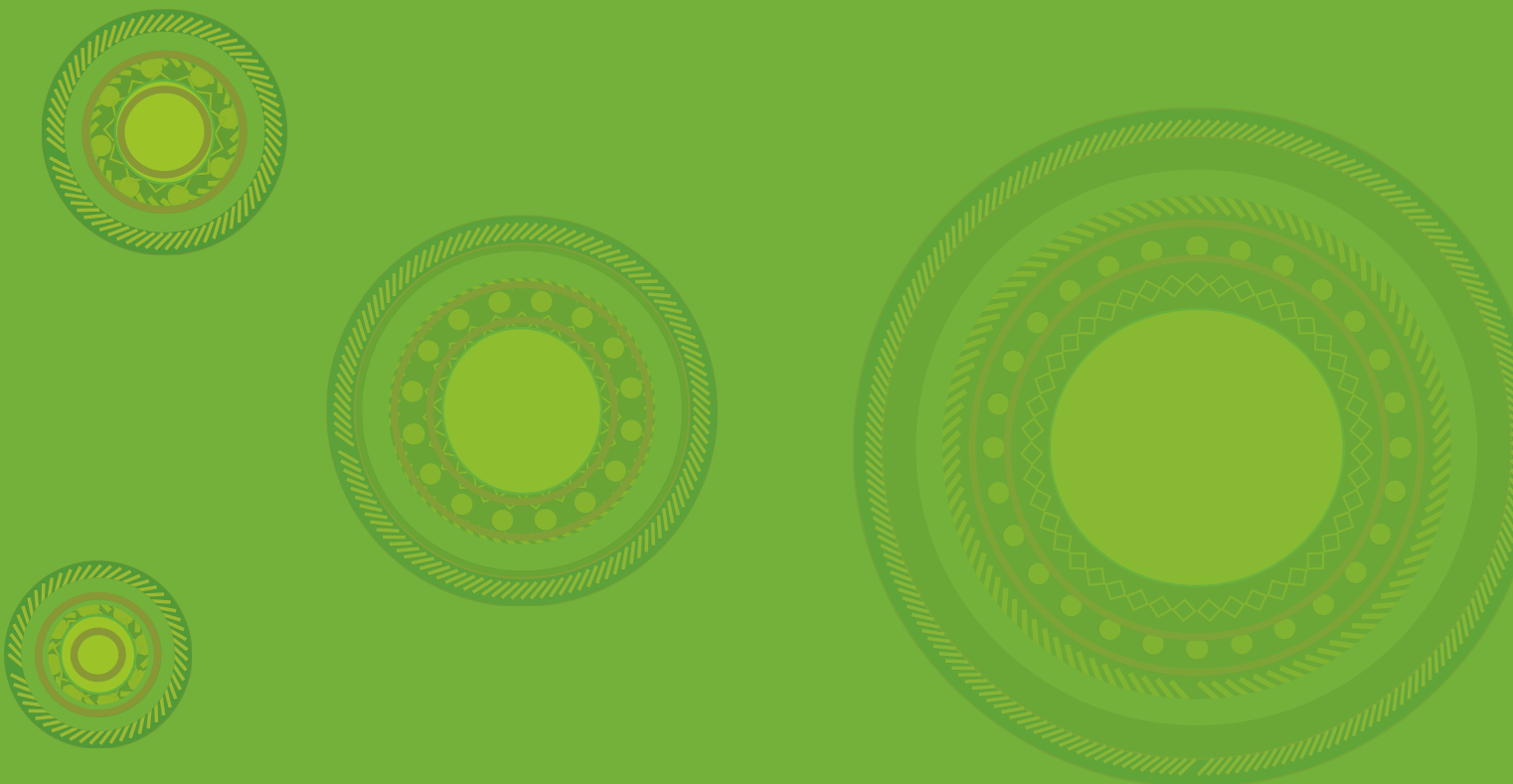


NATIONAL PARENTERAL NUTRITION PRACTICE

GUIDELINES FOR ADULTS



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Health
REPUBLIC OF SOUTH AFRICA

A long and Healthy Life for All South Africans





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Prepared and obtainable free of charge from:

Directorate: Nutrition
national Department of Health
Private Bag X828
Pretoria
0001

Tel: (012) 395 9621

Fax: 086 632 8484

Department of Health – 2016

www.health.gov.za

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Prof. Renée Blaauw: Lecturer – Stellenbosch University

Nolene Naicker: Assistant Director – national Department of Health

Luzette Van Niekerk: Assistant Director – Western Cape Department of Health

Charne de Lange: Dietitian – Western Cape Department of Health

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MP Matsoso

Director-General: Health

Acronyms

AAA	aromatic amino acids
AKI	acute kidney injury
ANH	artificial nutrition and hydration
BCAA	branched chain amino acids
BMD	bone mineral density
BMI	body mass index
CAPD	continuous ambulatory peritoneal dialysis
CLABSI	central line associated blood stream infection
CRRT	continuous renal replacement therapy
CVC	central venous catheter
CVP	central venous port
DEXA	dual energy X-ray absorptiometry
DRI	dietary reference intake
ECG	electrocardiographic
EN	enteral nutrition
FBC	full blood count
GFR	glomerular filtration rate
GIT	gastrointestinal tract
HD	haemodialysis
HPN	home parenteral nutrition
IBW	ideal body weight
IHD	intermittent haemodialysis
INR	international normalised ratio
MODS	multiple organ dysfunction syndrome
NICE	National Institute for Health and Care Excellence
NPE	non-protein energy
NPO	nil per os
NTT	nutrition therapy team
PN	parenteral nutrition
PVT	peripheral vein thrombosis
RDA	recommended dietary allowance
REE	resting energy expenditure
SIRS	systemic inflammatory response syndrome
TE	total energy
TPN	total parenteral nutrition

1 Definitions

Adult:	An individual over the age of 18 years.
All-in-one parenteral nutrition bag:	All macro- and micronutrients to meet the recommended dietary allowance are contained in one bag.
Enteral nutrition:	Nutrition therapy administered via a feeding tube
Parenteral nutrition:	The intravenous infusion of amino-acid (protein) solutions, hypertonic glucose, lipid emulsions, electrolytes, vitamins and trace elements into a central vein. Parenteral nutrition may, however, under specified conditions, be administered peripherally.
Supplemental parenteral nutrition:	Supplemental parenteral nutrition is used as an adjunct therapy to enteral nutrition in patients.
Total parenteral nutrition:	It serves as the sole source of nutrition for the individual.
Three chamber parenteral nutrition bags:	This bag contains macronutrients in separate pouches. Macronutrients are combined prior to use by rolling the bag to break the seals, allowing macronutrients to mix. These bags do not contain all required micronutrients in sufficient amounts.

2 Introduction

2.1 Purpose of the nutrition guideline

The aim of this guideline is to provide recommendations based on current evidence for best practice in the management of parenteral nutrition by health professionals and care workers for all adult patients receiving parenteral nutrition therapy in government health facilities.

It is outside the scope of this guideline to provide extensive clinical recommendations for nutrition requirements of all clinical states seen. However, a general overview of nutrition requirements has been provided.

2.2 Goals and objectives of the document

Enteral nutrition (EN) should always be the first option when feeding a patient whom is not able to consume adequate food orally. Parenteral nutrition (PN) should be used when the gastrointestinal tract (GIT) is not available or not able to absorb nutrients supplied on a short or long term basis. PN can be used either alone or in combination with enteral or oral foods to meet patients' estimated nutrition requirements.

Goals and objectives

The goals and objectives of this guideline is to ensure:

1. optimal and standardised use of PN
2. effective use of PN
3. that staff is aware of the coordinated policy regarding PN

3. Roles and responsibilities within the nutrition therapy team

It is recommended that nutrition therapy teams (NTT) be established in each facility to ensure that all the goals are met. The core NTT is indicated in **Table 1**.

Table 1: Recommended composition of the NTT

Member	Task
Dietitian	Dietary prescription, coordinator, request of biochemistry
Pharmacist	Procurement and safe compounding
Surgeon/physician/doctor	Prescribing privileges. Liaison with dietitian regarding prescription, request of biochemistry, correction of electrolytes (refeeding syndrome)
Professional nurse in ward	Administration, care and recording of PN
Other	More medical and paramedical members may be added as needed

4. Indications and contraindications of PN

Indications and contraindications for PN are summarised in **Table 2**. Patients should be fed because starvation and underfeeding of patients is associated with a higher incidence of morbidity and mortality.¹ All patients who are expected not to tolerate oral or adequate enteral nutrition (minimum 60 per cent of requirements) by day three to five should be started on PN as soon as possible post admission.¹ Early nutrition intervention and introduction of PN is especially necessary in patients with pre-existing malnutrition.^{2,3}

PN should, however, be administered with care, which includes appropriate monitoring and adherence to standards and techniques associated with aseptic techniques.⁴

Table 2: Indications and contraindications for PN³

Usual indications	Relative indications	Contraindications
<ul style="list-style-type: none"> high dose chemotherapy severe malnutrition with a non-functional GIT severe catabolism in the presence of malnutrition and a non-functional GIT for 3-5 days malnutrition (intensive surgery) GI route not available for 3-5 days documented inability to absorb adequate nutrients from the GI tract: <ul style="list-style-type: none"> massive small bowel resections/short bowel syndrome. (PN should be indicated in the initial period at least) radiation enteritis severe diarrhoea untreatable steatorrhea/malabsorption – if pancreatic insufficiency, small bowel bacterial overgrowth and celiac disease have been ruled out complete bowel obstruction severe catabolism with or without pre-existing malnutrition where enteral feeding is not possible for 5 – 7 days inability to obtain enteral access inability to provide sufficient nutrients enterally persistent GI haemorrhage Acute abdomen /prolonged ileus work-up requiring nil per os (NPO) status for several days in a patient with pre-existing malnutrition high output enterocutaneous fistula (> 500ml per 24hrs) with inability to gain enteral access distal to fistula site or if enteral feeding worsens fistula output trauma requiring repeat surgical procedures and lengthy periods of NPO status 	<ul style="list-style-type: none"> high dose chemotherapy enterocutaneous fistula (< 500ml output per 24hrs) hyperemesis gravidarum when nausea and vomiting persists for 5 – 7 days and enteral feeding is not possible partial small bowel obstruction severe mucositis intractable vomiting when small bowel feeding is not possible chylous ascitis or chylothorax when low fat or fat free enteral nutrition does not reduce output adequately abdominal compartment syndrome moderate to severe acute pancreatitis or pancreatitis accompanied by abdominal pain with jejunal feeding 	<ul style="list-style-type: none"> functional GIT need for emergency surgery patient refusal prognosis that does not warrant aggressive nutrition support intervention PN risk exceeds potential benefits inability to obtain venous access

Artificial nutrition is regarded as medical nutrition therapy and thus subject to all the ethical dilemmas and debates regarding treatment. Patient consent needs to be obtained before commencement of nutrition therapy, in this case PN. Healthcare professionals are not ethically obligated to provide artificial nutrition and hydration (ANH) in cases of end-of-life situations or “futile care”, if healthcare professionals establish that there is not enough evidence for providing nutrition therapy or if the risk of nutrition intervention outweighs its benefit.^{2,5}

A clear indication for the need for PN, and where possible a small amount of enteral or oral feeding, should be considered in order to maintain the integrity of the gastrointestinal tract and reduce the risk of hepatobiliary complications by stimulating gall bladder contractility.^{1,2,3}

The use of minimal enteral feeding in all intensive care patient populations is recommended, where possible.^{1,2,3}

Patients with uncontrolled cardiac failure and electrolyte imbalances should be stabilised prior to the commencement of PN.^{2,3}

5. Nutritional assessment of patients

An initial assessment of all patients should be done by an appropriate qualified nutrition expert e.g. dietitian before commencement of any PN in order to determine goals of nutrition therapy. Within this assessment a number of key questions should be asked: ^{1,2,3,6,7}

1. Is the nutrition therapy intended to maintain or replete body composition?
 2. Is PN required for short (less than two weeks) or long term?
 3. Are there any pre-existing medical conditions which may impact on substrate utilisation?
- A clear indication for the need for PN and where possible a small amount of enteral or oral feeding should be considered in order to maintain the integrity of the gastrointestinal tract and reduce the risk of hepatobiliary complications by stimulating gall bladder contractility. ^{1,2,3}
 - In intensive care patients on PN the use of minimal enteral feeding is recommended, where possible. ^{1,2,3}
 - Patients with uncontrolled cardiac failure and electrolyte imbalances should be stabilised prior to the commencement of PN. ^{2,3}
 - Cognisance of organ dysfunction and other medical disorders should be accounted for in the patients' medical notes e.g. renal, cardiac, hepatic and respiratory. ^{2,3} The patients' hydration status should be assessed with documentation of any ascites or edema. ³
Concomitant drug therapy and possible interactions with respect to the provision of nutrients and electrolytes and their requirements should be considered. ³

Note: Information about the functional status of a patient is important as it helps to determine the patient's nutrition requirements. Mobile patients will have increased nutrition requirements compared to the immobile/ventilated patients.

5.1 Anthropometric data:³

- current weight
- current height or substitute measure e.g. arm span
- recent changes in weight
- level of oedema

Nutritional status in patients requiring PN will vary and it is therefore important to assess their metabolic and nutrition profile with care. Information about appetite and weight change is important and should be elicited from the patient where possible. ^{6,7}

5.2 Biochemical data:³

- full blood count
- Na, K, Cl, urea, creatinine
- calcium, magnesium, phosphate
- serum triglycerides
- serum glucose
- liver function tests, including international normalised ratio (INR)
- c-reactive protein
- albumin – *Should not be used as an independent criterion*

Baseline laboratory data is vital and should be reviewed prior to the commencement of PN. In the severely malnourished or stressed patient, particular importance should be placed on the need for information regarding potassium, magnesium, calcium, phosphate, haemoglobin and coagulation. In those patients requiring long term PN, information about other trace elements will be required, as well as liver function tests. ^{1,2,3}

5.3 Clinical:³

A thorough history of the medical condition and anticipated treatment plan should be reviewed before the PN prescription can be compiled. Special attention should be given to the following:

- diagnosis
- anatomy – resections, ostomies or previous surgery
- pre-existing conditions – e.g. diabetes mellitus, renal failure, liver disease

- organ function
- treatment plan

Follow a structured approach to assess clinical signs of nutritional deficiencies, oedema, ascites and muscle wasting.

5.4 Diet history:³

- food/drug allergies or intolerances
- dietary intake prior to hospital admission
- period nil per mouth within hospital/when was last meal taken
- special dietary needs interventions
- drug-nutrient interactions
- herbal/supplement use

5.5 Medication:³

- home and current medication
- assess for any drug interactions or drug induced deficiencies

6. Nutritional recommendations

The dietitian is responsible for the calculation of the individualised nutritional requirements of all patients. Disease-specific guidelines are used and daily adaptations are made to the prescription.

Nutrition requirements with respect to the patients' clinical condition with regards to sepsis, severe malnutrition and or other factors should be determined. Each patient should have a nutrition prescription calculated by an appropriately qualified nutrition expert e.g. . Each nutrition prescription should include at least the following information:

- patient name
- hospital number
- ward
- date
- PN code prescribed
- total volume/administration rate
- route of administration (centrally or peripherally)

It is recommended that the responsible NTT member facilitates the placement of the **PN prescription** via pharmacy using a PN prescription schedule, which the **medical doctor must sign**. The aim of this process is to ensure that PN is administered to patients in an appropriate and coordinated manner.

6.1 Macronutrients

6.1.1 Refeeding syndrome:

6.1.1.1 Identification of patient at risk of developing refeeding syndrome:

These guidelines have been adopted from the National Institute for Health and Care Excellence (NICE) guidelines for identifying patients at high risk of developing refeeding syndrome. Guidelines are set out below in **Table 3**:

Table 3: Guidelines for identifying patients at high risk for refeeding syndrome

<p>Patient presents with ONE or more of the following:</p> <ul style="list-style-type: none"> • body mass index <16 • unintentional weight loss >15% in the past 3 – 6 months • little or no nutritional intake for >10 days • low levels of potassium, phosphate or magnesium before initiating feeds
<p>OR, the patient presents with TWO or more of the following:</p> <ul style="list-style-type: none"> • body mass index <18,5 • unintentional weight loss >10% in the past 3 – 6 months • little or no nutritional intake for >5 days • history of alcohol misuse or drugs, including insulin, chemotherapy, antacids or diuretics

6.1.2 Management of patients at risk of developing refeeding syndrome

Table 4: Regimen for management of refeeding syndrome: Applicable to EN and PN ^{8,9}

Day	Calorie intake	Supplements and electrolytes	Monitoring
1	10 kcal/kg/day or 5 kcal/kg/day in patients with BMI<14 or no food>15days CHO: 50 – 60% Fat: 30 – 40% Protein: 15 – 20%	Prophylactic supplements (unless high pre-feeding plasma levels): <ul style="list-style-type: none"> • PO₄²⁻: 0,5 – 0,8mmol/kg • K⁺: 1 – 3 mmol/kg • Mg²⁺: 0,3 – 0,4 mmol/kg • Na⁺: <1 mmol/kg • IV Thiamine 200 – 300mg stat + Vitamin B complex 30 minutes prior to feeding 	<ul style="list-style-type: none"> • do baseline biochemistry (urea, creatinine, Na⁺, K⁺, Cl⁻, Ca²⁺, Mg²⁺ and PO₄²⁻. Also LFTs if not done recently) • repeat biochemistry after 4 – 6 hours • monitor biochemistry daily • maintain zero fluid balance • monitor according to Table 5 daily • correction of electrolytes and fluid balance should be done along with feeding
2-4	increase by 5 kcal/kg/day or continue minimal feeding if patient has low tolerance, thus do not increase if biochemical shifts occurred. Supplement and repeat	<ul style="list-style-type: none"> • correct biochemistry abnormalities. See Table 6 • Thiamine 100mg + Vitamin B-complex supplementation, oral or IV. Continue until day 10 	<ul style="list-style-type: none"> • check biochemistry daily and correct any abnormalities • maintain zero fluid balance • monitor according to Table 5 daily
5-7	20 – 30 kcal/kg/day	<ul style="list-style-type: none"> • correct biochemistry abnormalities. See Table 6 • Thiamine 100mg + Vitamin B-complex supplementation, oral or IV. Continue until day 10 • consider iron supplementation from day 7 	<ul style="list-style-type: none"> • check biochemistry daily and correct any abnormalities • maintain zero fluid balance • monitor according to Table 5 daily
8-10	30 kcal/kg/day or increase to full requirements	<ul style="list-style-type: none"> • continue Thiamine 100mg and B complex supplementation until day 10 	<ul style="list-style-type: none"> • check biochemistry twice weekly • monitor according to Table 5 daily

Table 5 Monitoring ⁸

Clinical monitoring:
<ul style="list-style-type: none"> • monitor blood pressure and pulse rate • monitor feeding rate • strict documentation of fluid balance • monitor changes in body weight • clinical examination: oedema, blood pressure, pulse rate, cardiovascular and respiratory systems³ • monitor for neurological signs and symptoms • patient education
Biochemical monitoring:
<ul style="list-style-type: none"> • monitor biochemistry and electrolytes • monitor blood glucose levels • electrocardiographic (ECG) monitoring in severe cases • account for other sources of energy (e.g. dextrose, propofol, medication)

Table 6 Recommendations for electrolyte replacement¹⁰

Phosphate (0,8 – 1,45 mmol/l)	
Maintenance requirement	0,3 – 0,6 mmol/kg/day orally
Mild hypophosphataemia (0,6 – 0,85mmol/l)	0,3 – 0,6 mmol/kg/day orally
Moderate hypophosphataemia (0,3 – 0,6mmol/l)	9 mmol infused into peripheral vein over 12 hours
Severe hypophosphataemia (<0,3 mmol/l)	18 mmol infused into peripheral vein over 12 hours
Magnesium (0,77 – 1,33 mmol/l)	
Maintenance requirement	0,2 mmol/kg/day IV 0,4 mmol/kg/day orally
Mild to moderate hypomagnesemia (0,5 – 0,7 mmol/l)	Initial 0,5 mmol/kg/day IV over 24 hours then, 0,25 mmol/kg/day for 5 day IV
Severe hypomagnesemia (<0,5 mmol/l)	24 mmol IV over 6 hours, then follow guidelines for mild to moderate.

6.2 General and disease specific macronutrient and micronutrient requirements

Table 7: Disease Specific Requirements^{1,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29}

Energy	Protein	Carbohydrate	Fat	Fluid	Other
General information					
<ul style="list-style-type: none"> energy requirements are indicated as non-protein energy (NPE) or total energy (TE) where stated in the literature consider energy contribution from dextrose containing IV fluids and lipid based sedatives 	1gN ₂ = 6,25g protein	<ul style="list-style-type: none"> basal carbohydrate requirements = 2g/kg maximum glucose oxidation rate = 4 – 7 mg/kg/min (aim not to exceed 5mg/kg/min) hyperglycaemia should be avoided and carbohydrate provision adjusted if hyperglycaemia occurs 	<ul style="list-style-type: none"> essential fatty acids include linoleic acid (omega 6 fatty acid) and alpha-linolenic acid (omega 3 fatty acid) daily lipid requirements: 0.7 – 1.5 g/kg/day essential fatty acids should be provided at 7 – 10g/day, equating to 14 – 20g LCT from soya oil or 30 – 40g LCT from olive/soya oil mix I.V. Fish oil administration should be 0,1 – 0,2 g/kg/day in case of hypertriglyceridemia or poor fat clearance, the amount of lipid infused should be reduced and/or the type of fat should be changed Fish oil containing lipid emulsions have been shown to be anti-inflammatory and contain less hepatotoxic phytoosterols 	<ul style="list-style-type: none"> maintenance: 20 – 40 ml/kg/day Assess for and replace ongoing losses on a daily basis. E.g. diarrhea, losses due to fever, wound and fistula losses 	<p>Parenteral nutrition prescriptions should include a daily dose of multivitamins and trace elements</p>

	Energy	Protein	Carbohydrate	Fat	Fluid	Other
	20-25kCal/kg/d TE (acute phase) 25-30 Kcal/Kg/d TE (recovery phase) Obese ICU patient: (BMI>30) Hypo-caloric feeding: 11 – 14kCal/kg Actual BW Eucaloric feeding: 21kCal/kg Actual BW	1.3 – 1.5 g/kg/d Obese ICU patient: (BMI>30) Hypocaloric feeding: BMI30 – 39.9: ≥2g/kg IBW BMI>40: ≥2.5g/kg IBW Eucaloric feeding: Follow disease specific guideline	Minimum 2g/kg Maximum glucose oxidation rate in the stressed patient is 4 – 7mg/kg/min, Aim not to exceed 5mg/kg/min hyperglycemia (>10mmol/L) should be avoided	0.7 – 1.5g/kg/d Fish oil containing lipid emulsions probably decrease length of stay		All parenteral nutrition prescriptions should include a daily dose of multivitamins and trace-elements. Electrolyte requirements are highly variable and should be determined by plasma electrolyte monitoring
			Liver disease			
Alcoholic steato-hepatitis	1.3 x BMR	Well-nourished/ moderately malnourished: 1.2g/kg Severely malnourished: 1.5g/kg	50 – 60% NPE	40-50% NPE Use a lipid emulsion with lower omega-6 content than traditional pure soybean lipid emulsions		Water soluble vitamins: <ul style="list-style-type: none"> all water soluble vitamins according to recommended dietary allowance (RDA) thiamine prior to commencement due to high risk for Wernicke encephalopathy <ul style="list-style-type: none"> Prophylaxis: 250mg IM daily for 3 – 5 days Treatment: 500mg IV t.i.d for 2 – 3 days Fat soluble vitamins: <ul style="list-style-type: none"> all fat soluble vitamins according to RDA I.V Vitamin K if jaundice with fat-malabsorption Minerals and trace elements: <ul style="list-style-type: none"> daily routine administration of twice the RDA
Weight to be used: <ul style="list-style-type: none"> without ascites: Actual body weight with ascites: Ideal body weight 						

	Energy	Protein	Carbohydrate	Fat	Fluid	Other
<p>Liver Cirrhosis</p> <p>Weight to be used:</p> <ul style="list-style-type: none"> • without ascites: Actual body weight • with ascites: Ideal body weight 	1.3 x resting energy expenditure (REE) 30 – 35 kcal/kg dry body weight	1.2 – 1.5g/kg In encephalopathy grade III or IV consider use of solutions high in branched chain amino acids (BCAA) and low in aromatic amino acids (AAA), methionine and tryptophan	50 – 60% NPE Give as glucose In case of hyperglycaemia: 2 – 3 g/kg/d + IV insulin infusion	40 – 50% NPE Lower in omega 6		Water, electrolytes, water – and fat soluble vitamins, trace elements according to RDA If ascites: Na < 2000mg Administer Thiamine prior to starting glucose infusion in patients with alcoholic disease to reduce the risk of Wernicke's encephalopathy. <ul style="list-style-type: none"> o prophylaxis: 250mg IM daily for 3 – 5 days o treatment: 500mg IV t.i.d for 2 – 3 days
<p>Liver transplant and surgery</p>	Pre-operative follow guidelines for liver cirrhosis 1.3 X REE (NPE) (until 6-12 months post-operative)	PN: 1 – 1.5 g / kg /d Consider BCAA containing solutions in encephalopathic patients	Patients might be more prone to hyperglycemia due to immunosuppressant therapy	Lipid emulsion with lower omega 6 content like MCT/olive oil or MCT/fish oil containing emulsions were less immunosuppressive and pro-inflammatory		Water, electrolytes, water – and fat soluble vitamins, trace elements according to RDA Close monitoring of Mg levels in post-transplant patients to detect cyclosporine or Tacrolimus induced hypomagnesaemia
<p>Acute liver failure</p>	1.2 - 1.3 x REE	0.8 – 1.2 g/kg/d	2- 3 g/kg/d to avoid hypoglycemia	0.8 – 1.2 g/kg/d		Strict control of glucose, lactate and ammonia levels

	Energy	Protein	Carbohydrate	Fat	Fluid	Other
<p>Acute Kidney Injury (AKI)</p> <p>Weight to be used:</p> <ul style="list-style-type: none"> • normal • BMI: Actual body weight • over weight and critically ill: Ideal body weight 	<p>20 – 30 kcal/kg/day Increase to 35kCal/kg/day if undergoing continuous renal replacement therapy (CRRT)</p> <p>1.1 – 1.2 x REE</p>	<p>Conservative therapy, minimal catabolism: 0.8 – 1.0g/kg/d</p> <p>Dialysis: CRRT: 1.8 – 2.5g/kg/d</p> <p>Intermittent haemodialysis (IHD): 1.5 – 2.0g/kg/d</p>	<p>5 – 7 g/kg/day</p>	<p>1.2 – 1.5g/kg/day</p>		<p>In patients managed conservatively minimise exposure to renally regulated electrolytes and minerals, e.g. potassium, calcium, phosphorus, magnesium, vitamin A,B,C as well as zinc, selenium, copper and aluminium</p> <p>AKI patients on RRT might have increased needs for water-soluble vitamins. Inappropriate vitamin C supplementation might result in secondary oxalosis but patients might need more than the normal 50mg/day. Losses can be as high as 100mg/day of vitamin C and 600nmol/day of thiamine in the ultra-filtrate. Restrict Vitamin C to <100mg/day. Increase to maximum of 200mg in patients on CRRT. In patients receiving CRRT provide:</p> <ul style="list-style-type: none"> • Folate 1mg/day • Pyridoxine 10mg/day • Thiamine 25 – 100mg/day <p>Increased losses of Zn, Se, Cu and Al is uncommon and can be replaced with a standard trace-element preparation</p>

	Energy	Protein	Carbohydrate	Fat	Fluid	Other
Chronic Kidney Disease	<p>Non-dialysed: ≥30 – 35 kCal/kg/day TE</p> <p>Dialysed: < 60 years-35Kcal/kg/day TE >60 years-30-35Kcal/kg/day TE</p>	<p>Non-dialysed: Glomerular filtration rate (GFR) = 25 – 70ml/min: 0.55 – 0.6g/kg/d GFR <25ml/min: 0.6 -0.75 g/kg/d</p> <p>Dialysed: Haemodialysis (HD): 1.2 – 1.4g/kg Continuous ambulatory peritoneal dialysis (CAPD): 1.2 – 1.5g/kg</p>	50-60% of TE	25-35% of TE	<p>Dialysed: 1 000ml + urine volume</p>	<p>Non-dialysed: Phosphate: 600 – 1 000mg/d Potassium: 1 500 – 2000mg/d Sodium: 1.8 – 2.5 g/d</p> <p>Dialysed: Phosphate: 800 – 1000mg/d Potassium: 2000 – 2500mg/d Sodium: 1.8 – 2.5g/d</p>
Burns						
	Toronto formula	<p>Adults: 1.5-2.0g/kg/d</p>	<p>55- 60 % of TEMax 5mg/kg/min infusion rate corresponding to 7g/kg/day in an adult patient</p> <p>Keep blood glucose levels between 4.5 – 8.0 mmol/L using IV insulin therapy</p>	< 20%TE		<p>Zinc, Cu, Se B vitamins, C, folic acid, Vit D, Vit E, Vit A</p> <p>Duration of supplementation is related to total body surface area burned</p> <ul style="list-style-type: none"> • 7 - 8 days for burns 20 - 40% • 2 weeks for burns 40 - 60% • 30 days for burns > 60%

Energy	Protein	Carbohydrate	Fat	Fluid	Other
Acute pancreatitis					
25 kcal/kg NPE increasing to maximum 30kCal/kg NPE Restrict to 15 – 20 kCal/kg NPE in case of systemic inflammatory response syndrome (SIRS) or multiple organ dysfunction syndrome (MODS) or when risk for refeeding syndrome	1.2–1.5 g protein/kg/d	50 - 70% TE 4 – 7mg/kg/min	0.8 – 1.5g/kg Temporarily discontinue lipid infusion if hypertriglyceridemia persist for more than 72 hours (>12mmol/L)		RDA for vitamins and trace-elements. Insufficient data to recommend supranormal doses
Gastroenterology					
Crohn's disease: 25 – 30kCal/kg/d TE	Crohn's disease: Depending on disease complication				Crohn's disease: Yearly monitoring of serum Vit B12 and folate
Short bowel syndrome: 32kCal/kg TE	Short bowel syndrome: 1 – 1.5g/kg/day Should take increased digestive losses into account. 2g N ₂ per liter of gastric losses	Short bowel syndrome: 60% of NPE	Short bowel syndrome: 40% of NPE Restrict to <1g/kg lipid		Short bowel syndrome: Total micronutrient requirement should be given IV. Some should be given in increased amounts due to increased losses e.g. Zn and Mg. Special consideration should be given to electrolyte monitoring especially sodium and magnesium
Open abdomen: 25 – 35 kCal/kg NPE	Open abdomen: 1,5 – 2,5g/kg PLUS 29g/L of abdominal losses				High output fistulae: 2 x dietary reference intakes (DRIs) for vitamins and trace elements. Up to 5 x DRIs for vitamin C and zinc. At high risk of vitamin B12, zinc, magnesium and selenium deficiency
Fistula: • low output: 25kCal/kg TE • high output: At least 30kCal/kg TE	Fistula: • Low Output: 1 – 1.5g/kg • High Output: 1.5 – 2g/kg PLUS 2g/L effluent				

Energy	Protein	Carbohydrate	Fat	Fluid	Other
		Non-surgical oncology			
Ambulate patients: 30-35kcal/kg/day TE	Non stressed: 1-1.2g/kg/day	50% NPE	50% NPE		Micronutrients ~100% DRI
Bedridden patients: 20-25kcal/kg/day TE	Severe stressed: 1.5-2.5g/kg/day				
Weight gain: 30-40kcal/kg/day TE					
Hypermetabolic/ stressed: 35kcal/kg/day of TE	Hypercatabolic: 1.2-1.6g/kg/day				
Haemopoietic cell transplant: 30-35kcal/kg/day TE	Haemopoietic cell transplant: 1.5-2g/kg/day				
Surgery					
25KCal/kg ideal body weight (IBW) TE Up to 30KCal/kg TE in severe stress	1.5g/kg or 20% of TE	30% of TE 50 – 70% of NPE	30 – 50% of TE Lipid emulsion should probably include omega 3 fatty acids		100% of RDA for micronutrients

Energy	Protein	Carbohydrate	Fat	Fluid	Other
20 – 35kCal/kg TE MAX 40kCal/kg	Unstressed patient: 0.8 – 1g/kg NPE:N ₂ = 100 – 150:1	60% of NPE Administration of >7mg/ kg/min is associated with parenteral nutrition associated liver disease	Long term patients: <1g/kg/d Fish oil containing lipid emulsions is associated with less liver complications		<ul style="list-style-type: none"> restrict the amount of sodium to the daily requirements, including losses, to avoid sodium induced hypercalciuria the calcium, magnesium and phosphate content of the home parenteral nutrition (HPN) should maintain normal serum concentrations and 24-h urinary excretion the recommended ratio is 1mmol of calcium to 1mmol of phosphate the amount of amino acids prescribed should not be greater than losses, in order to limit hypercalciuria the recommended intravenous dose of vitamin D is 200 IU/day. Consider vitamin D withdrawal in patients with low bone mineral density (BMD), low serum parathyroid hormone, and 1, 25-dihydroxyvitamin D concentrations associated with normal 25-hydroxyvitamin D. Reducing infusion rates may decrease hypercalciuria bisphosphonates (such as clodronate 1500 mg IV or pamidronate 20 mg iv every 3 months), may maintain BMD in patients with osteopenia biochemistry and anthropometry at every visit monitoring of trace elements and vitamins are recommended at intervals of 6 months bone mineral density assessment by dual energy X-ray absorptiometry (DEXA) scanning is recommended at yearly intervals

6.3 Micronutrients

Pre-existing micronutrient (vitamins and trace elements) deficiencies are often present in hospitalised patients. Deficiencies occur due to inadequate or inappropriate administration, increased or altered requirements, and increased losses, affecting various biochemical processes and resulting in organ dysfunction, poor wound healing, and altered immune status with deleterious sequelae.^{30, 31}

There are commercially available preparations, which provide daily requirements for fat and water-soluble vitamins in addition to trace elements. All parenteral nutrition prescriptions should include a daily dose of multivitamins and trace elements.^{1,3} to prevent and/or correct nutrient deficiencies. Any additional supplementation should be disease-specific. Suggested composition of parenteral multivitamin and trace trace-elements are indicated in tables.

“If a patient develops a micronutrient deficiency state while in care, then there has been a severe failure of care”.

“Micronutrient supplementation should begin as soon as parenteral nutrition is started and continued daily as its role is crucial”.³⁰

Table 8: Suggested composition of parenteral multivitamin and trace-element products for adults³¹

Nutrient	Suggested composition ³¹
Fat-soluble vitamins	
Vit A	1mg
Vit D	5µg (200 IU)
Vit E	10mg
Vit K	150µg
Water-soluble vitamins	
Vit C	200mg
Folic Acid	600µg
Niacin	40mg
Riboflavin	3,6mg
Thiamine	6,0mg
Pyridoxine	6,0mg
B ₁₂	5µg
Pantothenic acid	15mg
Biotin	60µg
Trace-elements	
Zinc	2,5 – 5,0 mg
Selenium	20 - 60µg
Copper	0,3 – 0,5mg
Chromium	10 - 15µg
Manganese	60 – 100 µg
Iron	-
Fluoride	-
Iodine	-

7. Nutritional intervention

7.1 Medical nutrition therapy

7.1.1 Parenteral nutrition product formulations

PN products differ with regards to presentation (all-in-one bags versus 3-chamber bags); type of fat; addition of vitamins, minerals, trace elements and immunonutrients; volume, shelf life and number of options available (**Table 9**). Due to these differences, the cost of the bags cannot be directly compared.

Table 9: Comparison between PN solutions available in South Africa

Parenteral formulations				
Presentation	3-chamber bag A	3-chamber bag B	All-in-one bag	
Contains the following				
Carbohydrates	√	√	√	
Protein	√	√	√	
Fat	√	√	√	
Electrolytes	√	√	√	
Electrolyte-free options	√	√	√	
Water-soluble vitamins	-	-	√	
Fat-soluble vitamins	-	-	√	
Trace elements	-	-	√	
Glutamine	-	-	√(with and without glutamine)	
Source of fat				
LCT (Omega 6)	50%	20%	30%	100%
MCT	50%	-	30%	
Olive oil (Omega 9)	-	80%	25%	
Fish oil (Omega 3)		-	15%	
Combinations of above	-	-	√	
Shelf life	24 months (if not reconstituted)	24 months (if not reconstituted)	7 days	
Storage instructions	Room temperature (if not reconstituted)	Room temperature (if not reconstituted)	Refrigeration (below 5°C)	
Central administered bags	√	√	√	
Peripheral administered bags	√	√	√	

Note:

- All-in-one PN regimens contain the RDA for micronutrients and trace elements in the bag (unless specifically indicated). Not all bags include fish oil containing lipid emulsions.
- Three chamber PN regimens do not meet 100% of RDA for micronutrients and trace elements; therefore micronutrients and trace elements need to be added to the bag or administered separately.

7.1.2 Administration of PN

Note: At all times administration must be effected in a strictly aseptic environment. Different administration methods of PN are indicated on table 10.

Table 10: Comparison of administration methods

Peripheral PN	Central PN
Description	
PN is administered in the peripheral venous system through a peripheral vein. It is recommended that the largest accessible vein is accessed using a small cannula or catheter, which should be covered with a sterile and occlusive transparent dressing	<p>A central venous port (CVP) is surgically inserted using strict aseptic techniques at the juncture of either the superior vena cava or the right atrium</p> <p>A single or multiple lumen catheter may be used, but one lumen dedicated to TPN</p>
Indications and features	
<p>Usually provided to patients where: PN is required for a short duration (less than 14 days) The nutritional needs are < 1800 kcal per day and fluid restriction is not a concern ^{1,3,32}</p>	<p>Patients requiring PN for a longer duration (more than 14 days)</p> <p>PN solutions with higher osmolarities should only be administered via CVP</p>
Special considerations/precautions	
<p>Problems associated with peripheral feeding such as thrombophlebitis, which may be decreased through the use of low osmotic load PN solutions (< 900 - 1000mOsmo/L) and or prohibiting the catheter for non-feed use such as drug administration ^{1,3,32}</p> <p>Catheters should be inspected by the medical team at least once a day and should be managed with an appropriate aseptic technique. A catheter should be re-sited if there is any redness or pain around the site ³</p> <p>Catheter related complications may include peripheral vein thrombosis (PVT)</p>	<p>Placement should be confirmed via a chest X-ray including absence of any complications such as pneumothorax, haemothorax etc before commencement of feeding ^{1,3,32}</p>

Important guidelines:

- Do not exceed 24 hours of hang time for all PN bags. After 24 hours the infusion of the remaining PN in the bag should be discontinued and discarded and a new bag should be started without delay to prevent hypoglycemia ^{3,32,33,34}
- PN should be administered at the rate prescribed on the patient fluid balance chart

7.1.3 Safety

Administration standards

- All PN must be administered through a dedicated feeding line using a volumetric pump with occlusive and air-in-line alarms to minimise infusion related complications. The prescription should be checked and the volume and rate of infusion must be clearly recorded. The use of 0.2µm air eliminating filters for non-lipid containing PN solutions [changed every 72 hours] and 1.2µm air eliminating filters for lipid containing PN solutions [changed every 24 hours] as they protect patients against the consequences of air emboli, particulate, micro-precipitates, phlebitis and microbial contamination.
- Filters have sometimes been criticised as they may clog, causing infusion pumps to alarm requiring nursing attention. It should however, be recognised that a clogged filter is a potential sign of a precipitate. It is never appropriate to remove a clogged filter and allow the admixture to infuse without a filter. The entire administration set, filter and admixture solution should be discarded in preference of an entirely fresh administration set, filter and PN.
- Filters should not be viewed as a “cure” to potential sources of infection and contamination as they do not remove pathogens smaller than 1.2 micron e.g. bacteria. Strict aseptic techniques should still be employed in order to minimise the risk of harm to the patient.
- A dedicated catheter or lumen (if using multi-lumen catheter) should be used for PN solution. Protocols for catheter care site should be followed strictly.
- All PN should only hang for 24 hours and should be discarded thereafter^{3,32,33,34}.

Individualised PN versus standard PN

- Standard PN solutions should be used as far as possible to prevent errors in prescription and compounding and to achieve better nutrient delivery.
- Individualised bags should only be used for specific patients and checks should be in place to ensure that prescriptions are correct.
- Medication should be added to the PN at ward level. If co-infusion (same line, but different port) is the only option (due to limited line access), medication administration has to be discussed with the pharmacist/physician in charge.

Line management

- Meticulous care should be employed with regards to the catheter, with the principles of aseptic technique adhered to e.g. using sterile gloves, towels and antiseptic solutions. All members of the medical team involved with the administration or prescription of PN should receive training regarding aseptic techniques.

8. Patient monitoring and complications

8.1 Monitoring

A medical team [including a dietitian] should review **all patients** receiving PN on a daily basis as they require careful monitoring of clinical, laboratory and nutritional indices. This ensures that the nutrition prescription is appropriate and adequate and that the risks of complications are minimised through the thorough interpretation of the monitoring results and clinical examination.^{3,35,36}

It is recommended that **all patients** are monitored using the examinations as reflected in **Table 11**.

Table 11: Monitoring of parenteral nutrition patients

Anthropometry			
Parameter	Evaluation	Frequency	
Weight	Changes in weight	Weekly	
Biochemistry ³⁷			
Parameter	Frequency	Rationale	Interpretation
Na, K, Urea, Creatinine	<ul style="list-style-type: none"> baseline daily until stable then 1-2 times weekly 	Assessment of renal function, fluid status and Na and K status	Interpret with knowledge of fluid balance and medication
Magnesium, Phosphate	<ul style="list-style-type: none"> baseline daily if refeeding risk 3 times weekly until stable weekly once stable 	Depletion is common and under recognised	Low levels indicate poor status
Calcium, albumin	<ul style="list-style-type: none"> baseline then weekly 	Hypo or hypercalcaemia may occur	<ul style="list-style-type: none"> hypocalcaemia can be secondary to Mg deficiency low albumin reflects disease, not protein status
Liver functions tests, including INR	<ul style="list-style-type: none"> baseline twice weekly until stable then weekly 	Abnormalities common in parenteral nutrition	Complex. May be due to sepsis, other disease or inappropriate nutritional intake
Full blood count	<ul style="list-style-type: none"> baseline 1 or 2 times per week until stable weekly once stable 	Anemia due to iron or folate deficiency is common	Effects of sepsis may be important
Cholesterol and triglycerides	<ul style="list-style-type: none"> baseline twice a week for duration of PN 	Fatty liver can occur as a result of inappropriate PN prescription	Indication of nutritional status at baseline. Thereafter, indication of liver metabolism of fat
Iron, ferritin	<ul style="list-style-type: none"> baseline then every 3 – 6 months 	Iron deficiency is common in long term PN	In acute phase response, ferritin↑, Fe↓
Folate, VitB ₁₂	<ul style="list-style-type: none"> baseline then every 2 – 4 weeks 	Folate deficiency is common	Interpret with full blood count (FBC)
Glucose	<ul style="list-style-type: none"> baseline 6-hourly while on PN 	Glucose intolerance is common	Good glycemic control is important
C – reactive protein	<ul style="list-style-type: none"> baseline 2 – 3 times weekly until stable 	Assists interpretation of protein, trace element and vitamin results	<ul style="list-style-type: none"> to assess the presence of an acute phase response the trend is important
Zinc, copper	<ul style="list-style-type: none"> baseline every 3 – 4 weeks, depending on result 	Deficiency is common, especially with increased losses	Especially important when acute phase anabolism causes ↓Zn ↑Cu
Selenium	<ul style="list-style-type: none"> baseline if at risk for depletion monitoring depend on result 	Likely in severe illness, sepsis and long term nutrition therapy	Acute phase reaction causes ↓Se
Manganese	<ul style="list-style-type: none"> every 3 – 6 months on HPN 	Avoid excess provision	Red blood cells or whole blood, better indicator than plasma

Clinical		
Parameter	Evaluation	Frequency
Abdomen	Distention or discomfort	Daily
	Gastric residuals	4-hourly where appropriate
	Stool output and consistency	Daily
Oedema and dehydration	Check neck, arms and hands for signs of fluid overload or distention or inflammation of veins	Hourly in unstable patients 6-hourly once stable
	Fluid balance	Daily
Temperature	Abnormal values	Hourly in unstable patients 6-hourly in stable patients
Blood pressure and heart rate	Abnormal values	Hourly in unstable patients 6-hourly in stable patients
Line site	Infection, inflammation, oedema	Daily
PN bag	Cracking or separation of content. Leaking	Ongoing
Infusion rate and pump	Correct rate and pump is running	Ongoing
Diet		
Parameter	Evaluation	Frequency
Nutritional intake	Adequacy of delivery	Daily
	Readiness to introduce enteral or oral nutrition	Daily

Patients receiving parenteral nutrition require more intense biochemical monitoring, especially where there is ongoing losses and changes in the patient's condition. The most profound and possibly most dangerous changes in biochemical parameters can occur during the refeeding phase of establishing nutrition therapy.^{3, 36, 37}

8.2 Complications

The main complications from PN may be categorised into metabolic, physiological, mechanical or infectious as reflected in **Table 12**.

Table 12: Complications related to parenteral nutrition³⁸

Complications	Presentation and indicators	Pathophysiology	Management
Metabolic	Hyper/hypo glycaemia	Provision of high dextrose containing PN regimens/IV fluids	Avoid exceeding upper limit for dextrose provision
		Excessive administration of insulin	Avoid administration of other IV dextrose fluid if possible Adjust insulin dose if needed
	Fluid overload	Excessive volume provision. Inappropriate fluid retention	Decrease volume provision if possible Medical therapy for fluid retention if indicated
	Electrolyte abnormalities	Possible refeeding syndrome	Follow refeeding guidelines (Section 6.1)

Physiological	<p>Steatosis: Fat accumulation in the liver</p> <p>↑ AST and ALT generally occur within 2 weeks of starting PN and may return to normal even with continuation of PN</p>	<p>Overfeeding with dextrose and/or total calories or lipids</p> <p>Carnitine or choline deficiency</p>	<p>Avoid overfeeding</p> <p>Enteral feeding as soon as possible</p> <p>Antibiotics if bacterial over-growth is a possibility</p> <p>Add taurine to PN</p> <p>Cyclic PN</p>
	<p>Cholestasis: Impaired secretion of bile or biliary obstruction</p> <p>↑ ALP, GGT, Conjugated bilirubin</p> <p>AST and ALT may also be elevated</p> <p>May progress to cirrhosis and liver failure</p>	<p>Lack of enteral stimulation</p> <p>Overfeeding glucose, lipids and/or amino acids</p> <p>Choline deficiency</p> <p>Sepsis</p> <p>Short Bowel Syndrome</p> <p>Bacterial overgrowth</p>	<p>Avoid overfeeding</p> <p>Enteral feeding as soon as possible</p> <p>Antibiotics if bacterial over-growth is a possibility</p> <p>Cyclic PN</p>
	<p>Gallbladder sludge/stones</p> <p>Could lead to cholecystitis</p>	<p>Gallbladder stasis. More due to lack of enteral stimulation than PN itself</p>	<p>Enteral feeding as soon as possible</p>
	<p>Gastro-intestinal atrophy</p> <p>Enteric bacteremia and sepsis without clear source</p>	<p>Atrophy of villi due to lack of enteral nutrients</p>	<p>Enteral feeding as soon as possible</p>
Mechanical	<p>Catheter related</p> <ul style="list-style-type: none"> • thrombus • occlusion 		<p>Stop PN, remove catheter, wait for medical review</p>
	<p>Line insertion related</p> <ul style="list-style-type: none"> • pneumothorax • chylothorax • air embolism • cardiac arrhythmias • nerve injury 		<p>Remove catheter</p> <p>Medical review and management of complication</p>
Infectious	<p>Catheter or non-catheter related</p>		<p>If line sepsis is suspected the central line should be removed and the tip sent for microscopy, culture and sensitivity</p>

8.3 Weaning From parenteral nutrition

When considering weaning of patients from PN two outcomes should be considered:

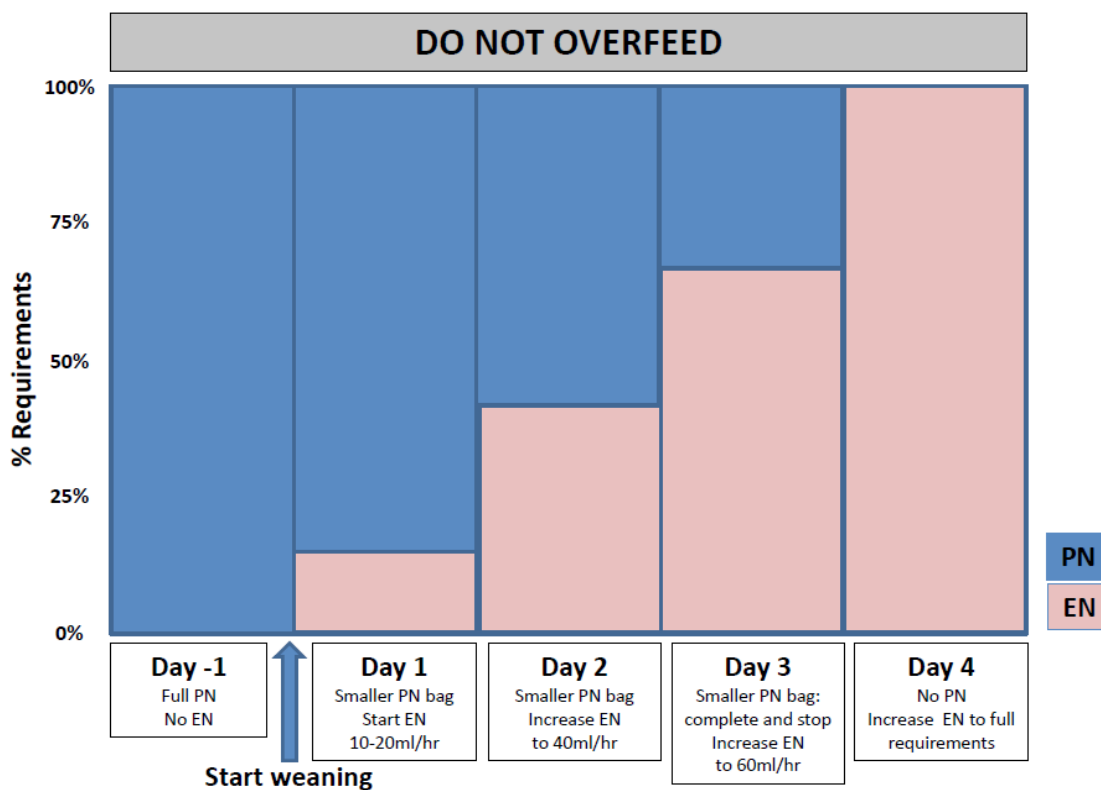
1. whether it is necessary for a patient to achieve full nutrition intake from an alternate route e.g. oral/enteral before PN is discontinued
2. whether or not the clinical symptoms, which required the use of PN have sufficiently abated

Introduction of oral/enteral feeds should be accompanied by a reduction in the amount of PN administered in order to minimise the risk of overfeeding and fluid overload. The weaning process should be controlled with a gradual increase in oral intake, while simultaneously decreasing the PN intake as illustrated in the weaning algorithm below. Please remember that the osmolalities of the EN and PN solutions are not similar. Care should be taken not to overfeed the patient while both routes of feeding are used. When more than 50 to 60 per cent of the patients' requirements are being met via an enteral/oral route, PN may be discontinued.^{2,3}

Note: Care should be taken with blood glucose control during the weaning period.

³A weaning algorithm is set out in **Figure 1**.

Figure 1: Weaning algorithm from parenteral nutrition



9. Summary

The information contained in this PN practice guideline should assist in ensuring an evidence-based and standardised approach to PN prescriptions in South African public health facilities.

10. Monitoring and evaluation assessment tool

Monitoring is the periodic and timely collection of data to determine if activities are being implemented as per the national guidelines.

The **Evaluation** process assists in determining the achievement of goals and objectives on a national and provincial level. Evaluation will give an opportunity to assess comprehensively and document the effectiveness of the inpatient management of PN. In the context of the current PN guidelines, monitoring will take place at inpatient level by the hospital based NTT and by the provincial nutrition team using the PN monitoring checklist (**Addendum 1**).

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Parenteral nutrition monitoring checklist

PN policy guideline	Compliant	Non-compliant	N/A
• Is there a copy of the latest official edition of the PN policy guideline available in the unit?			
• Is there a nutrition therapy team (NTT) in the facility (dietitian, pharmacist, surgeon, physician, registered nurse, other)?			
• Has the NTT been trained on the PN policy?			
• Have healthcare workers involved in central venous catheter (CVC) insertion been trained on CVC insertion, care and maintenance in CLABSI?			
• Are appropriately trained nurses present in intensive care units or wards where nurses manage patients with CVCs?			
• Is the fridge where the PN is stored defrosted and cleaned weekly?			
• Is the fridge temperature monitored regularly and charted?			
Storage/refrigeration			
• Is there a fridge log?			
• Is the temperature of PN supplies maintained at <5°C but above freezing?			
• Is stock rotation observed i.e. FIFO?			
• Is there any stock that has already expired?			
Sterile technique			
• Is the pharmacy, ward staff and dietitian trained in the use of sterile technique for handling of PN?			
• Does the staff wash their hands before handling PN?			
• Are the following hand wash facilities available: <ul style="list-style-type: none"> ○ hand wash basin ○ hot water ○ antibacterial soap ○ container for paper towels ○ paper towels ○ pedal bin or paper bin ○ hand sanitiser 			
Surveillance			
• Is daily culture and sensitivity testing for bacteria and fungi done?			
• Is there a register for patients on PN (pharmacy), i.e. name, registration number, age, date, time, signature of doctor and batch number?			
Insertion of catheter			
• Is this done as a surgical procedure after scrubbing, gowning and gloving and applying aseptic technique?			
• Is the operator, date and time of catheter insertion recorded on a standardised form or register?			
• Does the dressing allow easy observation of insertion site and surrounding tissues?			
• Are the CVC insertion sites examined every shift for tenderness at the site, fever with no obvious source, or other manifestations suggesting infection?			
Administration of solution			
• Is the PN solution administered after X-ray to confirm the position of the catheter?			
• Does the PN solution run for 24 hours after which the remaining solution and giving set is discarded?			
• Is there is a dedicated lumen for PN?			
Are other ports on the catheter are used for : <ul style="list-style-type: none"> ○ IV solutions or medications ○ blood or blood products ○ measuring CVP? 			
• Does the patient name on the bag match the name of the patient?			
• Does the type of bag match the prescription?			
• Does the infusion rate match the prescription?			
• Does the bag have a signed sticker indicating start and end time?			
Care of giving sets			
• Are giving sets changed every 24 hours and labelled with the date it was changed?			
• Is the extension set clamped when changing the giving set, to prevent air emboli?			
• Is the aseptic technique used when changing PN bags and giving sets?			

PN policy guideline	Compliant	Non-compliant	N/A
Removal of the line			
<ul style="list-style-type: none"> Is the distal end of the catheter cut with a sterile scissors, placed in a sterile container and send for quantitative culturing at the laboratories? 			
Change of dressing			
<ul style="list-style-type: none"> Is the aseptic technique observed for this sterile procedure? 			
<ul style="list-style-type: none"> Are records and reports of any skin appearance and inflammation done? 			
<ul style="list-style-type: none"> Is the catheter removed if any sepsis is present? 			
<ul style="list-style-type: none"> If there is a suspected infection: <ul style="list-style-type: none"> Is the catheter tip sent for MCS? Is a sample of the TPN from the bag sent for MCS? Are blood cultures sent from a peripheral site? 			
Nursing responsibilities			
<ul style="list-style-type: none"> Is the insertion site properly maintained to protect the patient from infection? 			
<ul style="list-style-type: none"> Is the catheter line kept dry and checked for leaks? 			
<ul style="list-style-type: none"> Is the catheter insertion site inspected 4-hourly and PN and records kept? 			
<ul style="list-style-type: none"> Is the catheter insertion site cleaned and a clean wound dressing applied under strict aseptic technique principles? <ul style="list-style-type: none"> Are records kept? 			
Observations			
<ul style="list-style-type: none"> Is the patient weighed 3 times per week? 			
<ul style="list-style-type: none"> Are 6-hourly vital signs observed? 			
<ul style="list-style-type: none"> Are any abnormal observations reported to the doctor and documented in the nursing process? 			
<ul style="list-style-type: none"> Is 6-hourly glucose testing done? 			
<ul style="list-style-type: none"> Is the patient closely observed for signs and symptoms of any complications? 			
Records available			
Are the following records available?			
<ul style="list-style-type: none"> Nursing care given 			
<ul style="list-style-type: none"> Date, time, site and name of doctor inserting PN line 			
<ul style="list-style-type: none"> Type of PN solution put up and quantity administered 			
<ul style="list-style-type: none"> Change of: <ul style="list-style-type: none"> PN solutions dressing insertion site 			
<ul style="list-style-type: none"> Observations 			
<ul style="list-style-type: none"> Reported abnormalities to doctor e.g: <ul style="list-style-type: none"> type of abnormality date and time of report name and signature of reporting officer 			
<ul style="list-style-type: none"> Biochemistry completed 			
Nutrition records			
<ul style="list-style-type: none"> Is the initial nutrition prescription (energy and protein) calculated by a dietitian and attached to patient notes? 			
<ul style="list-style-type: none"> Does the nutrition prescription include: <ul style="list-style-type: none"> total volume per day rate (ml/hr)? protein per day total kcal per day Glucose oxidation rate 			
<ul style="list-style-type: none"> Does it include a starting and weaning regimen? 			
<ul style="list-style-type: none"> Is the patient reviewed by a dietitian daily? 			
<ul style="list-style-type: none"> Are nutrition orders documented in the notes daily? 			
<ul style="list-style-type: none"> Is the baseline biochemistry: U & E, CMP, LFT, FBC – review by dietitian? 			
<ul style="list-style-type: none"> Is the 2 x weekly biochemistry: U & E, CMP, LFT, FBC – reviewed by a dietitian 			
<ul style="list-style-type: none"> Is the 6-hourly glucose monitoring reviewed by a dietitian? 			
<ul style="list-style-type: none"> Is a daily monitoring sheet used indicating time started, batch number etc? 			
<ul style="list-style-type: none"> Is the PN prescription signed by a doctor? 			
<ul style="list-style-type: none"> Is the PN administered using a volumetric pump? 			

Summarised report of PN audit

	Comments and remarks	Recommendations	Proposed action
PN policy guideline			
Storage/refrigeration			
Sterile technique			
Surveillance			
Insertion of catheter			
Administration of solution			
Removal of the line			
Care of giving sets			
Change of dressing			
Nursing responsibilities			
Observations			
Records available			
Nutrition records			

Signature of assessor: _____

Date: _____

Note: It is the responsibility of the nutrition therapy team to conduct this audit at least once per quarter.



National Department of Health
Civitas Building
Cnr Thabo Sehume and Struben Streets
Pretoria
0001

Switchboard: 012 395 8000