

## **1. Introduction**

Calculation of energy and protein requirements on an adult critical care patient is becoming more complex with different equations available and conflicting evidence. These are often different depending on Body Mass Index (BMI), ventilation mode and activity levels. Some variables can change frequently and so requirements should be checked at least twice weekly, more frequently if required. Prediction equations should be used to estimate energy requirements in the absence of indirect calorimetry which is currently unavailable in the Trust. NB when devising feeding regimen ensure that feed provides the obligatory carbohydrate 130 g per day.

## **2. Scope**

These guidelines are for use by Dietitians on all patients on the Adult Critical Care units in University Hospitals of Leicester NHS Trust. It applies to patients regardless of the route of feeding, i.e. oral, enteral or parenteral feeding.

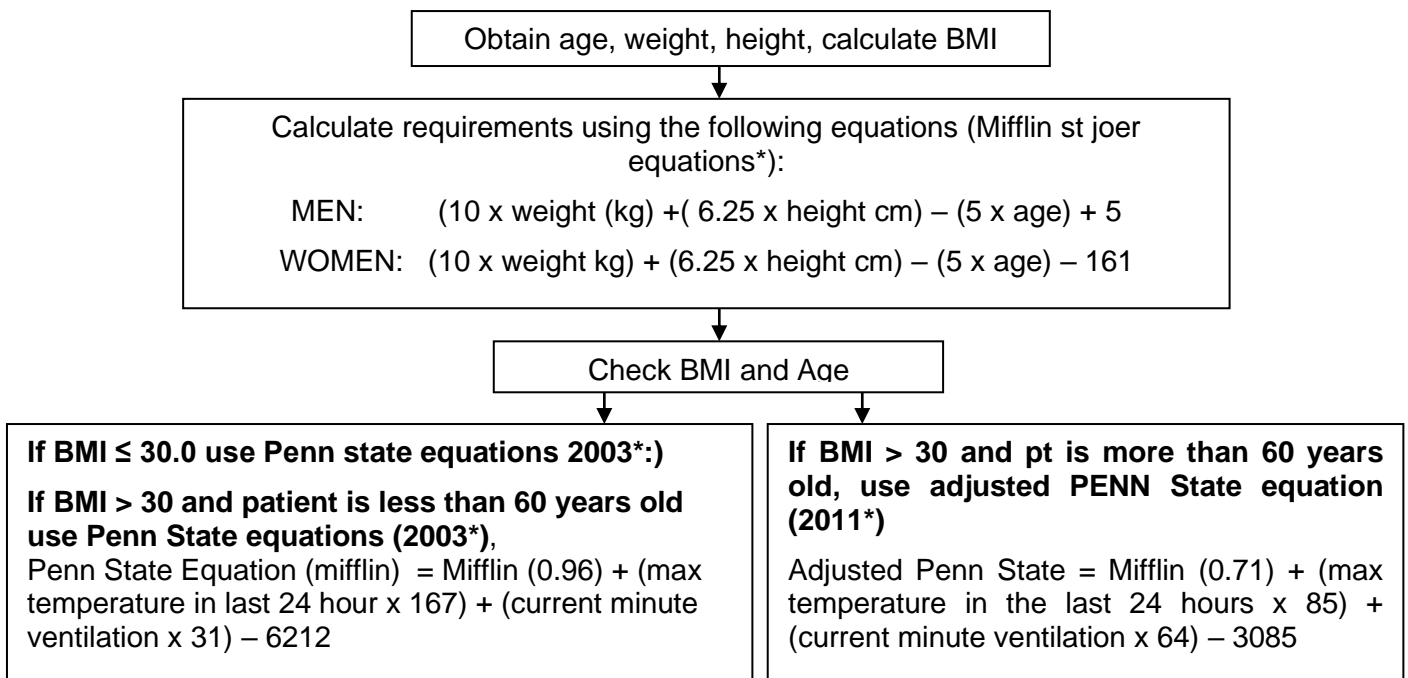
## **3. Recommendations, Standards and Procedural Statements**

**Calculating Energy Requirements** (see appendix 1 for rationale). Flow chart on page 2.

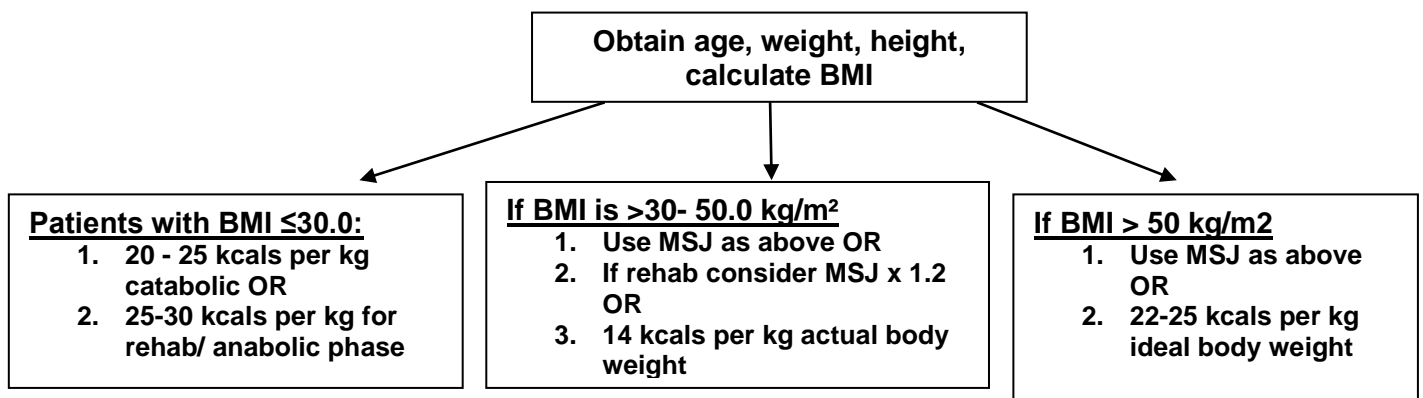
**Energy requirements - In order of preference**

1. Gold standard measurements - indirect calorimetry – not currently available in UHL
2. Consider checking VCO2 – Carbon dioxide production derived from the ventilator and using REE=VCO2 x 8.19
3. Predictive equations as detailed below and follow flow chart \*see excel calculator on shared drive
4. Mifflin St Joer for patients with BMI >30 with no minute volume or on ECMO
5. Weight based calculations for those with no minute volume or are on ECMO

**Energy requirements for patients with a minute volume and NOT on ECMO**



**Energy Requirements for patients with no minute volume or on ECMO**



**Pregnancy** use equations as above using actual weight  
 Consider adding additional calories 200-300 kcals in 3<sup>rd</sup> trimester for baby growth  
 Consider checking with midwives about USS to check for baby growth and liaising directly with them  
 Check vitamin A content of the enteral feed does not exceed 2000 mcg. Check no other sources of vitamin A

## **Protein Requirements**

### **For patients with a BMI < 30kg/m<sup>2</sup>:**

General ICU patients and ECMO – 1.3-1.5g/kg protein (a higher threshold of 2g/kg protein may be appropriate in the presence of significant wounds or extrinsic losses).

Trauma – 1.3-1.5g/kg protein

Continuous Renal Replacement Therapy (CRRT) - 1.5-1.7g/kg protein

If AKI present and no plan for Continuous Renal Replacement Therapy – 1g/kg protein

### **For patients with a BMI ≥30 kg/m<sup>2</sup>:**

Based on current European guidelines and clinical practice, calculate a range using 1.3g/kg protein based on:

(a) Adjusted body weight with ideal body weight calculated to a BMI 25kg/m<sup>2</sup>:  
(actual body weight – ideal body weight) x 0.33 + ideal body weight

(b) Actual body weight

However, it is important to note recommendations made in published International guidelines and include this in the calculated range as clinically appropriate:

- BMI >30-40.0 kg/m<sup>2</sup> - 2g/kg protein ideal body weight (BMI 25kg/m<sup>2</sup>)
- BMI >40 kg/m<sup>2</sup> - 2.5g/kg ideal body weight (BMI 25kg/m<sup>2</sup>)

For patients with BMI ≥30 kg/m<sup>2</sup>, it important to consider the following:

- If AKI present and no plan for Continuous Renal Replacement Therapy – 1g/kg protein actual body weight
- For ECMO patients, consider estimating as above but use clinical judgement on an individual patient basis as higher protein requirements may be required.

## **4. Education and Training**

Education and discussion will be through Dietitians Critical Care meeting with case studies for clinical supervision.

## **5. Monitoring and Audit Criteria**

<b>Key Performance Indicator</b>	<b>Method of Assessment</b>	<b>Frequency</b>	<b>Lead</b>
Patients requirements are calculated using these recommendations and documented with rationale in patients' medical notes	Review of electronic handover	Annually	Moira Dawson Aileen Case

## **6. Legal Liability Guideline Statement**

Guidelines or Procedures issued and approved by the Trust are considered to represent best practice. Staff may only exceptionally depart from any relevant Trust guidelines or Procedures and always only providing that such departure is confined to the specific needs of individual circumstances. In healthcare delivery such departure shall only be undertaken where, in the

judgement of the responsible healthcare professional' it is fully appropriate and justifiable - such decision to be fully recorded in the patient's notes

## **7. Supporting Documents and Key References**

Alberda C et al (2009) The relationship between nutritional intake and clinical outcomes in critically ill obese patients: results of an international multicentre observational. *Intensive Care Medicine*: 35: 1728-1737

Allan K (2016) Feeding Critically Ill Obese Patients: *Network Health Dietitians*: 111: 30-34

Allan K and Taylor S (2016) Optimal Protein Provision in Critical Illness: *Complete Nutrition*: 15 (6) 87-89

Barazzoni R et al (2020) ESPEN expert consensus statements and practical guidance for nutritional management of individuals with SARS-COV-2 infection, *Clinical Nutrition* 39 (6), 1631-1638

Fiaccadori E et al (2021) ESPEN guideline on clinical nutrition in hospitalised patients with acute or chronic kidney disease *Clinical Nutrition* 40 (2021)1644-1668

Frankenfield D et al (2009) Analysis of estimation of methods for resting metabolic rate in critically-ill adults, *Journal of Parenteral and Enteral Nutrition* 33 (1) 27-36

McLave et al (2016) Guidelines for the provision and assessment of Nutrition Support Therapy in the adult critically ill patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (ASPEN): *JPEN Volume* 40 (2) 159-211

Singer P et al (2019) ESPEN guideline on clinical nutrition in the intensive care unit, *Clinical Nutrition* 38: 48-79

## **8. Key Words**

Nutritional Requirements, Critical Care

## Energy Requirements

Please note energy requirements and protein requirements should be considered together to devise a feeding plan

**Step one – Obtain age, weight and height and calculate BMI.** The first option would be to use a documented actual weight and height. The second option would be to use a recalled weight and height from an awake patient or relative. Search through medical notes and contact GP practice if needed. Rationale: Weight, height, BMI and age will inform which calculation to use. If there is no height available, use ulna length to estimate height, then estimate BMI and then weight.

Where there is a VCO<sub>2</sub> measurement

**REE=VCO<sub>2</sub> x 8.19.** This has been recommended by ESPEN (2019) as best practice in the absence of indirect calorimetry.

Where there an accurate minute volume:

**If BMI ≤ 30.0 use Penn state equations 2003: Rationale: most accurate predictive compared to indirect calorimetry in nearly all groups of critically ill patients (Frankenfield 2009)**

**If BMI > 30 and patient is less than 60 years old use Penn State equations (2003),** but bear in mind that as BMI goes above 45, the reliability of these equations reduces. See Parenteral and Enteral Nutrition Group handbook for further options of energy requirements for specific conditions.

**If BMI > 30 and pt is more than 60 years old, use adjusted PENN State equation (2011) as these have improved accuracy**

**Patients where NO MINUTE VOLUME is available or where minute volumes would not be reliable e.g. in ECMO patients:**

**Patients with BMI ≤30.0: 20-25 kcals per kg (ESPEN 2019)**

**If BMI is >30- 50.0 kg/m<sup>2</sup> use MSJ or 14 kcals per kg actual body weight.** (ASPEN 2016)  
Rationale: hypocaloric feeding with adequate protein aims to maintain lean body mass whilst simultaneously losing fat mass. Underfeeding calories aims at avoiding the metabolic complications associated with overfeeding in Critical Care patients such as hyperglycaemia, increased infections and increased ventilator days.

**If BMI > 50 kg/m<sup>2</sup> then use MSJ or 22-25 kcals per kg ideal body weight (ideal body weight is 27.5 kg/m<sup>2</sup>)**

## Protein Requirements

It is widely acknowledged that the provision of protein is closely linked to positive outcomes in the critical care setting. Protein is the most important macronutrient for minimising loss of lean body mass, wound healing and supporting immune function. Higher targets in critical care are recommended compared to general hospitalised patients due to the effect of catabolism driving protein breakdown.

Unfortunately, determination of protein requirements remains difficult and therefore, weight-based equations and application of clinical judgement for disease-specific requirements is recommended in both European and International guidelines (McClave *et al*, 2016; Singer *et al*, 2019).

This table is used to track the development and approval and dissemination of the document and any changes made on revised / reviewed versions

<b>DEVELOPMENT AND APPROVAL RECORD FOR THIS DOCUMENT</b>			
<b>Author / Lead Officer:</b>	Moira Dawson	<b>Job Title:</b> Senior Specialist Dietitian	
<b>Reviewed by:</b>	UHL Critical Care Dietitians Group and Cathy Steele, Clinical Dietetic Manager		
<b>Approved by:</b>	<b>CSI Category C Policy and Guideline Committee</b>	<b>Date Approved: October 2016</b>	
<b>REVIEW RECORD</b>			
<b>Date</b>	<b>Issue Number</b>	<b>Reviewed By</b>	<b>Description Of Changes (If Any)</b>
November 2021	3	UHL Critical Care Dietitians Group	<ul style="list-style-type: none"> <li>- Update on estimation of both energy and protein requirements in Adult Critical Care to reflect up-to-date recommendations in European and International guidelines.</li> <li>- Inclusion of considerations to be made with pregnant patients (added due to increased numbers admitted to ICU in COVID pandemic).</li> </ul>
<b>DISTRIBUTION RECORD:</b>			
<b>Date</b>	<b>Name</b>	<b>Dept</b>	<b>Received</b>

<b>Title of P&amp;G Document Being Reviewed:</b>		<b>Yes / No / Unsure</b>	<b>Comments</b>
<b>1.</b>	<b>Title and Format</b>		
	Is the title clear and unambiguous?	yes	
	Is type of document clear (e.g. policy, guideline, procedure)	yes	
	Does the document follow UHL template format? <i>If no document will be returned to author</i>	yes	
<b>3.</b>	<b>Development Process</b>		
	Are the reasons for developing described (usually as part of introduction)	yes	
<b>4.</b>	<b>P&amp;G Content</b>		
	Does the P&G have an introduction and aims?	yes	
	Is the P&G scope clear?	yes	
	Does the P&G set out clear roles and responsibilities?	yes	
	Are P&G Statements/Standards clear and easy to follow?	yes	
<b>5.</b>	<b>Associated policies and supporting references</b>		
	Are associated policies listed and key references clearly cited?	yes	
<b>6.</b>	<b>Consultation and Endorsement</b>		
	Has there been appropriate consultation? (see the consultation proforma)	yes	
	Does the Document identify which who has endorsed it?	yes	
<b>7.</b>	<b>Dissemination and Implementation</b>		
	Has the dissemination plan been completed? (see Admin Proforma)		
	Have all implementation issues been addressed?	yes	
<b>8.</b>	<b>Equality and Benefits Realisation</b>		
	Has an Equality Impact Assessment Screening Tool been completed?		
	Have potential costs / benefits been considered or anticipated outcomes described?		
<b>9.</b>	<b>Process to Monitor Compliance</b>		
	Are there measurable outcomes / key indicators to support the monitoring of compliance?		
	Is there a plan to audit compliance with the document?		
	Have audit timescales and audit lead been identified?		
<b>10.</b>	<b>Document Control, Archiving and Review</b>		
	Have details regarding document control and archiving been provided?		
	Is the review date and reviewer identified?		
	If reviewed document, are changes identified or is there a statement that no changes required and 'fit for purpose'?		
<b>11.</b>	<b>Overall Responsibility for the Document</b>		
	Is it clear who is responsible for co-ordinating the dissemination, implementation?		

### Initial Equality Impact Assessment Tool

#### Pro-forma for the Initial Assessment

**Name of Policy / guidance Document : Guideline for the calculation of energy and protein requirements on critical care**

To be completed and attached to any procedural document (e.g. policies, guidance notes, etc) when submitted to the appropriate committee for consideration and approval.

An Equality Impact Assessment must always be carried out when there is a proposal to develop or change a function, e.g. Service Development within the Organisation.

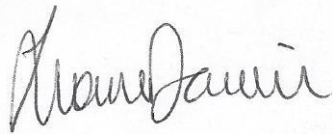
		<b>Comments</b>	
<b>1.</b>	<b>What is the purpose of the proposal/ Policy</b>	Ensure nutritional requirements are calculated consistently	
<b>2.</b>	<b>Could the proposal be of public concern?</b>	no	
<b>3.</b>	<b>Who is intended to benefit from the proposal and in what way?</b>	Clear, consistent guidance for Critical Care Dietitians on working out requirements.	
<b>4.</b>	<b>What outcomes are wanted for the proposal?</b>	All Dietitians use the same parameters to work out patients nutritional requirements	
		<b>Yes/No</b>	<b>Comments</b>
<b>5.</b>	<b>Is there a possibility that the outcomes may affect one group less or more favourably than another on the basis of:</b>	no	
	• Race	no	
	• Ethnic origins (including gypsies and travellers)	no	
	• Nationality	no	
	• Gender	no	
	• Culture	no	
	• Religion or belief	no	
	• Sexual orientation including lesbian, gay and transsexual people	no	
	• Age	no	
	• Disability - learning disabilities, physical disability, sensory impairment and mental health problems	no	



		Comments	
6.	Is there any evidence that some groups are affected differently?	no	
7.	If you have identified that some groups may be affected differently is the impact justified E.g. by Legislation: National guidelines that require the Trust to have a policy, or to change its practice.	n/a	
8.	Is the impact of the proposal / policy likely to be negative?		
9.	If so can the impact be avoided?		
10.	What alternatives are there to achieving the proposal/ policy without the impact?		
11.	Can we reduce the impact by taking different action?		

If you have identified a potential discriminatory impact; please ensure that you do a Full Impact Assessment.

**Initial Assessment completed by:**

<b>Name:</b>	<b>Moira Dawson</b>
<b>Signed:</b>	
<b>Date:</b>	<b>08.11.21</b>
<b>Contact number:</b>	<b>0116 258 5400</b>

If you require further advice please contact Service Equality Manager on 0116 2584382.

**POLICY AND GUIDANCE CONSULTATION PROFORMA**

(To be completed and attached to Policy and Guidance documents when submitted to the UHL Policy &amp; Guidelines Committee)

Elements of the Policy or Guidance Document to be considered (this could be at either directorate or corporate level or both)	Implications (Yes/No)	Local or Corporate	Consulted (Yes/No)	Agree with P/G content (Yes/No)	Any Issues (Yes / No)	Comments / Plans to Address
Education (ie training implications)	yes	Local	yes	Yes	No	Via critical care dietitians group
Corporate & Legal	No					
• Clinical Risk	NO					
• Health & Safety	NO					
• Manual Handling	NO					
• Legal Issues	NO					
IM&T (ie IT requirements)	NO					
Infection Prevention and Control	NO					
Human Resources	No					
Operations (ie operational implications)	yes					Dietetic Operations
Facilities (ie environmental implications)	No					
Finance (ie cost implications)	No					
Staff Side (where applicable)	NO					
Patients/Carers (where appropriate)	NO					
<b>Relevant CBUs or Divisions:</b>						
CSI						

Committee or Group (ie Directorate Board) that has formally reviewed the Policy or Guidance document	Date reviewed	Outcome / Decision
Critical Care Dietitians Group	Sept 2016	

Lead Officer(s) (Name and Job Title)	Contact Details
Moira Dawson Senior Specialist Dietitian	0116 258 5400

Reviewer	Contact Details	Review Date

Please advise of other policies or guidelines that cover the same topic area:

Title of Policy or Guideline:

**POLICY AND GUIDANCE ADMIN PROFORMA**

(To be completed and attached to Policy and Guidance documents when submitted to the UHL Policy & Guidelines Committee)

<b>Title of Policy / Guideline:</b> Guideline for Calculation of nutritional requirements on an adult critical care patient	
<b>Policy / Guideline Lead:</b>	Moira Dawson
<b>Date for P&amp;G Review:</b> November 2021	

<b>IMPLEMENTATION</b>	
Please advise how any implications around implementation have been addressed:	
<b>Financial</b>	None
<b>Training</b>	Via Critical Care Dietitians Group
<b>Benefits realisation</b>	How will the organisation benefit from implementing this policy (eg in terms of cost saving, improved governance)

<b>REVIEW OF PREVIOUS P&amp;G DOCUMENT</b>	
<b>Previous P&amp;G already being used?</b> No	<b>Trust Ref No:</b>
<b>If yes, Title:</b>	<b>SharePoint No:</b>
<b>Changes made to P&amp;G?</b> Yes / No?	<b>If yes, are these explicit</b> Yes / No? <b>If no, is P&amp;G still 'fit for purpose?</b> Yes / No?
<b>Supporting Evidence Reviewed?</b> Yes / No?	<b>Supporting Evidence still current?</b> Yes / No?

<b>VERSION CONTROL AND ARCHIVING</b>
<b>Where will previous versions be archived?</b> LNDS/UHL Critical Care/Guidelines
<b>Proposed action to retrieve expired paper copies of P&amp;G:</b> n/a – all Dietitians will be aware and able to access electronic copies

<b>DISSEMINATION PLAN</b>			
<b>Date Finalised:</b>	<b>Dissemination Lead (Name and contact details)</b> Moira Dawson		
<b>To be disseminated to:</b>	<b>How will be disseminated, who will do and when?</b>	<b>Paper or Electronic?</b>	<b>Comments</b>
Critical Care Dietitian	Critical care dietitians group	Electronic	

**CATEGORY 'C' POLICIES OR GUIDELINES ONLY**

**Divisional/CBU Approval Process:**

<b>Approving Group / Committee:</b>	
<b>Any comments?</b>	
<b>Date of Approval:</b>	

