Worcestershire Acute Hospitals NHS Trust

Critical Care Unit Nutrition Guidelines

This guidance does not override the individual responsibility of health professionals to make appropriate decision according to the circumstances of the individual patient in consultation with the patient and /or carer. Health care professionals must be prepared to justify any deviation from this guidance.

This guideline is for use by the following staff groups:

- Critical care consultant/lead clinician on duty
- Junior medical staff
- Nursing staff
- Dietician staff
- Pharmacy staff

Lead Clinician(s)

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Key amendments to this guideline

Date	Amendment	Approved by:
January 2021	Document approved for 3 years	Directorate Governance and SCS Divisional Governance
14th January 2024	Document extended for 3 months whilst new guideline is written and approved	Dr Bhardwaj
13th Nov 24	Document approved for 3 years at ICM Forum and MSC	ICM Forum and MSC

Contents

Definitions

Enteral nutrition (EN) – The provision of nutrition via the patient's gut. For the vast majority of critically ill patients, oral feeding will not be possible or entirely adequate, so these guidelines deal exclusively with the provision of food directly into the stomach or small bowel.

Parenteral nutrition (PN) – The provision of nutrition directly into the patient's blood stream.

Trophic feeding – The minimal administration of nutrients enterally having beneficial effects, such as preserving intestinal epithelium, stimulating secretion of brush border enzymes, enhancing immune function, preserving epithelial tight junctions, and preventing bacterial translocation.

Hypocaloric or underfeeding – Energy administration below 70% of the defined target.

Isocaloric diet – Energy administration at the defined target.

Overfeeding – Energy administration of 110% above the defined target.

Ideal body weight (weight corrected to BMI of 25): IBW = 25 x (height in m)^2

Adjusted ideal body weight (If BMI >30): (Actual weight – IBW) x 0.25 + IBW

1.0 Introduction

This WAHT guideline is based on the 2019 European Society of Parenteral and Enteral Nutrition (ESPEN) guidance, and the 2023 partially revised guideline. With additions from the 2018 British Dietetic Association recommendations, 2022 Society of Critical Care Medicine (SCCM), American Society for Parenteral and Enteral Nutrition (ASPEN), and Canadian Critical Care Practice Guidelines where stated.
The stages of critical illness can generally be split into:

i. Acute early phase (ICU day 1-2)
ii. Acute late phase (ICU day 3-7)
iii. Recovery phase (after ICU day 7)

The acute early phase (previously referred to as EBB phase) is defined by metabolic instability and severe increase in catabolism. Insulin resistance and endogenous energy production prioritises delivery of energy substrates to vital tissues.

The early late phase (previously referred to as FLOW phase) is defined by significant muscle wasting and stabilisation of metabolic disturbances.

The late phase follows with improvement and rehabilitation, or persistent inflammatory/catabolic state and prolonged hospitalisation.

1.1 Why do we need to feed patients?

Patients who are critically ill are at high nutritional risk and the significance of nutrition in the ICU cannot be overstated. Critical illness is typically associated with a stress/inflammatory response which leads to a catabolic state [1], driving protein breakdown and loss of muscle mass. Patients can lose up to two percent of their lean body mass per day during an intensive care stay, and this is more profound in those with multiple organ failure [2]. Malnutrition in critically ill patients is associated with increased morbidity and mortality [3, 4]. Many patients who are admitted to hospital are already malnourished which increases their vulnerability to infections, risk of skin breakdown, poor wound healing, muscle weakness, and reduced heart and lung function. Therefore, minimising further malnutrition along with the avoidance of overfeeding should be the aim for every patient in the ICU.
Nutrition support is associated with reduced complications and infections, improved wound healing, improved gut function, mediation of metabolic response to critical illness or injury, reduced length of hospital stay, improved clinical outcomes and cost savings [5].

1.2 When should we start feeding patients?

Studies have shown benefits of early enteral feeding – within 48 hours of admission to the intensive care unit – unless contraindicated. Early feeding is associated with a shorter length of stay, reduced incidence of infections and pneumonia, and an overall reduction in mortality [6]. We should therefore aim to begin feeding within 24-48hrs of admission to the intensive care unit (ICU).

2.0 Nutritional screening in critical care

The Malnutrition Universal Screening Tool (MUST) is not used within critical care as it is not a validated tool for these patients [7]. Some patients may be well nourished on admission to ICU, however, others may have a poor pre-admission nutritional status. Any critically ill patient staying for >48hrs in ICU should be considered at risk for malnutrition [8].

The NUTRIC score (minus IL6) is used across critical care in the Trust as a measure of nutritional risk. It is a nutritional assessment tool specifically developed and validated for the critically ill patient. A score ≥5 denotes high risk. It includes elements of nutritional status and disease severity to identify critically ill patients most likely to benefit from optimised micronutrients when considering mortality as an outcome [9, 10].

2.1 Nutritional assessment by the Dietitian

The dietitians are available to visit the critical care units on weekdays and liaise with medical and nursing staff about whether dietetic input is required. All patients in the ICU for >48hrs who are ventilated should be individually assessed by the dietitian as they are deemed to be at high nutritional risk.
Referral to the dietitian should be completed on ICE.
The dietitian will perform a nutritional assessment for each patient and formulate an individualised nutritional plan.

3.0 Calorie and protein requirements

3.1 Calories

The exact amount of calories to administer to critically ill patients is difficult to define and varies over time. It is generally accepted that calories administered should be matched to energy expended.
The gold standard for assessment of energy expenditure is indirect calorimetry (IC). Although recommended by ESPEN and ASPEN, we do not currently have access to this equipment at WHAT. This requires accurate measurements of oxygen consumption and carbon dioxide production from respiratory gases which are used in the abbreviated Weirs formula:

$$EE\ kcal/day = 3.941 \times VO2\ (L/min) + 1.11 \times VCO2\ (L/min) \times 1440$$

Due to its ease of acquisition the use of VCo_2 alone (with a standardised respiratory quotient – 0.86) measured by the ventilator has been evaluated as an alternative measure of EE and found to show better correlation with IC than predictive equations [11], given by the simplified formula:

$$REE = VCO_2 \times 8.19$$

Predictive equations such as the Harris-Benedict equation or the ESPEN guideline [12] of 25kcal/kg/day, are notoriously inaccurate for individual critically ill patients. These predictive equations are associated with significant inaccuracies in up to 90% of patients, with differences up to 43% below and 66% above indirect calorimetry values [13]. Zusman et al [14] performed a large retrospective cohort study where 60-day mortality was evaluated against energy and protein delivery measured using indirect calorimetry. They found delivery of 70% measured REE was associated with the lowest mortality. Energy delivery under or over this was associated with an increased mortality (see fig 1). There was a linear association with protein delivery (target 1.3g/kg/d), with a 1% decrease in mortality for each gram of protein delivered per day.

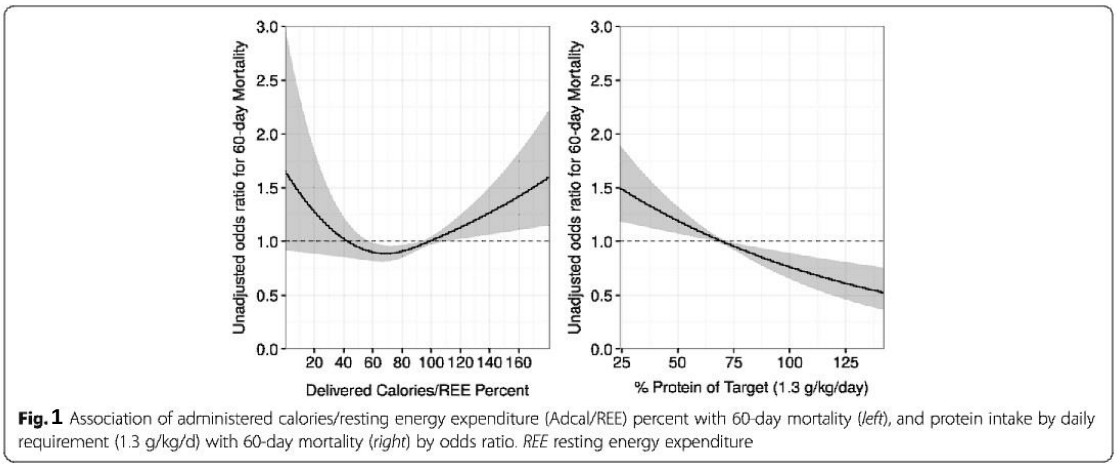


Fig. 1 Association of administered calories/resting energy expenditure (Adcal/REE) percent with 60-day mortality (*left*), and protein intake by daily requirement (1.3 g/kg/d) with 60-day mortality (*right*) by odds ratio. *REE* resting energy expenditure

Figure adapted from Zusman et al 2016 demonstrating a reduced odds of death when 70% of IC measured calories are delivered, and increased odds of death when delivered calories are above or below this. Also note reduced odds of death with each gram of protein delivered up to ~1.65g/kg/d

3.2 Protein

A protein target of 1.3g/kg/day should be progressively delivered (target achieved by 72-96 hrs post admission).

In the critical care setting, protein appears to be the most important macronutrient for healing wounds, supporting immune function, and maintaining lean body mass. Despite this, authors repeatedly find sub-optimal protein delivery in ICU, with only 0.6g/kg/day protein being delivered on average [15]. A recent audit (2023) on nutritional delivery at WAHT found that from 72 hours post admission, average protein delivery was 0.83g/kg/day.

Critical illness is associated with marked proteolysis and muscle loss (up to 1kg per day), which is associated with ICU acquired weakness [8]. For most critically ill patients, protein requirements are proportionately higher than energy requirements, and thus are not easily met by provision of routine enteral formulations (which have a high non-protein calorie to nitrogen ratio). Thus, protein supplementation may be required. The decision to add protein supplementation should be based on an ongoing assessment of adequacy of protein intake by the dietitian.

Although in some patient groups (trauma, burns etc.) higher protein doses may be required, when Heyland et al [16] compared ≥2.2g/kg/day to ≤1.2g/kg/day (actual protein received was 1.6g/kg/day vs 0.9g/kg/day) in this international, multicentre, registry based EFFORT Trial, there was no difference in the primary outcome of time to ICU discharge, or the secondary outcome of 60-day mortality. The study did, however, suggest that those with AKI and/or high SOFA scores on admission may be harmed by higher dose protein administration.

Serum protein markers (albumin, prealbumin, transferrin, CRP) are not validated for determining adequacy of protein provision and should not be used in the critical care setting in this manner [17].

4.0 Implementing a nutritional plan

4.1 What route of feeding should we use?

Factors to consider when making the decision about when and by which route(s) to start feeding:

- What is the reason for admission?
- What is the patient's nutritional status?
- Has the patient got a functioning gut?
- Have they had surgery? Does this surgery involve the gastro-intestinal tract?
- What are the possible routes of commencing nutrition?

Nutrition can be given by the following routes:

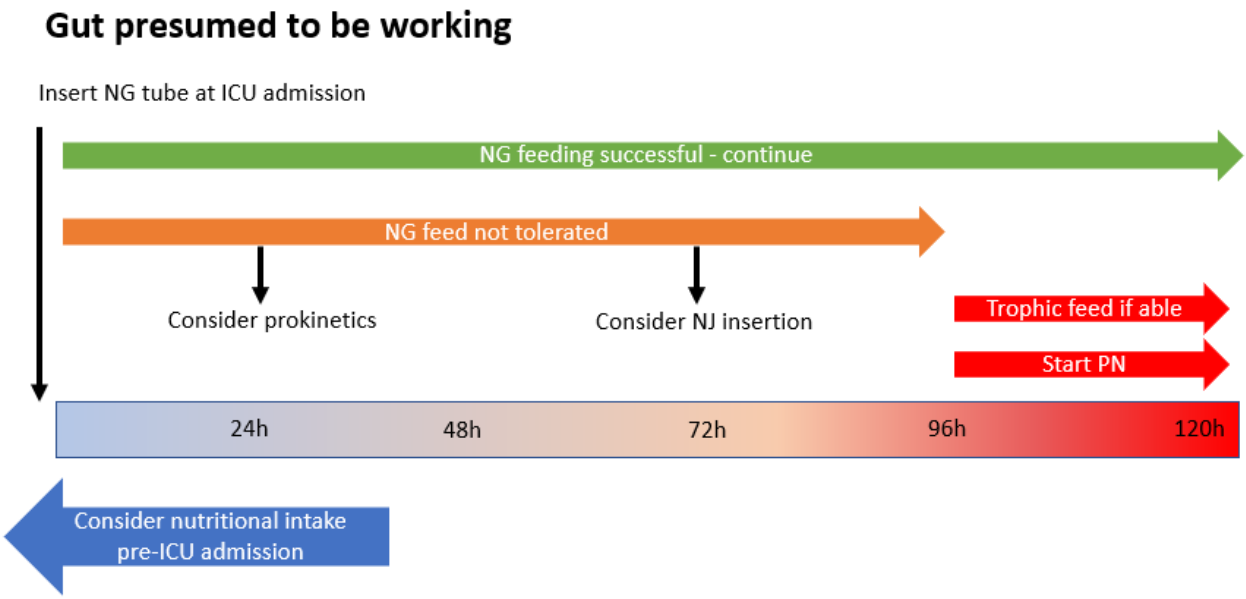
- Oral
- Nasogastric tube (NGT)
- Orogastric tube (OGT)
- Nasojejunal tube (NJT)
- Gastrostomy tube
  - Percutaneous Endoscopic Gastrostomy (PEG) tube
  - Radiologically Inserted Gastrostomy (RIG) tube
- Gastrostomy with jejunal extension
- Jejunostomy tube
- Parenteral Nutrition (PN)

Relative contraindications for enteral feeding

- Upper GI anastomotic leak/perforation
- Haemodynamically unstable patients (e.g. escalating dose of vasopressor, >0.5mcg/kg/min of noradrenaline, multiple vasopressors)
- Confirmed unresolved bowel ischaemia
- Intra-abdominal hypertension
- Emergency and elective open AAA repairs – guidance for starting feed from vascular surgeons.

Absolute contraindications for enteral feeding:

- Ileus
- Bowel obstruction
- Proximal gut fistulae
- Spinal cord injury (SCI) and spinal shock – refer to Sheffield Spinal Protocol



The presence or absence of bowel sounds, flatus, and/or stool does not preclude the initiation of enteral feeding. Enteral feeding may safely be introduced after both emergency and elective large bowel surgery early (and may reduce mortality, wound infections, pneumonia, anastomotic leakage, and length of hospital stay) but the views of the operating surgeon should be sought. Where a patient has not received adequate nutrition after 72 hours of attempting EN (this is defined as at least 60% of full feed rate), PN should be considered. After a maximum of 5 days of failed attempts to establish EN, PN should be given to supplement nutritional needs.

There is ongoing research into how best to feed patients who are critically unwell. Studies so far have shown a preference for EN as a first line route of nutrition as this helps to maintain the physiological function of the gut and is associated with a reduction in infectious complications and a shorter hospital stay[8]. In patients where EN is contraindicated or not tolerated, PN can be used. Some patients may need combination feeding with supplementary PN or trophic EN.

Feeding route and a nutritional plan should be documented in the patient's medical records stating whether the patient is nil by mouth, can eat and drink, or is receiving artificial nutrition.

4.2 Oral nutrition

If a patient is able to tolerate oral nutrition and this is documented in the medical notes, please keep a food chart. It is likely that even if a patient eats full meals that their nutritional intake will be insufficient for their nutritional needs. The hospital menu provides 1500kcal and 50-60g protein per day on average. Therefore, all patients who are able to eat and drink should be prescribed Fortisip Compact Protein BD, providing an additional 600kcal and 36g of protein per day.
Please follow the guidance for patients who are able to eat and drink in the critical care nutrition pathway.

4.3 Nasogastric tubes for enteral feeding

If the decision is made to enterally feed a level 3 patient an Enfit compliant NGT is usually used, unless advised otherwise by the patient's parent team. A size 12Fr 92cm feeding tube is recommended as standard. This is wide enough to minimise blockages and allow for successful aspiration for monitoring of gastric residual volumes.
Nasogastric tubes should be inserted and checked in accordance with the NPSA (2011) and Trust guidance (see separate protocol WAHT-NUR-065).

4.4 What do we need to feed patients?

The starter feed protocol should be commenced when the ICU team are happy to commence enteral feeding (see the adult critical care nutrition pathway) and a referral made to the dietitian via ICE. However, it is important to note there may be clinical situations where it would be preferable to begin the enteral feed at a slower rate. Please liaise with the patient's parent team for advice.

All patients requiring artificial feeding should be assessed by the dietitian to provide an individualised nutrition regime. Current working days are Monday-Friday.

A patient's nutritional requirements may change during their ICU stay as their clinical condition changes and they progress from the early acute phase to the late acute phase, then towards the rehabilitation or chronic phase. Due to this, a patient will initially be hypocalorically fed energy whilst aiming to reach protein targets by day 4 of ICU admission. Full energy requirements will not be reached until day 3-7 [8]. Requirements for both energy and protein are likely to further increase once the patient enters the rehabilitation/chronic phase. This will be reviewed by the dietitian and advice provided.

4.5 Refeeding Syndrome

Refeeding syndrome is defined as the potentially fatal shifts in fluid and electrolytes - particularly potassium, magnesium and phosphate - that may occur in malnourished patients undergoing refeeding, whether by the oral, enteral, or parenteral route. If a patient is identified as being at high risk of refeeding syndrome it is advisable to start their nutritional intake low and to build up gradually. The current enteral feeding guidelines have a safety net in place to limit the amount of feed provided to patients <50kg, or those at high risk of refeeding syndrome. This therefore mitigates the risk of inducing refeeding syndrome. However, a drop in serum phosphate >0.16mmol/L or an absolute value <0.65mmol/L after commencing enteral feed (or IV dextrose) should trigger a high degree of suspicion for refeeding syndrome. In such cases, enteral feeding rate should be halved, electrolytes (particularly phosphate, magnesium and potassium) should be corrected, and the critical care dietician should be informed.

Patients at high risk include those with significant recent weight loss, prolonged poor oral intake, low BMI, alcohol dependency, cancer, and anorexia nervosa. Those at risk of refeeding syndrome should be prescribed a 10-day course of IV pabrinex. In the event of limited availability of pabrinex, a course of forceval (one capsule/day) and thiamine (100mg BD) should be prescribed. Please seek support from the critical care dietitian and pharmacist.

4.6 Vitamin D

Vitamin D can be supplemented in patients with measured severely low plasma levels (25-hydroxy-vitamin D <30 nmol/L).

Discuss dosing and replacement route with pharmacist.

InVitaD3 oral solution 50,000U once weekly for 6weeks is currently recommended.

At risk populations include those with inflammatory bowel disease, obesity, bariatric surgery, chronic liver disease, pancreatic insufficiency, chronic intestinal failure, pregnant women, and older adults.

Low vitamin D levels are common in the ICU with a prevalence of up to 70% [18, 19]. They are associated with increased length of stay, susceptibility to sepsis, and increased mortality in patients with sepsis. Vitamin D levels of <30nmol/L increase the risk for osteomalacia and nutritional rickets dramatically and are therefore used to diagnose severe vitamin D deficiency [20].

After the phase 2 VITdAL-ICU [21] study suggested a reduced 28 day mortality could be achieved by treating those with severe vitamin D deficiency, a meta-analysis of 716 patients from 7 studies showed a reduction in mortality (31.6% vs 40.1%, OR 0.7, p=.04, NNT 12) with supplementation of vitamin D, and no adverse events with doses ranging from 200,000IU to 600,000IU [22]. Supplementation of low vitamin D levels was hence recommended by ESPEN in 2019. The subsequent phase 3 VIOLET study involving 1078 patients was stopped after the first interim analysis on the grounds of futility [23]. Despite the treatment group increasing mean vitamin D levels from 28+-12nmol/L to 117+-58nmol/L (day 3) with a single dose of 540,000IU of vitamin D, there was no difference in the primary end point (90-day mortality) or secondary end points (ventilator free days, hospital length of stay, hospital mortality, change in quality of life (EQ-5D), or organ failure). A health technology assessment using an individual patient data meta-analysis including >11,000 patients has, however, demonstrated prevention of respiratory infections with daily or weekly supplementation of vitamin D in those with severe deficiency [24]. A further study, VITDALIZE, is currently underway to evaluate the replacement of vitamin D (540,000IU loading dose + 4000IU/day) on 28-day mortality in critically ill patients [25].

4.7 Trace elements (Copper, Selenium, Zinc)

Trace elements should be measured in those on renal replacement therapy for >2weeks or otherwise deemed to be high risk of deficiency (i.e. alcoholism, severe malnutrition).

Forceval capsules (1 capsule/day) *(containing vitamins A, B complex, C, D2, E, trace elements (zinc, copper, selenium), molybdenum, chromium, manganese, iodine, phosphorus, calcium, iron and potassium)* and thiamine (200mg/day) should be prescribed in those deficient or deemed to be at high risk of deficiency.

4.7.1 Copper

Copper should be measured in high-risk groups and replaced in values <8µmol/L (or <12µmol/L and a CRP >20mg/L - 98% of circulating copper is bound to ceruloplasmin, an acute phase reactant, so plasma levels should be determined with CRP).

Copper enzymes regulate energy production, iron metabolism, connective tissue maturation, neurotransmission, and the activation and deactivation of different peptide hormones. In addition, copper is essential for cholesterol, thyroid hormone and glucose metabolism, aspects of immune function, and blood pressure control.

Copper depletion is observed in acute conditions such as major burns, post gastric and bariatric surgery, and in patients requiring continuous renal replacement therapy (RRT), or in prolonged PN or EN without adequate copper levels.

Symptoms of copper depletion are rare and include cardiac arrhythmias, myeloneuropathy, delayed wound healing, microcytic anaemia, neutropenia, osteoporosis, and hair depigmentation.

4.7.2 Selenium

A plasma selenium concentration of <0.75µmol/L should trigger supplementation.

Selenium is an essential element of selenoproteins, whose biochemical functions include antioxidant and redox activity, control of thyroid hormone metabolism, and may have a role in protecting vascular endothelium. Selenium deficiency can result in cardiomyopathy, osteochondropathy, and myopathy. Deficiency is also associated with increased incidence and virulence of viral infections and can have adverse effects on metabolism and tissue function.

Patients receiving renal replacement therapy and those suffering major trauma or burns are at risk of high loses of selenium and therefore becoming deficient.

Selenium is a negative acute phase reactant, and levels should be measured along with CRP. CRP concentrations of 10-40, 41-80, and >80mg/L are expected to produce falls in plasma selenium of 15-25%, ~35%, and ~50% respectively.

4.7.3 Zinc

Zinc is required for >300 metalloenzymes playing essential roles in virtually all metabolic pathways. Examples include carbonic anhydrase, alkaline phosphatase, RNA and DNA polymerases, and alcohol dehydrogenase. It is also required for wound healing and several aspects of the antioxidant defence system, and acts as a signalling mediator in endocrine, paracrine, and autocrine systems.

Features of zinc deficiency include alopecia, skin rash of face, groin, hands, and feet, growth retardation, delayed sexual development and bone maturation, impaired wound healing and immune function, diarrhoea, and blunting of taste and smell.

Those at risk of zinc deficiency include those with burns, trauma, sepsis, renal disease, prolonged renal replacement therapy, alcoholism, bariatric surgery, chronic pancreatitis, inflammatory bowel disease, and those with diabetes mellitus.

Zinc is a negative acute phase reactant, and levels should be measured in conjunction with CRP [26].

5.0 Monitoring and management of enteral feeding

5.1 Gastric residual volumes (GRVs/aspirates)

Patients receiving NG feed should have their GRVs checked every 6 hours. There are limitations to measuring the GRV as the volume obtained is dependent on the size of the enteral feeding tube, the patient's position, and the distal position of the feeding tube [27]. A GRV of 500ml has been shown not to increase the risk of aspiration and accounts for the stomach's intrinsic secretions [28].

The measurement of GRV for the assessment of gastrointestinal dysfunction may help to identify intolerance to EN. The use of prokinetics should be considered when GRV >250ml/6-hourly, although enteral feeding should not be delayed unless GRV >500ml/6-hourly or there are other signs of intolerance. Rather than withholding EN, the use of post-pyloric feeding should be considered if large GRV (>500ml) persists after 48 hours of prokinetic agents, unless an abdominal complication (obstruction, perforation, severe distention) is suspected.

5.2 Feed intolerance

If a patient is not tolerating the feed, evidenced by large or increasing GRVs/nausea/regurgitation of feed or vomiting, consider:

- Has anything changed clinically?
- Is the gut working?
    - Review if the patient has been opening their bowels/has an active stoma.
    - Could the patient have an ileus or bowel obstruction?
- Is the patient receiving sedatives, opioids, paralysing agents or inotropes/vasopressors? These will decrease gut motility – could any of these be reduced or stopped?
- Consider prokinetics if not already done.
- Check the position of the feeding tube.
- Is the patient supine? Could they be repositioned to 30-45°?
- Consider changing to wide bore NGT if the patient has a fine bore NGT in situ.
- If the patient has abdominal distention consider:
    - Is this a possible ileus? - If so, stop the enteral feed.
    - Is the patient constipated? - Treat if possible.

5.3 Prokinetics

In patients with intolerance to gastric feeding a combination of erythromycin (250mg PO TDS) and metoclopramide (10mg IV TDS) should be used for up to 72 hours. After this time, efficacy drops to a third and discontinuation is recommended. If there are concerns regarding side effects of combination therapy (i.e. ↑QTc) then single agent therapy with erythromycin is recommended.

Note: Both agents are associated with QT prolongation and a predisposition to cardiac arrhythmias, although large series have shown this risk to be low.

If two GRVs > 500ml IV erythromycin can be considered as an alternative to oral.

5.4 Nutritional monitoring

There is currently no suitable biomarker that is validated for use as a nutritional marker in critically ill patients. Serum protein markers (albumin, prealbumin, transferrin, CRP) are not validated for determining adequacy of protein provision and should not be used in the critical care setting in this manner [17].

6.0 Guidance for enteral feeding whilst proned

Patients can continue to be enterally fed whilst proned at the discretion of the critical care consultant.

1. Ideally stop NG/OG feed 1 hour prior to proning the patient.
    a. Ensure insulin infusion is adjusted appropriately.
    b. Aspirate tube and discard stomach contents directly before proning.
2. Once proned, recheck position of feeding tube and recommence feed at prescribed rate or as per feed starter protocol.
3. Check aspirates (GRVs) **4 hourly**.
    a. If less than **300mls**, replace and continue feed as prescribed.
    b. If GRVs are greater than 300mls or the patient vomits, reduce feed rate to 10ml/hour and initiate prokinetics.
4. Stop feed ideally 1 hour before deproning.
    a. Ensure insulin infusion is adjusted appropriately.
    b. Aspirate tube and discard stomach contents directly before deproning.
5. Once deproned, recheck position of feeding tube and recommence feed at prescribed rate or as per starter protocol.
6. Have a low threshold to consider prokinetics if there are any signs of delayed gastric emptying.
7. If high GRVs persist for more than 48-72hours, please consider alternative feeding options (e.g. NJ feeding or PN).

Based on Best Practice Guidance from BDA Critical Care Specialist Group, 2020.

7.0 Feed checklist

- Has the decision been made to start enteral feeding and has this been documented in the medical notes?
- Have contraindications been considered?
- Should feed be introduced more slowly than the starter feeding regimen?
- *NB: All Nutricia feeds are gluten and lactose free and are therefore suitable for patients with coeliac disease and/or lactose intolerance*
- *Nutrison Protein Plus is also wheat free and egg free – it is suitable for people following a kosher or halal diet. It does contain fish products and milk products. It is not suitable for vegetarians as it contains fish oils.*
- *Nutrison Soya is gluten free, wheat free and egg free. It is also free from fish products and milk products. It is suitable for people following a vegetarian diet. It is not suitable for people following a vegan diet as it contains vitamin D prepared from*

the wool of healthy living sheep. At present, there is not a vegan enteral feed available on the UK market.

8.0 Monitoring and management of parenteral nutrition

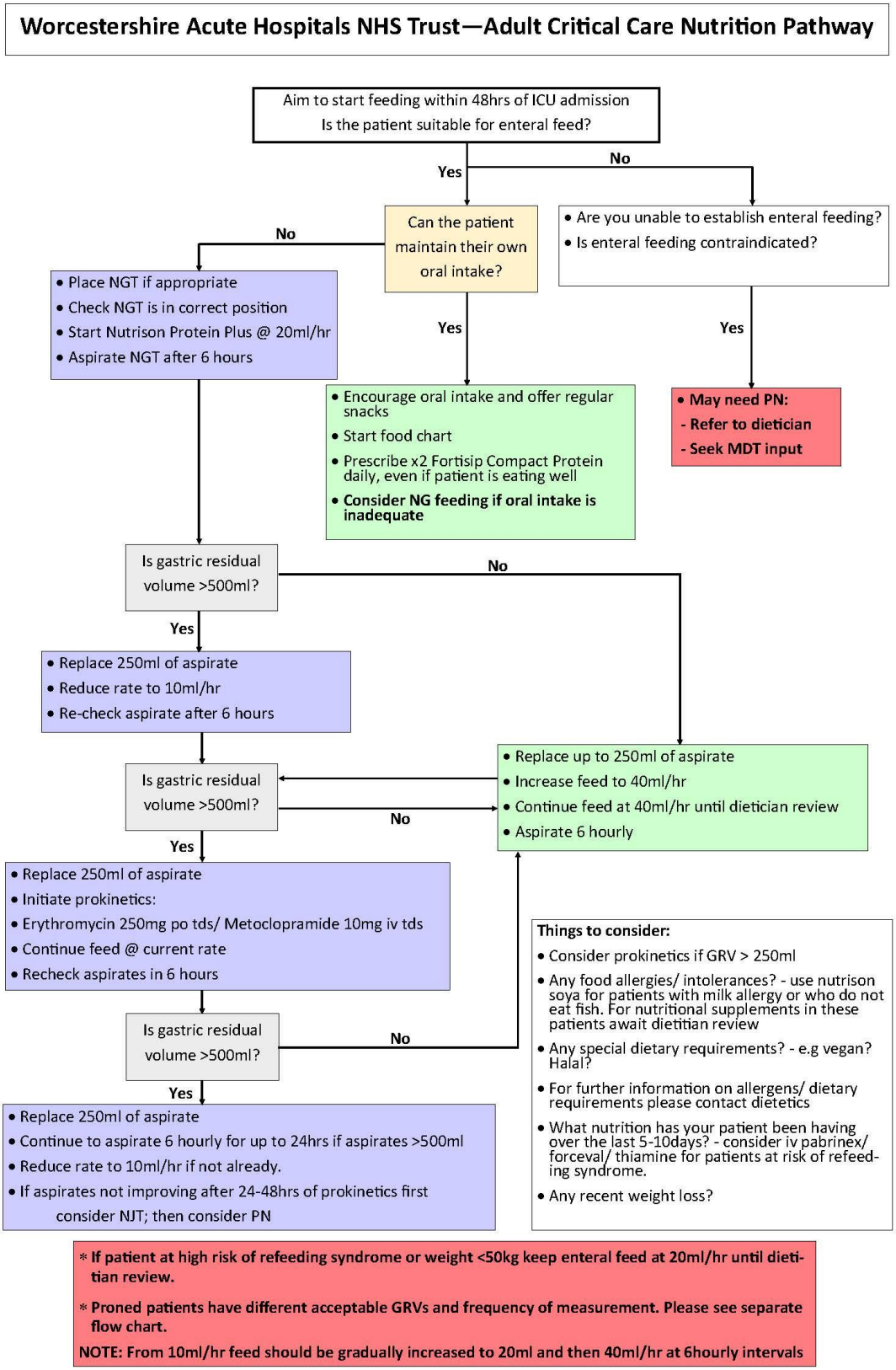
All other routes of nutrition should be considered and/or trialled prior to requesting PN. If PN is requested by the medical/surgical team, the indication should be clearly documented. Low albumin is not in itself an indication for PN. PN is never an emergency treatment and therefore if it requested on a weekend the patient will be assessed by the dietitian and pharmacist on their next working day.

The trust PN policy (WAHT-NUT-007) should be used for administering PN to critically ill patients, but a few points are reiterated here:

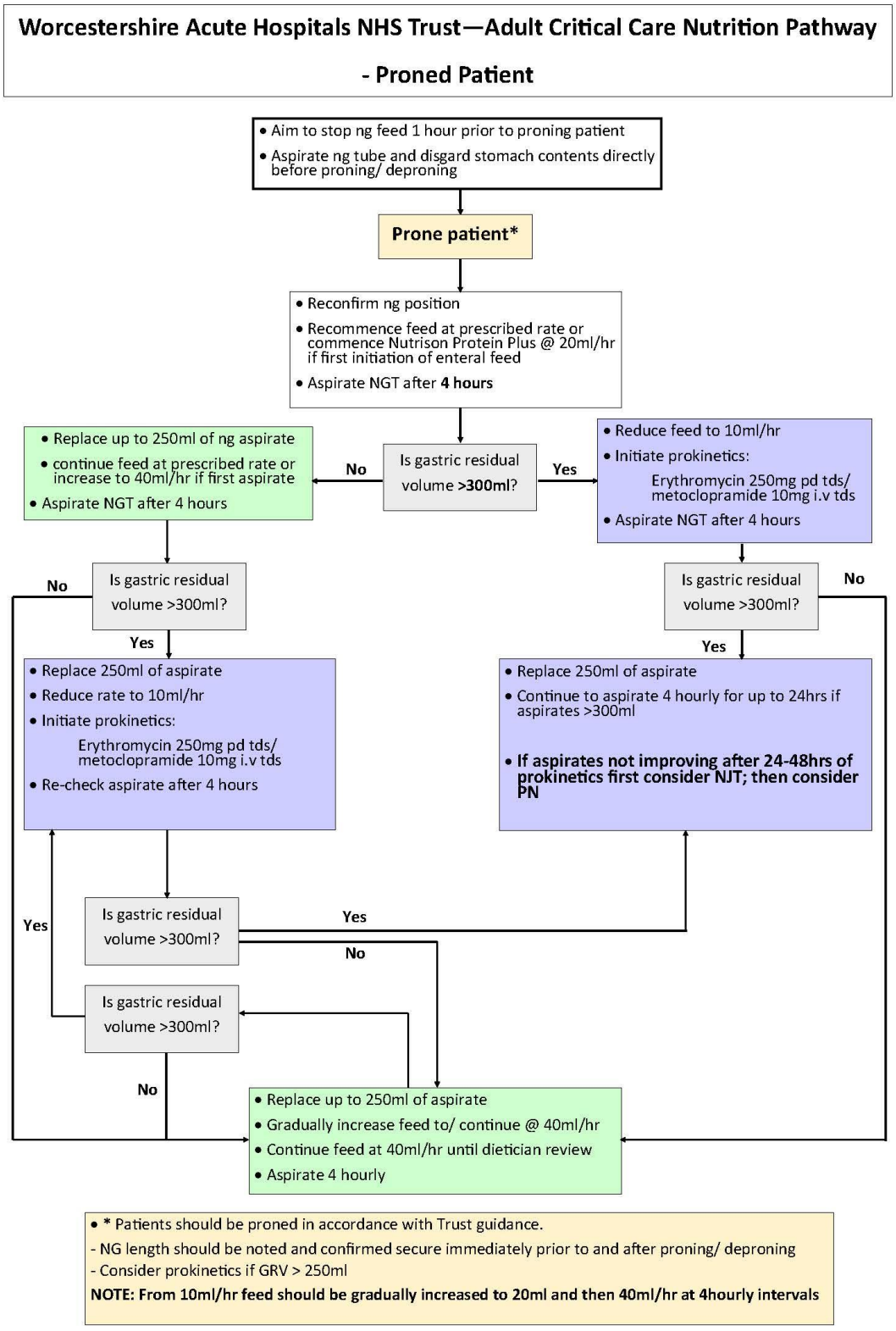
- Each patient who is referred for PN will be assessed by at least 1 member of the nutrition team (Nutrition consultant, Dietitian, Pharmacist, Nutrition nurse) who will arrange for a suitable prescription if it is felt to be indicated.
- All PN should contain multivitamins and trace elements and meet the assessed nutritional requirements of the patient.
- PN should be administered via either a single lumen tunnelled central venous line inserted for the purpose of administering PN (preferable) or via a dedicated, unused port on a multi-lumen central line inserted within the previous 24 hours.
- Lines inserted for PN should be placed in an aseptic manner to reduce catheter related blood stream infections.
- No other drug/fluid administration, or blood sampling, should occur through the dedicated PN line/port.

9.0 Appendix

9.1 WAHT Feeding flowchart



9.2 WAHT Proned feeding flowchart



9.3 Prokinetics

Summary of studies investigating prokinetic effect on gastric emptying

Erythromycin

Study	Design	Population	Intervention	Results
Chapman et al (2000) (ESPEN, ASPEN)[29]	Double blind Placebo Randomised controlled trial	20 ventilated ICU patients	Single dose 200mg erythromycin IV vs placebo	Gastric emptying measured 6-hourly with erythromycin was 139ml +/- 37 compared to -2ml +/- 46 with placebo
Berne et al (2002) (ESPEN, ASPEN)[30]	Double blind Placebo Randomised controlled trial	68 trauma ICU patients with NG feed within 72 hours of admission	250mg erythromycin IV 6-hourly vs placebo	In the erythromycin group, 56% had 4-hourly gastric residual volumes <150mls in the following 48 hours compared to 39% in the placebo group Feeding tolerated at 48 hours was 58% of target volume with erythromycin compared to 44% with placebo
Reigner et al (2002) (ESPEN, ASPEN)[31]	Double blind Placebo Randomised controlled trial	40 ICU patients requiring mechanical ventilation and NG feed	250mg erythromycin IV 6-hourly vs placebo	Gastric residual volume significantly reduced with erythromycin compared to placebo Neither group showed episodes of GRV >250mls

Metoclopramide

Study	Design	Population	Intervention	Results
Nursal (2007) (ESPEN, ASPEN)[32]	Double blind Randomised controlled trial	19 patients with traumatic brain injury. NG feed commenced within 48 hours of trauma	10mg metoclopramide IV 8-hourly vs saline TDS for 5 days	No difference between groups in gastric emptying, time to nutritional targets, intolerance to feeding, nutritional complication, or clinical outcomes
Yavagal (2000) (ESPEN, ASPEN)[33]	Placebo Randomised controlled trial	305 ICU patients with NG feeding commenced for >24 hours	10mg metoclopramide IV 8-hourly vs placebo	Development of nosocomial pneumonia while mechanically ventilated was 25.6% in metoclopramide group vs 29.3% in placebo group Metoclopramide delayed development of pneumonia but did not decrease frequency or mortality
Nassaji (2010) (ESPEN)[34]	Double blind Randomised controlled trial	220 ICU patients requiring NG feeding for >24 hours	10mg metoclopramide PO 8-hourly vs placebo	Nosocomial pneumonia developed in 33.8% of those in the metoclopramide group and 33.6% in the placebo group

Erythromycin vs metoclopramide

Study	Design	Population	Intervention	Results
Maclaren (2008) (ASPEN)[35]	Unblind Randomised trial	20 critically ill patients	Total 4 doses of: 250mg erythromycin IV 6-hourly OR 10mg metoclopramide IV 6-hourly	Gastric emptying defined by peak plasma concentration (Cmax) of acetaminophen and GRV Only erythromycin increased gastric emptying (Cmax 9.5 +/- 6.1mg/L to 17.7 +/- 11.9mg/L_ Erythromycin and metoclopramide both reduced GRV (122 +/- 48ml to 36 +/- 48ml and 103 +/- 88ml respectively) and allowed increased feeding rates

Erythromycin and metoclopramide

Study	Design	Population	Intervention	Results
Nguyen (2007) (ASPEN)[36]	Double blind Randomised controlled trial	75 mechanically ventilated patients	200mg erythromycin IV BD vs 200mg erythromycin IV BD + 10mg metoclopramide IV 6-hourly	Treatment with both erythromycin and metoclopramide had lower gastric residual volumes (136ml +/- 23), compared to erythromycin alone (293ml +/- 45) No difference between groups in length of hospital stay or mortality rates Watery diarrhoea was more common in combination therapy but was not associated with enteric infection

9.4 NUTRIC Nutritional Risk

Nutritional Risk in Critically Ill (NUTRIC) (2011, 2015)

A prospective, observational study of 597 patients in ICU expected to be admitted for >24 hours assessed factors that could be used to identify critically ill patients more likely to benefit from aggressive nutritional therapy. From this study, the Nutrition Risk in the Critically Ill (NUTRIC) score *(see below)* was developed to be applied specifically to the intensive care setting.

Critical Care Nutrition
www.criticalcarenutrition.com

NUTRIC Score[1]

The NUTRIC Score is designed to quantify the risk of critically ill patients developing adverse events that may be modified by aggressive nutrition therapy. The score, of 1-10, is based on 6 variables that are explained below in Table 1. The scoring system is shown in Tables 2 and 3.

Table 1: NUTRIC Score variables

Variable	Range	Points
Age	<50	0
	50 - <75	1
	≥75	2
APACHE II	<15	0
	15 - <20	1
	20-28	2
	≥28	3
SOFA	<6	0
	6 - <10	1
	≥10	2
Number of Co-morbidities	0-1	0
	≥2	1
Days from hospital to ICU admission	0 - <1	0
	≥1	1
IL-6	0 - <400	0
	≥ 400	1

Table 2: NUTRIC Score scoring system: if IL-6 available

Sum of points	Category	Explanation
6-10	High Score	➢ Associated with worse clinical outcomes (mortality, ventilation). ➢ These patients are the most likely to benefit from aggressive nutrition therapy.
0-5	Low Score	➢ These patients have a low malnutrition risk.

Table 3. NUTRIC Score scoring system: If no IL-6 available*

Sum of points	Category	Explanation
5-9	High Score	➢ Associated with worse clinical outcomes (mortality, ventilation). ➢ These patients are the most likely to benefit from aggressive nutrition therapy.
0-4	Low Score	➢ These patients have a low malnutrition risk.

*It is acceptable to not include IL-6 data when it is not routinely available; it was shown to contribute very little to the overall prediction of the NUTRIC score.[2]

[1] Heyland DK, Dhaliwal R, Jiang X, Day AG. Identifying critically ill patients who benefit the most from nutrition therapy: the development and initial validation of a novel risk assessment tool. Critical Care. 2011;15(6):R268.
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December 16th 2015

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Monitoring

Page/ Section of Key Document	Key control:	Checks to be carried out to confirm compliance with the Policy:	How often the check will be carried out:	Responsible for carrying out the check:	Results of check reported to: *(Responsible for also ensuring actions are developed to address any areas of non-compliance)*	Frequency of reporting:
	WHAT?	**HOW?**	**WHEN?**	**WHO?**	**WHERE?**	**WHEN?**
	Nutritional delivery on ICU	Audit/ ICCA prescribed/ delivered data	Once per year	Dieticians/ Clinicians	ICU Forum	Once per year

References

[You should include external source documents and other Trust documents that are related to this Policy]

Contribution List

Contribution List

This key document has been circulated to the following individuals for consultation;

Name	Designation
Dr Philip Pemberton	ICU Consultant
Hayley Ryan	Critical Care Dietician
Keith Hinton	Lead Pharmacist, Critical Care, Theatres & Surgery
Dr Niamh McConachie-Smith	FY1 Doctor

This key document has been circulated to the chair(s) of the following committee's / groups for comments;

Committee
ICM Forum
Medicines Safety Committee

Supporting Document 1 - Equality Impact Assessment Tool

. To be completed by the key document author and included as an appendix to key document when submitted to the appropriate committee for consideration and approval.

Please complete assessment form on next page;

Herefordshire & Worcestershire STP - Equality Impact Assessment (EIA) Form
Please read EIA guidelines when completing this form

Section 1 - Name of Organisation (please tick)

Herefordshire & Worcestershire STP		Herefordshire Council		Herefordshire CCG	
Worcestershire Acute Hospitals NHS Trust	x	Worcestershire County Council		Worcestershire CCGs	
Worcestershire Health and Care NHS Trust		Wye Valley NHS Trust		Other (please state)	

Name of Lead for Activity	**Dr Philip Pemberton/ Hayley Ryan**

Details of individuals completing this assessment	**Name**	**Job title**	**e-mail contact**
	Dr Philip Pemberton	Consultant in Anaesthetics & Critical Care	phil.pemberton@nhs.net
	Dr Niamh McConachie-Smith	FY1 Doctor	niamh.mcconachie-smith1@nhs.net
Date assessment completed	08/10/2024		

Section 2

Activity being assessed (e.g. policy/procedure, document, service redesign, policy, strategy etc.)	**Title:** Critical Care Unit Nutrition Guidelines			
What is the aim, purpose and/or intended outcomes of this Activity?	Establishing and updating the guideline for assessment, initiation, and monitoring of nutrition and feeding of patients in critical and intensive care units across Worcestershire Acute Hospitals Trust. Constructing a general feeding flowchart and feeding flowchart for the proned patient in critical and intensive care.			
Who will be affected by the development & implementation of this activity?	❑ ☒ ❑ ❑	Service User Patient Carers Visitors	☒ ❑ ❑ ❑	Staff Communities Other _____
Is this:	☒Review of an existing activity			

	☒New activity ❑ Planning to withdraw or reduce a service, activity or presence?
What information and evidence have you reviewed to help inform this assessment? (Please name sources, eg demographic information for patients / services / staff groups affected, complaints etc.	Reviewed national & international guideline and other research papers detailing assessment, risk scoring systems, and management of nutritional needs in critically ill patients.
Summary of engagement or consultation undertaken (e.g. who and how have you engaged with, or why do you believe this is not required)	Guideline reviewed by Critical Care MDT at monthly forum. No engagement/consultation required with patients/carers. This activity is designed to put in place procedures which are not in existence or fully implemented at present.
Summary of relevant findings	N/A

Section 3

Please consider the potential impact of this activity (during development & implementation) on each of the equality groups outlined below. **Please tick one or more impact box below for each Equality Group and explain your rationale**. Please note it is possible for the potential impact to be both positive and negative within the same equality group and this should be recorded. Remember to consider the impact on e.g. staff, public, patients, carers etc. in these equality groups.

Equality Group	Potential positive impact	Potential neutral impact	Potential negative impact	Please explain your reasons for any potential positive, neutral or negative impact identified
Age	X	X		The implementation of the actions advised in the guideline will ensure that there will be appropriate assessment, initiation, and monitoring of nutrition and feeding for patients across all equality groups. Individualised nutrition assessments will be performed by dieticians accounting for all equality groups and their specific needs. Age is included in assessment with the NUTRIC score to identify those at risk of adverse effects with aggressive nutrition therapy. Staff: Implementing new guidance and assessment will have neutral impact on staff through altering of day-to-day procedures.
Disability	X	X		The implementation of the actions advised in the guideline will ensure that there will be appropriate assessment, initiation, and monitoring of nutrition and feeding for patients across all equality groups. Individualised nutrition assessments will be performed by dieticians accounting for all equality groups and their specific needs. Individualised assessments allow for

Equality Group	Potential positive impact	Potential neutral impact	Potential negative impact	Please explain your reasons for any potential positive, neutral or negative impact identified
				consideration of disabilities in communication, understanding, or other needs of the patient. Staff: Implementing new guidance and assessment will have neutral impact on staff through altering of day-to-day procedures.
Gender Reassignment	X	X		The implementation of the actions advised in the guideline will ensure that there will be appropriate assessment, initiation, and monitoring of nutrition and feeding for patients across all equality groups. This data will not be used in, nor influence, the implementation of this guidance. Staff: Implementing new guidance and assessment will have neutral impact on staff through altering of day-to-day procedures.
Marriage & Civil Partnerships	X	X		The implementation of the actions advised in the guideline will ensure that there will be appropriate assessment, initiation, and monitoring of nutrition and feeding for patients across all equality groups. This data will not be used in, nor influence, the implementation of this guidance. Staff: Implementing new guidance and assessment will have neutral impact on staff through altering of day-to-day procedures.
Pregnancy & Maternity	X	X		The implementation of the actions advised in the guideline will ensure that there will be appropriate assessment, initiation, and monitoring of nutrition and feeding for patients across all equality groups. This data will not be used in, nor influence, the implementation of this guidance. Individualised nutrition assessments will be performed by dieticians accounting for all equality groups and their specific needs. For example, considering groups and individuals at risk for specific deficiencies that may need additional supplementation, multi-vitamins etc. Staff: Implementing new guidance and assessment will have neutral impact on staff through altering of day-to-day procedures.

Equality Group	Potential positive impact	Potential neutral impact	Potential negative impact	Please explain your reasons for any potential positive, neutral or negative impact identified
Race including Traveling Communities	X	X		The implementation of the actions advised in the guideline will ensure that there will be appropriate assessment, initiation, and monitoring of nutrition and feeding for patients across all equality groups. Individualised nutrition assessments will be performed by dieticians accounting for all equality groups and their specific needs. Staff: Implementing new guidance and assessment will have neutral impact on staff through altering of day-to-day procedures.
Religion & Belief	X	X		The implementation of the actions advised in the guideline will ensure that there will be appropriate assessment, initiation, and monitoring of nutrition and feeding for patients across all equality groups. This guidance considers alternative nutrition sources that address personal dietary choices, intolerance & allergy, and religious beliefs surrounding food. Staff: Implementing new guidance and assessment will have neutral impact on staff through altering of day-to-day procedures.
Sex	X	X		The implementation of the actions advised in the guideline will ensure that there will be appropriate assessment, initiation, and monitoring of nutrition and feeding for patients across all equality groups. This data will not be used in, nor influence, the implementation of this guidance. Staff: Implementing new guidance and assessment will have neutral impact on staff through altering of day-to-day procedures.
Sexual Orientation	X	X		The implementation of the actions advised in the guideline will ensure that there will be appropriate assessment, initiation, and monitoring of nutrition and feeding for patients across all equality groups. This data will not be used in, nor influence, the implementation of this guidance.

Equality Group	Potential positive impact	Potential neutral impact	Potential negative impact	Please explain your reasons for any potential positive, neutral or negative impact identified
				Staff: Implementing new guidance and assessment will have neutral impact on staff through altering of day-to-day procedures.
Other Vulnerable and Disadvantaged Groups (e.g. carers; care leavers; homeless; Social/Economic deprivation, travelling communities etc.)	X	X		The implementation of the actions advised in the guideline will ensure that there will be appropriate assessment, initiation, and monitoring of nutrition and feeding for patients across all equality groups. Individualised nutrition assessments will be performed by dieticians accounting for all equality groups and their specific needs. Staff: Implementing new guidance and assessment will have neutral impact on staff through altering of day-to-day procedures.
Health Inequalities (any preventable, unfair & unjust differences in health status between groups, populations or individuals that arise from the unequal distribution of social, environmental & economic conditions within societies)	X	X		The implementation of the actions advised in the guideline will ensure that there will be appropriate assessment, initiation, and monitoring of nutrition and feeding for patients across all equality groups. Individualised nutrition assessments will be performed by dieticians accounting for all equality groups and their specific needs. For example, considering groups and individuals at risk for specific deficiencies that may need additional supplementation, multi-vitamins etc. Staff: Implementing new guidance and assessment will have neutral impact on staff through altering of day-to-day procedures.

Section 4

What actions will you take to mitigate any potential negative impacts?	Risk identified	Actions required to reduce / eliminate negative impact	Who will lead on the action?	Timeframe
	Implementation of adequate nutrition will not impact on any of the 9 protected characteristics	.		

How will you monitor these actions?				
When will you review this EIA? (e.g in a service redesign, this EIA should be revisited regularly throughout the design & implementation)	As part of the 3-yearly review of the nutrition guidelines			

Section 5 - Please read and agree to the following Equality Statement

1. Equality Statement

1.1. All public bodies have a statutory duty under the Equality Act 2010 to set out arrangements to assess and consult on how their policies and functions impact on the 9 protected characteristics: Age; Disability; Gender Reassignment; Marriage & Civil Partnership; Pregnancy & Maternity; Race; Religion & Belief; Sex; Sexual Orientation

1.2. Our Organisations will challenge discrimination, promote equality, respect human rights, and aims to design and implement services, policies and measures that meet the diverse needs of our service, and population, ensuring that none are placed at a disadvantage over others.

1.3. All staff are expected to deliver services and provide services and care in a manner which respects the individuality of service users, patients, carer's etc, and as such treat them and members of the workforce respectfully, paying due regard to the 9 protected characteristics.

Signature of person completing EIA	Dr N. McConachie-Smith
Date signed	08/10/2024
Comments:	
Signature of person the Leader Person for this activity	Dr P. Pemberton
Date signed	08/10/2024
Comments:	

Supporting Document 2 – Financial Impact Assessment

To be completed by the key document author and attached to key document when submitted to the appropriate committee for consideration and approval.

	Title of document:	Yes/No
1.	Does the implementation of this document require any additional Capital resources	No
2.	Does the implementation of this document require additional revenue	No
3.	Does the implementation of this document require additional manpower	No
4.	Does the implementation of this document release any manpower costs through a change in practice	No
5.	Are there additional staff training costs associated with implementing this document which cannot be delivered through current training programmes or allocated training times for staff	No
	Other comments:	

If the response to any of the above is yes, please complete a business case and which is signed by your Finance Manager and Directorate Manager for consideration by the Accountable Director before progressing to the relevant committee for approval.