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# FURTHERING EDUCATION

Moving cancer nutrition education forward

Malnutrition in Cancer eLearning

Literature Review



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## OVERVIEW OF MALNUTRITION IN CANCER PATIENTS

### DEFINITIONS OF MALNUTRITION

- Malnutrition has been defined as ‘A state of nutrition in which a deficiency or excess (or imbalance) of energy, protein and other nutrients causes measurable adverse effects on tissue/body forms or function and clinical outcomes’ (1).
- Though this definition does encompass obesity as well as micronutrient or mineral imbalances, in the context of cancer malnutrition, the effect of broader macronutrient deficiency, particularly energy and protein, is of primary concern (2-3). Hence throughout this learning package, the term ‘malnutrition’ refers to the deficiency state or under-nutrition, also known as protein-energy malnutrition.
- ICD-10-AM (4) states “in adults, malnutrition includes weight loss of at least 5%, with evidence of suboptimal intake resulting in subcutaneous fat loss and/or muscle wasting”. Diagnostic criteria for protein-energy malnutrition as per the ICD-10-AM are described below:

#### **Protein-Energy Malnutrition Criteria in Adults (4)**

Degree of PEM*	Criteria for Classification
Severe PEM	BMI** <18.5 kg/m <sup>2</sup> or >10% unintentional loss of weight <i>and</i> evidence of suboptimal intake resulting in severe loss of subcutaneous fat and/or severe muscle wasting
Moderate PEM	BMI < 18.5 kg/m <sup>2</sup> or 5-9% unintentional loss of weight <i>and</i> evidence of suboptimal intake resulting in moderate loss of subcutaneous fat and/or moderate muscle wasting
Mild PEM	BMI < 18.5 kg/m <sup>2</sup> or 5-9% unintentional loss of weight <i>and</i> evidence of suboptimal intake resulting in mild loss of subcutaneous fat and/or mild muscle wasting

\*PEM=protein-energy malnutrition, BMI=body mass index

- Micronutrient deficiencies may exist and impact outcomes for cancer patients, either related to malnutrition or in isolation, however, there are no nutrition screening or assessment tools specifically designed to identify micronutrient deficiency and therefore clinical judgment is required (5).

### PREVALENCE OF MALNUTRITION IN PEOPLE WITH CANCER

- Oncology patients are more likely to be malnourished compared with other clinical groups (6-9)
- Malignant disease has been found to be an independent risk factor for malnutrition (OR 1.509, CI 1.180–1.930, P<0.01) (9)

- Overall prevalence of malnutrition in oncology patients in Australia has been found to be between 26-48% (5-6)
- This is in the range of figures reported in the international literature, with prevalence rates between 31-71% identified in Europe, Asia and South America (7-11)
- Prevalence of malnutrition amongst chemotherapy outpatients has been reported to be between 23-46% in Australia (5, 12-14)
- Prevalence of malnutrition in unselected radiotherapy outpatients is 9% in Australia (5), increasing to 35% amongst high-risk groups receiving RT to the head, neck, rectal or abdominal areas (15).
- This is similar to the 39% prevalence of malnutrition reported internationally during RT in high risk groups receiving RT to the head & neck, gastrointestinal tract or lung (16)
- Concurrent chemotherapy during RT is significantly associated with malnutrition ( $p=0.006$ ) (16). Prevalence of malnutrition during concurrent chemoRT has been found to be higher than during RT or chemotherapy alone (37% vs 9% or 23% respectively) (5)

## CAUSES AND CONTRIBUTORS OF CANCER MALNUTRITION

### Hospitalisation

- Many studies have found hospitalisation is significantly associated with malnutrition (5, 10-11)
- Oncology patients were 1.8 times more likely to eat <50% of food offered in hospital (6).
- Sub-optimal food intake over an extended time period whilst in hospital puts patients at risk of becoming malnourished or of further deterioration in nutritional status (6).

### Tumour Location

- Nutritional deterioration has been significantly linked with tumour location (2)
- Certain tumour groups have a high incidence of malnutrition and are well-recognised to be patients at high nutrition risk:
  - Head and neck: 40-47% malnourished (2, 5, 10-11)
  - Upper gastrointestinal (Stomach, oesophagus): 50- 62% malnourished (2, 5, 10-11)
  - Lung: 37-40% malnourished (5, 10)
- The physical presence of the tumour in upper gastrointestinal and head and neck cancers can cause obstruction/ stricture of the GI tract and nutrition impact symptoms such as pain, odynophagia and dysphagia, and hence reduce dietary intake (17-18)
- At early stages of disease, patients with head and neck and gastro-oesophageal cancers show significant reductions in dietary intake(2) and severe loss of weight (18)
- In lung cancers, malnutrition is likely related to increased energy needs which may lead to weight loss without change in dietary intake (19)

### Age

- Malnutrition has been found to be significantly more common in patients >65-70 years (35-43% respectively) compared to those in younger age groups (5, 9)
- The average age of malnourished patients has been found to be significantly greater than in those who were well nourished (7)
- Age correlates significantly with malnutrition (20), and higher age is an independent risk factor for malnutrition (9)

### Advanced disease

- Patients' nutritional deterioration has been found to be significantly related to cancer stage ( $P=0.0001$ ) (2)
- Advanced cancer stage is an independent factor associated with increased LOW (21).
- Malnutrition and weight loss were significantly higher and dietary intakes of energy and protein were significantly lower in patients with stage 3-4 cancers compared to patients with stage 1-2 cancers (2)
- Patients with advanced disease receiving treatment of palliative intent have significantly higher rates of malnutrition compared with patients receiving active/curative treatments (75% vs 46% respectively) (5)
- Presence of metastases is associated with the presence of malnutrition (10) and frequency of weight loss (21)

### Social situation

- Malnutrition is higher in patients living in residential care (50 per cent) versus living alone (35 per cent) versus living with family or a carer (30 per cent) (5)
- Prevalence of malnutrition was found to be higher in areas of lower per-capita income (20)

### Performance status

- Low performance status was associated with the presence of malnutrition (10)
- Patients who have lost weight are significantly more likely to have a poorer performance status than those who have not lost weight (22)

### Polypharmacy

- Polypharmacy is an independent risk factor for malnutrition (9)

### Nutrition Impact Symptoms (related to cancer itself)

- Stress and anxiety of a cancer diagnosis can affect appetite and food intake (5)
- Up to 62% of cancer patients present with symptoms that may affect eating (23)
- Symptom burden increases with advanced cancer, with a mean of 3.7 symptoms impacting dietary intake (24)
- A higher incidence of adverse symptoms prior to treatment has been correlated with increased loss of weight (23)
- The most commonly reported symptom amongst cancer patients is anorexia, with 38-52% of patients experiencing poor appetite (11, 23-25)
- Other commonly reported symptoms include:
  - Pain- 22-30% (11, 23, 25)
  - Early Satiety- 22-27% (11, 23)
  - Nausea- 18-38% (23, 25)
- The absence of nausea and vomiting has been found to be an independent determinant of weight stabilization (26)

### Nutrition Impact Symptoms/ Toxicities related to cancer treatment

- Nutritional deterioration in advanced cancer has been significantly associated with previous surgery or chemotherapy ( $P=0.02$ ) (2)
- Treatment with radiotherapy has been significantly associated with the presence of malnutrition (10)
- RT and/or chemotherapy may cause a number of side-effects that can affect nutritional status e.g. Mucositis, nausea, vomiting, anorexia, diarrhoea, fatigue (22, 27-31)
- Acute toxicity is greater for combined chemoRT compared with chemotherapy or RT alone due to chemotherapeutic agents acting as radio-sensitizers (31)
- Increased severity of toxicity was strongly associated with decline in nutritional status in patients undergoing radiotherapy (30)
- Radiation-induced toxicities can continue for weeks to months beyond the end of treatment (27-29, 32)
- Toxicity from radiotherapy has been found to be more frequent, severe and of longer duration when nutritional intake is suboptimal (29)
- Symptoms such as appetite loss, nausea and vomiting and fatigue were significantly worse in malnourished patients compared with well-nourished patients during chemotherapy (33)

### Modified diets

- Patients with dysphagia or poor dentition (34), or toxicity from treatments e.g. mucositis/odynophagia, may require texture-modified diets
- Inpatients on texture modified diets were least likely to consume all the food offered in the Australian Nutrition Care Day Survey (6).
- In older adults, patients on texture-modified diets had significantly lower intakes of energy and protein compared to patients consuming a normal diet (34)
- Even in healthy adults, texture modification significantly reduced food intake by 7- 9% (35)

- Standard texture meals were rated significantly more palatable than texture-modified meals by healthy adults (35)
- Possible reasons for poor intake of texture modified diets include: a higher incidence of eating difficulties in patients requiring texture modification, reduced food choice, unappealing presentation of food and foods being less palatable(34)

#### Additional requirements related to cancer itself

- Energy expenditure has been shown to vary greatly in cancer patients (3)
- Treatment and disease stage may alter metabolic requirements over time (36)
- Hypermetabolism has been found to be present in approximately 50% of patients with advanced cancer and is not compensated for by increased intake, which can make a large contribution to negative energy balance and wasting (3, 37)
- Cancer cachexia also increases nutritional requirements (36) likely mediated by systemic inflammatory processes (38)

#### Additional requirements related to cancer treatment

- Evidence-based practice guidelines recommend increased intakes of energy and protein during chemotherapy and radiotherapy are required for weight stability (36, 39)
- Additional energy and protein is also required for recovery from surgery (40-41)

#### Dietary restrictions

##### *Cancer diets*

- Many patients with cancer use complementary and alternative medicine, of which diets and nutritional supplements are most common (42)
- Often cancer diets are based on theories of carcinogenesis which do not agree with modern scientific concepts (42)
- Restrictive or imbalanced dietary intakes associated with cancer diets have been associated with risks such as excesses or deficiencies of macro- and micro-nutrients, weight loss metabolic derangements and death (42)

##### *Peri-operative care*

- Traditional perioperative care involves extensive fasting periods or fluid-only diets to prepare the bowel for surgery and to 'rest' the gut following surgery, and is still common in hospitals throughout Australia (43)
- Conservative views on progression to full ward diet post-operatively can mean advice such as 'go slow' and 'take it easy' with food and fluid intake is commonly given to patients (43)
- Despite awareness of the ERAS nutrition protocols many hospitals have not been able to fully implement the evidence-based nutrition care guidelines (43)
- "A significant gap between the literature and clinical practice remains in the nutritional management of colorectal surgery patients" (43)

##### *Fasting for procedures*

- The Australian Nutrition Care Day Survey identified being away for a diagnostic test/procedure was the second most common reason why participants did not consume between-meal snacks (6)

## CONSEQUENCES OF CANCER MALNUTRITION

#### Increased mortality

- Many studies have found mortality rates are significantly higher in malnourished patients when compared with well-nourished patients (5, 7-8, 10, 44-45)
- Risk of death increases with severity of malnutrition (10)

- Malnutrition has been found to be independently associated with mortality (10, 45-46) and is a significant predictor of overall mortality (7)
- Malnourished patients were found to have up to a four-fold increase in risk of death at one year follow up (7)
- Similarly, weight loss has also been associated with reduced survival in oncology patients in a number of studies (18, 21-22, 37, 47)
- Risk of death for GI cancer patients undergoing chemotherapy was increased by 43% for those who had lost weight (22)
- Weight loss is a significant predictor of decreased survival independent of tumour extent and performance status- even small amounts of weight loss (<5%) may considerably worsen prognosis (21)
- Mortality rates among patients with >10% loss of weight were observed to be approximately double that of patients with <10% loss of weight (47)
- Weight stabilisation is also associated with significantly longer survival compared with continued weight loss (22, 26)

#### Increased relapse rates

- Patients who had lost weight had significantly shorter failure-free survival (median 5.1 months) than those who had not lost weight (6.3 months,  $P < 0.0001$ ) (22)
- Weight loss >5% has been found to be a prognostic factor for distant metastatic recurrence (18)
- Weight loss is a significant predictor of progression-free (48) and disease-free (18) survival
- Weight stabilisation resulted in a significant improvement in both progression-free and overall survival in lung cancer patients receiving chemotherapy (46)

#### Poor immunity/increased risk of infection

- Severe or long term malnutrition can lead to decreased immunity, resulting in susceptibility to infection (21)
- Antibiotic use in hospital has been found to be significantly increased in malnourished patients compared to well-nourished patients ( $P < 0.001$ ) (5, 10)
- Incidence of infectious complications is significantly higher in malnourished patients compared to well-nourished patients (19.4 vs 10.1%,  $p < 0.01$ ) (45)
- Nutrition support has been found to be more effective in reducing infectious complications than non-infectious ones (47) suggesting nutrition may be able to modulate the immune response

#### Increased incidence of in-hospital complications

- Malnourished patients have a significantly higher incidence of complications than well-nourished patients (8, 45, 47)
- Malnutrition and weight loss are independent risk factors for complications (45, 47), and the risk of complications increases continuously as the percent weight loss exceeds 10% (47)
- Nutrition support has been shown to significantly decrease the risk of complications when compared with standard IV fluids post-operatively ( $p < 0.001$ ) (47)
- A clinically but not statistically significant difference was seen when comparing the presence of pressure ulcers in malnourished and well-nourished patients (83 per cent versus 55 per cent,  $p = 0.075$ ) (5)
- Incidence of in-hospital complications rose significantly together with increasing severity of malnutrition (49)
- Patients who developed complications stayed significantly longer in hospital than patients without complications (49)

#### Reduced treatment tolerance

- Weight loss has been associated with reduced chemotherapy response rates in oncology patients (21-22)
- Significantly fewer patients with weight loss completed 3 cycles of chemotherapy than those without weight loss (67% vs 81%,  $P < 0.001$ ) due to early disease progression or toxicity (46)
- Treatment was delayed significantly more frequently in chemotherapy patients with weight loss compared to those without weight loss (46)

- Radiotherapy patients who required treatment breaks experienced significantly greater weight loss than those who did not require breaks (30)
- Patients with weight loss had an increased occurrence of dose-limiting toxicity and consequently, were found to receive on average, 30 days less treatment than those without weight loss either due to longer or more frequent breaks during treatment (22)
- Patients with weight loss may also receive less treatment due to beginning chemotherapy at a lower dose, as dose is based on body surface area which is calculated using body weight (22)
- Reduced time on treatment may mean the overall dose of treatment received may be insufficient to effectively eradicate the malignancy (22)

#### Reduced muscle mass/poor physical function

- Malnutrition is associated with functional impairment, with significantly more malnourished patients having a poor performance status (>2 as per WHO criteria) than good performance status (<2 as per WHO criteria) (43.3% vs 19.6%,  $p<0.0001$ ) (10)
- Weight change (21), poorer nutritional status (33) as well as daily calorie and protein intake (50) have also been correlated with physical performance status of cancer patients
- Physical function has been found to improve significantly with nutrition support pre-operatively, while worsening in patients with no pre-operative nutrition support (17)

#### Reduced QOL

- Nutritional status has been significantly associated with global QOL both at the beginning of and during radiotherapy (15) and during chemotherapy (33)
- In patients undergoing chemotherapy, those who had lost weight had a poorer quality of life than those who had not (22)
- Changes in QOL were proportional to changes in nutritional intake and nutritional status (29)
- Nutritional status at baseline predicted 16% of the variation in global QOL after 4 weeks of radiotherapy (15)
- 26% of change in QOL was explained by change in nutritional status (15)
- Correspondingly, QOL measures have been found to improve with nutrition intervention (counselling, ONS and ENS) preoperatively and during/post radiotherapy (17, 29)
- Weight stable patients reported significantly higher QOL than those who were losing weight (26)

#### Increased length of hospital stay

- Malnutrition is an independent risk factor impacting on length of hospital stay (45, 49)
- Median length of stay has frequently been shown to be significantly longer in malnourished patients when compared with well-nourished patients, with malnourished patients staying an additional 3-6 days in hospital (5, 7, 9-10, 25, 45)
- Length of hospital stay increased significantly in accordance with the severity of malnutrition (49)
- Malnutrition is associated with a 42-45% increase in length of hospital stay (9-10)
- 9% of the variance in length of stay is attributable to nutritional status (25)

#### Increased hospital admissions

- Malnourished patients are significantly more likely to be re-admitted to hospital within 15-30 days of discharge than well-nourished patients (5, 7, 25)
- Malnourished patients had a 60% increase risk of readmissions within 15 days when compared to well-nourished patients (7)

#### Increased health care costs

- Malnutrition is an independent risk factor impacting on hospital costs (45)
- Within diagnosis related groups, the cost of hospitalisation was 24% higher than average for malnourished patients, and significantly higher than that for well-nourished patients (7)
- "Malnourished patients represented a mean daily expense of US\$228.00 per patient compared to the US\$138.00 per patient in the well-nourished. This represented an increased cost of 60.5% for malnutrition." (45)



## COSTS OF MALNUTRITION

- Malnutrition is often underdiagnosed and hence undertreated, with many studies finding only a small percentage of patients who are malnourished are receiving nutrition support (5, 8, 10-11, 20, 45)
- Similarly, <7% of malnourished inpatients were coded for malnutrition (5, 7) despite the significantly higher prevalence rates of malnutrition. Improved documentation of malnutrition allows increased financial reimbursements for health services for the costs associated with the identification and treatment of malnutrition (5).
- Malnutrition and weight loss are potentially preventable and reversible, and should not be considered an expected side effect from cancer or its treatments (5).

## BENEFITS OF SCREENING AND EARLY INTERVENTION

- Given the numerous physical, emotional, social and financial consequences of malnutrition outlined previously, approaches that identify malnutrition early and support maintenance or enhancement of nutritional status can positively influence patient outcomes and reduce health care costs associated with adverse events.

# NUTRITIONAL IMPLICATIONS OF CANCER AND CANCER THERAPIES

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## NUTRITIONAL IMPLICATIONS OF CANCER

- Disease and malnutrition interact in a reciprocal manner (28), so cancer may cause secondary malnutrition, while malnutrition may also have adverse effects on the underlying cancer

### Tumour Location

- Nutritional deterioration has been significantly linked with tumour location (2)
- The physical presence of the tumour in certain locations can cause obstruction, stricture or compression of the gastrointestinal tract, e.g. Head and neck (17), oesophageal (18), lung (51), colorectal (52), gynaecological (53), or urological tumours (54), which can impede dietary intake and/or cause nutrition impact symptoms
- Presence of the tumour may cause symptoms that restrict dietary intake, such as dysphagia, odynophagia, nausea, anorexia, fatigue (17-18, 23) or symptoms which can reduce nutrient absorption, such as diarrhoea and vomiting (23)

### Nutrition Impact Symptoms related to cancer itself

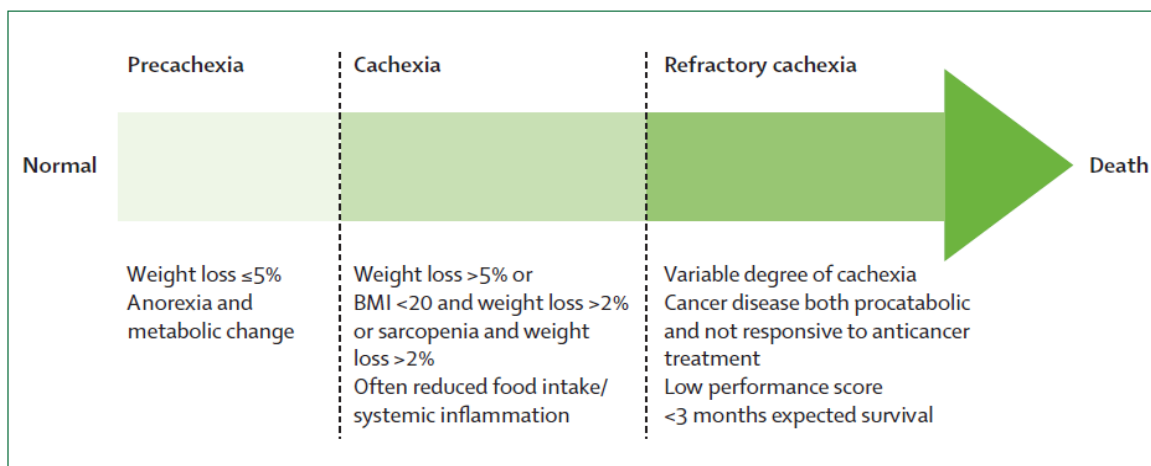
- Stress and anxiety of a cancer diagnosis can affect appetite and food intake (5)
- Up to 62% of cancer patients present with symptoms that may affect eating (23), and up to 37% present with more than one nutrition impact symptom prior to receiving any treatment (32)
- Symptom burden increases with advanced cancer, with a mean of 3.7 symptoms impacting dietary intake (24)
- A higher incidence of adverse symptoms prior to treatment has been correlated with increased loss of weight (23)
  
- A commonly reported symptom amongst cancer patients is anorexia, with 38-52% of patients experiencing poor appetite (11, 23-25)
- Other commonly reported nutrition impact symptoms associated with cancer include:
  - Pain- 22-30% (11, 23, 25)
  - Early Satiety- 22-27% (11, 23)
  - Nausea- 18-38% (23, 25)
- The absence of nausea and vomiting has been found to be an independent determinant of weight stabilization (26)
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- Cancer-related fatigue is defined as a “distressing, persistent, subjective sense of tiredness or exhaustion related to cancer and cancer treatment that is not proportional to recent activity and interferes with usual functioning” (55) and is prevalent in up to 77% of cancer patients and survivors (56)
- Cancer-related fatigue is more severe, more distressing and less likely to be relieved by rest than fatigue in healthy individuals (55)
- Cancer-related fatigue has been reported throughout the course of malignant disease: from diagnosis, during treatment, and for months to years post treatment (57)
- History of depression and impaired performance status are related to the occurrence of moderate to severe fatigue (56)
- Often symptoms of fatigue can be improved with improvements in dietary intake, adequate hydration and electrolyte balance (55)

### Additional requirements related to cancer itself

- Energy expenditure has been shown to vary greatly in cancer patients, but hypermetabolism has been found to be present in approximately 50% of patients with advanced cancer (3)
- Cancer cachexia also increases nutritional requirements (36)

### Cancer Cachexia

- Cancer cachexia is defined as “a multifactorial syndrome defined by an ongoing loss of skeletal muscle mass (with or without loss of fat mass) that cannot be fully reversed by conventional nutritional support and leads to progressive functional impairment.” (58)
- The current diagnostic criterion for cachexia is:
  - “weight loss greater than 5% over the past 6 months (in absence of simple starvation), or,
  - weight loss greater than 2% in individuals already showing depletion according to current bodyweight and height (body-mass index [BMI] <20kg/m<sup>2</sup>) or skeletal muscle mass (Appendicular skeletal muscle index consistent with sarcopenia: males <7.26 kg/m<sup>2</sup>; females <5.45 kg/m<sup>2</sup>) (58)
- Loss of skeletal muscle is key in patients’ functional impairment (58)
- “Cancer cachexia is characterised by a negative protein and energy balance driven by a variable combination of reduced food intake and abnormal metabolism” (58)
- Hypermetabolism in cancer patients is not found to be compensated for by an increase in spontaneous food intake (37)
- Reduced energy intake is common in cancer patients (3, 24-25) often associated with anorexia (3, 37)
- A cycle of sustained hypermetabolism and reduced intake due to anorexia may contribute to development of cancer cachexia by creating a large negative energy balance and subsequent wasting (37)
- The energy deficit created by this anorexia and hypermetabolism is exacerbated by a lack of homeostatic negative feedback mechanisms that would usually regulate energy balance (3, 37-38).
- Weight loss in cancer cachexia is distinct from starvation (energy deficit alone) as it is predominantly drawn from lean body mass rather than fat stores (21, 59), and thought to be due to the inflammatory response (59).
- “Weight loss in cancer cachexia is different from the weight loss of starvation or anorexia... due to accelerated loss of skeletal muscle in relation to adipose tissue, presence of pro-inflammatory cytokines and prolonged acute phase protein response that contributes to increased resting energy expenditure and weight loss.” (36)
- “In starvation more than three-quarters of the weight lost is from body fat and only a small amount from muscle. In cancer cachexia, weight loss arises equally from loss of muscle and fat.” (36)
- Catabolic drivers of cachexia may include systemic inflammation and other tumour-mediated effects, however cachexia may occur without evident systemic inflammation (58)
- The most widely accepted index of systemic inflammation is serum C-reactive protein (CRP) (58), with the presence of inflammation (or an acute-phase protein response) defined as a CRP >5mg/L (38) evans 2008
- Tumour related factors are generated by the tumour itself and include proteolysis-inducing factor and lipid mobilization factor (38)
- Humoral factors are generated by the body in response to the presence of the tumour and include cytokines such as tumour necrosis factor and interleukins (38)
- Tumour necrotic factor activates protein breakdown and reduces muscle uptake of glucose and amino acid. (38)
- Interleukins mediate anorexia and a reduced insulin response which together with increases in glucagon, cortisol and catecholamines often found in cancer patients, promotes catabolism (38)
- Cachexia related weight loss may not always be reversible with nutrition support. Recent international consensus refers to cachexia as a continuum, with Pre-cachexia and Cachexia the stages which may still be responsive to intervention (58)



- Cachexia may be refractory due to advanced or rapidly progressive disease. Refractory Cachexia is characterized by poor performance status (WHO score 3-4) and an anticipated survival of <3 months. It is associated with active catabolism and aggressive management of weight loss may no longer be appropriate. Focus should be on symptom control (58)

## NUTRITION-RELATED IMPLICATIONS OF CHEMOTHERAPY AND ITS COMMON SIDE EFFECTS

- Nutritional deterioration in advanced cancer has been significantly associated with previous chemotherapy ( $P=0.02$ ) (2)
- The incidence of malnutrition increases significantly during chemotherapy, with 19.4% of patients malnourished prior vs 82.4% malnourished after chemotherapy ( $P < 0.001$ ) (60)
- Nutritional status, as well as global fat and muscle mass, has been observed to decline significantly during chemotherapy (60)
- Malnutrition/weight loss may interact reciprocally with treatment toxicity, as weight-losing and malnourished patients are more likely to experience toxicity during chemotherapy, and their symptoms are significantly worse than well-nourished/non-weight losing patients (22, 33), whilst more severe toxicities may compound nutritional deterioration (61)
- Symptoms may persist beyond the end of treatment, with 46% of patients still experiencing nutrition impact symptoms 12 months following commencement of chemotherapy (28)
  -
- Side-effects of chemotherapy are dependent on the chemotherapeutic agent used refer [eviQ.org.au](http://eviQ.org.au)
  -

### Nutrition impact symptoms that occur in patients undergoing chemotherapy:

- Mucositis (22, 60, 62)
- Dysguesia (28, 60)
- Xerostomia (28)
- Nausea (14, 28, 60-61)
- Vomiting (14, 28, 60-61)
- Diarrhoea (28, 60-62)
- Constipation (28, 60-61)
- Anorexia (28, 61)
- Fatigue (56, 60)
- Early satiety (60)
- Depression (60)

### Late effects

- Late effects that may commonly occur across survivors of different cancers include fatigue, sexual dysfunction, sleep disturbance, cognitive impairment and musculoskeletal symptoms (63-64)
- Other physical symptoms which may arise include pain, nausea and/or vomiting, diarrhea, neuropathy, cardiomyopathy, reduced bone mineral density, skin rashes, cachexia, and lymphedema (63, 65)
- Psychological late effects/long term effects of cancer treatment may include anxiety, depression and post-traumatic stress disorder (64-65)
- “For cancer survivors, as for individuals without a history of cancer, physical health directly influences mental health status and overall quality of life”. (63)
- Functional difficulties with returning to work and restricted physical and social activities have also been identified in some survivors. Impaired activities were generally those requiring muscle strength, stamina, or mobility (64)

## NUTRITION-RELATED IMPLICATIONS OF RADIOTHERAPY AND ITS COMMON SIDE EFFECTS

- Approximately 60% of cancer patients will undergo radiotherapy as a part of their treatment (66)
- The incidence and severity of radiation-induced toxicity depends on several factors, including radiation field size, total radiation dose, dose per fraction, patient-related risk factors, inherent organ sensitivity, and treatment with other modalities, such as chemotherapy and surgery (66)
- Treatment toxicities may not only limit food intake, but may also impair nutrient absorption (27)
- Increased treatment toxicity has been found to be strongly associated with decline in nutritional status (44) and with weight loss (31, 67) in patients undergoing radiotherapy
- Toxicity from radiotherapy has been found to be more frequent, severe and of longer duration when nutritional intake is suboptimal (29)
- Severe treatment toxicity may cause unplanned delays in treatment and reduced chance to escalate the treatment dose to more effective levels, which can reduce tumour control and survival rates (67)
- Immediately after treatment cessation, patients are likely to experience the worst radiation-induced toxicities (62, 67), but side-effects may continue for weeks to months beyond the end of treatment (27, 29, 32, 67-68)
- High-risk patients (with head and neck or gastrointestinal cancers) have been found to lose weight during radiotherapy despite nutritional counselling and/or oral nutrition supplements (27, 30-31), and body weight may not return to baseline levels post treatment (31-32)
- Dietary intake in lung cancer patients was found to decrease from week 3 of radiotherapy and continued to decline until the end of treatment (19)
- The proportion of head and neck patients with documented eating problems nearly doubled after 3 weeks of radiotherapy compared to pre-treatment, and at the end of radiotherapy all patients had documented eating problems (69)
- Patients may continue to lose weight post treatment (68) and many still rely on oral nutrition support for several weeks-months after completion of treatment (19, 68)

### Radiotherapy can cause several systemic nutrition impact symptoms, such as:

- Fatigue (19, 29-30, 56)
  - Fatigue may compromise the timing or completion of treatment regimens, either because fatigue is a dose-limiting adverse effect or because it reduces the patient’s willingness to adhere to treatment (57)
  - 45% of patients undergoing active treatment reported moderate to severe fatigue (56)

- >5% weight loss within the previous 6 months was a significant contributor to incidence of fatigue (56)
- Pain (29, 68-69)
- Loss of appetite (29-30, 68-69)
- Reduced physical performance (19)
  - Patients' muscle strength declined significantly in the first weeks of concurrent CT-RT, with decline beginning at initiation of treatment and reaching the lowest rates by weeks 2-3 (19)

Radiotherapy also causes/contributes to nutrition impact symptoms specific to the particular area being irradiated:

#### Head and neck

- Head and neck cancer patients experienced significantly greater weight loss than other patients during radiotherapy (31)
- Head and neck tumour location was an independent risk factor for weight loss in patients undergoing radiotherapy (31)
- Swallowing capacity, loss of appetite, pain and mucositis were significant predictors of energy intake and weight loss in head and neck patients undergoing radiotherapy (68)
- Mucositis (31, 68-69)
- Dysphagia (19, 44, 68-69)
- Odynophagia
- Xerostomia (68-69)
- Dysguesia (68-69)
- Chewing difficulties (69)
- Oral fungal infection (69)
- Thick/ropy saliva (69)

#### Chest

- Oesophagitis (18-19, 30, 62, 67)
  - Experienced in up to 72% of oesophageal cancer patients (62)

#### Abdomen

- Nausea (29-30)
- Vomiting (29-30)

#### Pelvis

- “Bowel injury is the primary radiation dose limiting factor in the treatment of a number of malignancies, including those of gynaecologic, urologic, and gastrointestinal origin” (66)
- Diarrhoea (29-30)
- Constipation (70)
- Abdominal pain/cramps (70)
- Intestinal gas/ Flatulence (70)

#### Combined chemo-radiation

- Combined chemo-radiation results in improved survival for loco-regionally advanced cancers compared to radical radiotherapy alone, but comes at the cost of increased acute morbidity (71)
- Acute toxicity is greater for combined chemo-radiation compared with chemotherapy or radiotherapy alone due to chemotherapeutic agents acting as radio-sensitizers (31, 71)

- Use of chemotherapy during radiotherapy was found to be an independent risk factor for weight loss (31)
- Patients undergoing chemo-radiation experienced greater reduction in dietary intake, greater weight loss and worse quality of life than patients undergoing radiotherapy alone and these deficits persisted longer post-treatment than in radiotherapy patients (68)

#### Late effects

- Late effects of radiotherapy can be a major source of chronic morbidity and may substantially impair quality of life in long term survivors (71-72)
- Late complications from radiotherapy are likely related to damage of endothelial cells and associated reduction in microvascular flow which leads to ischaemia, fibrosis and loss of organ/tissue function (66, 72)
- Thoracic: pulmonary fibrosis, dyspnoea (62, 66)
- Head and neck: mandibular osteoradionecrosis, dysphagia, chronic xerostomia, dental decay, chronic infection of the oral cavity, hypothyroidism (66, 71)
- Pelvic: permanent change in bowel habit, gastrointestinal symptoms such as significant diarrhea, constipation, distention, abdominal pain or rectal bleeding, osteoradionecrosis of the femoral head (66, 72)

### NUTRITION IMPLICATIONS OF COMMON CANCER SURGERIES

- Nutritional deterioration in advanced cancer has been significantly associated with previous surgery ( $P=0.02$ ) (2)
- “Patients undergoing surgery face many metabolic and physiological challenges that may compromise nutritional status” (73)
- General side-effects of surgery may include: Postoperative nausea, vomiting, pain, and anorexia (73-74)
- For major surgeries: increased hypermetabolism, catabolism, infection, and wound healing may constitute additional difficulties (73)
- Nutritional requirements are increased post-surgery to support wound healing and hypermetabolism associated with recovery (41, 73)
- Inadequate nutrition post-operatively can result in muscle wasting, immune dysfunction and diminished visceral protein status (73)
- Since the 1980s, it has been recognised that malnutrition correlates with increased rates of a range of complications, defined as post-operative outcomes such as death, inadequate wound healing, wound infection, wound dehiscence or sepsis (75).
- Patients who already have nutritional deficits pre-surgery are at greater risk of poorer post-operative outcomes than those who are well-nourished going into surgery (75)
- Patients who become malnourished post-surgery are likely to stay in hospital significantly longer than patients who maintain their nutritional status (74)
- Old age (>60 years old), preoperative weight loss and open surgery were found to be significant risk factors for severe postoperative malnutrition in GI cancer patients (74)

#### Head and Neck surgery (e.g. laryngectomy, glossectomy, mandibulectomy)

- “Swallowing problems after surgery for head and neck cancer will be dependent on the extent of the resection, the specific structures resected, and to a limited extent, the nature of reconstruction. A greater extent of resection is associated with worse swallowing function.” (76)
- “Preservation of anatomy does not necessarily translate into the preservation of organ function.” (76)
- Swallowing ability is frequently impaired after head and neck surgery (including total and subtotal glossectomy, pharyngectomy and partial laryngectomy) – 15-19% of patients remain partially or fully dependent on tube feeding to meet nutritional requirements post-operatively due to dysphagia (77-79)
- Supracricoid partial laryngectomy produces severe dysphagia initially with 100% of patients aspirating on fluids 4 weeks post-operatively and 55% aspirating foods (78)

- Even in patients who return to full oral diet post glossectomy, chewing/swallowing function may remain impaired with 75% of these patients relying on soft-puréeed foods and 25% requiring a liquid diet (79)
- Late pharyngeal stricture occurred in 15% of patients post partial laryngectomy (77)
- In a small sample of patients undergoing lateral mandibulectomy, no patients were dependent on a feeding tube, and <2 months post-operatively, 60% of patients tolerated a normal or soft diet (80)
- Factors associated with improved dietary intake post mandibulectomy included reconstruction with a vascularized bone flap rather than a soft tissue flap, obtaining proper dental occlusion and trying a variety of diets progressing from liquid or puree to solid (80)
- Postoperative function in both bone and soft tissue mandibular reconstruction groups gradually improved over time, with 96% of patients tolerating a normal or soft diet at final follow up (80)

### Oesophagectomy

- Postoperative catabolism is common in patients undergoing oesophagectomy, often on a background of pre-operative weight loss with almost 20% of patients having lost >10% of their body weight prior to surgery. (81)
- Dietary intake of energy has also been found to be inadequate pre-oesophagectomy in 43-54% of patients (81)
- Oesophagectomy may cause nutrition impact symptoms such as early satiety, postprandial dumping syndrome, dysphagia, reflux, absence of hunger and altered stool frequency (haverkort 2012)
- An anastomotic leak is a post-operative complication associated with high mortality (82)
- Other complications that have been observed post oesophagectomy include chyle leak, ileus, aspiration, and recurrent laryngeal palsy (82)
- Large weight losses were observed post-oesophagectomy irrespective of complications (average 6.7-9.7kg) and 6 months later, only 8% of patients regained their pre-operative weight. (82)
- At 6 months post-oesophagectomy, energy and protein intakes have been found to remain inadequate in 24% and 7% of the patients, respectively and less than 10% of the patients had a sufficient intake of all micronutrients (83)
- Folic acid, vitamin D, copper, calcium, and vitamin B1 were the micronutrients most often reported to have a suboptimal intake post-oesophagectomy (83)
- Over 50% of patients developing complications post-oesophagectomy require an alternative to oral feeding beyond 30 days. (82)
- 48% of oesophagectomy patients required tube feeding upon discharge and 22% of patients were still requiring oral nutrition supplements 12 months post-surgery. (83)
- “All patients at the time of diagnosis with oesophageal cancer need dietary assessment and supplementation if nutritional intake is poor.” (82)
- “There is also a clear need for dietary supplementation in those patients with long-term reduced appetite and poor oral intake.” (82)

### Gastrectomy

- Many patients are malnourished prior to gastrectomy- based on SGA, 31% mildly/moderately malnourished and 11% severely malnourished and dietary intake as a percentage of requirements was inadequate in 72% of patients at diagnosis. (84)
- Resection of the stomach reduces reservoir function which may cause early satiety and reduced dietary intake. This can lead to significant weight loss and post-operative malnutrition post-gastrectomy (74, 84)
- Innervation of the stomach may also be damaged post-gastrectomy leading to anorexia, absence of hunger sensations and post-prandial abdominal discomfort which can also lead to a significant reduction in dietary intake (84)
- Symptoms of dumping syndrome include abdominal pain/cramping, dullness, diarrhea, feelings of hunger, dizziness, sweating or shivering, and nausea (85)
- Vitamin B12 deficiency may occur after gastric resection due to a lack of intrinsic factor and may need to be replaced by regular intramuscular injections (86)
- After surgery for GI cancer, patients’ body weight was significantly reduced, nutritional status significantly declined and the proportion of severely malnourished patients significantly increased compared to pre-surgery (74)



- Total gastrectomy is associated with dramatic weight loss, which continues post-discharge, with patients losing an average of 15.5 kg by 3-month follow up. (84)
- Stomach cancer was found to be a significant risk factor for severe postoperative malnutrition (74)
- The proportion of severely malnourished stomach cancer patients increased significantly from 2.2% to 29.7% ( $p= 0.006$ ) from pre-op to post-op. Of note, there was no difference in the incidence of postoperative malnutrition between patients who received total gastrectomy to patients who received subtotal gastrectomy in this study (74)
- Patients are made nil by mouth following total gastrectomy for up to a week post-surgery to prevent nausea and vomiting and to allow the anastomosis time to heal. However without nutrition support this can result in patients who are already malnourished at baseline suffering further nutritional deterioration postoperatively (84)
- Provision of nutrition support (TPN) postoperatively significantly reduced in-hospital weight loss and also helps to attenuate further weight loss post-discharge (84)
- Patients with >10% weight loss perioperatively had a significantly higher rate of complications and a significantly higher mortality rate than patients who lost <10% body weight (26.2% versus 51.9%,  $p = 0.036$  and 11.1% versus 0%,  $p = 0.027$ , respectively). (84)

#### Pancreatic surgery (e.g. Whipple's procedure/pancreatectomy)

- Pancreatoduodenectomy remains a standard treatment for resectable pancreatic adenocarcinoma, as it offers the only chance for a cure. (87)
- Many patients undergoing pancreatic resection are malnourished prior to surgery, and significant weight loss is common postoperatively (87)
- Due to reduced presence of glandular tissue, pancreatic enzyme secretion may be reduced. Symptoms of exocrine insufficiency include diarrhoea, steatorrhoea, abdominal pain, bloating, and weight loss. (86-87)
- Patients who have undergone pancreatic resection may be advised to follow a low fat diet to avoid steatorrhoea secondary to fat malabsorption. This may result in an unpalatable diet deficient in calories and fat soluble vitamins (A, D, E, K) (86-87)
- zinc and iron status may be affected in pancreatic surgery as they are absorbed proximally in the gut (87)
- Both enzyme therapy and dietitian involvement can help optimize absorption and nutrition status in patients with malabsorption. (87)
- Delayed gastric emptying/gastroparesis is a common cause of post-operative morbidity in patients undergoing pancreatoduodenectomy and can delay initiation of oral diet (86-87)
- Other nutrition impact symptoms which may occur post pancreatic resection include nausea/vomiting, bloating, cramping, early satiety and poor appetite which can further compromise nutrition status. (87)
- Small intestine bacterial overgrowth (an excess number of bacteria in an unusual location of the bowel) may occur due to intestinal stasis and diminished gastric acid, both of which may be present after pancreatic surgery. This may cause bloating, flatulence, abdominal discomfort, diarrhea, steatorrhea, weight loss, and potentially micronutrient deficiencies. Bacterial consumption of vitamin B12 can cause deficiency of this vitamin (87)
- Hyperglycaemia is common postoperatively (87) and diabetes mellitus is a common long-term consequence of pancreatic surgery (86)
- It is possible for pre-existing lactose intolerance to increase after pancreatic resection and therefore a brief lactose-restricted diet may be beneficial. (86-87)

#### Cholecystectomy

- Post cholecystectomy diarrhea may occur, possibly due to increased presence of bile in the large bowel. (88)
- Diarrhoea may last a week to a few months post cholecystectomy, with higher intake of fatty food associated with an increased duration of diarrhoea. (88)
- upset stomach, nausea, vomiting, gas, bloating, diarrhea, or persistent pain in the upper right abdomen are other symptoms which may occur post cholecystectomy (88)
- Patients may also experience symptoms of gastritis secondary to duodenogastric reflux of bile acids. (88)

### Hepatectomy/ Liver resection

- Hepatic resection is the mainstay of treatment for both primary and some secondary malignancies. (89)
- Fluid and electrolyte imbalances are common in the postoperative period after hepatic resection and may be further accentuated by derangements of liver function. (89)
- Hypophosphatemia is encountered in nearly all patients after major hepatic resection. (89)
- Hyperlactemia is also common, as usually the liver consumes 40-60% of lactate during gluconeogenesis, however when the liver is damaged or stressed, lactate is produced rather than metabolized (89)
- Glucose intolerance/insulin resistance induced by surgical stress after liver resection causes hyperglycaemia which can dysregulate liver metabolism and immune function (89-90)
- Transient liver insufficiency/encephalopathy is another common complication after liver resection (90)
- Transient hypocholesterolemia may also occur, thought to be related to the acute-phase response, haemodilution from blood loss and liver dysfunction. Cholestasis, if present, moderates the degree of hypocholesterolemia. (90)

### Lower GI surgery (e.g. ileal resection/ ileostomy, APR, anterior resection, colectomy/ colostomy), pelvic exenteration)

- Severe malnutrition increased from 2.6% to 19.9% in colorectal cancer patients perioperatively, indicating the need for attentiveness to nutritional status in this group (74)
- Similarly, the prevalence of malnutrition in patients undergoing pelvic exenteration for rectal cancer was 24% on admission and increased to 51% by discharge. Patients were losing weight during admission and weight loss continued post-discharge (91)
- Nutrition intervention is required pre- and post-operatively to improve outcomes for patients undergoing pelvic exenteration (91)
- Many oncology patients undergoing abdominal or pelvic surgery may require faecal and/or urinary diversions in the form of an ileostomy, colostomy or urostomy/ileal conduit (92)
- Level IIa recommendation: "Counselling by a Registered Dietitian should be performed for clients with an ostomy who are at risk for, or who develop, nutritional complications" (93)
- Maintenance of fluid-electrolyte balance is important for patients with ileostomies as they lose at least 250–500mL more fluid per day than an individual with an intact colon, so are at high risk for dehydration. The colon is also the primary area for absorption of sodium and potassium so patients with ileostomies are prone to increased electrolyte losses. The risk of fluid/electrolyte imbalance is increased in the presence of diarrhoea, vomiting or excess perspiration (92-94)
- A major concern for patients with an ileostomy is medication absorption, as they are unable to completely absorb a number of drugs (e.g. large pills, sustained-release medications, and enteric-coated medications) therefore liquid forms should be used if possible (92)
- Lactose intolerance and fat malabsorption may also occur in some patients (94)
- A complication unique to ileostomy patients is food blockage which may occur when a mass of insoluble fibre gets stuck proximally to the stoma. Symptoms of food blockage may include no output or high-volume liquid output, cramping pain, distention, and potentially nausea and vomiting. (92)
- Management of gas/flatus is a common concern for any patient with a faecal diversion (92)
- Patients with ileostomies and colostomies may experience diarrhoea which can also affect fluid and electrolyte balance (92, 94)
- In patients with distal colostomies, constipation/bowel obstruction may occur with inadequate fluid/fibre intake (92-93)
- Management for patients with an ileal conduit is focused on maintenance of adequate fluid intake which is critical to prevent infection (92)

## NUTRITION IMPLICATIONS OF BIOLOGICAL THERAPIES, IMMUNOTHERAPIES AND TARGETED THERAPIES

- “Biological therapy uses living organisms, substances derived from living organisms, or synthetic versions of such substances to treat cancer” (95)
- Some types of biological therapy do not target cancer cells directly but stimulate the body’s immune system to attack and destroy the cancer cells- this is called immunotherapy (95)
- “Immunotherapeutics can be defined as a broad class of therapies designated to elicit immune-mediated destruction of tumor cells.” (96)
- Other biological therapies do not rely on the body’s immune response, but target cancer cells directly, such as monoclonal antibodies (95)
- Targeted therapies are a type of biological therapy that interferes with specific molecules involved in cancer cell growth and survival (95, 97)
- Molecular targeted therapies are used in patients whose tumours possess specific genetic alterations. (96)
- Targeted therapies have been approved for use in many different types of cancer including melanoma, breast cancer, renal cell carcinoma, head and neck cancer, haematological malignancies, lung cancer, gastric cancer, colorectal cancer, sarcomas and prostate cancer. (71, 96-97)
- Toxicities associated with biological therapies vary according to treatment type but pain, swelling, soreness, redness, itchiness, and rash at the injection/infusion site are common (95)
- Toxicities associated with immunotherapies are thought to be immune-related and can include mild flu-like symptoms (fever, chills, weakness, muscle/joint aches, nausea/vomiting, headache), changes in blood pressure, breathing difficulties, allergic reactions, hepatitis, endocrinopathies, nephritis, photosensitivity or pruritus (71, 95-96, 98)
- Toxicities commonly associated with targeted therapies include diarrhoea and liver problems (hepatitis, elevated LFTs), other toxicities include skin problems (rashes, dryness), difficulties with blood clotting/wound healing and high blood pressure (97)
- The main nutrition impact symptoms that have been associated with immunotherapies/ targeted therapies include diarrhoea/ colitis (which can be severe), nausea or vomiting, xerostomia and fatigue (71, 96-98)

## CLINICAL TRIALS

### Clinical Trials

Clinical trials are medical research conducted to allow safe evaluation and data collection of new treatments (eg. drugs, radiation) test and devices to determine if the new development is more effective than current clinical practice [ref2]. The trials are very strictly regulated to ensure the safety of the patients. Each trial must go before a Human Research Ethics Committee (HREC) to ensure there is satisfactory evidence to conduct the trial safely and to determine that the trial is conducted by competent clinicians [ref2].

Clinical trials are particularly important in oncology to determine whether new drugs are more effective than current drugs. Medications undergo extensive testing in laboratories, however this is not sufficient to determine how a medication will effect a human. The clinical trials also enable the researchers to determine the correct dosage of medication to have the desired result.

There are different categories of clinical trials depending on the stage that the particular drug/treatment, device or test is at:

- Phase I: First trial on humans aimed at evaluating the safety/toxicity profile of the intervention.
- Phase II: Second trial to determine the effect on patients with the particular condition that the drug, test or device is aimed at. To see what effect the drug has – whether it improves the condition and by how much, and again, whether there are any side effects.

- Phase III: Similar trial to a Phase II trial, except the trial is conducted with a larger population (including a control group) to investigate the impact on the condition and whether any side effects result.
- Phase IV: Comparison of the existing practice (drug, test or device) to the trial drug, test or device. Phase IV trials are more qualitative research, aiming to determine where exactly the drug is mostly useful and in what sort of patient.

# MALNUTRITION SCREENING AND FLAGS

## METHODS OF IDENTIFYING MALNUTRITION RISK

### Physical Signs

Physical signs indicative or suggestive of malnutrition (99)

Location	Normal appearance	Sign associated with malnutrition
Face	Skin colour uniform; smooth, pink, healthy appearance; not swollen	Nasolabial seborrhea (Scaling of skin around nostrils) paleness
Eyes	Bright, clear, shiny; no sores at corner of eyelids; membranes a healthy pink and moist; no prominent blood vessels mound of tissue or sclera	Pale conjunctiva Red membranes Bitot's spots Conjunctival xerosis Keratomalica (softening of the cornea) Redness and fissuring of eyelid corners Night blindness
Gums	Healthy, red, do not bleed, not swollen	Spongy, bleeding receding gums
Skin	No signs of rashes, swellings, dark or light	Xerosis (dryness), follicular hyperkeratosis (sandpaper feel to the skin), petechiae Pellagrous dermatosis (red swollen pigmentation of areas exposed to sunlight) Excessive bruising Flakey paint dermatitis Scrotal and vulval dermatosis Subcutaneous fat loss
Nails	Firm, pink	Koilonychia (spoon shape), brittle; ridged
Neck	-	Goitre
Lips	Smooth not chapped or swollen	Angular stomatitis (white or pink lesions at corners of mouth) Angular scars, cheilosis (redness or swelling of lips and mouth)
Tongue	Deep red in appearance; not swollen or smooth	Glossitis

Filiform papillae atrophy or hypertrophy  
Tongue fissuring  
hypoguesia

### Biochemical Markers

- Serum albumin and prealbumin were more weakly correlated with nutritional status (SGA) than with anthropometric variables which may indicate that serum proteins are not such a sensitive marker of nutritional status in oncology patients (24)
- The level of serum albumin might be affected by the neoplastic disease itself, or by inflammatory reactions of any cause, severe liver disease, dehydration and hyperhydration, conditions often seen in patients with neoplastic diseases (24)
- Albumin has been criticized as a measure of nutritional assessment due to its lack of specificity and long half-life (approximately 20 days) (73)
- Albumin levels may decline in the setting of acute injury and illness or with hepatic insufficiency or failure, while nephrotic syndrome can cause renal losses and enteropathies can result in losses via the gastrointestinal tract (73)
- Fluid overload reduces serum albumin, whereas dehydration or intravenous albumin infusion can increase levels temporarily (73)
- Prealbumin, also referred to as transthyretin, has a much shorter half-life (two to three days) than albumin making it a more favorable marker of acute change in nutritional status (73)

### Unintentional weight loss

- A trend in unintentional weight loss is an important clue indicating prolonged suboptimal nutritional intake. (73)
- Identifying clinically significant weight loss will be discussed in more detail below

### Body Mass Index

- A BMI of  $<18.5\text{kg/m}^2$  is generally considered to be consistent with malnutrition (4)
- The limitations of the use of BMI in the oncology population will be discussed in more detail below

### Other flags

- Dietary restrictions, particularly the avoidance of any specific food groups that may lead to deficiencies in certain nutrients (73)
- Problems with dentition, absorption or appetite should also be noted (73)

## IMPORTANCE OF MALNUTRITION RISK SCREENING FOR ALL TUMOUR STREAMS AND PATIENT GROUPS

- Malnutrition screening is a rapid and simple initial evaluation for identifying an individual's level of risk of malnutrition (100-102)
- Current guidelines recommend routine screening for malnutrition should occur in the acute, rehabilitation, residential aged care and community settings to improve identification of risk and enable nutrition care planning (101-104)
- Nutrition assessment requires trained staff and is too time consuming to complete on all patients. (105-106)
- An appropriate screening tool can be used by staff other than trained nutrition professionals and allows for the early identification of individuals who are at risk of malnutrition. This should then lead to a comprehensive nutrition assessment by a dietitian (5) so that appropriate nutritional care can be initiated before malnutrition becomes a major problem. (106)

- In the absence of formal malnutrition screening with validated tools, patients at risk of malnutrition may not be identified, so issues related to malnutrition and symptoms that limit dietary intake are likely to be addressed reactively rather than proactively (14)
- Risk factors for malnutrition can be poorly recognised by cancer clinicians and appropriate referrals to the dietitian may fail to be made, particularly in the outpatient setting (107)
- Forty percent of patients with significant weight loss (>10%) failed to be referred for dietetic assessment (107)
- Only 9% of patients with 10% weight loss who did not require hospital admission were referred for dietetic assessment (107)
- Despite clear hospital guidelines for nutrition referral, 32% of patients with 10% weight loss at first assessment failed to be referred to a dietitian on admission (107)
- The likelihood of referral was significantly associated with amount of weight loss, often delaying access to appropriate nutritional intervention as patients are not always identified early in their treatment for referral to dietetic services (107)
- Though some specific patient groups are considered at higher risk for malnutrition, even a minor deterioration in nutritional status can have adverse effects on outcomes (108)
- "oncologists should be aware of the intrinsic adverse effects of marginal malnutrition and of the potential role of nutritional support in the early stages of disease" (108)
- The ideal screening tool would be 100% specific and sensitive. As this is generally not achievable, the need to correctly classify all patients who are malnourished (sensitivity) takes precedence over misclassifying well-nourished patients (specificity) (105-106)

## IDENTIFYING SIGNIFICANT LOSS OF WEIGHT

- Anthropometric measurements are often used to assess nutritional status, with weight change being useful, inexpensive and easy to obtain (14, 44, 109)
- Weight loss is associated with malnutrition and is a component of many screening tools used to assess nutritional risk (14)
- When used as a measure of nutritional status, weight loss is often expressed as a percentage loss compared to usual or pre-illness weight (2, 21, 73)
- Weight loss is usually determined to be significant or severe depending on the percentage of usual body weight lost and the time period over which the loss occurs, e.g. involuntary loss of >10% of usual body weight within 6 months, or ~5% of usual body weight in 1 month (110)
- Weight loss of >10% body weight is a commonly used cut-off point in the literature, with a general consensus that this indicates clinically severe loss of weight and nutritional deterioration (24, 37, 47, 84)
- Percentage weight loss in the past 3-6 months demonstrated 76% sensitivity and 85% specificity for predicting malnutrition in cancer patients (as determined by PG-SGA) (111) and is able to detect mild nutritional changes (2)
- Some limitations to the use of weight loss as an indicator of nutritional status:
  - unknown accuracy of patient recall of their weight some months prior (23)
  - lack of information on the type of body tissue depletion (27)
  - confounding by abnormalities in fluid status (73, 109, 112)
  - It is a delayed marker of malnutrition (112)

### Self-reported height/ weight

- Self-reporting is advantageous in patients who are unable to undergo a reliable examination of anthropometry (e.g., patients who were unable to stand up, patients with a heavy plaster, patients with edema or fluid disturbances, and pregnant women) (113)
- A high level of agreement has been observed between self-reported anthropometric data and clinical assessment by a professional for height, weight, calculated BMI, and classification of nutritional status in pre-operative elective surgical outpatients (majority oncology) (113)
- Differences between self-reported data and clinically assessed height (.01 m), weight (1.3 kg), and BMI (0.7 kg/m<sup>2</sup>) were found to be small but statistically significant (P<0.001). Clinically, however, these differences are insignificant as patients had a tendency to overestimate their height, to

underestimate their body weight, and consequently to underestimate their BMI resulting in a small number of false positives, but no false negatives (113)

- Using an objective definition of malnutrition (>5% weight loss in 1 month, >10% weight loss in 6 months or BMI<18.5 and BMI<20.0 in patients over 65), 8% of patients were identified as malnourished based on self-reported data compared with 6% based on clinical assessment (113)
- Compared with the objective definition, self-reports had a sensitivity of 97% and a specificity of 98% (113)

## BARRIERS TO THE USE OF BODY MASS INDEX (BMI) AS A MARKER OF NUTRITIONAL STATUS

- BMI is calculated by dividing weight in kilograms by height in metres, squared
- Interpretation of BMI is dependent on reference ranges, so it is possible for an individual initially at the upper end of a given reference range to experience significant nutritional deterioration before their BMI falls below that reference range (109)
- BMI does not reflect the changes in body composition that can occur with cancer as it cannot differentiate between loss of lean body mass (LBM) or fat mass (27)
- Excess body fat can mask an underlying loss of lean body mass, meaning patients with malnutrition may not be correctly identified if they are still categorised in a healthy or overweight/obese range (15, 25)
- Although commonly used in other areas of dietetic practice, using the BMI as an indicator of malnutrition in cancer patients is not recommended (15, 25, 27)
- BMI has a poor sensitivity (27%) and specificity (23-27%) for detecting malnutrition as defined by PG-SGA (2, 111)
- Several studies in oncology patients have shown that assessing malnutrition according to BMI (<18.5kg/m<sup>2</sup>) dramatically underestimates the proportion of patients assessed as malnourished by significant weight loss or SGA
  - 7-11% of patients were classified as underweight or 'malnourished' according to BMI (<20 kg/m<sup>2</sup>), though 70 to 76% were actively losing weight at diagnosis (11, 84)
  - Using BMI <18.5 kg/m<sup>2</sup> only 4.1% of all patients were classified as malnourished vs 27.4% according to SGA (9)
- Many patients who are malnourished or who have experienced significant weight loss have BMIs that fall into the 'healthy', 'overweight' or 'obese' categories so may not be identified if BMI alone is used to assess malnutrition
  - 79% of malnourished patients (as per SGA) and 82% of patients reporting significant weight loss were within the normal, overweight or obese BMI ranges (14)
  - Severe loss of body weight was seen in both patients with normal body weight and in overweight patients (24)
  - 21% of patients identified as malnourished by SGA were classified by BMI as overweight or obese (114)
  - 40% of cancer patients in the healthy weight range as per BMI and 20% of overweight/ obese cancer patients were found to be malnourished according to PG-SGA (5)
  - Six of the seven malnourished participants who reported no prior dietetic contact were within the normal or overweight or obese BMI ranges (14)
  - According to BMI classification, only 6% were underweight vs 26% malnourished by PGSGA (13)
  - BMI was not found to be a sensitive indicator of malnutrition as only 12.4% of the 30.9% of patients with malnutrition were identified (10)

### Sarcopaenia

- Sarcopaenia is depletion of skeletal muscle which can occur independently of adiposity (115)
- Diagnosis of sarcopaenia should encompass the presence of low muscle mass as well as low muscle function (strength and/or performance) (116)
- Sarcopaenic obesity, in which severe obesity and low muscle mass occur simultaneously (115)
- In patients with GI and respiratory solid tumours 15% of obese patients were classified as having sarcopaenia by CT (115)



- Sarcopaenic obesity was associated with poorer functional status compared with obese patients who did not have sarcopenia ( $p=0.009$ ), and was an independent predictor of survival (hazard ratio [HR] 4.2 [95% CI 2.4–7.2],  $p<0.0001$ ) (115)

## COMMON, VALIDATED NUTRITION SCREENING TOOLS USED IN THE ONCOLOGY POPULATION

### Malnutrition Screening Tool (MST)

- The MST is widely used in Australia and New Zealand but less commonly worldwide (117)
- It is valid and reliable in the oncology population- including adult acute hospital patients (including oncology inpatients) (105), radiotherapy patients (106) and outpatient chemotherapy patients (13)
- It is an uncomplicated and easy-to-use screening tool based on two questions regarding recent unintentional weight loss and appetite (105) and it does not require any calculations so is quick to complete (13)
- MST has been validated using self-reported weights (105) enhancing its ease of use
- MST was quicker to complete than a range of other nutrition screening tools (including MUST, MNA-SF and NRS-2002), taking approximately 3 minutes (118)
- It can be completed by health care professionals, administrative staff, the patient or their family, friends or carers (13, 105)
- The scoring system of the MST also allows prioritization of patients requiring more urgent treatment which facilitates a more effective use of dietetic time and resources (105-106)
- The MST had a sensitivity of 100% and a specificity of 81% in radiotherapy patients, indicating it strongly predicts nutritional status (as defined by SGA) (106)
- The MST was a strong predictor of nutritional risk in chemotherapy patients with 100% sensitivity and 92% specificity (relative to the PG-SGA) (13)
- In adult acute hospital inpatients, the MST had a sensitivity and specificity of 93% and was significantly associated with objective nutrition parameters (except immunologic parameters) and length of stay demonstrating predictive and convergent validity (105)
- MST also has an acceptable inter-rater reliability with agreement by administration staff/nursing staff/patient/nutrition assistant and the dietitian in 90-97% of cases (13, 105)
- For inpatients, it is recommended that nutritional screening be performed within 24hr of hospital admission (105)
- Patients not at risk of malnutrition (MST score 0-1) should be rescreened weekly during radiotherapy treatment (106) and during hospital admission (105) to monitor changes in nutritional status.
- Patients at risk of malnutrition (MST score 2-5) should undergo a more detailed nutrition assessment to identify if they are malnourished and determine appropriate nutrition support (105-106)

### Malnutrition Universal Screening Tool (MUST)

- MUST is the official tool used by the British Dietetic Association, the Royal College of Nursing, the Registered Nursing Homes Association and the British Association for Parenteral and Enteral Nutrition (BAPEN) and widely used in Europe (111)
- MUST was developed by a multi-disciplinary group of health professionals and patients to detect both undernutrition and obesity in adults of different ages and diagnoses in different healthcare settings (100)
- MUST involves assessment of weight status (calculation of BMI), change in weight, and the presence of an acute disease resulting in no dietary intake for more than 5 days (or likely to result in no dietary intake for more than 5 days) (100)
- MUST, although simple and quick to apply, requires skilled personnel due to calculations required (Amaral 2008)
- The tool categorises subjects into low, medium, or high risk of malnutrition and identifies the obese (100)
- MUST takes 3–5 min to complete (118)

- MUST has been validated in the radiation oncology setting, successfully detecting patients at risk of malnutrition with 80% sensitivity, 89% specificity, 0.87 positive predictive value and 1.0 negative predictive value (compared with PG-SGA) (111)
- MUST and SGA have shown excellent agreement in medical inpatients (118) as well as in radiation therapy outpatients (111)
- MUST also had very good to excellent reproducibility when different observers assessed the same patients in hospitals (in-patients and out-patients), GP surgeries, and care homes (kappa values between 0.8 and 1.0) (100)

#### Short Nutrition Assessment Questionnaire (SNAQ)

- SNAQ is widely used in the Netherlands but less commonly worldwide (117)
- The SNAQ includes 3 questions on unintentional weight loss, appetite and use of supplement drinks or tube feeding, all of which were found to be predictive of malnutrition. (119)
- Completion of the SNAQ results in a score with  $\geq 2$  points indicating moderately malnourished patients and  $\geq 3$  points indicating severely malnourished patients. This score may also be used to determine the level of nutrition intervention needed. (119)
- In an inpatient population (including oncology patients), SNAQ was 79-86% sensitive and 83-89% specific for predicting moderate-severe malnutrition (119)
- Nurse–nurse reproducibility was 69% and between a nurse and a dietitian was 91% (119)
- In a heterogeneous patient group in the Netherlands, implementation of early screening (using SNAQ) and treatment of malnourished patients reduced the length of hospital stay in malnourished patients with low handgrip strength (i.e., frail patients) (120)
- To shorten the mean length of hospital stay by 1 day for all malnourished patients, a mean investment of €76 (US\$91) in nutritional screening and treatment (dietetic consult, nutrition assistant, provision of 2x mid-meal snacks) was needed (120)
- In the subgroup of patients with low handgrip strength, the incremental costs to reduce the length of hospital stay by 1 d were only €50.40 (US\$60.48). (120)
- Application of the SNAQ screening and treatment plan significantly improved the recognition of malnourished patients- 76% of malnourished patients in the intervention group were referred to a dietitian on the basis of their SNAQ scores vs 47% in the usual care group (referred by a nurse or physician) (120)
- Routine screening provided the opportunity to start treatment for malnutrition at an early stage of hospitalization with the mean number of days in the hospital before the first consultation with a dietitian significantly lower in the intervention group (~3 days) than in the control group (~6days)  $P < 0.001$  (120)
- The role of a nutritional assistant is of great importance in the treatment plan. The assistant stimulates patients to eat both their regular meals and their in-between meals and reports to the dietitian when oral nutrition is insufficient (120)
- No significant difference in the total number of consultations with a dietitian was observed between the intervention and control groups, indicating the dietitian visited some patients in the control group more often than patients in the intervention group. This can be explained by the increased efficiency of the standardized nutritional care in the intervention group. (120)
- Through standardization of nutritional care, the daily intake of the malnourished patients increased by 600 kcal and 12 g protein. The number of meals was increased and dietary intake was shifted from supplement drinks to more normal food (120)

# NUTRITION INTERVENTION

## COMPONENTS OF A FULL DIETETIC ASSESSMENT

- “Nutrition assessment is a systematic approach to collect, record, and interpret relevant data from patients, clients, family members, caregivers, and other individuals and groups. Nutrition assessment is an ongoing, dynamic process that involves initial data collection as well as continual reassessment and analysis of the patient’s/client’s status compared to specified criteria.” (121)
- Nutrition-related assessment data includes:
  - food and nutrition history (qualitative and quantitative)
  - biochemical data, medical tests and procedures
  - anthropometric measurements (e.g. height and weight)
  - nutrition-focused physical exam findings (e.g. overweight, normal weight)
  - client history (e.g. age, occupation, living situation, medical history) (121)

## NUTRITION ASSESSMENT TOOLS USED IN THE CANCER POPULATION

### Subjective Global Assessment (SGA)

- The SGA was developed as a simple, clinically useful tool able to be used routinely to identify malnourished surgical patients at risk of adverse medical outcomes (122-123)
- The SGA contains two sections: the history and a physical examination. (124)
- The history includes weight changes, presence of gastrointestinal symptoms, functional capacity and the metabolic demands of the patient’s underlying disease. (124)
  - Weight loss in the past 6 months both in kg and % loss of body weight are assessed (<5% classified as a “small” loss, 5-10% as a “potentially significant” loss, and >10% as a “definitely significant” loss). The rate and pattern of weight loss is also noted, with recent stabilization or weight gain considered an indicator of better nutrition than ongoing weight loss. (124)
  - Dietary intake in relation to usual intake is assessed as normal or abnormal, and the duration and degree of abnormal intake are noted (starvation, hypocaloric liquids, full liquid diet, suboptimal solid diet). (124)
  - Presence of significant gastrointestinal symptoms (anorexia, nausea, vomiting, diarrhoea) is noted, with ‘significant’ defined as persisting on virtually a daily basis for >2 weeks (124)
  - Functional capacity is rated as full capacity, suboptimal, ambulatory or bedridden. (124)
  - The metabolic demands of the patient’s underlying disease state are rated as no stress, low stress (e.g. Mild infection/ malignancy), moderate stress or high stress (eg. Ulcerative colitis flare) (124)
- The physical examination looks at loss of subcutaneous fat in the triceps region and the lower rib region, occurrence of muscle wasting in the quadriceps and deltoids as determined by loss of tone and volume, and fluid retention via presence of ankle or sacral oedema or ascites. Features of the physical examination are subjectively rated as normal or showing mild, moderate, or severe levels of depletion (with co-morbidities such as neurological deficits or congestive cardiac failure taken into account). (124)
- All aspects of the SGA are then taken into account to subjectively categorise the patient as A, well-nourished; B, having moderate or suspected malnutrition; or C, having severe malnutrition (124)
- The SGA can be easily completed in several minutes (75)
- SGA can be performed by many different health professionals e.g. Medical residents, nurses, clinical nutrition specialists (75, 124-125)
- Advantages of the SGA: it is cost-effective compared to traditional laboratory measures of nutritional status, it does not rely too heavily on a single measure, it allows identification of patterns of change rather than just using absolute values e.g. with weight loss and can account for clinical influences, eg. fluid retention which may interfere with traditional objective measurements (49, 124)
- Use of the SGA does require appropriate training of staff (49, 124), however, even in physicians inexperienced with the tool, SGA has been found to be a reliable assessment technique (125)

- The SGA has a high inter-observer reproducibility, with agreement rates between 79-91% between doctors, medical residents, nurses and clinical nutrition specialists (75, 122-125)
- Significant correlations between SGA and objective measures of nutritional status, such as LOW indices of muscle mass indices of fat mass and serum albumin levels (24, 49, 122, 124-125) demonstrate the tool's convergent validity.
- Predictive validity of the SGA has also been demonstrated, with SGA rating shown to be predictive of hospital length of stay and developing post-operative complications, such as wound healing issues, infection and sepsis (49, 122-124)
- The SGA is recommended in Australia as an appropriate tool for nutritional assessment in patients receiving radiotherapy/chemotherapy, patients with cancer cachexia and patients with head and neck cancer (36, 39, 126)

#### Scored Patient-Generated Subjective Global Assessment (PG-SGA)

- The scored PG-SGA is a modification of the original SGA, created to be more specific to the oncology patient (127)
- PG-SGA includes all aspects of the original SGA, but encompasses more detail on recent weight loss, more nutrition impact symptoms relating to cancer or its treatment, more options to describe levels of functional capacity and assesses more areas of the body in the physical examination (127-128)
  - Weight loss in the PG-SGA is assessed on a sub-acute and acute basis (over the past month and over the past 2 weeks). Only if this information is unavailable is weight loss over the past 6 months used (128)
  - In addition to symptoms of anorexia, nausea, vomiting, diarrhea assessed in the SGA, the PG-SGA includes constipation, mouth sores, dry mouth, pain, things taste funny or have no taste, smells bother me and other as additional options. (128)
  - Functional capacity has more options in the PG-SGA and can be rated as: 'normal', 'not my normal self, but able to be up and about with fairly normal activity' 'not feeling up to most things but in bed less than half the day' 'able to do little activity and I spend most of the day in bed' or 'pretty much bedridden' (128)
  - The physical assessment of the PG-SGA includes examination of fat pads under the eye, wasting of the temporalis muscle, prominence of the clavicle and scapula (indicating loss of pectoral, deltoid, latissimus dorsi and trapezius muscles), interosseous muscle, and calf (gastrocnemius) muscle in addition to the regions assessed in the original SGA. When completing the scoring for the physical assessment, muscle deficit takes precedence over fat loss or fluid imbalance (128)
- The tool is referred to as 'patient-generated' because the initial history section (including weight change, food intake, nutrition impact symptoms and functional capacity) is completed by the patient. This streamlines nutrition assessment in a clinical oncology setting and allows the clinician to spend more time addressing identified issues instead of data collecting (128)
- The second section is carried out by the health professional and involves accounting for underlying disease state, metabolic stress (including fever and corticosteroid use), as well as the physical examination assessing muscle and subcutaneous fat stores and fluid status
  - Scoring criteria for diseases/conditions are specified in the PG-SGA, with cancer, AIDS, Pulmonary or cardiac cachexia, Presence of decubitus, open wound or fistula, Presence of trauma and Age >65 years all scoring 1 point. (128)
  - Levels of metabolic stress are also defined in the PG-SGA as 'none', 'low', 'moderate' or 'high', with points allocated for severity of fever or fever duration (higher points for higher temperatures or longer duration) and additional points allocated for corticosteroid use (increasing points for increasing doses). The highest fever score is added to the corticosteroid score (128)
- The scored PG-SGA gives a numerical score on completion taking into account all sections of the tool, with a higher score generally representing poorer nutritional status (128)
- An overall subjective classification of nutritional status (A- well nourished, B- moderate or suspected malnutrition, or C-severe malnutrition as per the original SGA) is also given on completion of the PG-SGA (127-128)
- The addition of a numerical score in the PG-SGA allows tracking of more subtle changes in nutritional status over time which may not be detected by SGA category alone (15, 25, 112)

- To move one SGA category (either improvement or deterioration), a change in PG-SGA score of 9 was required. Therefore, serial measurements of PG-SGA score may reflect clinically important changes, even if a patient is classified as in the same SGA category on different occasions (15)
- The PG-SGA score may also be used to determine the level of nutrition intervention required, with a current cut-off score of >9 indicating critical need for nutrition intervention (128)
- The PG-SGA is an efficient and cost-effective tool (128). It usually takes under 10 minutes to complete (11, 44) but should be administered by a well-trained practitioner (112, 128)
- The PG-SGA is a valid and reliable assessment tool in both inpatient and outpatient settings (25, 44, 128)
- The PG-SGA has a high sensitivity and specificity for detecting malnourished patients, with values of 80-98% and 82-89% respectively (2, 25)
- Inter-observer agreement with the PG-SGA is also high, with agreement of overall SGA category between a doctor and dietitian in 90% of patients (44)
- PG-SGA score has been found to correlate significantly with objective measures of nutritional status, including percentage weight loss, energy intake and serum albumin (2, 15, 25, 44), indicating convergent validity
- Additionally, the PG-SGA has demonstrated predictive validity, and is associated with outcomes such as survival, length of hospital stay, quality of life and nutrition-related complications, such as infection (15, 25, 44, 112)
- PG-SGA is recommended in Australia as an appropriate tool for nutritional assessment in patients receiving radiotherapy/chemotherapy, patients with cancer cachexia and patients with head and neck cancer (36, 39, 126)

#### Abridged Patient-Generated Subjective Global Assessment (abPG-SGA)

- The abPG-SGA was developed to be a less time consuming method of identifying malnutrition in a busy outpatient setting (129)
- The tool features the history section of the scored PG-SGA but omits the physical examination (129)
- The abPG-SGA has been validated for detecting malnutrition in an outpatient setting with a 94% sensitivity and 78% specificity. This was slightly lower than PG-SGA (97% sensitivity, 86% specificity) but higher than the MST (81% sensitivity, 72% specificity) (129)

#### Mini Nutritional Assessment (MNA)

- The MNA was developed initially for the purpose of identifying frail and healthy elderly at risk of malnutrition to allow early nutrition intervention when needed (130)
- The MNA is most frequently used for hospitalized or nursing home patients. (117)
- The MNA is made up of a combination of simple measurements and questions and is able to be completed in less than 20 minutes (130)
- There were 5 sections to the original MNA: (130)
  - 1. Anthropometric measurements (weight, height and weight loss) – 6 points
  - 2. Global assessment (6 quick questions related to lifestyle, medication and mobility) -6 points
  - 3. Dietary questionnaire (8 questions related to number of meals, food and fluid intake and autonomy of feeding) – 8 points
  - 4. Subjective assessment (self-perception of health and nutrition) -3 points
  - 5. Biological markers (such as albumin, CRP, cholesterol and lymphocyte count) -7 points
- The tool generates a maximum score of 30 if all sections are completed: A score of 24-30 points categorizes the patient as a) normal (adequate nutrition), 17-23.5 points is b) borderline (at risk of malnutrition), and a score of less than 17 points indicates c) undernutrition (130)
- Borderline status identifies elderly at risk of malnutrition who require further assessment, though 75% of elderly can be categorised without further assessment (130)
- The MNA was found to accurately assess the nutritional status of the elderly and was developed and cross-validated across a series of studies from healthy to very frail elderly populations (130)
- The current full version of the MNA excludes the biological marker section, and contains a total of 18 questions in 4 sections: anthropometric measurements (four questions), global assessment (six questions), dietary questions (six questions), and self-perception of health and nutrition (two questions) (131)

- The MNA has been tested against the PG-SGA in the oncology population and found to have a sensitivity of 79-97% and a specificity of 54-82% at different time-points during the cancer journey. When comparing the tools in elderly patients alone (>65yr), similar results were obtained. (112)
- The MNA's low specificity indicates a higher level of false positives (patients categorised as needing nutrition intervention when actually they do not) – this may be due to the fact that points are deducted for taking >3 prescription medications or for eating less than 3 full meals which are common in cancer patients who are often prescribed pain relief, antiemetic's, etc. and may eat small frequent snacks or use nutritional supplements to achieve adequate oral intake (112)
- An advantage of the MNA is that it is more simply applied than the PG-SGA and may be administered by non-dietetic professionals after minimal training (112)
- Both the MNA and PG-SGA “are able to correctly classify patients as malnourished, although the MNA lacks specificity. Therefore, the PGSGA should be the tool of choice for nutritional assessment in cancer patients”. (112)

#### Mini Nutrition Assessment – Short Form (MNA-SF)

- The MNA's length and complexity limit its usefulness as a brief screening tool (131)
- The MNA-SF was developed as a shorter screening version of the original MNA to minimise the time and training needed for administration but still maintain good diagnostic accuracy (131)
- Items were chosen for the MNA-SF on the basis of correlation with the total MNA score and clinical nutritional status, internal consistency, reliability, completeness, and ease of administration. Items that were redundant, required special training to administer, involved difficult subjective recall, or produced too many missing or “don't know” answers were avoided (131)
- The original MNA-SF has 6 questions instead of 18 (including food intake, weight loss, mobility, psychological stress or acute disease, neuropsychological problems and BMI), eliminates time-consuming and subjective items, and can be administered in approximately 3 minutes. (131)
- The MNA-SF has a total score ranging from 0 to 14, where  $\geq 12$  is classified as 'normal', and  $\leq 11$  represents possible undernutrition. It was proposed to use this tool as part of a two-step screening process where those identified as “at risk” on the MNA-SF, would undergo the full MNA to confirm the diagnosis of undernutrition (131)
- Using this cut-off, sensitivity was 97.9%, specificity was 100% and diagnostic accuracy was 98.7% for predicting undernutrition. (131)
- The MNA-SF was strongly correlated with the total MNA score ( $r=0.945$ ). (131)
- The current version of the MNA-SF was revised to include calf circumference if BMI is unavailable and was found to perform equally well. (132)
- The scoring classifications were also revised to encompass three-categories:
  - 12-14 points- normal nutritional status
  - 8-11 points- at risk of malnutrition; and
  - 0-7 points – malnourished (132)
- The revised MNA-SF has 91.7% sensitivity compared to the full MNA – slightly lower than the original MNA-SF as it was validated in a wider range of populations including African, Asian and Australian in addition to European elderly (132)

## COMMON DIETARY INTERVENTIONS WHICH MAY BE PRESCRIBED FOR THE CANCER PATIENT

#### Oral Nutrition Support

- “Healthcare professionals should consider oral nutrition support to improve nutritional intake for people who can swallow safely and are malnourished\* or at risk of malnutrition\*\* –Grade A recommendation
  - \*Malnourished: BMI <18.5 kg/m<sup>2</sup>, unintentional weight loss >10% within the last 3-6 months, a BMI<20 kg/m<sup>2</sup> and unintentional weight loss >5% within the last 3-6 months

- *\* At risk of malnutrition: eaten little or nothing for more than 5 days and/or likely to eat little or nothing for the next 5 days or longer or poor absorptive capacity, and or high nutrient losses and or increased nutritional needs from causes such as catabolism” (103)*
- “Oral nutrition support should be considered for any patients taking inadequate food and fluid to meet their requirements, unless they cannot swallow safely or have inadequate gastrointestinal function” (103)
- “Oral nutrition support includes any of the following methods to improve nutritional intake: fortified food with protein, carbohydrate and/or fat, plus minerals and vitamins; snacks; oral nutritional supplements; altered meal patterns; the provision of dietary advice” (103)
- Dietary counselling and the use of oral nutritional supplements such as nutritionally complete pre-packaged drinks or vitamin/mineral tablets may be used either individually or in combination to increase nutrient intake. (103)
- 

#### *Dietary counselling*

- The provision of dietary advice to increase food intake is a core dietetic skill (133)
- Individualised dietary counseling allows the patients’ clinical condition, symptoms, psychological factors as well as personal eating patterns and preferences to be taken into account in a tailored dietary prescription (29, 134)
- Dietary counselling may include facilitating the addition of ingredients high in energy and/or protein to the diet (e.g. butter, cream, milk, sugar); adaptation of usual meal structures (e.g. small frequent meals and snacks) and/or inclusion of ‘nourishing fluids’ (e.g. milk drinks, fruit juices, smoothies) (103)
- Counselling may also include diet-related hints to minimise the side effects of the tumour and therapy (27, 135)
- Dietary counselling has potential advantages in that it offers greater variety, can be tailored to individual needs and may be associated with lower costs to the health service (103, 133)
- In addition, frequent evaluation of dietary intake allows for timely adjustments to be made to dietary advice and may also enable sustained dietary changes to occur (29, 134, 136)
- 
- There is evidence that dietary counselling is effective in radiotherapy patients, with individualised dietary counselling shown to improve nutritional intake, nutritional status, QoL and reduce severity and duration of radiotherapy-induced morbidity in small prospective RCTs in colorectal and head and neck cancer patients undergoing RT (29, 134)
- individualized dietary counselling was as effective or more effective than nutrition supplements alone in improving outcomes in patients during and post radiotherapy (29, 134)
- At 3 months post treatment, counselling during RT maintained a significant impact on patient outcomes (29, 134)
- Similarly, a review of studies in head and neck cancer patients undergoing (chemo)RT found that individualized dietary counseling compared to no counseling or general nutritional advice showed significant beneficial effects on nutritional intake, body weight, nutritional status and QoL, though effects on complications were inconsistent and effects on mortality were not reported. (136)
- However in a broader context the evidence supporting the use of dietary counselling in malnutrition is less clear - reviews of the literature have concluded that there is insufficient evidence to establish whether dietary advice alone improves the outcomes of patients with illness-related malnutrition (103, 133)
- It has been proposed that oral nutrition supplements are more important than dietary advice in increasing intake and maintaining body weight in malnourished patients, however the definition of dietary advice in this review included advice from other health professionals (e.g., nurses, health-care assistants), not only individualized nutrition counselling by a dietitian. Frequency of contact and follow up were not described (133)

#### *Oral Nutrition Supplements*

- Prescription of complete oral nutritional supplements is simple and many products are available (103)
- Studies have shown patients found oral nutritional supplements an acceptable form of nutrition support (103, 137)

- A meta-analysis on the effect of ONS on outcomes in malnourished patients shows statistically significant improvements in body weight along with reductions in complications and mortality (103)
- A ‘review of reviews’ on the evidence for ONS found largely consistent clinical benefits with oral nutritional supplements in meta-analyses of trials across patient groups, including:
  - significant reductions in mortality in acutely ill, hospitalised and elderly patients with a range of conditions (particularly in those who were malnourished)
  - Significant reductions in complications (e.g. infections, incomplete wound healing, development of pressure ulcers), particularly in the acutely ill, elderly and surgical patients.
  - improved total nutritional intake and improvements in weight (weight gain/ reduced weight loss) (118)
- Functional improvements, such as muscle strength, quality of life, immune function and mobility in individual randomized controlled trials comparing ONS to routine care (118)
- In surgical patients, compared with routine care, post-operative use of ONS substantially improved total energy and protein intakes, attenuated weight loss and led to functional benefits, including increased hand grip strength and improved quality of life indices. In addition, significant reductions in length of hospital stay as well as reduced complications in GI surgical patients translate to cost savings (118)
- In cancer patients, meta-analysis showed that liquid, multinutrient ONS given for 6–70 days significantly increased total energy intakes compared with routine care in patients undergoing radiotherapy. Individual trials in patients with cancer also indicated improvements in protein intakes. However it was recommended that large, well designed trials investigating the role of different forms of nutrition intervention in quality of life and clinical outcomes are needed in specific cancers and according to treatment type (118)
- In a review on head and neck cancer patients undergoing (chemo)radiotherapy, ONS showed beneficial effects on energy and protein intake during radiotherapy, though the effects on nutritional status were inconsistent (136)
- Oral nutritional supplements may be associated with significant advantages in the management of weight loss compared with dietary counselling alone in the short term (133)
- Nutritional supplements may be beneficial in mitigating weight loss, but whether this can be sustained in the longer term is uncertain (133)
- Evidence is lacking for the effect of ONS on mortality and other clinical outcomes (103, 133)
- One issue with prescription of ONS may be patient compliance, however a recent systematic review has found that overall compliance to ONS is high (78%) across a wide variety of patient groups in hospital and community settings (138)
- ONS have been found to have little suppressive effect on appetite and food intakes, with the majority of ONS energy being additive to food, resulting in significant increases in total energy and nutritional intake (118, 138)
- Age was found to be negatively associated with compliance, with lower compliance in acutely/critically ill elderly patients in hospitals (67%) (138)
- Energy density was positively associated with compliance, likely to be due to smaller volumes needing to be consumed (91% compliance for ONS  $\geq 2$  kcal/ml). (138)
- Although long-term supplementation is frequently cited to be associated with reduced compliance, a relationship between duration of ONS consumption (from 4d to 1y) and compliance has not been demonstrated. (138)
- “Overall, ONS can be regarded as a safe intervention as no systematic reviews or meta-analyses or individual RCTs show significant adverse effects of ONS on clinical outcome” (118)



***Selected recommendations for use of oral nutritional supplements (ONS) in clinical practice (118)***

- Consider ONS as part of the care plan for the treatment of malnutrition\*.
- ONS can be used if improvements in energy, protein and micronutrient intakes are required. ONS tend not to suppress appetite or voluntary food intake.
- ONS can be particularly effective at improving total nutritional intake in acutely ill, elderly and post-surgical patients.
- ONS can be used to attenuate weight loss in the acutely ill patient or aid weight gain in chronically ill patients. Improvements in weight (>2 kg), especially in the underweight, are associated with improvements in function in the chronically ill.
- ONS (~250–600 kcal/day) can be used to help improve clinical outcome in hospitalised patients, acutely ill elderly, and patients undergoing GI surgery and in hip fracture patients.
- When providing ONS, consider patients' needs for energy, protein and micronutrients. Any specific identifiable nutrient deficiencies (trace elements, minerals, vitamins) should be corrected where possible.
- The goal(s) of treatment with ONS should be identified for an individual patient at the start of treatment. Thereafter, regular and frequent monitoring of patients receiving ONS should be undertaken to:
  - Assess ONS acceptability.
  - Monitor ONS effectiveness by monitoring the patients' progress towards the treatment goal (s). These could include measures of energy and nutritional intake, appetite, nutritional status, functional measures, clinically relevant outcomes (pressure ulcer size, infection, quality of life).
  - Encourage compliance with ONS where appropriate.
  - Assess whether ONS are still required or if other forms of nutritional support (e.g. tube feeding) are warranted.
  - Monitor changes in clinical and nutritional status

\*The care plan, including when to refer to a dietitian or nutrition support team, should be devised by a multidisciplinary team, according to local policy and resources.

*Dietary counselling + oral nutrition supplements*

- Commonly dietary counselling and oral nutrition supplements may be used in combination to achieve nutrition goals (103)
- Based on recent evidence based practice guidelines (39), nutrition intervention in the form of dietary counselling +/- oral nutrition supplements has been shown to...
  - improve energy and protein intake and nutritional status during radiation therapy. (Grade A)
  - improve patient-centered outcomes (quality of life, physical function and patient satisfaction) during and post radiation therapy (Grade B)
  - reduce treatment breaks and unplanned hospital admissions resulting in decreased costs compared with usual care in radiotherapy (Grade C)
  - increase dietary intake and weight in chemotherapy patients (Grade A)
- But
  - does not improve patient-centered outcomes (quality of life, physical function and patient satisfaction) in chemotherapy patients (Grade B)
  - does not improve survival in chemotherapy or radiation therapy patients undergoing radiation therapy or chemotherapy with curative intent (Grade B)
- ESPEN guidelines (139) also recommend:
  - “Use intensive dietary advice and ONS to increase dietary intake and to prevent therapy associated weight loss and interruption of radiation therapy” (Grade A recommendation)
- And in head and neck cancer patients undergoing radiotherapy and chemotherapy:

- “Nutrition intervention (dietary counselling and/or supplements and/or tube feeding) improves/maintains nutritional status.” –Grade A recommendation
- “Nutrition intervention (dietary counselling and/or supplements and/or tube feeding) improves patient-centred outcomes (quality of life, physical function and patient satisfaction).” –Grade B recommendation
- “Nutrition intervention (dietary counselling and/or supplements) for 3 months post treatment improves/maintains nutritional status.”-Grade A recommendation
- “Nutrition intervention (dietary counselling and/or supplements) for 3 months post treatment improves/maintains quality of life.” –Grade A recommendation (126)
- In surgical patients:
  - “Encourage patients who do not meet their energy needs from normal food to take ONS during the preoperative period” (Grade C Recommendation) (41)
  - “Peri-operative oral nutrition support should be considered for surgical patients who can swallow safely and are malnourished”- Grade B recommendation (103)
  - “Healthcare professionals should consider giving ... gynaecological surgical patients who can swallow safely, some oral intake within 24 hours of surgery”- Grade A recommendation (103)
  - “Healthcare professionals should consider giving post-abdominal surgery patients who can swallow safely, and in whom there are no specific concerns about gut function or integrity, some oral intake within 24 hours of surgery. The patient should be monitored carefully for any signs of nausea or vomiting”- Grade A recommendation (103)
- 
- In a prospective randomized controlled trial in head and neck and gastrointestinal radiotherapy patients, patients receiving nutrition intervention (dietary counselling + supplements if required) had a significantly higher mean total energy ( $P=0.029$ ) and protein intake ( $P<0.001$ ), statistically smaller deteriorations in weight ( $P<0.001$ ), nutritional status ( $P=0.020$ ) and global QoL ( $P=0.009$ ) compared with those receiving usual care (general advice from nurses, nutrition booklet, up to 2 dietitian consults if requested). (27, 140)
- Patients receiving the nutrition intervention increased energy and protein intake during the first 4 weeks of treatment and then maintained an intake similar to that consumed at baseline. In contrast, those in the standard practice group had a steady decrease in energy intake, which only started to increase at week 12, when it was still 177 kcal/day less than at baseline. (140)
- Changes in fat-free mass over time were clinically, but not statistically ( $p=0.195$ ), significant with patients receiving nutrition intervention gaining a mean of 0.5kg and the patients receiving usual care experiencing a mean loss of 1.4 kg fat free mass over 12 weeks (27)
- The intensity and frequency of the nutrition counseling by a dietitian as well as the substantial period of follow-up post RT is the suggested reason for improved outcomes and maintenance of these outcomes in the nutrition intervention group compared with the usual care group (27, 140)
- Similarly an RCT in patients undergoing chemo-radiation for gynaecological and GI cancers found that weekly individualized dietary counselling + supplement during treatment significantly reduced the proportion of patients experiencing weight loss compared with controls who received general advice from nurses, dietitian review only if required (38% versus 72%,  $p < 0.05$ ), but this difference was not seen at follow-up 12 weeks post treatment. (135)
- At the end of treatment the intervention group had significantly higher daily intake of both energy ( $p < 0.05$ ) and protein ( $p < 0.001$ ) compared to the control group. At follow up, protein intake remained significantly elevated ( $p < 0.05$ ) in the intervention group, though energy intake was unchanged (135)
- no significant differences between groups were observed in quality of life measurements at the end of treatment or at follow-up in this study (135)
- Notably, intensive individual dietary counseling was provided during treatment but not afterward which may have impacted on the lack of effect on outcomes after treatment (135)
- In weight-losing patients with advanced unresectable pancreatic cancer, nutrition intervention including weekly dietitian contact and oral nutrition supplements was shown to markedly attenuate weight loss, with 59% of patients losing  $<1$  kg over the 8 week study period (26)
- Patients with weight stabilisation survived significantly longer from baseline (median survival 259 days vs 164 days,  $P=0.019$ ), and reported higher QoL scores ( $P = 0.037$ ) and a greater mean energy intake ( $P<0.001$ ) after 8 weeks than those who continued to lose weight (26)
- With intensive nutrition intervention, continued weight loss is not inevitable in patients with unresectable pancreatic cancer in the short term and may be associated with clinically important

improvements in QoL and survival in a patient group for whom there is rapid progression of disease. (26)

### *Supplement preferences*

- Studies have shown taste preference for supplements varies within both cancer patients and healthy controls (137, 141)
- No significant differences in preference were observed between males and females or associated with site or stage of disease. (141)
- Control subjects rated supplements in a similar way to patients with no significant differences between the groups. (141)
- Overall, milk-based products tend to be more frequently preferred than fruit-juice typed supplements ( $p < 0.001$ ). (137, 141)
- Overall pleasantness was rated significantly higher for milk based supplements than for fruit-juice type supplements ( $p < 0.01$ ) (137)
- Fresh milk-based supplements (made from fresh milk and powder) were preferred to pre-packaged milk-based supplements by both patients and controls (141)
- Digestive tolerance was comparable between milk-based and fruit-juice type supplements (137)
- Milk-based ONS were reported to have significantly less aftertaste than sweet and salty fruit-juice typed ONS ( $p < 0.01$ ). (137)
- Sweet fruit-juice type ONS were rated as being more acidic than salty fruit-juice typed and milk-based ONS (137)
- In terms of flavours, vanilla, coffee and strawberry had comparable good results among milk-based supplements, whereas chocolate was less frequently chosen and neutral never. (137)
- For fruit-juice typed products, tomato obtained better results than orange or apple (137)
- Despite a majority preferring the milk-based supplements, 12% of oncology patients and 14% of controls rated the juice-based supplement as the product which they 'definitely liked', therefore it is important for all patients to be offered a chance to sample a range of brands and flavours to find an acceptable supplement (141)
- Taste fatigue may occur when nutritional supplements are consumed regularly over a prolonged period, however in the short term, there were no changes in supplement preference observed among patients after 6 weeks of chemotherapy (141)
- Taste preferences should be taken into account in order to improve the individual compliance of malnourished patients to ONS. It is also important that patients are offered flavours that they like (137)
- It should be noted that a good palatability score is not predictive of long-term compliance (137, 141)
- 

### Dietary Modifications

#### *Manage malabsorptive conditions*

- Elemental feeds provide protein in the form of free amino acids or peptides and may be used in the presence of severe maldigestion or malabsorption (103)
- Evidence from RCTs for the efficacy of elemental formula during pelvic RT is weak, however total replacement of diet with elemental formula may be appropriate if severe toxicity is present- this is likely to require delivery via an enteral feeding tube (142)
- Evidence suggests oral elemental formulas are not well tolerated in large volumes and patients are unable to consume sufficient quantities to produce therapeutic benefit (143)
- Manipulation of dietary fibre in the diet is thought to assist management of malabsorptive symptoms however the evidence for its efficacy is weak as no high-quality RCTs have been conducted (142)
- There is limited evidence to suggest that patients can become lactose-intolerant during pelvic radiotherapy, secondary to lactase deficiency related to radiation-induced damage of the intestinal mucosa and depletion of brush border enzymes. Unabsorbed lactose contributes to an osmotic load in the colon causing watery diarrhoea. There is however no high grade evidence that restricting lactose consumption is helpful (142)

#### *Texture modified diets/ Thickened fluids*

- Modification of the consistency, temperature and/or taste of liquids and food may help to maintain or improve the nutritional status of patients with oropharyngeal dysphagia (103)
- Modification of texture and consistency may compromise hydration status, nutritional intake, and swallowing safety/efficiency for patients and so assessment by appropriately trained healthcare professionals is necessary and all oral and non-oral options must be considered (103)
- Inpatients on texture modified diets were least likely to consume all the food offered in the Australian Nutrition Care Day Survey (6).
- In older adults, patients on texture-modified diets had significantly lower intakes of energy and protein compared to patients consuming a normal diet (34)
- Even in healthy adults, texture modification significantly reduced food intake by 7- 9% (35)
- Standard texture meals were rated significantly more palatable than texture-modified meals by healthy adults (35)
- Important considerations before modification of nutrition support and hydration include: need for assistance with feeding, perceived palatability and appearance of food or drink, metabolic and nutritional requirements and level of alertness amongst others (103)
- “Healthcare professionals with relevant skills and training in the diagnosis, assessment and management of swallowing disorders should regularly monitor and reassess people with dysphagia who are having modified food and liquid until they are stable.” –Grade D recommendation (Good Practice Point) (103)

*Increase or decrease specific nutrients in the diet to meet nutritional requirements, e.g. Food fortification*

- Increasing the energy density of texture modified and standard meals has been found to result in a corresponding increase in energy intake by >40% with no evidence of subsequent energy compensation resulting in daily energy intakes remaining significantly higher in healthy individuals (35)
- Fortifying meals with additional energy was not found to affect hunger, fullness or desire to eat and there were no observed differences in absolute food intakes between fortified vs standard meals in healthy individuals (35)
- Using a fortified menu (with ~20% reduction in portion size and increased energy density) similarly resulted in elderly hospitalised patients having higher energy intakes compared to the usual menu despite being served a lower weight in food (1711kcal/d vs 1425kcal/d respectively,  $p < 0.001$ ) (144)

*Increase or decrease specific nutrients in the diet to meet nutritional requirements, e.g. Wound healing*

- the process of replacing injured tissue with new tissue demands an increased need for energy and particular nutrients like protein (145)
- Insufficient protein intake reduces the amino acids available to maintain body proteins and healing (145)
- Presence of a wound alters the body’s metabolism by the release of stress hormones resulting in a catabolic state which may cause the body to break down protein for energy resulting in loss of lean body mass. (145)
- Increased losses of lean body mass mean wound healing is more likely to be delayed. (145)
- Nutrients such as vitamin C, vitamin A, zinc and iron play important roles in wound healing (145)
- Supplementation of conditionally essential amino acids such as L-arginine may also be beneficial (145)

Enteral Nutrition

- “Enteral tube feeding refers to the delivery of a nutritionally complete feed (containing protein or amino acids, carbohydrate +/- fibre, fat, water, minerals and vitamins) directly into the gut via a tube” (103)
- “Enteral tube feeding is used to feed patients who cannot attain an adequate oral intake from food and/or oral nutritional supplements, or who cannot eat/drink safely” (103)
- Studies have shown EN in patients who may not be achieving adequate oral intake is effective in increasing nutritional intake to a greater level than that observed with standard care and/or oral supplements. This has been linked with improvement in nutritional status, however, does not seem to produce consistent benefit in terms of length of stay, complications or mortality rates. (103)
- The GI tract must be accessible and functioning sufficiently to absorb the feed administered (103)

- The feeding tube may be placed into the stomach, duodenum or jejunum via either the nose, mouth or percutaneously- the choice of route depends on expected period of feeding, clinical condition, and anatomy (103)
- EN may be used in combination with oral and/or parenteral nutrition (103)
- Common indications for EN relevant to the cancer population (103)
  - Unconscious patient e.g. ventilated patient
  - Dysphagia
  - Physiological anorexia
  - Upper GI obstruction e.g. Oro-pharyngeal or oesophageal stricture or tumour
  - GI dysfunction or Malabsorption e.g. Dysmotility, reduced bowel length (although PN may be needed)
  - Increased nutritional requirements
  - Specific treatment e.g. for short term enteral access during surgery i.e. head and neck cancer
- Grade D Recommendation (Good Practice Point): “Healthcare professionals should consider enteral tube feeding in people who are malnourished\* or at risk of malnutrition\*\* and have:
  - inadequate or unsafe oral intake, and
  - a functional, accessible gastrointestinal tract” (103)

*\* Malnourished: BMI <18.5 kg/m<sup>2</sup>, unintentional weight loss >10% within the last 3-6 months, a BMI <20 kg/m<sup>2</sup> and unintentional weight loss >5% within the last 3-6 months.*

*\*\* At risk of malnutrition: eaten little or nothing for more than 5 days and/or likely to eat little or nothing for the next 5 days or longer or poor absorptive capacity, and or high nutrient losses and or increased nutritional needs from causes such as catabolism*
- Enteral tube feeding should be used during chemoradiotherapy where severe oesophagitis is predictable (139)

In head and neck cancer patients undergoing radiotherapy: (126)

- Tube feeding can improve protein and energy intake when oral intake is inadequate - Grade B recommendation
- Tube feeding may reduce unplanned hospital admissions and reduced disruptions to treatment compared to oral intake alone- Grade C recommendation
- Prophylactic tube feeding compared to oral intake alone or intervention tube feeding demonstrates improved nutrition outcomes with less weight loss, may improve quality of life during and post-treatment and may reduce unplanned hospital admissions. -Grade B recommendation

In head and neck cancer patients undergoing surgery:

- Tube feeding using standard formula can be used to minimise weight loss in the acute post-operative period -Grade C recommendation. (126)
- Grade D recommendation (Good Practice Point): “Enteral tube feeding should be stopped when the patient is established on adequate oral intake” (103)

*Nasogastric tubes:*

- used mainly for short-term nutrition support in patients who do not have vomiting, gastro-oesophageal reflux, poor gastric emptying, ileus or intestinal obstruction (103)
- Fine bore (5–8Fr) NG tubes should be used for feeding (unless there is a need for repeated large volume gastric aspiration i.e. gastric decompression). (103)
- Advantages: may be inserted at bedside, suitable for short-term nutrition support (103)
- Disadvantages: tube dislodgement and need for replacement can be invasive and uncomfortable, the location and securing by tape of the NGT can be irritating, the tube itself may cause discomfort in the back of the throat and occasionally swallowing problems, may be potentially dangerous in patients with an unsafe swallow and those who need to be nursed prone or flat (103)
- “The possible negative impact of carrying a tube in one’s nose for ten days, which undoubtedly has an impact on one’s personal life and activities, was not reflected in the QOL scores’ (17)

### *Gastrostomy tubes*

- Pass through the abdominal wall directly into the stomach (103)
- Usually used for patients who require medium to long-term feeding or where NG access is difficult (103)
- usually placed endoscopically (Percutaneous Endoscopic Gastrostomy - PEG) but can also be placed radiologically or surgically (103)
- Advantages: cannot be dislodged as easily as a NGT, can remain unseen and is more comfortable (103)
- Disadvantages: potential difficulties and risks in placement; feed aspiration can still occur (though risks may be lower than with NG feeding) and there can be greater difficulties surrounding any decision to withdraw gastrostomy feeding compared to NG/NJ feeding (103)
- Studies have not found any significant difference between early or late fed groups post PEG insertion for mortality or complications. Therefore in an uncomplicated patient there is no reason to delay commencement of feeding for more than 4 hours after insertion of a new PEG tube (103)
- Grade D Recommendation (Good Practice Point): “Gastrostomy feeding should be considered in people likely to need long-term (4 weeks or more) enteral tube feeding” (103)
- Grade A recommendation: “Percutaneous endoscopic gastrostomy (PEG) tubes which have been placed without apparent complications can be used for enteral tube feeding 4 hours after insertion” (103)

### *Post pyloric feeding:*

- Jejunostomy tubes pass through the abdominal wall into the jejunum and are usually placed surgically. (103)
- In patients at high risk of aspiration, jejunostomy tubes or PEGJ tubes should be considered since they probably do reduce aspiration risks. (103)
- In patients unable to tolerate enteral feeding via NGT due to gastro-oesophageal reflux or delayed gastric emptying despite drug intervention, nasoduodenal or nasojejunal feeding should be considered (103)

### *Enteral Nutrition vs Parenteral Nutrition*

- Evidence supports the widely recognized notion that EN is a cheaper option than PN in patients with functioning GI tracts (103)
- “Enteral tube feeding offers the theoretical advantage over PN of improved maintenance of GI mucosal integrity via regular delivery of nutrients into the GI tract. This is suggested to reduce the risk of mucosal atrophy, bacterial translocation, infectious complications, multiorgan failure, and death.” (73)
- A reduction in infectious complications with EN compared to PN may be an additional advantage (73)
- PN provides no significant advantages when enteral tube feeding can be used and tube fed patients tend to do better for outcomes such as weight gain, length of stay and infections (103)
- 

### Parenteral Nutrition

- Parenteral nutrition (PN) refers to the administration of nutrients by the intravenous route. (103)
- PN is generally used if enteral tube feeding is impossible or impractical (for reasons of tube access), or unlikely to be successful (e.g. failure of gut function with obstruction, ileus, dysmotility, fistulae, surgical resection or severe malabsorption to a degree that prevents adequate gastrointestinal absorption of nutrients that has either persisted for several days (e.g. >5 days) or is likely to persist for many days (e.g. ≥5 days)) (103)
- PN is an invasive and relatively expensive form of nutrition support and can be associated with risks from line placement, line infections, thrombosis and metabolic disturbance (103)
- Studies in surgical patients have shown preoperative PN only does not improve outcomes, but pre- and post-operative PN support did suggest benefits such as lower mortality, reduced complications and increased weight gain (103)

- For well-nourished patients there is no evidence that pre or postoperative PN support is of benefit but for severely malnourished GI and thoracic surgical patients preoperative/perioperative and postoperative PN there is evidence of benefit (103)
- Healthcare professionals should consider parenteral nutrition in people who are malnourished\* or at risk of malnutrition\*\*, and meet either of the following criteria:
  - inadequate or unsafe oral and/or enteral nutritional intake
  - a non-functional, inaccessible or perforated gastrointestinal tract. –Grade D recommendation (Good Practice Point)
  - \*Malnourished: BMI <18.5 kg/m<sup>2</sup>, unintentional weight loss >10% within the last 3-6 months, a BMI<20 kg/m<sup>2</sup> and unintentional weight loss >5% within the last 3-6 months.
  - \*\*At risk of malnutrition: eaten little or nothing for more than 5 days and/or likely to eat little or nothing for the next 5 days or longer or poor absorptive capacity, and or high nutrient losses and or increased nutritional needs from causes such as catabolism (103)
- “Healthcare professionals should consider supplementary peri-operative parenteral nutrition in malnourished surgical patients who have an inadequate or unsafe oral and/or enteral nutritional intake or a non-functional, inaccessible or perforated (leaking) gastrointestinal tract.” –Grade B recommendation (103)
- “Peri-operative supplementary parenteral nutrition should not be given to surgical patients unless they are malnourished or at risk of malnutrition and have an inadequate or unsafe oral and/or enteral nutritional intake or a nonfunctional, inaccessible or perforated (leaking) gastrointestinal tract.” - Grade B recommendation (103)
- “Parenteral nutrition should be stopped when the patient is established on adequate oral and/or enteral support.” –Grade D recommendation (Good Practice Point) (103)
- Establishing and maintaining intravenous catheters needed for PN can lead to: Trauma on central line placement (e.g. carotid puncture, pneumothorax), thrombophlebitis, catheter occlusion and thromboembolism, air embolism or catheter related sepsis. All can be reduced if lines for PN use are inserted by trained and experienced personnel using full aseptic technique. (103)
- PN overrides many homeostatic mechanisms and may cause serious derangement of biochemistry (including re-feeding syndrome), fluid overload, hyperglycaemia (especially if a patient is diabetic or has stress induced insulin resistance) and liver dysfunction (though this is uncommon). Careful monitoring of patients receiving PN is therefore essential (103)
- “Theoretical arguments that nutrients “feed the tumor” are not supported by evidence related to clinical outcome and should not be used to refuse, diminish or stop feeding [103a, 103b, 103c, 103d]

#### Recommended nutrient intakes during treatment

##### Energy and protein requirements during radiotherapy:

- Grade C recommendation: Aim for energy and protein intakes of at least 125 kJ/kg/day and 1.2 g protein/kg/day in patients receiving radiation therapy. (39)
- head and neck patients: Grade C recommendation- Aim for energy and protein intakes of at least 125kJ/kg/day (30kcal/kg/day) and 1.2g protein/kg/day in patients receiving radiotherapy or chemoradiotherapy. (126)
- Energy and protein requirements during chemotherapy:
  - Grade C recommendation: Total daily energy expenditure in cancer patients may be assumed to be similar to healthy subjects, or 20–25 kcal/kg/day (84-105kJ/kg/d) for bedridden and 25–30 kcal/kg/day (105-126kJ/kg/d) for ambulatory patients (146)
  - As a rule-of-thumb the following assumptions for total energy expenditure can be made for non-obese patients using the actual body weight: Ambulant patients : 30-35 kcal=kgBW/d (126-147kJ/kg/d); Bedridden patients : 20-25 kcal=kgBW/d (84-105kJ/kg/d) (139)
  - The optimal nitrogen supply for cancer patients cannot be determined at present. Recommendations range between a minimum amino acid supply of 1 g/kg/d and a target of 1.2–2 g/ kg/day. (139, 146)
- Energy and protein requirements for surgery:

- Grade B recommendation: The commonly used formula of 25 kcal/kg ideal body weight furnishes an approximate estimate of daily energy expenditure and requirements. Under conditions of severe stress requirements may approach 30 kcal/kg ideal body weights. (40)
- Grade B recommendation: In illness/stressed conditions a daily nitrogen delivery equivalent to a protein intake of 1.5 g/kg ideal body weight (or approximately 20% of total energy requirements) is generally effective to limit nitrogen losses (40)
- Consider using ideal body weight when calculating energy and protein requirements for obese patients, as these figures may otherwise severely overestimate needs (40)
- Head and neck surgery: Grade C recommendation- Aim for energy intakes of at least 125kJ/kg/day (30kcal/kg/day). As energy requirements may be elevated post operatively, monitor weight and adjust intake as required. (126)
- Energy and protein requirements during bone marrow transplant:
  - Energy requirements may reach 130-150% of predicted basal energy expenditure, therefore aim 126-145kJ/kg/d (147)
  - Protein requirements 1.4-1.5g/kg/d (147)
- Fluid requirements:
  - Aim for 35-45mL/kg/day (99)
- Micronutrient requirements:
  - Aim for EARs (148)



### Diet for cancer prevention/ survivorship

*American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention (2012)-  
Recommendations for individual choices: (149)*

- **Achieve and maintain a healthy weight throughout life.**
  - Be as lean as possible throughout life without being underweight.
  - Avoid excess weight gain at all ages.
  - For those who are overweight or obese, losing even a small amount of weight has health benefits and is a good place to start.
  - Get regular physical activity and limit intake of high-calorie foods and drinks as keys to help maintain a healthy weight.
- **Be physically active.**
  - Adults: Get at least 150 minutes of moderate intensity or 75 minutes of vigorous intensity activity each week (or a combination of these), preferably spread throughout the week.
  - Children and teens: Get at least 1 hour of moderate or vigorous intensity activity each day, with vigorous activity on at least 3 days each week.
  - Limit sedentary behavior such as sitting, lying down, watching TV, and other forms of screen-based entertainment.
  - Doing some physical activity above usual activities, no matter what one's level of activity, can have many health benefits.
- **Eat a healthy diet, with an emphasis on plant foods.**
  - Choose foods and drinks in amounts that help you get to and maintain a healthy weight.
  - Limit how much processed meat and red meat you eat.
  - Eat at least 2½ cups of vegetables and fruits each day.
  - Choose whole grains instead of refined grain products.
- **If you drink alcohol, limit your intake.**
  - Drink no more than 1 drink per day for women or 2 per day for men

*American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Survivors (2012) (150)*

- **Achieve and maintain a healthy weight.**
  - If overweight or obese, limit consumption of high-calorie foods and beverages and increase physical activity to promote weight loss.
- **Engage in regular physical activity.**
  - Avoid inactivity and return to normal daily activities as soon as possible following diagnosis.
  - Aim to exercise at least 150 minutes per week.
  - Include strength training exercises at least 2 days per week.
- **Achieve a dietary pattern that is high in vegetables, fruits, and whole grains.**
  - Follow the American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention.

### **Complementary and Alternative Medicines (CAMs)**

- The US National Center for Complementary and Alternative Medicine defines CAM as an array of health care approaches with a history of use or origins outside of mainstream medicine (151)
- “Complementary” generally refers to using a non-mainstream approach together with conventional medicine, while “alternative” refers to using a non-mainstream approach in place of conventional medicine (151)

- True alternative medicine is not common as most people use non-mainstream approaches along with conventional treatments (151)
- Complementary health approaches may include natural products (e.g. Herbal, vitamin, mineral or probiotic nutritional supplements) or mind and body practices (eg. Acupuncture, massage, meditation, relaxation techniques, hypnotherapy, etc.). (151)
- Biological-based methods such as diets and nutritional supplements are most often used in Western countries (42)
- According to number of google hits, the most common anti-cancer diets are: Budwig’s diet, Low carb diet, Macrobiotics, Gerson’s regime, Alkaline diet and Raw diet (42)
- Vegan diet/ variations thereof are commonly encountered in practice
- Below is a summary table of the features of these common anti-cancer diets, though variations may exist

Diet	Theory	Recommendations	Benefits	Risks
Gerson regimen	Cancer arises from a misbalance between sodium and potassium	To increase potassium, patients should consume juice of at least 10kg fruit/vegetables per day.  Fat should be avoided. Protein from animals only in small quantities. 3-4 coffee enemas per day.  The diet has been combined with other approaches to stimulate metabolism such as raw liver extract, pancreatic and thyroid extracts or Lugol’s solution containing iodine, or infusions of potassium, glucose and insulin	Nil	Death, sepsis, coma from hyponatraemia or hyperkalaemia in case reports
Alkaline diet	Acidosis is the reason for diseases such as cancer	Diet with vegetables and low-sugar fruit. Avoid sugar, grains, dairy and meat.	No clinical data published	No clinical data published
Budwig diet	Omega-3 fatty acids and proteins with high content of sulphur from curd cheese and linseed oil	Cancer arises from an abundance of trans fatty acids and a deficit in omega-3 and -6 fatty acids	No published clinical data. Possible benefit: as an additional serving Budwig’s curd cheese (curd cheese and linseed oil) offers extra protein and calories to patients who may be losing weight	No published clinical data. Possible risks: following the strict diet, deficiency in vitamins and other micronutrients
Ketogenic/Low carb diet	Based on the ‘Warburg effect’ which describes cancer cells	Different forms exist, with varying degrees of	Nil	Possible risks: micronutrient deficiency, LOA,

	gain energy preferably by anaerobic glycolysis and therefore reducing carbohydrate intake will stop cancer growth	carbohydrate restriction. Usually no intake of refined carbohydrate and reduced total carbohydrate intake. Caloric intake mainly from fat (omega-3 and -6) and protein. Aim for rising ketone level		nausea, constipation, LOW, hypoglycaemia, hyperlipidaemia, dehydration, metabolic acidosis, fatigue, sedation
Raw food diet	Cooked food causes diseases such as cancer	Consumption of uncooked (also mostly unprocessed) food.	Possible benefits: avoidance of preservatives such as salt or toxins created by cooking (e.g. Hetero-cyclo amines)	Possible risks: likely not as well tolerated in patients with mucositis or patients with a stoma, and potential increased risk of GI infection in immunocompromised patients
Macrobiotic diet	Cancer arises from a misbalance between yin and yang. Created by two Japanese scientists who endeavored to create a whole system of living which promoted health, peace and happiness. The original diet was combined with other lifestyle changes and intended as a cancer cure which may not be achieved conventionally	Cereals are the most important part of nutrition, modern versions= 50-60% cereals, 20-30%, small amount of fish and eggs allowed. Meat, milk products, sugar, potatoes and tomatoes discouraged	Nil	Risks: Under strict diet, several deaths have been reported. Weight loss, anaemia and scurbut. Deficiency in protein, vitamins B12, C and D, zinc, calcium and iron.
Vegan diet	Strict vegetarian diet, often ethical considerations.	Complete avoidance of animal products.	High consumption of dietary fibre, vitamins C & E, magnesium and folic acid. Low in saturated fat.	Weight loss, deficiency in vitamins B12 & D, zinc and calcium.

(Adapted from Huebner et al 2014, (42))

- No clinical evidence on level 1 or 2 was identified for any of the described diets, though case reports and pre-clinical data point to the potential harm of some of these diets (42)
- Some diets are based on hypotheses of carcinogenesis which are not compatible with modern scientific concepts (42)
- Diets for which no clinical benefit has been shown, but which may entail risks should not be recommended. These include: Breuss cure, Fasting, Gerson regimen, Kelley/Gonzalez Regimen, Ketogenic Diet, Livingston-Wheeler Regimen, Moermann diet. (42)
- Note: Ian Gawler's diet is based on the Gerson regimen
- One major concern with cancer diets is that patients may rely on these diets alone and delay or decline conventional cancer treatments which can lead to progression of disease, relapse and/or suffering from cancer-related symptoms (42)

- Guidance of patients is of high importance. Counselling patients on cancer diets should take psychological facts and their consequences into account. Merely providing evidence will not be sufficient. (42)
- Patients who are searching for hope and cure turn to these methods (42)

Selected recommendations for discussing cancer diets with patients (42):

- "...Attitudes of family members and friends are also of interest. It is important to know patient's beliefs concerning diets and their influence on cancer. If they are interested in or adhere to a cancer diet, their expectations and his experiences should be asked for."
- "Lack of knowledge or misconceptions should be pointed out and the scientific evidence explained. If the patient has a misunderstanding of the situation of their disease, it may be helpful to explain this first and then advance to talking about nutrition and diets. If it is not the oncologist who is doing the consultation, it may be useful to refer the patient to them, if misconceptions on the disease persist. Communication with respect means that individual beliefs of the patient should be acknowledged but divergent concepts between the patient's point of view and the medical point of view should be named."
- "...All cancer diets the patient wants to discuss should be described from a scientific point of view but using lay vocabulary. Besides pointing out lack of evidence, fallacies in the underlying cancer theories must be addressed and adverse effects such as malnutrition must be discussed. In order not to leave the patient discouraged, an individual concept of healthy nutrition should be provided."
- "If the patient adheres to a cancer diet despite counseling against it, follow-up is of great importance in order to detect adverse events early and to be able to discuss the diet again. Besides measuring weight, malnutrition can be detected by taking blood levels of micronutrients, or measuring muscle mass or albumin in order to assess protein deficiency. If deficits become obvious, the patient should be informed of the consequences and strongly advised against continuing the diet. In the case of their further adhering to the diet prescription of supplements must be discussed even if they are no adequate substitute."

Summary of evidence based guidelines for discussing CAM with patients (152):

- (1) Elicit the person's understanding of their situation; e.g. What is your understanding of things at this point?
- (2) Respect cultural and linguistic diversity and different epistemological frameworks; e.g. What do you believe might have caused your illness?
- (3) Ask questions about CAM use at critical points in the illness trajectory; e.g. Are you currently taking any other medications or treatments?
- (4) Explore details and actively listen; e.g. What does it involve? How often do you use it? Have you used it before?
- (5) Respond to the person's emotional state; e.g. How are you coping with all of this?
- (6) Discuss relevant concerns while respecting the person's beliefs; e.g. How do you think you might feel if you followed this advice but did not achieve the outcome you had hoped for?
- (7) Provide balanced, evidence-based advice; Encourage use of CAM that may be beneficial, Accept use of CAM for which there is no evidence of physical harm or benefit, Discourage use of CAM where there is good evidence it will be unsafe or harmful (either directly or in combination with conventional treatment).
- (8) Summarize discussions;
- (9) Document the discussion;
- (10) Monitor and follow-up.

## HOSPITAL-WIDE INITIATIVES TO ASSIST WITH MALNUTRITION MANAGEMENT

### Medpass

- The TwoCal HN Med Pass program was initially developed for institutionalised older adults who are underweight or losing weight (153)
- Traditional nutritional intervention may include snacks (e.g., cheese and biscuits), nourishing drinks (e.g., milkshakes), small frequent meals, liberalised diets, and oral nutritional supplements (ONS). (153)

- ONS are commonly used in a variety of health care settings including acute care, long term care, and home care (153)
- Oral nutrition supplements have been shown to be of benefit in the treatment of malnutrition and may have a greater role than dietary advice in the short-term improvement of body weight (133)
- Despite this, many facilities experience waste as ONS may be ignored, forgotten, not distributed by staff, or only partly consumed by the patient. Reasons for poor patient compliance and acceptance of ONS include taste, flavour fatigue, and the perception that ONS are an "optional food" and not part of the comprehensive medical plan. (153)
- MedPass was designed to overcome some of the common issues surrounding the use of oral nutrition supplements, such as cost, compliance, waste, and acceptability. (153)
- The program involves providing 60mL of a nutritionally complete, high-calorie, high-protein ONS four times a day. The product is offered by the nursing staff during the medication round, rather than by dietary or food service staff at or between meals. (153)
- Compliance with ONS consumption is significantly improved on the Med Pass program because it is seen as part of the medication round and is less likely to be refused when seen as a medication versus an optional supplement (153)
- Med Pass may also be beneficial for individuals who find it difficult to consume a full 237mL serve of ONS or who are volume sensitive- the small amount given at each medication round should be well tolerated. Also, small volumes are less likely to interfere with appetite at meals. (153)
- The program has been associated with improvements in weight status, improved meal intake, a decreased incidence of pressure ulcers, improved functionality, and reduced mortality (153)
- A recent RCT in the acute care setting (including surgical and oncology patients) found that a higher frequency and lower volume of ONS during medication rounds (4x per day) increased the compliance to ONS compared to usual care (2x a day in higher volumes between meals) (154)
- No differences were observed between patients receiving higher volumes of ONS twice a day in between meals or twice a day during medication rounds, hence the effect appears to be due to the lower volume rather than the delivery with the med round (154)
- Medpass and traditional supplement delivery both resulted in malnourished older adult rehab patients achieving recommended dietary intakes more often than a mid-meal snack trolley, though quality-of-life ratings improved significantly with MedPass, however, did not change with traditional intervention ( $P = 0.05$ ) (155)
- Medpass resulted in substantially greater caloric and protein intake (380 kcal and 17 g protein) than either the mid-meal snack trolley (288 kcal and 9 g of protein ) or traditional supplement delivery (304 kcal and 11 g protein) (155)
- Cost effectiveness is improved by improving compliance, reducing waste and improving outcomes (153)
- Criteria for identifying suitable patients for the Med Pass program relevant to the oncology population include:
  - Loss of  $\geq 5\%$  of weight in 30 days.
  - Loss of 10% of weight in 180 days.
  - Below ideal body weight.
  - Cancer and cancer treatment
  - Diagnosis of malnutrition, cachexia, protein-energy malnutrition, kwashiorkor, or marasmus.
  - Loss of appetite or significantly reduced dietary intake for 7 days or more (153)
- The involvement of the nurse is a critical factor in the success of the Med Pass program. Nurses play an important role in assessing patients, selecting candidates for the program, implementing the program, and monitoring patients. (153)
- Nurses were initially reluctant to participate in the trial due to perceived increased work load and the risk of making errors when providing the medication. This was addressed with nutrition assistants preparing the drinks while the nursing staff prepared the medication, resulting in minimal additional effort in the nurses' daily routines on busy inpatient wards and no distractions in provision of medication. (154)

#### Parenteral Nutrition (PN) rounds

- PN teams generally consist of at least four members of a multidisciplinary team, including a doctor, dietitian, pharmacist and nurse (156-157)
- PN delivery in hospitals without PN teams was primarily managed by intensivists (156)

- Most hospitals have a hospital protocol for the delivery of PN (156)
- The multidisciplinary team approach is aimed to assess nutritional status, prescribe the correct nutrition requirements and reduce the incidence of metabolic complications through regular monitoring (157)
- In a UK hospital trust, introduction of a multidisciplinary PN team reduced TPN usage and expenditure by 52%, equating to a cost saving of £44,572.89 over a 1 year period (~AU\$80,280) (158)
- The PN round was found to be effective in stopping the use of inappropriate PN as well as instigating switch to enteral feeding when clinically indicated (158)
- PN rounds also led to a 75% reduction in weekend requests, reducing the prescription of inappropriate regimens for patients and increasing patient safety (158)
- A review of PN teams indicates that the incidence of total mechanical complications (including air embolism, catheter malposition, blocked catheter, subclavian artery puncture, dislodgement or disconnection of catheter, catheter infection, subclavian vein thrombosis or pneumothorax) is reduced in patients managed by the PN, though the benefit of the team in reduction of catheter related sepsis remains inconclusive. (157)
- Fewer total metabolic and electrolyte abnormalities have been reported in patients managed by a multidisciplinary PN team (157)
- Patients managed by a PN team were more likely to receive their optimal caloric intake (less likely to be over- or under-fed) (157)
- It remains unclear whether the management of patients by a PN team prevents inappropriate use of PN. It is acknowledged that PN is a more expensive form of nutrition support and assessment for the most appropriate form of nutrition support may cause a shift to enteral feeding resulting in significant cost savings. (157)
- There is evidence that a team approach in management of patients on PN is a cost effective strategy- financial benefits are suggested from the introduction of multidisciplinary PN teams in the hospital setting due to a reduction in waste, reduction in complications and identification of patients appropriate for PN, though administrative and personnel costs associated with the establishment of the PN team were not accounted for (157)

#### Protected Meal Times

- The Australian Nutrition Care Day Survey identified 4% of patients did not consume a main meal and 7% did not consume between-meal snacks because they were away for a diagnostic test/procedure (6)
- “The objective of this strategy is to protect mealtimes from unnecessary and avoidable interruptions, providing an environment conducive to eating and enabling staff to provide patients with support and assistance with meals” (159)
- Having an organisational policy which addresses Protected Mealtimes is a critical factor to successful implementation (159)
- Benefits:
  - reduced patient complaints, reduced food wastage, weight gain (160)
  - significantly more patients had their tray within reach, time provided to eat meals significantly increased by a median of 4 min, the proportion of inpatients receiving feeding assistance when required nearly doubled, median time until first assistance was received in those that required it at dinner also improved by 4 min (161)
- The top four barriers to protected mealtimes in the UK were found to be:
  - Ward rounds
  - Diagnostic tests
  - Visitors
  - Other healthcare professionals (160)
- Two key factors identified as impacting on implementation are:
  - Lack of “Board to Ward” level leadership
  - Lack of education and training of all staff groups (160)
- The critical success factors identified are:
  - Policy related to Protected Mealtimes (160)
- Evaluations of the Protected Mealtime initiatives have demonstrated an improved level of team-work and higher staff morale on wards where protected mealtimes were introduced (159)

- A recent review has found protected mealtime policies can successfully reduce mealtime interruptions however not all studies have demonstrated improved intake as a result of this (162)
- Some studies have shown intake was similar between pre- and post- protected mealtimes implementation over the day and between meals (Huxtable 2013) though others have demonstrated significantly more patients achieved adequate energy and protein intakes post protected mealtimes implementation (163)
- The proportion of patients interrupted at mealtimes increased by 9% post-implementation of protected mealtimes, except on the pilot ward where there was strong support from a nurse ward champion- this suggests outcomes may be improved if a nurse champion was driving implementation of protected mealtimes on the wards (161)
- Other studies have found no overall reduction in the occurrence of mealtime interruptions but a significant reduction in non-clinical nursing tasks at mealtimes (163)
- Staff breaks were rearranged so that more nurses were available at main meals to provide mealtime assistance, but may have inadvertently increased mealtime interruptions (nursing staff interruptions represented 61% of all interruptions observed) and hence resulted in no change to inpatient consumption. (161)

### Red Tray System

- At-risk patients have their food provided on a red tray to provide a visual indicator for all staff that they should receive help and support in eating their food (164)
- It was initially used as part of a total strategy (including a nutrition assessment tool and staff education) implemented in a trauma rehabilitation unit for mainly older adults to improve the level of nutritional care in the unit (164)
- It is the responsibility of all healthcare staff to ensure that suitable food not only reaches the patient, but also is eaten (164)
- Nurses have a specific responsibility for ensuring that initial and continual nutritional monitoring takes place, that vulnerable patients are assisted to eat their food and to identify the reason for any failure to eat the food (164)
- Food service staff should not take away food served on a red tray until instructed by a nurse (164)
- The ward communication whiteboard that listed patients currently on the ward was used to identify patients at risk on admission, or at the weekly nutritional assessment who would receive a red tray with a red square. In this way, food service staff and members of the multidisciplinary team could quickly identify those at risk (164)
- There have been limited higher level studies investigating the efficacy of the red tray system, though subjectively the concept of the red tray has been successful in identifying and providing support for patients at nutritional risk (164)
- The system has refocused attention on patients' food consumption, and patients and their relatives have commented positively on the level of attention placed on what and how much they eat. (164)
- Subjectively the innovation does not appear to have increased staff workload either. (164)

### Feeding assistance

- Grade C recommendation: Feeding support provided by health care assistants may improve outcomes including energy intake, body composition, use of antibiotics and life expectancy in the acute care setting (101)
- A recent review of the literature has found mealtime assistance, particularly provided by volunteers or dietary staff, appears to promote food intake. (162)
- An RCT investigating the use of health care assistants to provide extra feeding support and encouragement to patients to eat in an acute setting reduced the need for and duration of intravenous antibiotics without change to the food provision or without targeting higher risk patients (165)
- Feeding support did not improve nutritional status or have an effect on length of stay in the study period- targeting care to those with the most difficulties and those who are already malnourished or in rehabilitation or longer term care environments where the intervention would be more prolonged may produce better results (165)
- health care assistant feeding support included: Ensuring that the patient is seated comfortably and in the best possible position to eat their meal; ensuring that the meal tray is in reach and all packets are opened and lids removed; checking the correct food has been served and the patient can complete the menu; ensuring the patients vision is optimised (glasses on and clean); discussing the patients

nutritional needs with relatives; ensuring dentures are in the mouth before meals; assisting with cutting up food; providing additional milky drinks or distributing prescribed supplements; and providing encouragement to the patient (165)

- There was a trend towards a greater intake for the feeding support group (5410 vs. 5780 kJ (P=0.53) and 47 vs. 50 g protein (P=0.62) in the control and feeding support groups, respectively) though this was not statistically significant (165)
- Introduction of a dedicated nursing assistant for feeding assistance in the acute setting resulted in a significant increase in mealtime assistance from 30 to 79%,  $p < 0.01$  (163)
- Significantly more patients were able to meet energy and protein requirements post implementation of a feeding assistance intervention (163)
- In older medical inpatients aged >65 years, patients with cognitive impairment or feeding dependency appeared to gain substantial benefit from mealtime assistance interventions (163)
- Feeding assistance intervention appears to have minimal impact on participants with anorexia (163)

#### Food fortification

- Grade B recommendation: Modifications to food provision methods (including strategies such as nutrient density, small portion sizes and improvements to the dining experience) may improve outcomes including energy intake, weight status and global nutritional status in the acute care setting; and may improve weight status and global nutrition status in the community setting (101)
- Using a fortified menu (with ~20% reduction in portion size and increased energy density) resulted in elderly hospitalised patients having higher energy intakes compared to the usual menu despite being served a lower weight in food (1711kcal/d vs 1425kcal/d respectively,  $p < 0.001$ ) (144)
- Energy density was increased mainly by the addition of fat (butter, cream and cheese) and some carbohydrate (glucose polymers) so that the mean daily energy provision on the fortified menu was increased by 200 kcal, although the total protein provision was reduced by 5 g/day (144)
- Serving a cooked breakfast rather than cereal resulted in significantly higher protein provision and intake (144)
- The mean daily protein intakes were still below recommended levels on fortified, usual and cooked breakfast menus. Further fortification of protein content may be required (144)

#### Mid meal trolleys

- A recent review concluded point-of-service choice for food appears to lead to greater satisfaction, but further research with food intake and nutritional outcomes is needed (162)
- “A selective mid-meal intervention, defined as provision of snacks between meals in the form of familiar snack food and beverages, lends itself to improved choice and control for the patient over selection at the point of service.” (155)
- Patient satisfaction including sensory qualities (taste, look, temperature, size) and perceived benefit (improved health and recovery) was rated highest for mid-meal trolley compared with med pass and traditional supplement delivery (155)
- Mid-meal trolley group was provided with a self-selection from a mid-meal trolley of high-protein and/or high-energy snacks or commercial drinks delivered between breakfast and lunch, and again between lunch and dinner (offering a selection of up to four products per day (up to two per occasion) providing 70–120 kcal and 0-6 g protein, per selection, including flavoured milk, chocolate-coated biscuits, soda, mixed nuts, potato crisps, etc. (155)
- Consumption of mid meals was significantly greater than traditional supplement delivery (73.8% vs 91.7%)  $P < 0.05$ , and nutrient provision was similar (288 kcal and 9 g of protein/day vs 304 kcal and 11 g protein/day) (155)
- mid-meal trolley was the most cost-effective compared with MedPass and traditional supplement delivery, with lower total labour and also product cost per 100 kcal consumed (\$AU0.81) (155)
- Patients in the mid-meal trolley group did not achieve estimated requirements, yet reported higher satisfaction and improvements in QOL, at the lowest cost (155)
- for some patients, the concept of mid-meals is unfamiliar, and the degree of selection may have been affected by a lack of familiarity with this pattern of eating (155)

#### Dining rooms



- Grade B recommendation: Modifications to food provision methods (including strategies such as nutrient density, small portion sizes and improvements to the dining experience) may improve outcomes including energy intake, weight status and global nutritional status in the acute care setting; and may improve weight status and global nutrition status in the community setting (101)
- Social and environmental factors are important influences of food intake. (159)
- Studies demonstrate increases in food intake when there is improvement in the social and environmental surroundings, and when people dine together. (159)
- Using a supervised dining room, can increase opportunities for patients to enjoy the social aspects of mealtimes, increase food intake and can potentially lead to weight gain and improvements in nutritional status and rehabilitation (159)
- elderly inpatients on an acute medical ward who ate in a dining room had significantly higher intakes of energy than the control group who ate lunch by the bedside (489 vs 360kcal,  $p < 0.013$ ) (166)
- There was no significant difference in protein intake (18.9 vs 17.7g,  $p=0.63$ ). (166)
- there was a trend towards a greater number of people gaining weight in the dining room group over the 6 week study period (dining room: three lost weight and 14 gained; control: seven lost weight and nine gained,  $p=0.12$ ) though this was not statistically significant (166)
- A qualitative study of a dining room in an orthopedic ward showed subjective improvements in patient mobility, increased oral intake (due to both greater monitoring by nursing and peer support), increased socialization and improved psychological wellbeing of patients, improved food service (prompt service, better food quality, appropriate temperature) and provided patients with “an escape from the hospital environment” (167)

#### Enhanced Recovery After Surgery (ERAS)

- ERAS is a term used to describe multimodal perioperative care programs that have been shown to improve outcomes after major surgery (168)
- While ERAS was initially developed for colonic resections, these principles are now being used in a range of operations (168), and have been shown to be effective in gynaecological, urological, liver and pancreatic surgeries (169-172)

#### Summary of the latest ERAS guidelines for perioperative care in elective colonic surgery (168)

Preoperative	Intraoperative	Postoperative
<ul style="list-style-type: none"> <li>• Detailed information</li> <li>• Stop smoking</li> <li>• Screen nutrition status and liberal nutrition support with oral nutrition supplements</li> <li>• No oral bowel preparation</li> <li>• No “nil per os” from midnight—preoperative carbohydrate drink 2 hours before anesthesia</li> <li>• No routine long-acting sedatives</li> <li>• Prophylaxis against thromboembolism</li> <li>• Antimicrobial prophylaxis</li> <li>• Skin preparation</li> </ul>	<ul style="list-style-type: none"> <li>• Standard anesthetic technique aiming to maintain homeostasis and reduce stress</li> <li>• Avoid long-acting opioids</li> <li>• Open surgery: mid-thoracic epidural</li> <li>• Laparoscopic: spinal or patient-controlled analgesia as an alternative to epidural</li> <li>• Multimodal postoperative nausea and vomiting prophylaxis</li> <li>• Laparoscopic surgery if available</li> <li>• Prevention of hypothermia</li> <li>• Fluid optimization using mixtures of colloids and crystalloids</li> <li>• Vasopressors to control hypotension</li> <li>• No routine drains</li> </ul>	<ul style="list-style-type: none"> <li>• No routine nasogastric tubes</li> <li>• Early (when lucid after surgery) oral intake of fluids and solids</li> <li>• Liberal use of oral nutrition supplements</li> <li>• Prevention of postoperative ileus: fluid balanced; avoiding opioids, chewing gum; magnesium oxide and alvimopan may be used.</li> <li>• Urinary drainage removed days 1–2 postoperatively</li> <li>• Glucose control; primarily avoiding insulin resistance, insulin treatment in intensive care unit for severe hyperglycemia</li> <li>• Early mobilization</li> </ul>

Adapted from Gustafsson et al.<sup>2</sup>

- Full guidelines with levels of evidence available in Gustafsson 2013
- The ERAS protocol has been built with everyone involved in the entire chain of events during the patient’s journey, including surgeons, anesthetists, intensive care/high-dependency specialists, nurses, dietitians, and physical therapists. All have to come together to form a team that runs ERAS locally- this forms the cornerstone of ERAS implementation process but is also vital for maintenance, sustainability, and further development over time. (168)
- “It is often said that it takes up to 15 years for a proven medical treatment to become common practice. This is obviously far too slow, but it shows how hard it is to move knowledge into daily practice.” (168)
- Changes of old routines take hard work. Importantly once change is initiated it should be audited and followed up appropriately to ensure change is maintained (168)
- The ERAS team should run regular audits and feedback to the units where problems may arise. (168)
- “Working with true data is the only way to keep things running at their best.” (168)
- Nutrition related practices/recommendations addressed in ERAS:
  - Pre-op fasting and CHO treatment recommendation: “Clear fluids should be allowed up to 2 h and solids up to 6 hrs prior to induction of anaesthesia. In those patients where gastric emptying may be delayed (duodenal obstruction etc.) specific safety measures should be at the induction of anaesthesia. Preoperative oral carbohydrate treatment should be used routinely. In diabetic patients carbohydrate treatment can be given along with the diabetic medication”. (173)
  - Perioperative nutritional care recommendation: “Patients should be screened for nutritional status and, if deemed to be at risk of under-nutrition, given active nutritional support. For the standard ERAS patient, preoperative fasting should be minimised and postoperatively patients should be encouraged to take normal food as soon as possible after surgery. ONS can be used to supplement total intake.” (173)
  - Early oral feeding post-op has been shown to be safe but the risk of vomiting increases, especially in the absence of multimodal anti-ileus therapy (173)
  - Most studies show that there is clinical benefit from immunonutrition due to a reduction in complications and shortened LOS in the context of traditional care, but results are heterogeneous. There are no trials of the effectiveness of these formulas in an ERAS setting if stress is minimised. There is evidence suggesting immunonutrition is most effective in malnourished patients (173)
- The nutrition components of the ERAS guidelines focus on shortened fasting periods prior to surgery, pre carbohydrate (CHO) loading, the absence of bowel preparation, early introduction of oral diet following surgery, prevention of nausea and vomiting and avoiding routine use of nasogastric decompression tubes. Whilst not all of these processes are directly managed by a dietitian, these clinicians are in a prime position to advocate for adherence to these practice principles (43)
- There is a high level of evidence that ERAS reduces LOS after elective colonic surgery but mixed results have been found with regard to morbidity and hospital readmissions (173)
- In Australia, full implementation of ERAS nutrition protocols has been found to be lacking (43)
  - Fear of change, lack of time, lack of resources and (perceived) lack of skills in implementing change were commonly reported barriers (43)
  - Awareness raising/appropriate education about the benefits of ERAS and having a key member of the team as a ‘champion’ who took an active role in guideline implementation, development and education were identified as facilitators of guideline adoption (43)

### Immunonutrition

- Level of evidence varies depending on the patient group and treatment type as well as the type of immunomodulating nutrients studied.
- Immuno-nutrients are hypothesised to influence the immune and inflammatory response related to cancer and/or its treatment. Examples include:
  - **Eicosapentaenoic acid (EPA):** a long-chain polyunsaturated omega-3 fatty acid which appears to have anti-inflammatory effects (174). It can be administered in capsules as mixed marine triglycerides (fish oil) or as a semi-purified ethyl ester; or as fish oil in combination with a high protein, high energy oral nutrition supplement (139)
  - **Arginine:** a conditionally essential amino acid, stores of which may become depleted in times of stress. It plays an important role in T- and B-cell immunity as well as in the production of

nitric oxide (174). These characteristics suggest that arginine could enhance wound healing and reduce infection, especially in situations that compromise immune function, such as surgery or critical illness (175)

- **Nucleotides:** the building blocks of DNA and RNA, derived from RNA in the diet (174)
- **Glutamine:** the primary oxidative fuel of the gut epithelium and has potential radioprotective properties (67). It can be administered orally or intravenously (174, 176). For oral glutamine, 20 to 40g per day is recommended during metabolic stress and active tumor growth, with powder forms preferred to pills and capsules due to improved cost, absorption and tolerance of higher doses (177)

#### *Cachexia/ weight loss in advanced cancer:*

- Grade C recommendation: “Regarding omega-3 fatty acids, randomised clinical trial evidence is contradictory/controversial and at present it is not possible to reach any firm conclusion with regard to improved nutritional status/physical function. It is unlikely that omega-3 fatty acids prolong survival in advanced cancer” (139)
- A systematic review completed in 2005 found there was “insufficient evidence to support the use of oral fish oil (on its own or in the presence of other treatments) for the management of the weight loss syndrome often seen in patients with advanced cancer” (178)
- However, the most recent evidence-based practice guidelines for nutritional management of cancer cachexia include a Level C recommendation: “The prescription of EPA improves outcomes in patients with cancer cachexia.” It is noted that the body of evidence provides some support for this recommendation but care should be taken in its application (36)
- High protein high energy supplements enriched with EPA have been associated with improved outcomes such as increased energy and protein intake, improved body composition, performance status and quality of life in patients with cancer cachexia in open trials, but there is a lack of higher level evidence from randomised trials to confirm these results (36)
- As such, the guidelines suggest EPA supplementation can be considered as a component of nutrition intervention in patients with cancer cachexia. (36)
- If EPA is included in nutrition prescription, it should be consumed at a level of 1.4–2.0 g/day for at least four weeks to achieve clinical benefit. (36)

#### *Stem cell transplants:*

- Grade C recommendation: “During stem cell transplantation enteral administration of glutamine or eicosapentanoic acid is not recommended due to inconclusive data” (139)
- A systematic review and meta-analysis of seventeen RCTs concluded glutamine may have beneficial effects in haematopoietic stem cell transplantation:
  - oral glutamine may reduce mucositis and GVHD
  - intravenous glutamine may reduce infections (but may increase risk of relapse at six months)
  - Larger high-quality trials are needed to confirm the benefits and to investigate possible adverse effects before glutamine supplementation can be recommended for routine use. (179)
- RCTs compared oral or intravenous glutamine, at doses ranging from 1.02 to 7.31g per kg per day and at various dosing schedules, with a control group without glutamine. The participants varied in age and included children. The transplant types included autologous and allogenic (179)
- Survival and other outcomes: There was no difference with oral or intravenous glutamine in mortality up to or after day 100, days of fever, days of antibiotics, mean maximum daily temperature, days of mucositis, presence of severe mucositis, maximum mucositis score, time to platelet recovery, time to neutrophil recovery, length of stay, weight change, duration of total parenteral nutrition, and transfusions (179)
- More recent guidelines state that “IV glutamine should not be used for the prevention of oral mucositis in patients receiving high-dose chemotherapy (with or without TBI) prior to HSCT” (Level II evidence) (176)
- No studies have shown oral glutamine (including mouthwash- swish and swallow) to be effective in objectively reducing severity of mucositis lesions during HSCT conditioning (high-dose chemotherapy and TBI). There is some evidence of reduced TPN and narcotics use and reduced duration and severity of mouth pain, but due to inconclusive data, no guideline was possible (176)

- Combined IV and oral glutamine in patients undergoing HSCT demonstrated no reduction in mucositis severity or days of TPN compared with control (glycine), however no guideline was possible due to insufficient evidence in this setting (176)

#### *Surgery- gastrointestinal*

- Grade A recommendation: “Use EN preferably with immuno-modulating substrates (arginine, omega-3 fatty acids and nucleotides) perioperatively independent of the nutritional risk for those patients:
  - undergoing major abdominal cancer surgery (oesophagectomy, gastrectomy, and pancreaticoduodenectomy)” (41)
- Grade A recommendation: “In all cancer patients undergoing major abdominal surgery preoperative EN preferably with immune modulating substrates (arginine, omega-3 fatty acids and nucleotides) is recommended for 5–7 days independent of their nutritional status” (139)
- Grade C recommendation: “The optimal PN regimen for critically ill surgical patients should probably include supplemental n-3 fatty acids, though the evidence-base requires further input from prospective randomised trials” (40)
- In a double-blind randomized controlled trial in oesophageal cancer surgery, patients receiving EN enriched with 2.2g EPA/d maintained fat free mass and had a reduced acute phase response while patients receiving standard EN lost ~2kg of lean mass in 3 weeks postoperatively. No significant differences were observed in the incidence of major complications between groups (81)

#### *Surgery- head and neck*

- A recent review and meta-analysis found that administration of arginine-enriched enteral nutrition (of varying doses between 6.25-18.7 g/L) was associated with a significant reduction in fistulas and hospital stay in patients undergoing surgery for head and neck cancer. No effect was seen on infections or occurrence of diarrhea (175)
- Grade C recommendation: “Pre-operative immunonutrition has no additional benefits compared to standard nutrition support for patients undergoing surgery for head and neck cancer” (126)
- Grade B recommendation: “Post-operative immunonutrition may be considered to reduce length of stay, although the mechanism is unclear, as other clinical benefits such as reduced complications and infections were not demonstrated” (126)
- Some studies have shown a reduction in the length of hospital stay, less complications and decrease of fistula complications in patients treated with an arginine enhanced formula postoperatively (174)
- A suitable powered clinical trial is required before firm recommendations can be made on the use of immunonutrition in head and neck cancer patients postoperatively (174)
- Grade C recommendation: “If immunonutrition is to be used post operatively, this should be given for a minimum of 7 days” (126)
- Grade C recommendation: “Perioperative omega-3 fatty acid enriched nutrition support may improve nutritional outcomes such as weight, lean body mass and fat mass” (126)
- Grade A recommendation: “Use EN preferably with immuno-modulating substrates (arginine, o-3 fatty acids and nucleotides) perioperatively independent of the nutritional risk for those patients:
  - undergoing major neck surgery for cancer (laryngectomy, pharyngectomy)” (41)

#### *Chemotherapy:*

- No guideline was possible regarding use of oral glutamine (including mouthwash- swish and swallow) in patients with various solid tumors and hematological cancers receiving standard dose chemotherapy due to conflicting evidence with similar numbers of studies showing benefit or no benefit (176)
- No guideline was possible regarding IV glutamine in patients receiving standard dose chemotherapy due to insufficient evidence - only one small pilot study with no statistically significant differences in mucositis between glutamine and control groups is currently available (176)
- Clinical guidelines for the prevention and treatment of GI mucositis- No guideline possible for the use of glutamine due to conflicting data. Previous guideline was not to use systemic glutamine because of severe toxicity, however several small but double-blinded randomized controlled trials have since shown effect without severe toxicity in patients with haematological and solid tumours receiving chemotherapy (180)

- A review of available evidence in 2003 suggested that “Glutamine supplementation may decrease the incidence and/or severity of chemotherapy-associated mucositis, irinotecan-associated diarrhea, paclitaxel-induced neuropathy, hepatic veno-occlusive disease in the setting of high dose chemotherapy and stem cell transplantation, and the cardiotoxicity that accompanies anthracycline use” (181)
- Given the potential benefits and low cost of glutamine supplementation, it is recommended that “further studies, particularly placebo-controlled phase III trials, are needed to define its role in chemotherapy-induced toxicity” (181)

#### *Radiotherapy:*

- No guideline was possible regarding topical glutamine (mouthwash that is not swallowed) in head and neck cancer patients undergoing radiotherapy due to insufficient evidence: only one small pilot study exists which found the duration and severity of objective mucositis were lower in the glutamine group, though there was no difference in the duration and severity of subjective symptoms and analgesic use (176)
- Some small retrospective studies have demonstrated beneficial effects of oral glutamine supplementation in lung cancer patients treated with thoracic radiotherapy, including reduced incidence and severity of acute radiotherapy-induced esophagitis (ARIE), delayed onset of ARIE and reduced weight loss during treatment (67, 177)
- Glutamine supplementation does not appear to be beneficial in preventing radiation induced enteritis associated with pelvic radiotherapy though robust clinical trials are lacking (181)

#### Multidisciplinary clinics

- “In the setting of increased demand on health care services, innovative and cost-effective new service delivery models are being sought” (182)
- Models of care involving co-located multidisciplinary clinics or non-physician led services have been shown to be effective in various oncology settings including:
  - Pre-treatment (183, 186)
  - During treatment (182-183)
  - Post treatment (182, 184)
  - Metastatic disease/ palliative care (185)
- Disciplines represented in a multidisciplinary clinic may include: various medical specialists (e.g. Radiation oncologist, medical oncologists, surgeons, palliative care specialists, and other consulting doctors), nurses/ clinical nurse specialists, allied health professionals (eg. Dietitians, social workers, psychologists, spiritual care counsellors), pathologists, radiologists, genetic counsellors (182-183, 185-186)
- Benefits of a co-located multidisciplinary clinic include:
  - Improved communication between disciplines (182-183, 186)
  - Increased knowledge sharing and education opportunities among different professionals (183)
  - Improved patient care- time saving (not having multiple appointments on different days, etc.) (183, 186), reduced invasive treatment at end-of-life and improved patient support in decision making (185)
  - Improved patient outcomes- significantly reduced nutrition related admissions, unplanned feeding tube insertions and improved transition to oral feeding in head and neck radiotherapy patients (182); increased diagnoses at early stage of disease, reduced time to treatment and improved overall survival in hepatocellular carcinoma patients (186)
  - improved efficiency in care delivery- increased case-load and improved use of physician time (182-183)
  - improved cost-effectiveness (182-183)
  - reduced practice variation in patient care (182-183)
  - promotion of collaboration and research amongst different disciplines (183)
- “A high-volume caseload facilitates accrual into and development of clinical trials” (183)

- Radiation oncologist review at 2 weeks post radiotherapy was reduced from 32% to 15% of patients (p=0.009) with the implementation of dietitian led follow up for head and neck radiotherapy patients (182)
- “A busy team-oriented multidisciplinary ...clinic fosters invaluable interchange of knowledge and experience among specialists from multiple disciplines, which is of great educational benefit to all involved” (183)
- Multidisciplinary clinics offer “a feasible model of care and an effective way of integrating best-practice guidelines into clinical care.” (182)
- “The total number of nutrition-related admission days reduced from 199 to 62 (with implementation of a dietitian-led clinic model of care in head and neck radiotherapy patients), a cost saving of \$95,000 (AU) per annum based on a cost per day of \$693 (AU) excluding radiotherapy costs” (182)
- The multidisciplinary clinic format as well as non-physician led follow up models have been shown to be acceptable to patients (182, 184)
- A recent review has found “in studies in which nurse-led follow-up was compared with physician-led follow-up, the outcomes revealed similar medical safety and adequate detection of cancer recurrence during, and health related quality of life and patient satisfaction were either equivalent or slightly better” (184)
- “Evidence collected to date has demonstrated that nurse-led services are applicable to nearly every cancer population” (184)

#### Pre-op or pre-admission screening

- Successful pre-procedure preparation requires the involvement of a multidisciplinary team including, but not limited to: the surgeon, anaesthetist, nurses, administrative and clerical staff, allied health professionals (including interpreters, physiotherapists, pharmacists, occupational therapists, speech pathologists, dietitians, podiatrists and social workers) the patient’s General Practitioner and the patient and their carer (187)
- “All patients [undergoing elective surgery] require pre-admission review using a triage process” (187)
- Several guidelines recommend all patients should be screened for malnutrition on presentation, and if clinically indicated, their nutritional status assessed (102-104)
- Pre-procedure preparation is intended to optimise the patient’s condition for their planned surgery or procedure and recovery, including allied health planning and discharge planning (187)
- The pre-admission clinic should be a 'one stop' service for all the necessary anaesthetist and nurse appointments, tests, investigations and allied health consultations (187)
- “Different sources of information must be checked to ensure that appropriate referrals are made to Allied Health personnel” (187)
- Allied health professionals should be consulted according to procedure specific and social circumstances (187)
- Malnutrition prior to surgery may be caused by decreased oral food intake, preexisting chronic disease, tumour cachexia or low socioeconomical status (188)
- “Malnutrition is a well-known major risk factor for poor postoperative outcome. Preoperative nutritional screening is therefore mandatory to identify patients who need perioperative nutritional support” (188) “
- Based on the current literature and guidelines, it is recommended that all patients undergoing major surgery should be screened for malnutrition” (188)
- The objective of diagnosing malnutrition is to treat it as early as possible in order to improve patient outcomes (188)
- “Depending on the degree of malnutrition and the type of surgery, nutritional support should start within 14–7 days preoperatively” (188)
- “While perioperative nutritional support is recommended, some studies suggest that nutrition limited to the preoperative phase might have the same beneficial effects than combined pre- and postoperative nutrition” (188)
- The role of preoperative nutritional support is to improve nutritional status prior to surgery, while postoperative nutrition aims to maintain nutritional status in the catabolic period after surgery (188)
- Prolonged fasting or inadequate oral intake postoperatively can worsen pre-existing malnutrition (188)

## COMMUNITY INITIATIVES TO ASSIST MALNUTRITION MANAGEMENT

- Grade B recommendation: Modifications to food provision methods (including strategies such as nutrient density, small portion sizes and improvements to the dining experience) may improve outcomes including energy intake, weight status and global nutritional status in the acute care setting; and may improve weight status and global nutrition status in the community setting (101)
- Red tray system, dining rooms, food fortification, feeding assistance, mid meal trolley and MedPass initiatives described above are also applicable to community residential care settings

### Home delivered Meals (HDM):

- Most studies on HDM have been conducted in older adults (>60yo)
- HDM has been found to have a positive impact on the nutritional well-being of community dwelling older people (189)
- A recent review concluded that home-delivered meal programs improve diet quality and increase nutrient intakes among recipients (190)
- After receiving meals for 6-12 months, participants receiving HDM showed greater improvement in most dietary intake variables than either a non-HDM comparison group or HDM participants who ate no HDM meal on the day of assessment (189)
- HDM programs may also reduce food insecurity and nutritional risk (190)
- Compared to values before receiving any meals, participants improved significantly in some variables for dietary patterns, nutrient intake, and nutrient density, and were less likely to be food insecure after receiving HDM (189)
- Other beneficial outcomes of HDM programs include increased socialization opportunities, improvement in dietary adherence, and higher quality of life. (190)
- HDM was more likely to be beneficial in those living alone and those with poorer initial status (189)
- HDM programs can help older adults maintain independence and remain in their homes as their health and function declines, which can direct costs away from long-term care in nursing homes to more community based services (190)

## GOVERNANCE STRATEGIES TO SUPPORT APPROPRIATE NUTRITIONAL CARE

### Staff education

- “The workforce should be trained in the use of screening and assessment tools and optimising patient nutrition care.” This may include:
  - “Orientation program resources, education materials and attendance at training by the workforce on screening and assessment tools and optimising patient nutritional status
  - Ongoing education and training of the workforce in the area of nutrition and food
  - Evaluation of education programs
  - Ongoing assessment of education and competency-based training needs
  - Auditing patient clinical records for use of and compliance with risk screening on admission and rescreening when clinically indicated” (191)

### Appropriate policies and procedures

- “In order to facilitate a coordinated approach there should be structures and processes which can monitor, evaluate and report on all aspects of patient nutritional status and the quality of nutritional care”. (191)
- Policies, procedures and/or protocols should be developed, including associated tools, based on current national and international guidelines. (191)
- Policies, procedures and guidelines should cover: nutrition screening and assessment processes, oral, enteral and parenteral nutrition, food allergies and intolerances, management of pre-existing

nutritional conditions, implementation of an appropriate individual nutrition care plan and food service systems for the prevention of nutritional risks and management of nutritional care (191)



# MULTIDISCIPLINARY TEAM INVOLVEMENT

## MULTIDISCIPLINARY VS INTERDISCIPLINARY CARE

Multidisciplinary team approach	Utilises individual skills and knowledge from different disciplines. Each discipline approaching the patient from their own perspective in separate consultations. Often involved case-conferences or team meetings to discuss patient issues and care plans. Provides more knowledge and experience than disciplines operating in isolation.
Interdisciplinary team approach	<p>Integration of separate disciplines into a single consultation. Patient history, assessment, diagnosis, intervention and management plans are determined by the alongside the patient at the one time. Patient is intimately involved in discussions and decision making.</p> <p>Potential benefits: true patient-centred approach, stimulating work environment encouraging professional development and understanding of scope of practice and professional roles.; time and cost savings, potential evolution of new workforce roles,</p> <p>Potential detriments: dominant personalities of traditional hierarchies may interfere with the process. Ideally this can be managed through well-defined and respectful communication protocols.</p>

(192-194)

## MEMBERS OF THE MULTIDISCIPLINARY TEAM

Health Professional	Summary of role
Medical oncologist	Doctor who specialises in diagnosing and treating cancer with chemotherapy and other drugs
Radiation oncologist	Doctor who specialises in the use of radiation to treat cancer
Surgical oncologist	Doctor who specialises in using surgery to treat cancer
Haematologist	Doctor who specialises in diseases of the blood and blood-forming tissues
General Practitioner	Medical practitioner who treats acute and chronic illnesses and provides preventive care and health education to patients
Nurse coordinator	coordinates the patient's care throughout diagnosis, treatment, and recovery
Practice Nurse	Registered nurse who is employed by, or whose services are otherwise retained by a general practice
Nursing staff	Registered nurses may assess, educate, and treat patients, families, or even communities. They may work in almost any health specialty and are often involved in all aspects of cancer care across the journey
Art or music therapist	Provides psychotherapy in form of music, art, drawing or creative play
Dietitian	Expert in food and nutrition who provides individualised nutrition assessment, intervention and counselling in order to optimise nutritional status and treatment tolerance

Exercise physiologist	Health professional who specialises in use of physical activity and lifestyle behaviours to prevent and manage illness or injury.
Occupational therapist	Therapist who works with people to manage any disabilities or assist in optimising performance of daily activities.
Palliative Care team	Includes a team of doctors, nurses, pharmacists and other health professionals who help keep a person comfortable by managing symptoms such as pain, nausea, or fatigue. Intent of therapy is to enhance quality of life rather than goal for cure. They can help at any stage of cancer, from diagnosis to the end of life.
Pharmacist	Involved in preparation of medication, therapies and treatments and educating patients on side effects and appropriate use.
Physiotherapist	Assists in examination, assessment and treatment of any physical impairment through use of exercised and other methods restore or maintain the body's strength, mobility, and function
Prosthetist	Involved in design, production and fitting of devices to replace absent body parts
Psychologist	This specialist assesses a person's mental and emotional status and provides testing and counselling services to manage cognitive and behavioural aspects of the illness.
Radiation therapist	Specialist in the use of equipment that delivers radiation therapy. This expert is often involved with correct positioning and delivery of radiation therapy.
Speech pathologist	Health professional who is specially trained to work with people to help manage disorders of speech, language and swallowing.
Social worker	Health professional with special training in dealing with social, emotional, and environmental problems that may come with illness or disability.
Stomal therapist	Registered nurse trained in an accredited program in enterostomal therapy to assist in management of ostomies and other wounds including PEG and JEJ feeding tubes
Spiritual care	Draws on respect, trust and understanding in order to provide a supportive presence which can add to spiritual and emotional health and wellbeing.

(195-196)

- It is important to note that the patient is an integral member of the team and should be considered as such. (196)
- Different conditions and situations may require the involvement of other health professionals not mentioned above and not all health professions will be indicated to be involved in every patient's care (196)
- Many of the health professionals listed will be available through treating institutions, community based or private services. Community and private services are particularly important for the coordination of ongoing care post discharge.

## BENEFITS OF THE MULTIDISCIPLINARY TEAM APPROACH TO THE MANAGEMENT OF THE MALNOURISHED PERSON WITH CANCER

For the patient	For the health professional
Increased survival for patients managed by a MDT	Improved patient care and outcomes

Shorter timeframes from diagnosis to treatment	Streamlined treatment pathways and reduction in duplication of services
Increased detection and management of psychosocial and emotional needs	Enhanced coordination of care
Increased access to information	Educational and mentoring opportunities for health professionals
Improved satisfaction with treatment and care.	Improved mental well-being of health professionals
Greater opportunities to participate in clinical trials	Enhanced communication and sharing of information
Increased likelihood of receiving care in accordance with clinical practice guidelines	Improved team functioning

Adapted from Cancer Australia (197) (43, 198-218)

## SCOPE OF PRACTICE

- Most health professionals will have professional associations or regulatory bodies that define and describe appropriate scope of practice for the profession within Australia
- Whilst it is of great value and importance to practice within an interdisciplinary team, health professionals are required to practice within the guidelines of their qualifications and not provide advice or care beyond what they have been trained and deemed competent to provide.
- The scope of practice of a medical, nursing or allied health professional refers to the broad frameworks and context of health practice of the individual professions including: (1) the range of roles; (2) functions and responsibilities; and (3) decision making capacity which the professional performs in the context of their practice.
- The scope of practice of an individual health professional includes (1) education, training and development (in the widest sense); (2) authorisation to undertake scope of practice and (3) competence to perform.
- An individual's scope of practice is influenced by his/her education, knowledge, experience, currency (recentness of practice) and skills. The scope of practice of an individual may be more specifically defined than the scope of the profession. To practice within the full scope of practice of the profession may require the individual to update or expand their knowledge, skills and competence.
- Advanced scope of practice is taken to mean an increase in clinical skills, reasoning, knowledge and experience so the practitioner is an expert working within the scope of traditional practice. Extended scope is seen to include expertise beyond the currently recognised scope of practice. (219-220)

## EFFECTIVE COMMUNICATION WITHIN THE MULTIDISCIPLINARY TEAM

- "Ineffective communication is the most frequently cited category of root causes of sentinel events. Effective communication, which is timely, accurate, complete, unambiguous, and understood by the recipient, reduces errors and results in improved patient safety" (221)
- Adhering to the five standards of effective communication below is likely to facilitate improvements in the exchange of information between healthcare professionals:

<b>Complete</b>	It answers all questions to a level that is satisfactory to those involved in the exchange of information.
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<b>Concise</b>	Wordy expressions are shortened or omitted. It includes only relevant statements and avoids unnecessary repetition.
<b>Concrete</b>	The words used mean what they say; they are specific and considered. Accurate facts and figures are given.
<b>Clear</b>	Short, familiar, conversational words are used to construct effective and understandable messages.
<b>Accurate</b>	The level of language is apt for the occasion; ambiguous jargon is avoided, as are discriminatory or patronizing expressions

(222)

- Effective communication in the healthcare setting can lead to:
  - Improved safety
  - Improved quality of care and patient outcomes
  - Decreased length of patient stay
  - Enhanced patient and family satisfaction
  - Enhanced staff morale and job satisfaction (221, 223-225)

# CASE STUDIES

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## HEAD AND NECK CASE

Diagnosis: T3 SCC tonsil

- Patients with head and neck tumours are well-recognised to be at high nutrition risk and have a high incidence of malnutrition (2, 5, 10-11)
- Malnutrition has been significantly associated with advanced cancer stage with weight loss significantly higher in patients with stage 3-4 cancers compared to patients with stage 1-2 cancers (2)
- Hypermetabolism has been found to be present in approximately 50% of patients with advanced cancer and is not compensated for by increased intake, which can make a large contribution to negative energy balance and wasting (3, 37)

Relevant history: 3 months post parotidectomy and ND

- Nutritional requirements for both energy and protein are increased in recovery from surgery, when periods of fasting and/or catabolism are expected (40-41)

Treatment plan: 7 weeks chemoradiation with cisplatin weeks 1,4,7

- Patients receiving definitive chemoradiation with 3-weekly cisplatin are at high risk of nutritional deficit (226)
- Head and neck tumour location was an independent risk factor for weight loss in patients undergoing radiotherapy (31)
- High dose cisplatin is associated with high emetogenic risk (226)
- Patients having chemotherapy may receive supplemental intravenous hydration which can result in overhydration (128) and cause an apparent increase body weight

Common Nutrition Impact Symptoms

- Radiotherapy to the head and neck area can cause nutrition impact symptoms of: Dysphagia, Odynophagia, Mucositis, Xerostomia, Dysguesia Chewing difficulties, Oral fungal infection, Thick/ropy saliva (19, 31-32, 44, 69)
- Nutrition impact symptoms associated with high dose cisplatin:
  - Immediate- onset hours to days: Nausea and Vomiting, Taste and Smell Alteration (226)
  - Early- onset days to weeks: Oral Mucositis, Diarrhoea, Anorexia, Fatigue (226)
- Acute toxicity is greater for combined chemo-radiation compared with chemotherapy or radiotherapy alone due to chemotherapeutic agents acting as radio-sensitizers (31, 71)
- The proportion of head and neck patients with documented eating problems nearly doubled after 3 weeks of radiotherapy compared to pretreatment, and at the end of radiotherapy all patients had documented eating problems (69)
- Immediately after treatment cessation, patients are likely to experience the worst radiation-induced toxicities (62, 67), but side-effects may continue for weeks to months beyond the end of treatment (27-28, 68).

Elements of dietetic management

Goal: Weight maintenance/ Optimise nutritional status

- Grade A recommendation: Aim to minimise a decline in nutritional status/weight in patients receiving radiotherapy/chemotherapy (126)

Goal: Maintain QOL

- Grade A recommendation: Aim to maintain quality of life and symptom management in patients receiving radiotherapy/chemotherapy (126)
- Grade B recommendation: Nutrition intervention (dietary counselling and/or supplements and/or tube feeding) improves patient-centred outcomes (quality of life, physical function and patient satisfaction) (126)
- Nutritional status has been significantly associated with global QOL both at the beginning of and during radiotherapy (15)

- Nutritional status at baseline predicted 16% of the variation in global QOL after 4 weeks of radiotherapy (15)
- 26% of change in QOL was explained by change in nutritional status (15)
- QOL measures have been found to improve with nutrition intervention (counselling, ONS and ENS) during/post radiotherapy (29)

Objective: weight stability

- Patients should have their weight and nutritional intake monitored regularly to determine whether their energy requirements are being met (126)

Objective: minimise nutrition impact symptoms

- Grade B recommendation: the role of the multidisciplinary team is essential to ensure management of treatment side effects (e.g. pain, dysphagia, and mucositis) and other psychosocial factors are addressed to enable patients to follow dietary advice (126)

Targets: Estimated Energy Requirements /Estimated Protein Requirements

- Grade C recommendation: Aim for energy and protein intakes of at least 125kJ/kg/day (30kcal/kg/day) and 1.2g protein/kg/day in patients receiving radiotherapy or chemoradiotherapy. Patients should have their weight and nutritional intake monitored regularly to determine whether their energy requirements are being met (126)

Targets: Estimated Fluid Requirements:

- Aim for 35-45mL/kg/day (99)

Targets: Micronutrients

- Aim for Estimated Average Requirements (EARs) for micronutrients (148)
- Grade A recommendation: Vitamin E, at high doses of 400IU/d, may be associated with reduced survival or recurrent disease (126)
- Grade B recommendation: Vitamin A, at high doses of 200 000IU/week, has no benefits and may have an adverse effect on survival and disease outcomes (126)
- Grade C recommendation: Zinc at doses of 25mg tds taken during or post (chemo) radiotherapy has been linked with survival benefits in patients with nasopharyngeal cancer, however care needs to be taken in its use due to potential and unknown interactions with chemotherapy and radiotherapy. (126)
- Grade C recommendation: Zinc at doses of 25mg tds taken during or post (chemo) radiotherapy may reduce side effects (mucositis, taste changes), however care needs to be taken in its use due to potential and unknown interactions with chemotherapy and radiotherapy. (126)
- Grade C recommendation: Selenium supplementation of 200ug/d taken daily during treatment may improve immune function, but has not been shown to have any impact on clinical symptoms. (126)

Interventions:

- Grade A recommendation: Nutrition intervention (dietary counselling and/or supplements and/or tube feeding) improves/maintains nutritional status. (126)
- Grade A recommendation: Dietary counselling and/or supplements are effective methods of nutrition intervention, and weekly dietitian contact improves outcomes in patients receiving radiotherapy. (126)
- Grade A recommendation: Monitor weight, intake and nutritional status during and post (chemo) radiotherapy. (126)
- Grade B recommendation: Tube feeding can improve protein and energy intake when oral intake is inadequate. (126)
- Use intensive dietary counselling and ONS to increase dietary intake (Grade A recommendation) and to prevent therapy-associated weight loss and interruption of radiation therapy in patients undergoing radiotherapy of gastrointestinal or head and neck areas (Grade A recommendation) (41)
- Tube feeding is suggested if severe local mucositis is expected, which might interfere with swallowing, e.g. in intensive radiotherapy or in combined modality radio-chemotherapy regimens including radiation of throat or esophagus (Grade C recommendation) (139)
- Grade C recommendation: Tube feeding may reduce unplanned hospital admissions and reduced disruptions to treatment compared to oral intake alone (126)

Patient education:

5% weight loss for nasogastric tube

- involuntary loss of ~5% of usual body weight in 1 month is usually deemed to be significant or severe (104)
- Nutritional therapy should be started if it is anticipated that the patient will be unable to eat for more than seven days. EN should also be started if an inadequate food intake (<60% of estimated energy expenditure) is anticipated for more than 10 days (Grade C recommendation) (139)

Multidisciplinary Team

- “Head and neck cancer treatment is complex and combined modality therapy is common; communication with more than one type of clinician may be required as it is recommended a multidisciplinary team (MDT) is involved in all stages of treatment, and with the management of sequelae associated with treatment.” (226)

Key personnel: Dietitian

- Grade A recommendation: “A dietitian should be part of the multidisciplinary team for treating patients with head and neck cancer throughout the continuum of care, as frequent dietitian contact has been shown to improve nutrition outcomes and quality of life” (126)
- Grade A recommendation: All patients receiving radiation therapy to the head and neck area should be referred to the dietitian for nutrition support. (126)

Key personnel: Speech pathologist

- “All head and neck patients presenting with either a swallowing and/or communication problem should be referred to a speech pathologist” (226)

Key personnel: dentist

- Dental assessment is recommended for all patients prior to starting definitive chemoradiotherapy for head and neck cancer. Dental examinations should continue during and post cancer treatment (226)
- Practice point: To achieve long term oral health and reduce the risk of dental complications and osteoradionecrosis, it is important to seek the advice of a dentist who is experienced in the management of post radiation therapy patients. (126)

Follow up:

- Patients should be closely monitored during, and for months following treatment, as mucosa and eating may take a long time to return to normal (226)
- Grade A recommendation: Patient should be seen weekly by a dietitian during radiotherapy. (126)
- Grade A recommendation: head and neck cancer patients should receive minimum fortnightly follow up by a dietitian for at least 6 weeks post treatment. (126)
- Grade C recommendation: Energy and protein requirements remain elevated post treatment and weight should continue to be monitored and intervention adjusted as appropriate. (126)
- Grade C recommendation: Patients should be reviewed by a dietitian as required for up to 6 months post treatment, and then for as long they require management of chronic toxicities, weight loss or tube feeding. (126)
- Grade D recommendation: As many patients may require tube feeding during or post treatment, follow up with a dietitian and speech pathologist is recommended for rehabilitation. Patients should be able to maintain their nutritional status with safe swallowing prior to tube removal. (126)

## LUNG CASE

Diagnosis (cough, hoarseness, fatigue, unintentional weight loss)

- Weight loss at presentation has been observed in up to one-third of lung cancer patients (23)

Diagnosis- T1N3M0 NSCLC, LOW, fatigue

- Weight loss at presentation has been observed in up to one-third of lung cancer patients (23)
- Cancer-related fatigue has been reported throughout the course of malignant disease: from diagnosis, during treatment, and for months to years post treatment (57)

Cachexia in lung cancer

- Lung cancer patients have a high incidence of malnutrition (5, 10) and are recognised to be patients at high nutrition risk

Screened by nursing staff- MST=2

- Grade B recommendation: "...patients at nutritional risk can be identified using a nutrition screening tool which has been validated in patients receiving radiation therapy (e.g. Malnutrition Screening Tool)". (39)
- The MST is valid and reliable in the oncology population- including radiotherapy patients (Ferguson 1999-2) and outpatient chemotherapy patients (13)
- An appropriate screening tool can be used by staff other than trained nutrition professionals (5)
- Patients at risk of malnutrition (MST score 2-5) should undergo a more detailed nutrition assessment to identify if they are malnourished and determine appropriate nutrition support (105-106)

#### Referral to dietitian made

- Early identification of individuals who are at risk of malnutrition should lead to a comprehensive nutrition assessment by a dietitian (5) so that appropriate nutritional care can be initiated before malnutrition becomes a major problem (106)

#### Assessment: 6.3% LOW, BMI 19, PG-SGA 10-B

- 6% loss of usual body weight = clinically significant (involuntary loss of >5% in 1 month) (104)
- BMI in normal range (18.50-24.99kg/m<sup>2</sup>) (227)
- Although commonly used in other areas of dietetic practice, using the body mass index (BMI) as an indicator of malnutrition in cancer patients is not recommended (15, 25, 27)
- BMI has a poor sensitivity (27%) and specificity (23-27%) for detecting malnutrition as defined by PG-SGA (2, 111)
- Grade B recommendation: "Validated nutrition assessment tools (e.g. scored Patient-Generated Subjective Global Assessment, (PG-SGA) or Subjective Global Assessment (SGA) should be used to assess nutritional status in patients receiving radiation therapy" (39)
- PG-SGA score of 9 or more indicates a critical need for symptom management and/or nutritional intervention. These patients require multidisciplinary input to address all issues impacting on nutritional status (128)

#### Treatment plan- 6 weeks radical chemoradiation with weekly cisplatin/etoposide

- Lung cancer patients have a high incidence of malnutrition (5, 10) and are recognised to be patients at high nutrition risk
- Acute toxicity is greater for combined chemo-radiation compared with chemotherapy or radiotherapy alone due to chemotherapeutic agents acting as radio-sensitizers (31, 71)
- Lung cancer patients receiving concurrent chemotherapy with radiotherapy were more likely to have >5% weight loss (40 versus 0%, phi ¼ 0.35, p < 0.001) (228)

#### Common nutrition impact symptoms/timing:

- High emetogenic risk with weekly cisplatin/etoposide: patients should be monitored and managed for nausea and vomiting (229)
- Clinical instructions specify dietitian review with this treatment (229)
- Nutrition impact symptoms associated with weekly cisplatin/etoposide:
  - Immediate- onset hours to days: Nausea and Vomiting, Taste and Smell Alteration (229)
  - Early- onset days to weeks: Oral Mucositis, Anorexia, Fatigue, Oesophagitis (229)
- Fatigue is a common side effect with 45% of patients undergoing active treatment reporting moderate to severe fatigue (56)
- Radiotherapy to the thoracic area for lung cancer is associated with acute toxicities including oesophagitis (19, 67)
- Immediately after treatment cessation, patients are likely to experience the worst radiation-induced toxicities (62, 67), but side-effects may continue for weeks to months beyond the end of treatment (15, 28, 68)
- Dietary intake in lung cancer patients was found to decrease from week 3 of radiotherapy and continued to decline until the end of treatment (19)

#### Vegetarian

- Adequate protein intake is essential during all stages of cancer treatment (230)
- The best choices to meet protein needs are foods that are also low in saturated fat (e.g., fish, lean meat and poultry, eggs, nonfat and low-fat dairy products, nuts, seeds, and legumes) (230)- many of these foods may be included in a lacto-ovo vegetarian diet



- Vegan diet (or variations thereof) may have benefits of high consumption of dietary fibre, vitamins C & E, magnesium, folic acid and it is generally low in saturated fat. Risks include weight loss, deficiency in vitamins B12 & D, zinc and calcium (42)
- Well-designed lacto-ovo vegetarian meal plans have been shown to adequately meet Australian nutrient reference value requirements for macro- and micronutrients for all age groups and both sexes (in healthy individuals) as well as the higher requirements set for iron and zinc for vegetarians. An exception was for pregnant women, for whom increased iron requirements were not met (231)
- Lacto-ovo vegetarian meal plans in the study were designed to be nutrient-dense to meet nutritional requirements without supplying excess energy, though people who have higher energy needs may need to add additional discretionary kilojoules (231)
- Qualified dietetics professionals can assist planning balanced lacto-ovo-vegetarian diets for patients with special dietary needs because of chronic disease, and provide information about meeting requirements for vitamin B-12, calcium, vitamin D, zinc, iron, and n-3 fatty acids because poorly planned vegetarian diets may not include adequate amounts of these nutrients (232)

#### High Dose Vitamin C

- “the use of supplemental antioxidants during chemotherapy and radiation therapy should be discouraged because of the possibility of tumour protection and reduced survival” (233)
- Grade A recommendation: “There is insufficient evidence to support use of antioxidant supplements during radiotherapy and chemotherapy treatment.” (39)

#### Dandelion Tea

- Orally, dandelion may be used for loss of appetite, dyspepsia, flatulence, gallstones, bile stimulation, muscle aches... (234)
- Dandelion is also used as a laxative, diuretic, circulatory tonic, skin toner, blood tonic, and digestive tonic. It is also used to treat infection, especially viral infections, and cancer. (234)
- In foods, dandelion may be used in teas. (234)
- Safe during treatment (234)

#### Apricot Kernels

- Orally and intravenously, apricot kernel is used for cancer. (235)
- Also known as laetrile, vitamin B17, amygdalin (235)
- A recent Cochrane review of RCTs on use of laetrile in the treatment of cancer concluded: “The claims that laetrile or amygdalin have beneficial effects for cancer patients are not currently supported by sound clinical data. There is a considerable risk of serious adverse effects from cyanide poisoning after laetrile or amygdalin, especially after oral ingestion. The risk-benefit balance of laetrile or amygdalin as a treatment for cancer is therefore unambiguously negative.” (236)
- Laetrile’s lack of effectiveness and the risk of side effects from cyanide poisoning have led the Food and Drugs Agency (FDA) in the US and the European Commission to ban its use (236)
- Access to laetrile or amygdalin is available via the internet, however as these markets are unregulated, preparations may come from questionable sources or could be contaminated. (236)
- “Cancer patients should be informed about the high risk of developing serious adverse effects due to cyanide poisoning after laetrile or amygdalin, especially after oral ingestion. This risk could increase with concomitant intake of vitamin C and in vegetarians with vitamin B12 deficiency” (236)

#### Juicing

- Juicing can be a good way to consume vegetables and fruits, especially for those who have difficulty chewing or swallowing (230)
- “There is no convincing scientific evidence that extracted juices are healthier than whole foods” (237)
- “Overall, juicing is considered safe when it is used as part of a healthy diet” (237)
- “Overuse of juicing or consuming too much of certain juices can cause severe diarrhoea” (237)
- “Relying on this type of treatment alone and avoiding or delaying conventional medical care for cancer may have serious health consequences.” (237)

- Juice extractors remove the fibre-containing pulp from fruits and vegetables, resulting in reduced fibre intake (237)

Elements of dietetic management: Goals- weight maintenance, nutritional adequacy, assist management of symptoms, maintain QOL

- Grade C recommendation: Aim to minimise weight loss and maintain quality of life and symptom management in patients receiving radiation therapy. (39)
- Grade A recommendation: Aim to prevent decline/improve nutritional status and associated outcomes in adults with malnutrition or at risk of malnutrition (39)

Targets: Estimated Energy Requirements/ Estimated Protein Requirements:

- Grade C recommendation: Aim for energy and protein intakes of at least 125 kJ/kg/day and 1.2 g protein/kg/day in patients receiving radiation therapy. (39)

Targets: Estimated Fluid Requirements:

- Aim for 35-45mL/kg/day (99)

Targets: Micronutrients

- Aim for Estimated Average Requirements for micronutrients (148)

Pt education:

5% LOW for NGT

- involuntary loss of ~5% of usual body weight in 1 month is usually deemed to be significant or severe (104)
- Nutritional therapy should be started if it is anticipated that the patient will be unable to eat for more than seven days. EN should also be started if an inadequate food intake (<60% of estimated energy expenditure) is anticipated for more than 10 days (Grade C recommendation). (139)

Weeks 3-6: symptoms

- Immediately after treatment cessation, patients are likely to experience the worst radiation-induced toxicities (62, 67), but side-effects may continue for weeks to months beyond the end of treatment (27-28, 68)
- Fatigue is a common side effect with 45% of patients undergoing active treatment reporting moderate to severe fatigue (56)
- Radiotherapy to the thoracic area for lung cancer is associated with acute toxicities including oesophagitis (19, 67)
- Dietary intake in lung cancer patients was found to decrease from week 3 of radiotherapy and continued to decline until the end of treatment (19)

Intervention

- Grade A recommendation: "Dietary counselling and/or supplements are effective methods of nutrition intervention, and frequent (at least fortnightly) dietitian contact improves outcomes in patients receiving radiation therapy." (39)
- Grade A recommendation: "Regular nutrition intervention (dietary counselling +/- supplements) improves energy and protein intake and nutritional status during radiation therapy." (39)
- Grade B recommendation: Nutrition intervention (dietary counselling +/- supplements) during and post radiation therapy improves patient-centred outcomes (quality of life, physical function and patient satisfaction). (39)
- Grade C recommendation: "Nutrition intervention reduces treatment breaks and unplanned hospital admissions resulting in decreased costs compared with usual care." (39)
- A systematic review of 2 low level studies (NHMRC level III-3 and IV) suggests dietary counseling or oral nutritional supplements may reduce weight loss and maintain nutritional status in lung cancer

patients during radiotherapy treatment but this is insufficient evidence to draw conclusions on the effect of nutrition intervention (238)

- Current literature suggests simple dietary counseling improves energy and protein intake during chemotherapy in patients with lung cancer but due to limitations of these studies this finding should be interpreted with caution. (238)

#### Nasogastric tube insertion

- “Nutritional therapy should be started if it is anticipated that the patient will be unable to eat for more than seven days. EN should also be started if an inadequate food intake (<60% of estimated energy expenditure) is anticipated for more than 10 days” –Grade C recommendation (139)
- Body weight has been found to stabilise following the commencement enteral feeding in lung cancer patients undergoing radiotherapy +/- chemotherapy suggesting nutrition intervention can be effective in this group (228)
- 42% of lung cancer patients commenced enteral feeding after the completion of radiotherapy (228)

#### May require close monitoring week 4 to 2 weeks post

- Immediately after treatment cessation, patients are likely to experience the worst radiation-induced toxicities (62, 67)

#### Recommended follow up:

- Grade A recommendation: “...frequent (at least fortnightly) dietitian contact improves outcomes in patients receiving radiation therapy”. (39)
- Grade D recommendation: “In the short term, nutrition follow-up is recommended for approximately six weeks post-radiation therapy. In the long term, a minimum of six-month follow-up is recommended for patients who require alternative feeding during radiation therapy.” (39)
- The majority of patients experienced clinically significant loss of weight after the completion of radiotherapy for lung cancer (228)
- This has important implications for clinical practice since in the post treatment period patients are less likely to be in frequent contact with the treating team at a time when there is potential for nutritional deterioration. This highlights the importance of a model of care that incorporates post treatment rehabilitation and survivorship interventions (228)
- Patients may continue to rely on oral nutrition support for several weeks after completion of chemoradiotherapy for NSCLC (19)
- Patients’ body weight 4 weeks post radiotherapy for NSCLC was still not totally recovered to baseline levels (19)

#### 2 months post

- Grade D recommendation: “In the long term, a minimum of six-month follow-up is recommended for patients who require alternative feeding during radiation therapy. Oral rehabilitation and preventing PEG dependency, as well as managing late side effects impacting on nutritional status should be considered”. (39)
- Telephone counselling has previously been shown to be effective in modifying dietary intakes of cancer patients (239)
- PG-SGA score of 7 indicates requirement for intervention by dietitian, in conjunction with nurse or physician, as indicated by symptoms survey (128)

## GASTROINTESTINAL CASE

Diagnosis- advanced oesophageal cancer, dysphagia

- Patients with tumours of the upper gastrointestinal tract (Stomach, oesophagus) have a high incidence of malnutrition (50- 62%) and are well-recognised to be patients at high nutrition risk (2, 5, 10-11)

- The physical presence of the tumour in oesophageal cancers can cause obstruction/ stricture of the gastrointestinal tract and nutrition impact symptoms such as pain, odynophagia and dysphagia, and hence reduce dietary intake (18)
- Dysphagia has been independently associated with reduced survival in patients with advanced cancer (240)

Assessment- BMI 16.5kg/m<sup>2</sup>, 18% weight loss in 1 month

- 18% LOW in 1/12= clinically significant (involuntary loss of >5% in 1 month) (104)
- BMI in underweight range (<18.50)- 'moderate thinness' (16.00-16.99) (227)
- Severe Protein-Energy Malnutrition as defined by ICD-10-AM: "BMI <18.5 kg/m<sup>2</sup> or >10% unintentional loss of weight *and* evidence of suboptimal intake resulting in severe loss of subcutaneous fat and/or severe muscle wasting" (4)
- Level III-2 evidence: In the acute care setting the PG-SGA is a valid nutrition assessment tool for all adults (101)

Treatment- palliative radiotherapy

- Usual dose 20Gy/5# (241)
- "EBRT [external beam radiotherapy] is an effective, non-invasive, and generally well-tolerated treatment to palliate dysphagia in patients with incurable oesophageal carcinoma" (241)
- the priority for managing patients with advanced oesophageal cancer is symptom control which can help to improve dietary intake if successful (241)
- 75% of patients who complained of dysphagia reported an improvement in swallowing, and 25% of patients gained weight following palliative radiotherapy (241)
- Side effects are generally minimal- fatigue and radiation induced oesophagitis were most commonly reported (241)

Admission and treatment- oesophageal stent

- Subsequent insertion of a stent was required in 26% of patients after palliative EBRT (241)
- insertion of a stent results in faster relief of dysphagia than EBRT (241)

Referral to dietitian: nutritional management- small frequent meals, High Energy High Protein diet, food fortification, oral supplements

- Goals of management: Grade A recommendation: "Aim to prevent decline/ improve nutritional status and associated outcomes in adults with malnutrition..." (101)
- Intervention: Grade A recommendation: Multi-nutrient oral nutrition supplements (high energy and/or protein) may improve outcomes including weight status, body composition, complications, energy intake, protein intake, global nutritional status and life expectancy in the acute care setting (101)
- Intervention: Grade C recommendation: Dietary counselling (with multi-nutrient oral nutrition supplements if deemed necessary) by a dietitian may improve outcomes including weight status, physical function and body composition in the acute care setting (101)
- Intervention: Grade C recommendation: Individually prescribed nutritional support using mixed approaches (high energy diets +/- ONS; enteral tube feeding; parenteral nutrition) may improve outcomes including complications, risk of infection, length of stay, energy intake, wound healing, weight status. (101)

EN in advanced stages of incurable disease- Prognosis <3/12, ?NGT

- Level IV evidence: "If the expected survival due to spread of the cancer exceeds 2–3 months, which is the survival time of a completely starving subject, it can be reasonably expected that EN will prolong the survival of an incurable cancer patient, who is unable to eat" (139)
- "Since it may be difficult to judge the expected survival time of a cancer patient and thus the potential benefit of EN, these patients should be seen and discussed together by the oncologist, the nutritionist and the palliative care specialist, and the treatment designed on a personalised basis". (139)
- Grade C recommendation: "EN should be provided in order to minimize weight loss, as long as the patient consents and the dying phase has not started" (139)
- Grade B recommendation: "When the end of life is very close, most patients require only minimal amounts of food and little water to reduce thirst and hunger" (139)

#### End of life care at home

- “Supportive and palliative care services should be delivered, as much as possible, where patients and carers want them- in the community (including a patient’s own home...)” (242)
- Specialist palliative care teams require: palliative medicine consultants, palliative care nurse specialists, a team secretary/administrator, and a range of expertise provided by: physiotherapists, occupational therapists, dietitians, pharmacists, social workers, chaplains/spiritual care givers. (242)

## HAEMATOLOGY CASE

Diagnosis- Acute Myeloid Leukaemia (AML): anaemia, fatigue, frequent infections, abdominal discomfort.

- Patients with AML often have several non-specific symptoms including weight loss, fatigue, fever, night sweats, and loss of appetite (243)
- Most symptoms of AML result from a shortage of normal blood cells, which happens when the leukemia cells crowd out the normal blood-making cells in the bone marrow. As a result, red blood cell (*anaemia*), white blood cell, and platelet counts can be low (243)
- Anaemia can cause fatigue (243)
- Infections can occur because of a shortage of normal white blood cells (*leukopenia*) or a shortage of normal neutrophils (*neutropenia*) (243)
- Leukemia cells may collect in the liver and spleen, causing them to enlarge. This may be noticed as a fullness or swelling of the abdomen (243)

Treatment Plan: Induction chemotherapy, ?consolidation, ?transplant

- induction chemotherapy is the first step in treatment for AML, it usually consists of two cycles (244)
- The goal of induction is to achieve a remission, where the abnormal, immature leukaemia cells (blasts) can no longer be detected in the blood and normal bone marrow has developed again. (244)
- Even in remission there may still be a small number of abnormal cells present, even if signs of leukaemia cannot be detected. Consolidation chemotherapy consists of further cycles of treatment to reduce the risk of the leukaemia coming back. (244)
- If there is a high risk of the leukaemia recurring after chemotherapy, high-dose chemotherapy followed by a stem cell transplant may be recommended. (244)

Treatment: 7+3 chemotherapy (modified) - cytarabine/idarubicin

- Nutrition Impact Symptoms associated with this regimen:
  - Immediate- onset hours to days: Nausea and Vomiting, Taste and Smell Alteration (245)
  - Early- onset days to weeks: Oral mucositis, Anorexia, Diarrhoea, Fatigue (245)
- “Antiemetic therapy should be administered throughout the duration of the chemotherapy protocol and to cover delayed nausea” (245)

Doctor completed MST = 0, no pre-treatment referral to dietitian

- MST score 0-1 = not at risk of malnutrition (105)
- Patients not at risk of malnutrition should be rescreened during hospital admission (105) to monitor changes in nutritional status.

Screened- high nutrition risk:

- Known nutrition impact symptoms as above (245)

Assessment: PG-SGA 1-A, weight stable, BMI= 22kg/m<sup>2</sup>

- No significant loss of body weight (involuntary loss of >5% in 1 month) (104)
- BMI in normal range (18.50-24.99kg/m<sup>2</sup>) (227)
- PG-SGA score of 0-1 indicates no nutrition intervention necessary at this time. Re-assessment on routine and regular basis during treatment (128)

Goals: adequate nutritional intake, weight maintenance, assist management of symptoms, minimise risk of food borne illness, maintain QOL

- Grade A recommendation: “Nutrition intervention (dietary counselling and/or supplements) increases dietary intake and weight in chemotherapy patients”. (39)
- Grade B recommendation: “Nutrition intervention (dietary counselling and/or supplements) does not improve patient-centered outcomes (quality of life, physical function and patient satisfaction) in chemotherapy patients” (39)
- Grade A recommendation: “In chemotherapy patients, simple nutrition intervention (simple dietary counselling and/or supplements without medical nutrition therapy) is effective at improving dietary intake and weight but does not improve patient-centered outcomes.” (39)
- “Although the effect of low-microbial or sterile diets on risk of infection is unknown, neutropenic patients should avoid foods associated with an increased infectious risk.” (246)

#### Targets: Estimated Energy Requirements/ Estimated Protein Requirements

- Estimated Energy Requirements may reach 130-150% of predicted basal energy expenditure, therefore aim 126-145kJ/kg/d (147)
- Protein requirements 1.4-1.5g/kg/d (147)

#### Targets: Estimated Fluid Requirements

- Aim for 35-45mL/kg/day (99)

#### Targets: Micronutrients

- Aim for Estimated Average Requirements for micronutrients (EARs) (148)

#### Education/intervention: High Energy High Protein diet/ supplements/ food safety

- Grade A recommendation: “Nutrition intervention (dietary counselling and/or supplements) increases dietary intake and weight in chemotherapy patients.” (39)
- Grade B recommendation: “Nutrition intervention (dietary counselling and/or supplements) does not improve patient-centered outcomes (quality of life, physical function and patient satisfaction) in chemotherapy patients” (39)
- Grade A recommendation: “In chemotherapy patients, simple nutrition intervention (simple dietary counselling and/or supplements without medical nutrition therapy) is effective at improving dietary intake and weight but does not improve patient-centered outcomes”. (39)
- Grade C recommendation: “Patients should receive dietary counseling regarding foods which may pose infectious risk and safe food handling during periods of neutropenia” (246)

#### PN vs EN

- Grade B recommendation: “Nutrition support therapy is appropriate in patients receiving active anticancer treatment who are malnourished and who are anticipated to be unable to ingest and/or absorb adequate nutrients for a prolonged period of time (7-14 days).” (246)
- Grade C Recommendation: Supplemental PN is recommended in patients if inadequate food and enteral intake (<60% of estimated energy expenditure) is anticipated for more than 10 days (146)

#### Monitoring:

- Grade C recommendation: “...Patients should have their weight and food/energy intake monitored regularly to determine whether their energy requirements are being met.” (39)

#### Follow up:

- “There is insufficient evidence to support whether weekly dietitian contact improves outcomes in chemotherapy patients.” (39)

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