bone of the wrist (styloid process).

- Use the table on page 12 to convert ulna length (cm) to height (m).
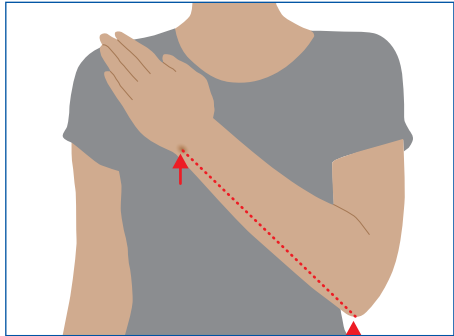
(ii) Knee height

- Measure left leg if possible.

- The subject should sit on a chair, without footwear, with knee at a right angle.

- Hold tape measure between 3rd and 4th fingers with zero reading underneath fingers.

- Place your hand flat across the subject's thigh, about 4 cm (1½ inches) behind the front of the knee.

- Extend the tape measure straight down the side of the leg in line with the bony prominence at the ankle (lateral malleolus) to the base of the heel. Measure to nearest 0.5 cm.

- Note the length and use the table on page 13 to convert knee height (cm) to height (m).
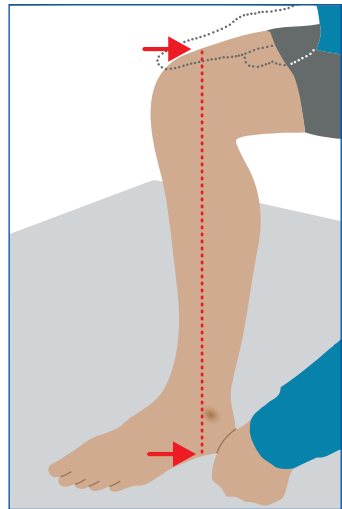
Table 5   Estimating height from ulna length

Height (m)	Ulna length (cm)	32.0	31.5	31.0	30.5	30.0	29.5	29.0	28.5	28.0	27.5	27.0	26.5	26.0	25.5
	Men (<65 years)	1.94	1.93	1.91	1.89	1.87	1.85	1.84	1.82	1.80	1.78	1.76	1.75	1.73	1.71
	Men (≥65 years)	1.87	1.86	1.84	1.82	1.81	1.79	1.78	1.76	1.75	1.73	1.71	1.70	1.68	1.67
	Women (<65 years)	1.84	1.83	1.81	1.80	1.79	1.77	1.76	1.75	1.73	1.72	1.70	1.69	1.68	1.66
	Women (≥65 years)	1.84	1.83	1.81	1.79	1.78	1.76	1.75	1.73	1.71	1.70	1.68	1.66	1.65	1.63

Height (m)	Ulna length (cm)	25.0	24.5	24.0	23.5	23.0	22.5	22.0	21.5	21.0	20.5	20.0	19.5	19.0	18.5
	Men (<65 years)	1.69	1.67	1.66	1.64	1.62	1.60	1.58	1.57	1.55	1.53	1.51	1.49	1.48	1.46
	Men (≥65 years)	1.65	1.63	1.62	1.60	1.59	1.57	1.56	1.54	1.52	1.51	1.49	1.48	1.46	1.45
	Women (<65 years)	1.65	1.63	1.62	1.61	1.59	1.58	1.56	1.55	1.54	1.52	1.51	1.50	1.48	1.47
	Women (≥65 years)	1.61	1.60	1.58	1.56	1.55	1.53	1.52	1.50	1.48	1.47	1.45	1.44	1.42	1.40

Table 6   Estimating height from knee height

Height (m) — Men (18-59 years)	1.81	1.82	1.83	1.84	1.85	1.86	1.865	1.87	1.88	1.89	1.90	1.91	1.92	1.93	1.94
Men (60-90 years)	1.80	1.81	1.82	1.83	1.84	1.85	1.86	1.87	1.88	1.89	1.90	1.91	1.92	1.93	1.94
Knee height (cm)	58.0	58.5	59.0	59.5	60.0	60.5	61.0	61.5	62.0	62.5	63.0	63.5	64.0	64.5	65.0
Height (m) — Women (18-59 years)	1.76	1.77	1.78	1.79	1.80	1.81	1.82	1.83	1.84	1.85	1.86	1.87	1.875	1.88	1.89
Women (60-90 years)	1.73	1.74	1.75	1.76	1.77	1.78	1.79	1.80	1.81	1.82	1.83	1.835	1.84	1.85	1.86

Height (m) — Men (18-59 years)	1.67	1.68	1.69	1.70	1.705	1.71	1.72	1.73	1.74	1.75	1.76	1.77	1.78	1.79	1.80
Men (60-90 years)	1.64	1.65	1.66	1.67	1.68	1.69	1.70	1.71	1.72	1.73	1.74	1.76	1.77	1.78	1.79
Knee height (cm)	50.5	51.0	51.5	52.0	52.5	53.0	53.5	54.0	54.5	55.0	55.5	56.0	56.5	57.0	57.5
Height (m) — Women (18-59 years)	1.62	1.63	1.64	1.65	1.66	1.67	1.68	1.69	1.70	1.71	1.72	1.73	1.735	1.74	1.75
Women (60-90 years)	1.59	1.60	1.61	1.62	1.625	1.63	1.64	1.65	1.66	1.67	1.68	1.69	1.70	1.71	1.72

Height (m) — Men (18-59 years)	1.53	1.54	1.55	1.555	1.56	1.57	1.58	1.59	1.60	1.61	1.62	1.63	1.64	1.65	1.66
Men (60-90 years)	1.48	1.49	1.51	1.52	1.53	1.54	1.55	1.56	1.57	1.58	1.59	1.60	1.61	1.62	1.63
Knee height (cm)	43.0	43.5	44.0	44.5	45.0	45.5	46.0	46.5	47.0	47.5	48.0	48.5	49.0	49.5	50.0
Height (m) — Women (18-59 years)	1.48	1.49	1.50	1.51	1.52	1.53	1.54	1.55	1.56	1.57	1.58	1.585	1.59	1.60	1.61
Women (60-90 years)	1.44	1.45	1.46	1.47	1.48	1.49	1.50	1.51	1.52	1.53	1.54	1.55	1.56	1.57	1.58

(iii) Demispan

- Ideally the subject should stand as this makes taking the measurement easier.

- Locate and mark the mid-point of the sternal notch (V at the base of the neck).

- Ask the subject to raise the right arm until it is horizontal with the shoulder (give assistance if necessary, make sure wrist is straight).

- Place a tape measure between the middle and ring finger of the subject's right hand, with zero at the base of the fingers.

- Extend the tape measure along the length of the arm to the mid-point of the sternal notch and note the measurement to the nearest 0.5 cm.

Use the table on page 15 to convert demispan length (cm) to height (m).
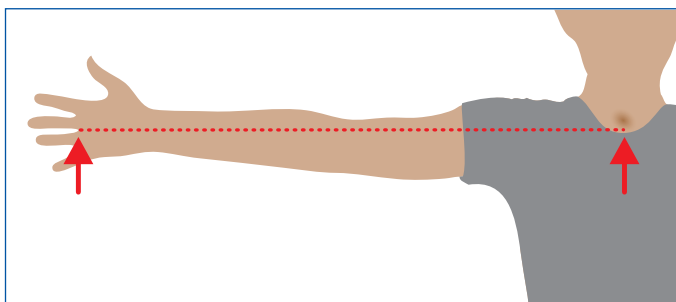
Notes:
- Demispan should not be used in subjects with severe or obvious curvature of the spine (kyphosis or scoliosis).

- For bed bound subjects, those with severe disabilities and those with kyphosis or scoliosis, it is preferable to use ulna length to estimate height.

Weight
If subject cannot be weighed, use a weight recently documented in their notes or use self-reported weight (if reliable and realistic).

Recent weight loss
- If weight measurements are not possible, a history of weight loss may be helpful. Use serial measurements, documented in subject's notes or self-reported weight loss (if reliable and realistic). If it is not possible to obtain any of these measurements, subjective criteria (see page 7) should be used to obtain a clinical impression of an individual's overall nutritional risk category.

Table 7 Estimating height using demispan

Height (m)																	
Men (16-54 years)	1.97	1.95	1.94	1.93	1.92	1.90	1.89	1.88	1.86	1.85	1.84	1.82	1.81	1.80	1.78	1.77	1.76
Men (≥55 years)	1.90	1.89	1.87	1.86	1.85	1.84	1.83	1.81	1.80	1.79	1.78	1.77	1.75	1.74	1.73	1.72	1.71
Demispan (cm)	99	98	97	96	95	94	93	92	91	90	89	88	87	86	85	84	83
Height (m)																	
Women (16-54 years)	1.91	1.89	1.88	1.87	1.85	1.84	1.83	1.82	1.80	1.79	1.78	1.76	1.75	1.74	1.72	1.71	1.70
Women (≥55 years)	1.86	1.85	1.83	1.82	1.81	1.80	1.79	1.77	1.76	1.75	1.74	1.73	1.71	1.70	1.69	1.68	1.67

Height (m)																	
Men (16-54 years)	1.75	1.73	1.72	1.71	1.69	1.68	1.67	1.65	1.64	1.63	1.62	1.60	1.59	1.58	1.56	1.55	1.54
Men (≥55 years)	1.69	1.68	1.67	1.66	1.65	1.64	1.62	1.61	1.60	1.59	1.57	1.56	1.55	1.54	1.53	1.51	1.50
Demispan (cm)	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66
Height (m)																	
Women (16-54 years)	1.69	1.67	1.66	1.65	1.63	1.62	1.61	1.59	1.58	1.57	1.56	1.54	1.53	1.52	1.50	1.49	1.48
Women (≥55 years)	1.65	1.64	1.63	1.62	1.61	1.59	1.58	1.57	1.56	1.55	1.54	1.52	1.51	1.50	1.49	1.47	1.46

Estimating body mass index (BMI) category

If neither height nor weight can be measured or obtained, a likely BMI range can be estimated using the mid upper arm circumference (MUAC) which may be used to support an overall impression of the subject's risk category using subjective criteria (see page 7).

Please note, use of MUAC is not designed to generate a score


Fig.1

Measuring mid upper arm circumference (MUAC)
See Fig.1

- The subject should be standing or sitting.
- Use left arm if possible and ask subject to remove clothing so arm is bare.
- Locate the top of the shoulder (acromion) and the point of the elbow (olecranon process).
- Measure the distance between the 2 points, identify the mid point and mark on the arm.
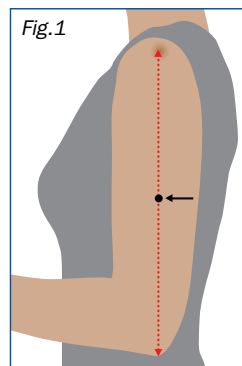
See Fig.2

- Ask subject to let arm hang loose and with tape measure, measure circumference of arm at the mid point. Do not pull the tape measure tight - it should just fit comfortably round the arm.

Fig.2
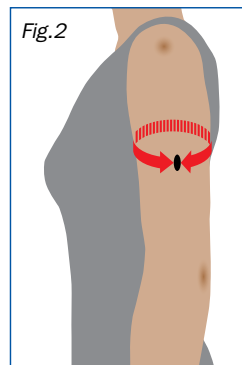
If MUAC is less than 23.5 cm, BMI is likely to be less than 20 kg/m^2 i.e. subject is likely to be underweight.

If MUAC is more than 32.0 cm, BMI is likely to be more than 30 kg/m^2 i.e. subject is likely to be obese.

Weight change over time

- MUAC can also be used to estimate weight change over a period of time and can be useful in subjects in long term care.
- MUAC needs to be measured repeatedly over a period of time, preferably taking 2 measurements on each occasion and using the average of the 2 figures.

If MUAC changes by at least 10% then it is likely that weight and BMI have changed by approximately 10% or more.

Without further evidence it is not possible to assign absolute values to measurement of MUAC or percentage changes.

4. Notes, charts and tables

Notes

1. The BMI values on the BMI chart provided with the 'MUST' have been rounded to the nearest whole number. The yellow shaded area represents BMI values of 18.5 - 20.0 kg/m^2. Therefore, values of 20 which lie above this shaded area represent values greater than 20 and less than 20.5 kg/m^2. Values of 18 which lie below this area represent values less than 18.5 and above 17.5 kg/m^2.

2. Care should be taken when interpreting the patient's BMI or percentage weight loss if any of the following are present:

Fluid disturbances: (i) BMI More significant if underweight with oedema; subtract ~2kg for barely detectable oedema (severe oedema is >10 kg; *see The 'MUST' Report*); can use MUAC when there is ascites or oedema in legs or trunk but not arms; re-measure weight after correcting dehydration or overhydration; inspect the subject to classify as thin, acceptable weight, or overweight/obese. *(ii) Weight change* When there are large and fluctuating fluid shifts, a history of changes in appetite and presence of conditions likely to lead to weight change, are factors that can be used as part of an overall subjective evaluation of malnutrition risk (low or medium/high risk categories).

Pregnancy: *(i) Pre-pregnancy BMI* Measured in early pregnancy; self reported or documented weight and height (or estimated using measurements in early pregnancy); MUAC at any time during pregnancy. *(ii) Weight change* Weight gains <1 kg (<0.5 kg in the obese) or >3 kg per month during the 2nd and 3rd trimester generally require further evaluation. See The 'MUST' Report for further details.

Lactation: *(i) BMI* Measured BMI. *(ii) Weight change* As for oedema(above).

Critical illness: *Acute disease effect* (and no dietary intake for >5 days). This generally applies to most patients in intensive care or high dependency units.

Plaster casts: *BMI* Synthetic and plaster of paris casts for upper limb weigh <1 kg; lower leg and back 0.9 - 4.5 kg depending on material and site. See The 'MUST' Report for further details.
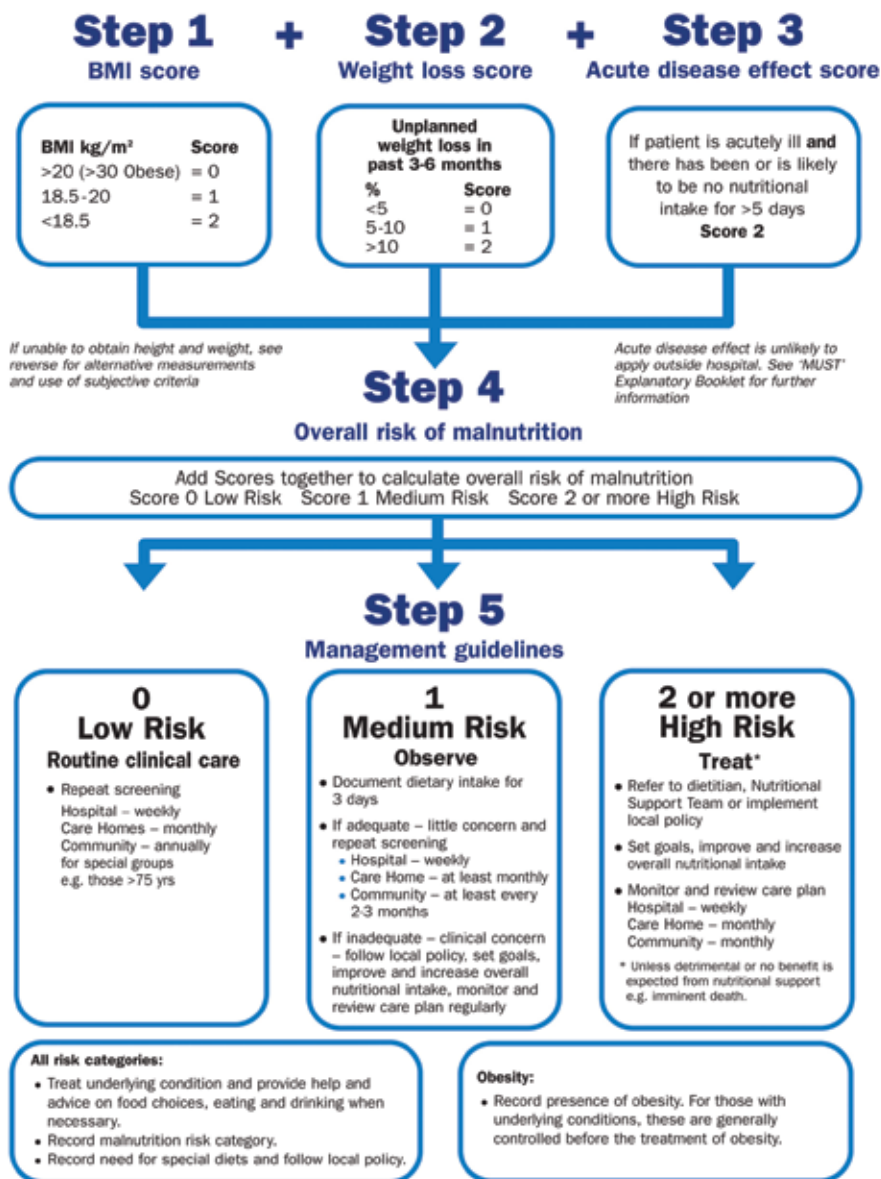
Amputations: *BMI* Adjustments of body weight can be made from knowledge of missing limb segments: upper limb 4.9% (upper arm 2.7%; forearm, 1.6%; hand, 0.6%); lower limb 15.6% (thigh 9.7%; lower leg 4.5%; foot 1.4%).

Calculations to obtain pre-amputation weights are given below:

Table 8   Calculations to obtain pre-amputation weights

Amputation	Calculation
Below knee	Current weight (kg) x 1.063
Full leg	Current weight (kg) x 1.18
Forearm	Current weight (kg) x 1.022
Full arm	Current weight (kg) x 1.05

3. For those patients who are identified as being overweight or obese and are acutely ill, the need to address weight loss should be postponed until that individual is in a more stable clinical position.

Step 1 + Step 2 + Step 3
BMI score **Weight loss score** **Acute disease effect score**

BMI kg/m²	Score
>20 (>30 Obese)	= 0
18.5-20	= 1
<18.5	= 2

Unplanned weight loss in past 3-6 months

%	Score
<5	= 0
5-10	= 1
>10	= 2

If patient is acutely ill **and** there has been or is likely to be no nutritional intake for >5 days
Score 2

If unable to obtain height and weight, see reverse for alternative measurements and use of subjective criteria

Acute disease effect is unlikely to apply outside hospital. See 'MUST' Explanatory Booklet for further information

Step 4
Overall risk of malnutrition

Add Scores together to calculate overall risk of malnutrition
Score 0 Low Risk   Score 1 Medium Risk   Score 2 or more High Risk

Step 5
Management guidelines

0 Low Risk
Routine clinical care

- Repeat screening
  Hospital – weekly
  Care Homes – monthly
  Community – annually
  for special groups
  e.g. those >75 yrs

1 Medium Risk
Observe

- Document dietary intake for 3 days
- If adequate – little concern and repeat screening
  - Hospital – weekly
  - Care Home – at least monthly
  - Community – at least every 2-3 months
- If inadequate – clinical concern – follow local policy, set goals, improve and increase overall nutritional intake, monitor and review care plan regularly

2 or more High Risk
Treat*

- Refer to dietitian, Nutritional Support Team or implement local policy
- Set goals, improve and increase overall nutritional intake
- Monitor and review care plan
  Hospital – weekly
  Care Home – monthly
  Community – monthly
- * Unless detrimental or no benefit is expected from nutritional support e.g. imminent death.

All risk categories:
- Treat underlying condition and provide help and advice on food choices, eating and drinking when necessary.
- Record malnutrition risk category.
- Record need for special diets and follow local policy.

Obesity:
- Record presence of obesity. For those with underlying conditions, these are generally controlled before the treatment of obesity.

Re-assess subjects identified at risk as they move through care settings
See The 'MUST' Explanatory Booklet for further details and The 'MUST' Report for supporting evidence.

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Step 1 – BMI score (& BMI)

Weight (st)

Height (feet and inches)

Weight	4'9½	4'10½	4'11	5'0	5'0½	5'1½	5'2	5'3	5'4	5'4½	5'5½	5'6	5'7	5'7½	5'8½	5'9½	5'10	5'11	5'11½	6'0½	6'1	6'2	6'3	Weight (st)
100	47	45	45	43	42	41	40	39	38	37	36	36	35	34	33	32	32	31	30	29	29	28	28	15 10
99	46	45	44	43	42	41	40	39	37	37	36	35	34	34	33	32	31	30	30	29	29	28	27	15 8
98	46	44	44	42	41	40	40	38	37	37	35	35	34	33	32	31	31	30	30	29	29	28	27	15 6
97	45	44	43	42	41	40	39	38	37	36	35	35	33	33	32	31	31	30	29	29	28	27	27	15 4
96	45	43	43	41	41	39	39	37	36	36	35	34	33	33	32	31	30	30	29	28	28	27	26	15 2
95	45	43	42	41	40	39	38	37	36	35	34	34	33	32	31	30	30	29	29	28	28	27	26	14 13
94	44	43	42	40	40	39	38	37	36	35	34	33	32	32	31	30	30	29	29	28	27	27	26	14 11
93	44	42	41	40	39	38	38	36	35	35	34	33	32	32	31	30	29	29	28	27	27	26	26	14 9
92	43	42	41	40	39	38	37	36	35	34	33	33	32	31	30	30	29	28	28	27	27	26	25	14 7
91	43	41	41	39	39	37	37	36	34	34	33	32	31	31	30	29	29	28	28	27	26	26	25	14 5
90	42	41	40	39	38	37	36	35	34	34	33	32	31	31	30	29	28	28	27	27	26	25	25	14 2
89	42	40	40	38	38	36	36	35	34	33	32	32	31	30	29	29	28	27	27	26	26	25	25	14 0
88	41	40	39	38	37	36	35	34	33	33	32	31	30	30	29	28	28	27	27	26	26	25	24	13 12
87	41	39	39	37	37	36	35	34	33	32	31	31	30	30	29	28	28	27	26	26	25	25	24	13 10
86	40	39	38	37	36	35	35	34	33	32	31	31	30	29	28	28	27	26	26	25	25	24	24	13 8
85	40	38	38	37	36	35	34	33	32	32	31	30	29	29	28	27	27	26	26	25	25	24	23	13 5
84	39	38	37	36	36	34	34	33	32	31	30	30	29	29	28	27	27	26	25	25	24	24	23	13 3
83	39	38	37	36	35	34	33	32	31	31	30	30	29	28	27	27	26	26	25	24	24	23	23	13 1
82	38	37	37	35	35	34	33	32	31	31	30	29	28	28	27	26	26	25	25	24	24	23	23	12 13
81	38	37	36	35	34	33	33	32	31	30	29	29	28	28	27	26	26	25	25	24	24	23	22	12 11
80	38	36	36	34	34	33	32	31	30	30	29	28	28	27	26	26	25	25	24	24	23	23	22	12 8
79	37	36	35	34	33	32	32	31	30	29	29	28	27	27	26	25	25	24	24	23	23	22	22	12 6
78	37	35	35	34	33	32	31	30	30	29	28	28	27	27	26	25	25	24	24	23	23	22	21	12 4
77	36	35	34	33	33	32	31	30	29	29	28	27	27	26	25	25	24	24	23	23	22	22	21	12 2
76	36	34	34	33	32	31	31	30	29	28	27	27	26	26	25	24	24	23	23	22	22	22	21	12 0
75	35	34	33	32	32	31	30	29	28	28	27	27	26	26	25	24	24	23	23	22	22	21	21	11 11
74	35	34	33	32	31	30	30	29	28	28	27	26	26	25	24	24	23	23	22	22	22	21	20	11 9
73	34	33	33	31	31	30	29	29	28	27	26	26	25	25	24	23	23	22	22	22	21	21	20	11 7
72	34	33	32	31	30	30	29	28	27	27	26	26	25	24	24	23	23	22	22	21	21	20	20	11 5
71	33	32	32	31	30	29	29	28	27	26	26	25	25	24	23	23	22	22	22	21	21	20	20	11 3
70	33	32	31	30	30	29	28	27	26	26	25	25	24	24	23	22	22	22	21	21	20	20	19	11 0
69	32	31	31	30	29	28	28	27	26	26	25	25	24	23	23	22	22	21	21	20	20	20	19	10 13

tones and pounds)

Score 0

Score 1

Score 2

Height (m)

1.46 1.48 1.50 1.52 1.54 1.56 1.58 1.60 1.62 1.64 1.66 1.68 1.70 1.72 1.74 1.76 1.78 1.80 1.82 1.84 1.86 1.88 1.90

Weight (kg)

Step 2 – Weight loss score

Weight before weight loss (kg)

	SCORE 0 Wt Loss <5%	SCORE 1 Wt Loss 5-10%	SCORE 2 Wt Loss >10%
34 kg	<1.70	1.70 – 3.40	>3.40
36 kg	<1.80	1.80 – 3.60	>3.60
38 kg	<1.90	1.90 – 3.80	>3.80
40 kg	<2.00	2.00 – 4.00	>4.00
42 kg	<2.10	2.10 – 4.20	>4.20
44 kg	<2.20	2.20 – 4.40	>4.40
46 kg	<2.30	2.30 – 4.60	>4.60
48 kg	<2.40	2.40 – 4.80	>4.80
50 kg	<2.50	2.50 – 5.00	>5.00
52 kg	<2.60	2.60 – 5.20	>5.20
54 kg	<2.70	2.70 – 5.40	>5.40
56 kg	<2.80	2.80 – 5.60	>5.60
58 kg	<2.90	2.90 – 5.80	>5.80
60 kg	<3.00	3.00 – 6.00	>6.00
62 kg	<3.10	3.10 – 6.20	>6.20
64 kg	<3.20	3.20 – 6.40	>6.40
66 kg	<3.30	3.30 – 6.60	>6.60
68 kg	<3.40	3.40 – 6.80	>6.80
70 kg	<3.50	3.50 – 7.00	>7.00
72 kg	<3.60	3.60 – 7.20	>7.20
74 kg	<3.70	3.70 – 7.40	>7.40
76 kg	<3.80	3.80 – 7.60	>7.60
78 kg	<3.90	3.90 – 7.80	>7.80
80 kg	<4.00	4.00 – 8.00	>8.00
82 kg	<4.10	4.10 – 8.20	>8.20
84 kg	<4.20	4.20 – 8.40	>8.40
86 kg	<4.30	4.30 – 8.60	>8.60
88 kg	<4.40	4.40 – 8.80	>8.80
90 kg	<4.50	4.50 – 9.00	>9.00
92 kg	<4.60	4.60 – 9.20	>9.20
94 kg	<4.70	4.70 – 9.40	>9.40
96 kg	<4.80	4.80 – 9.60	>9.60
98 kg	<4.90	4.90 – 9.80	>9.80
100 kg	<5.00	5.00 – 10.00	>10.00
102 kg	<5.10	5.10 – 10.20	>10.20
104 kg	<5.20	5.20 – 10.40	>10.40
106 kg	<5.30	5.30 – 10.60	>10.60
108 kg	<5.40	5.40 – 10.80	>10.80
110 kg	<5.50	5.50 – 11.00	>11.00
112 kg	<5.60	5.60 – 11.20	>11.20
114 kg	<5.70	5.70 – 11.40	>11.40
116 kg	<5.80	5.80 – 11.60	>11.60
118 kg	<5.90	5.90 – 11.80	>11.80
120 kg	<6.00	6.00 – 12.00	>12.00
122 kg	<6.10	6.10 – 12.20	>12.20
124 kg	<6.20	6.20 – 12.40	>12.40
126 kg	<6.30	6.30 – 12.60	>12.60

Weight before weight loss (st lb)

	SCORE 0 Wt Loss <5%	SCORE 1 Wt Loss 5-10%	SCORE 2 Wt Loss >10%
5st 4lb	<4lb	4lb – 7lb	>7lb
5st 7lb	<4lb	4lb – 8lb	>8lb
5st 11lb	<4lb	4lb – 8lb	>8lb
6st	<4lb	4lb – 8lb	>8lb
6st 4lb	<4lb	4lb – 9lb	>9lb
6st 7lb	<5lb	5lb – 9lb	>9lb
6st 11lb	<5lb	5lb – 10lb	>10lb
7st	<5lb	5lb – 10lb	>10lb
7st 4lb	<5lb	5lb – 10lb	>10lb
7st 7lb	<5lb	5lb – 11lb	>11lb
7st 11lb	<5lb	5lb – 11lb	>11lb
8st	<6lb	6lb – 11lb	>11lb
8st 4lb	<6lb	6lb – 12lb	>12lb
8st 7lb	<6lb	6lb – 12lb	>12lb
8st 11lb	<6lb	6lb – 12lb	>12lb
9st	<6lb	6lb – 13lb	>13lb
9st 4lb	<7lb	7lb – 13lb	>13lb
9st 7lb	<7lb	7lb – 13lb	>13lb
9st 11lb	<7lb	7lb – 1st 0lb	>1st 0lb
10st	<7lb	7lb – 1st 0lb	>1st 0lb
10st 4lb	<7lb	7lb – 1st 0lb	>1st 0lb
10st 7lb	<7lb	7lb – 1st 1lb	>1st 1lb
10st 11lb	<8lb	8lb – 1st 1lb	>1st 1lb
11st	<8lb	8lb – 1st 1lb	>1st 1lb
11st 4lb	<8lb	8lb – 1st 2lb	>1st 2lb
11st 7lb	<8lb	8lb – 1st 2lb	>1st 2lb
11st 11lb	<8lb	8lb – 1st 3lb	>1st 3lb
12st	<8lb	8lb – 1st 3lb	>1st 3lb
12st 4lb	<9lb	9lb – 1st 3lb	>1st 3lb
12st 7lb	<9lb	9lb – 1st 4lb	>1st 4lb
12st 11lb	<9lb	9lb – 1st 4lb	>1st 4lb
13st	<9lb	9lb – 1st 4lb	>1st 4lb
13st 4lb	<9lb	9lb – 1st 5lb	>1st 5lb
13st 7lb	<9lb	9lb – 1st 5lb	>1st 5lb
13st 11lb	<10lb	10lb – 1st 5lb	>1st 5lb
14st	<10lb	10lb – 1st 6lb	>1st 6lb
14st 4lb	<10lb	10lb – 1st 6lb	>1st 6lb
14st 7lb	<10lb	10lb – 1st 6lb	>1st 6lb
14st 11lb	<10lb	10lb – 1st 7lb	>1st 7lb
15st	<11lb	11lb – 1st 7lb	>1st 7lb
15st 4lb	<11lb	11lb – 1st 7lb	>1st 7lb
15st 7lb	<11lb	11lb – 1st 8lb	>1st 8lb
15st 11lb	<11lb	11lb – 1st 8lb	>1st 8lb
16st	<11lb	11lb – 1st 8lb	>1st 8lb
16st 4lb	<11lb	11lb – 1st 9lb	>1st 9lb
16st 7lb	<12lb	12lb – 1st 9lb	>1st 9lb

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