Patients who are critically ill are at greater risk of malnutrition and nurses must be able to accurately assess their nutritional needs to help them recover.

**Giving nutrition support to critically ill adults**

**In this article...**
- How the body responds to physiological stress
- What to consider when conducting nutritional assessments
- When to refer to dietitians and nutrition support teams

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Patients who become critically ill can have problems maintaining nutritional intake and it can be challenging for nurses to provide nutritional support. No one assessment method can identify each patient’s risk of malnutrition, so nurses need to look at different aspects in their nutritional assessment and refer for specialist help from dietitians and nutrition support teams when needed. This article focuses on how severe physiological stress affects patients who are critically ill and impacts on their nutritional requirements. A nursing nutritional assessment is explored, as are nutritional support methods that may be used to manage these patients’ nutritional needs.

Nutrition is essential for health but is particularly important at times of critical illness when the body undergoes extreme physiological stress. In response to this stress, the basal metabolic rate rises and leads to an increase in energy and, in particular, protein requirements. As a result, patients who are critically ill are at high risk of developing malnutrition.

Assessing individual requirements in terms of energy, protein, vitamins and minerals, and fluid is essential to allow a plan of care to be made. Maximising oral intake and the use of artificial nutrition in the form of enteral or parenteral feeding is key to supporting patients who are critically ill, as is a multidisciplinary team approach. Dietitians and nutrition support teams provide important support for nurses and medical teams caring for these patients, so nurses need to be aware of when to refer to these specialties.

**Stress response**
The basal metabolic rate is the amount of energy a person needs to carry out normal physiological processes, such as breathing and cardiac function, while they are at rest, with no other demands on the body. During a period of simple starvation, the body is adept at conserving energy stores by reducing the basal metabolic rate. Glucose and fat stores are used for energy but protein stores (generally found in muscle and organs) are preserved as much as possible. The purpose of this is to keep normal physiological processes functioning for the entire period of starvation until nutritional intake is restored. During a period of physiological stress, however, the body’s response is very different.

Physiological stress occurs in response to infection, illness or injury, which may include surgery, burns or tissue damage from other means, for example, pressure ulcers or gunshot wounds. The body’s stress response involves a series of changes in hormone levels that alter metabolism and help the body mount a defence against the stress. Table 1 outlines the main metabolic effects of different hormonal changes. The overall effect of the stress response is that the metabolic rate rises, causing an increase in energy requirements at the same time.

These hormonal changes mean that, during critical illness, the patient is in a catabolic state, rapidly breaking down all the body’s stores of nutrients.
Insulin secretion, which normally helps with the storage of energy, is reduced, while that of hormones such as glucagon, which is responsible for the breaking down (catabolism) of body stores of energy, is increased. This is to ensure the body has a ready and immediate supply of glucose to provide energy, for example, to raise the body temperature and cause fever to fight infection. However, as insulin secretion is reduced at this time and glucose stores are mobilised, patients who are critically ill are at high risk of developing hyperglycaemia (Viana et al, 2014). In a patient who is critically ill, hyperglycaemia is a particular problem as it may lead to impaired wound healing, fluid and electrolyte imbalance, and impaired immune function.

Another very important aspect of the stress response is that protein stores are broken down in readiness for the body to convert these into more essential proteins, for example, to repair damaged tissue or to manufacture inflammatory mediators such as C-reactive protein. Protein is also particularly useful in that, once glucose stores are exhausted, the body can make more glucose from the amino acids that form protein, thereby providing a further source of energy. This protein degradation and the lack of protein synthesis are some of the reasons why muscle wastage is so visible in patients who are critically ill (Scheinfeld et al, 2010).

The immune response will also be active in the presence of infection and injury. Immune factors such as cytokines are released, some of which – for example, cachectin – cause anorexia and loss of appetite. This may impair the patient’s ability to take enough nutrition orally and increases their risk of malnutrition at a time of rising nutritional demands.

**Effects of malnutrition**

Malnutrition, or more specifically undernutrition, predisposes patients to:

- Poor wound healing;
- Muscle breakdown;
- Lack of movement and generalised weakness – leading to pressure ulcer development, respiratory tract infections and poor respiratory function;
- Poor immunity;
- Organ dysfunction (British Association of Parenteral and Enteral Nutrition, 2012).

If malnutrition is left uncorrected, patients who are malnourished ultimately will have worse outcomes and higher mortality rates than those who are better nourished (Lim et al, 2012).

Malnutrition from simple starvation is straightforward to correct by replenishing nutrients (Conce Morton and Fontaine, 2009), taking into account the refeeding syndrome (Box 1) and those who are at particular risk (Box 2). However, during periods of physiological stress, malnutrition is much more complicated due to the body’s changing response to infection and illness. As such, nutritional assessment of patients who are critically ill is essential to ensure a care plan is devised that will give the patient enough energy and protein to reduce the breakdown of stored protein in the muscles and organs, without inducing refeeding syndrome, where there is a risk of this.

**Nutrition assessment**

Detecting people who are at risk of malnutrition is most easily done through nutrition assessment and screening. However, the terms “nutrition screening” and “nutrition assessment” describe two distinct activities and should not be confused.

**Nutrition screening**

Nutrition screening is the use of a quick screening tool that identifies risk factors such as weight loss, current body mass index (BMI) and clinical conditions that may indicate whether a person is likely to develop malnutrition (Fletcher, 2009). One example of a nutrition screening tool is the malnutrition universal screening tool (MUST) (Todorovic et al, 2011).

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- Maintaining hydration in enteral tube feeding
- Bit.ly/NTEnteralHydration
It is important to note that nutrition screening tools alone have limited benefit in patients who are critically ill, partly due to the fact that they use weight changes to indicate risk, and weight changes can occur as a result of the hormonal changes in the body that take place at times of physiological stress. For example, looking at Table 1, it can be seen that an increase in anti-diuretic hormone leads to water retention. This might cause the patient to develop oedema, which may be compounded by the use of intravenous sodium chloride. Again, referring to Table 1, the increase in aldosterone causes sodium retention, which may lead to further water retention and oedema. As such, measurements might show increased weight, which could be a result of fluid gain when nutritional changes have actually caused weight loss.

If the patient does not appear to be losing weight, it could be that oedema is masking nutritional depletion. It is still important to continue nutrition screening as in line with national guidance (NICE, 2006) and take weight measurements to monitor fluid changes. Once oedema resolves, it is possible to identify nutritional weight.

**Nutrition assessment**

Nutritional assessment is a detailed investigation that might include consideration of the patient’s diet, medical history and biochemistry results; it is likely to be undertaken by a dietician or nutrition support team. Using a more comprehensive nursing nutritional assessment, as illustrated in Table 2, allows nurses to monitor a patient’s nutritional weight.

The information collected in nutrition screening before the patient becomes critically ill is important as it provides a baseline to inform this assessment. Hospital and GP records are also useful sources of information regarding previous weight and nutritional changes.

**Estimating nutrient requirements**

A full range of nutrients including vitamins and minerals need to be provided to all critically ill patients. However, when nutritional requirements are discussed, they tend to refer quite specifically to the amount of energy (calories/kcals) and protein a patient needs. Determining the nutritional requirements of patients is often difficult, so referral to a diettitian is essential.

Providing too few calories may predispose the patient to malnutrition, but a slow, controlled delivery of nutrition is required if the patient is at risk of refeeding syndrome. Overfeeding patients who are critically ill can be harmful, as excess calories may simply convert energy to fat, cause hyperglycaemia and exacerbate respiratory failure (Walker and Heuberger, 2009). Guidance from the European Society for Clinical Nutrition and Metabolism (Kreymann et al, 2006) and NICE (2006) suggest the following:

- For patients who are very ill: 20-25 kcal per kilogram (kg) of body weight per day, i.e. 1,400-1,750 kcal per day for a patient weighing 70 kg (Kreymann et al, 2006);
- For patients who are more stable/recuperating: 25-30 kcal/kg/day (Kreymann et al, 2006);
- For patients at risk of refeeding syndrome: commence feeding at 10 kcal/kg/day and increase slowly according to their clinical condition NICE (2006).

Although patients’ requirements for protein increase when they are critically ill, guidelines suggest there is little benefit in giving any more than 1.25g/kg/day of protein via enteral feed (Forsyth, 2011); as such, a 70kg patient would be given approximately 87g protein per day. In practice it is very difficult to ascertain exactly how much energy and protein a patient who is critically ill needs, as this will change according to their clinical condition, so it is essential that nurses are aware of when to refer for specialist help.

**Meeting nutritional needs**

Wherever possible, a food-first approach should be used, encouraging patients to select high-protein foods. However, as already discussed, patients who are critically ill are likely to have a poor appetite, so the use of oral nutritional supplements should be offered in addition to dietary intake to increase their energy and protein intake.

**Oral nutritional supplements**

Oral nutritional supplements (ONS) are commercially prepared products, usually presented as drinks, that typically contain a mixture of nutrients. These should be used to supplement any food intake the patient is able to take orally; two per day are usually recommended.

ONS have been shown to improve the intake of energy and protein in people who are concordant with therapy (Stratton and Elia, 2007).

To aid concordance, they should be given in between meals rather than with a meal. If administered around mealtimes, the ONS might impact on the patient’s appetite as they may be too full to eat food. They are normally more palatable when served chilled and sipped over the course of the day. It is essential to record the patient’s oral intake; if it remains poor after 24 hours, referral should be made to a diettitian for further assessment and input.

When the patient has a functioning gastrointestinal (GI) tract, the diettitian may suggest nutritional support in the form of enteral tube feeding.

**Enteral tube feeding**

Enteral feeding refers to delivering liquid nutrition via an enteral feeding tube, such as a nasogastric tube.

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**TABLE 1 HORMONAL CHANGES IN CASES OF SEVERE PHYSIOLOGICAL STRESS**

<table>
<thead>
<tr>
<th>Increased hormone secreted</th>
<th>Metabolic effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catecholamines</td>
<td>Glucagon release increased</td>
</tr>
<tr>
<td>Catecholamines Glucagon</td>
<td>Stored glucose in the form of glycogen released for energy. During simple starvation in a man of average weight (70kg), liver glycogen stores last approx 12-18 hours (Murray et al, 2012)</td>
</tr>
<tr>
<td>Glucagon</td>
<td>Breakdown of protein to use amino acids to make more essential proteins and glucose</td>
</tr>
<tr>
<td>Cortisol</td>
<td>Breakdown of fat to mobilise free fatty acids for energy</td>
</tr>
<tr>
<td>Anti-diuretic hormone</td>
<td>Water retention</td>
</tr>
<tr>
<td>Aldosterone</td>
<td>Sodium retention</td>
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</tbody>
</table>

Note: Catecholamines include adrenaline, noradrenaline and dopamine (Source: Rolffes et al, 2014)
When patients cannot meet all of their nutritional needs orally, intake can be supported in this way with supplemental feeding; alternatively, if oral intake is extremely poor, total feeding can be done using this method.

Patients who are ventilated or unconscious will require enteral feeding.

Though there is debate about the best time to commence enteral feeding during a period of critical illness (Schetz et al, 2013), national guidance recommends that enteral feeding should be commenced within 24-48 hours of a critical illness (Dhalwal et al, 2014; Nguyen et al, 2012). Reference to local guidelines and input from a dietician is essential at this point to ensure the correct type and amount of enteral feed is prescribed for the patient, according to their clinical condition.

Patients who are critically ill, as well as those who are constipated, sometimes experience problems with delayed gastric emptying, so careful monitoring of symptoms, such as vomiting or high nasogastric tube aspirates, is needed when starting enteral feeding.

Where patients have a nasogastric tube in situ, these are often aspirated regularly, but the exact frequency will depend on local policy and the patients condition. Pro-kinetic drugs, which enhance gastrointestinal motility, and laxatives may need to be considered by nursing and medical teams to help with gastric emptying and treat constipation.

Dietitians can advise on the most suitable feed rates and type of feed to minimise these problems, or suggest other routes for enteral feeding such as a nasojunal tube.

Using the GI tract for feeding is always preferable to parenteral nutrition (PN), in terms of reduced complications, cost and risk to the patient. However, for patients whose GI tract is not functioning properly, or where enteral feeding is not tolerated, PN might need to be considered. Depending on local services, this may require referral to a specialist dietician, pharmacist or nutrition support team for assessment and prescribing.

Parenteral nutrition
PN, also known as total parenteral nutrition (TPN), refers to delivering nutrition directly into the venous system via a central access device. Feeds meet all of the patient’s nutritional requirements but, in practice, the patient might receive other forms of nutrition, such as enteral nutrition, concurrently; as such, the term PN may be used instead of TPN.

This method of feeding carries with it:
- Risks of catheter-related sepsis;
- Increase in risk of hyperglycaemia;
- Metabolic complications.

As a result, this should only be used in patients who cannot be fed adequately via the enteral route. There is controversy over when PN should be commenced. ESPEN guidelines (Kreymann et al, 2006) suggest starting PN as early as possible during an episode of illness. However, a study by Casaer et al (2011) found that when PN was delayed for seven days, survival rates in critically ill patients were better than in those who had earlier feeding. Local guidelines about when to start PN and patient aftercare should always be followed.

Conclusion
Physiological stress causes changes in hormone levels that increase metabolic rate and cause the body to become catabolic, breaking down stores of energy and protein. This puts patients who are critically ill at high risk of developing malnutrition. Nursing assessment is essential and must make use of nationally recognised screening tools and take into account a wider assessment of the patient. By monitoring the patient’s oral intake and general clinical condition, nurses can quickly determine those who are likely to be at risk of malnutrition and refer to a dietician for specialist help quickly.

Although food and oral feeding should be offered first, patients who are critically ill are likely to have very poor appetites, so the use of ONS and enteral tube feeding should be considered early. Dietitians and nutrition support teams can offer helpful advice on how best to manage these complex nutritional requirements.
TABLE 2 CONDUCTING A NURSING NUTRITIONAL ASSESSMENT IN PATIENTS WHO ARE CRITICALLY ILL

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Rationale</th>
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<tbody>
<tr>
<td>Weight loss before becoming acutely unwell</td>
<td>Unintentional weight loss over 3-6 months is indicative of a pre-existing nutritional problem; loss of around 10% of body weight is of clinical concern (BAPEN, 2003).</td>
</tr>
<tr>
<td>Anthropometric measurements – MUAC</td>
<td>In some circumstances, MUAC measurement may be used to give an indication of possible nutritional weight loss where there is no oedema in the arms and where sequential measurements are taken (BAPEN, 2003).</td>
</tr>
<tr>
<td>Nutrient intake before becoming acutely unwell</td>
<td>A history of poor oral intake might suggest that the patient is already nutritionally depleted; this means their risk of malnutrition is increased and referral to a dietitian is required quickly</td>
</tr>
<tr>
<td>Current nutrient intake – record of all patient’s food, fluid and nutritional supplements over a full 24-hour period</td>
<td>If intake is very poor, a decision can be made regarding referral to a dietitian for further input</td>
</tr>
<tr>
<td>GI tract function</td>
<td>The GI tract is the key organ in terms of digestion and absorption of nutrients. If it is not functioning normally, the patient might not be able to obtain enough nutrition from oral or enteral feeding. Symptoms such as vomiting and diarrhea must be identified quickly as these may lead to further nutritional depletion and would have an impact on the nursing plan to meet the patient’s needs. Other GI complications, such as pancreatitis, small bowel obstruction or post-operative paralytic ileus, will impact on the patient’s ability to absorb nutrients (Fletcher, 2009).</td>
</tr>
<tr>
<td>Other comorbidities</td>
<td>Other comorbidities, such as neurological disorders leading to dysphagia, will impact on the patient’s ability to eat and might indicate that nutritional support in the form of enteral feeding is required</td>
</tr>
<tr>
<td>Severity of stress response – biochemical markers</td>
<td>Traditionally, low blood levels of the proteins albumin, prealbumin, transferrin and retinol binding protein were thought to suggest a patient is malnourished. However, in patients who are critically ill, this is not useful – low levels of these proteins are a reflection of the stress response and not the nutritional status (McClave et al, 2009). As such, low blood levels of albumin, for example, are unlikely to be linked to malnutrition and are an indication of the inflammatory response or the extent to which a patient is unwell</td>
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</tbody>
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Note: GI = gastrointestinal; MUAC = mid-upper arm circumference