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Nutrition support in adults: oral supplements, enteral and parenteral feeding

FOREWORD

It is important to acknowledge that when people are unwell they often eat and drink inadequately, although this problem may only be short-lived as part of an acute illness. If an inadequate intake persists for several days, the patient can become undernourished to an extent that their recovery is impaired or they incur additional medical problems. Malnourishment is a surprisingly common occurrence in the UK.

The consequences of malnutrition include vulnerability to infections, delayed wound healing, impaired function of heart and lungs, muscle weakness and depression. As a result, the malnourished consult their general practitioners more frequently, go to hospital more often and for longer periods, and have higher complication and mortality rates. For example a patient with a very poor dietary intake or a complete inability to eat persists for more than a few weeks the resulting malnourishment can be life-threatening in itself.

Malnourishment can be prevented with the provision of food and fluid but when the patient is unwell and unable to eat and drink normally intervention is required, unless ethical considerations make artificial prolongation of the patient's life inappropriate. The provision of nutrition support is possible and can be given as an oral intervention such as the use of sip feeds, enteral feeding using a tube or parenteral feeding involving the administration of intravenous nutrition. However, the decisions on when to intervene and the most effective and safe means to do so are complex, and current knowledge amongst UK health professionals of the causes and consequences of malnourishment and the best ways to treat it is often poor. Providing nutrition support without input from experts in nutrition can be dangerous: oral supplementation for dysphagic patients can lead to pneumonia, and enteral tube or parenteral feeding come with many potential risks including gastrointestinal problems, infection, metabolic upset and even trauma. They should not be undertaken without expert input.

The objective of these guidelines is to provide guidance on how to improve the practice of nutrition support by providing evidence and information to assist all health care professionals to correctly identify malnourished patients in community, hospital and care home settings, and to help them choose the most appropriate form of support at the appropriate time. The Guideline Development Group believes that we have met part of that objective but we have to admit difficulties. The breadth of our remit was enormous and time and resources were finite. The evidence base for nutrition support is difficult to interpret, since it contains a multitude of small trials, applying different interventions and outcome measures, to heterogeneous populations in variable settings. This not only leads to individual trials being statistically underpowered but makes it difficult to combine them into meta-analyses. Furthermore, when it comes to the 'invasive' nutrition support techniques of enteral tube feeding (ETF) and parenteral nutrition (PN), there are near insurmountable problems with trial interpretation. It is unethical not to feed patients who cannot eat at all and so most studies on ETF

and PN do not contain patients with an absolute need for such support. Instead, they examine the 'elective', supplementary use of these methods and it is therefore difficult to apply the results to routine clinical practice in which ETF and PN are only used for patients with a definite requirement. In the light of these difficulties, many of our recommendations have had to be derived from first principles and clinical experience, in addition to trial evidence. Nevertheless, they contain an obvious message:

Do not let your patients starve and when you offer them nutrition support, do so by the safest, simplest, effective route possible.

We hope that this work helps you to do that well.

Mike Stroud

Chair, Guideline Development Group.

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Guideline Review Panel

The Guideline Review Panel is an independent panel that oversees the development of the guideline and takes responsibility for monitoring its quality. The members of the Guideline Review Panel were as follows.

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Stakeholder Involvement

The following stakeholders registered with NICE and were invited to comment on draft versions of these guidelines:

Collaborating Centres
Patient Involvement Unit for NICE

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Manchester Royal Infirmary
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Middlesbrough Primary Care Trust
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North Glamorgan NHS Trust - Merthyr Tydfil
North West Wales NHS Trust
Powys Local Health Board
Princess Alexandra Hospital NHS Trust
Royal Liverpool Children's NHS Trust
Royal United Hospital Bath NHS Trust
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South & Central Huddersfield PCTs
South Birmingham Primary Care Trust
South Tees Hospitals NHS Trust
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The Royal West Sussex Trust
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University College Londons Hospital NHS Trust
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Vale of Glamorgan Local Health Board

Patient/Carer Organisation
Age Concern England
Alzheimer's Society
British Dyslexia Association
British Liver Trust
Children's Liver Disease Foundation
Depression Alliance
Eating Disorders Association, The
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Help the Aged
Help the Hospices
L'Arche UK

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British Association of Oral and Maxillofacial Surgeons
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British Association of Paediatric Surgeons
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National Care Standards Commission
Nutrition Society
Royal College of Anaesthetists
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Statutory Body
British National Formulary (BNF)
Department of Health
Healthcare Commission
Medicines and Healthcare Products Regulatory Agency
National Institute for Clinical Excellence
National Patient Safety Agency
National Public Health Service - Wales
NHS Information Authority, (PHSMI Programme)
NHS Modernisation Agency, The
NHS Quality Improvement Scotland
Scottish Intercollegiate Guidelines Network (SIGN)
Welsh Assembly Government (formerly National

Abbreviations

aa	Amino Acid
ASPEN	American Society for Parenteral and Enteral Nutrition
BAPEN	British Association for Parenteral and Enteral Nutrition
BDA	British Dietetic Association
BMI	Body Mass Index
CEA	Cost Effectiveness Analysis
CI	Confidence Interval
COPD	Chronic Obstructive Pulmonary Disorder
CVA	Cerebrovascular disease
CVC	Central venous catheter
DEALE	Declining Exponential Approximation of Life Expectancy
EN	Enteral nutrition
ESPEN	European Society of Parenteral and Enteral Nutrition (European Society for Clinical Nutrition and Metabolism)
ETF	Enteral tube feeding
GDG	Guideline Development Group
GI	Gastrointestinal
GP	General Practitioner
GPP	Good Practice Point
HIV	Human Immunodeficiency Virus
HEN	Home enteral nutrition
HPN	Home parenteral nutrition
HRQL	Health Related Quality of Life
HTA	Health Technology Assessment
HTBS	Health Technology Board for Scotland
ICER	Incremental Cost Effectiveness Ratio
IP	Inpatient
IV	Intravenous
LOS	Length of Stay
LY	Life-year
MAC	Mid arm circumference
MAMC	Mid arm muscle circumference
MDT	Multidisciplinary Team
MNA	Mini Nutritional Assessment
MNA-SF	Mini Nutritional Assessment-Short Form
MND	Motor Neuron Disease
MRC	Medical Research Council
MS	Multiple Sclerosis
MUST	Malnutrition Universal Screening Tool
NCC-AC	National Collaborating Centre for Acute Care
ND	Nasoduodenal
NG	Nasogastric
NHS	National Health Service
NI	Nutrition intake
NICE	National Institute for Clinical Excellence
NNT	Number needed to treat
ONS	Oral Nutritional Supplement
PEG	Percutaneous endoscopic gastrostomy
PICC	Peripherally inserted central catheters
PN	Parenteral nutrition
QALY	Quality adjusted life year
RCT	Randomised controlled trial

RDA	Recommended Dietary Allowance
SIGN	Scottish Intercollegiate Guidelines Network
SR	Systematic review
TEN	Total enteral nutrition
TPN	Total parenteral nutrition
TSF	Tricep skinfold
UK	United Kingdom
WHO	World Health Organisation

Glossary of Terms

Amended from a glossary produced by the Patient Involvement Unit, NICE.

Absolute risk	Measures the probability of an event or outcome occurring (e.g. an adverse reaction to the drug being tested) in the group of people under study. Studies that compare two or more groups of patients may report results in terms of the *Absolute Risk Reduction*.
Absolute Risk Reduction (ARR)	The ARR is the difference in the risk of an event occurring between two groups of patients in a study – for example if 6% of patients die after receiving a new experimental drug and 10% of patients die after having the old drug treatment then the ARR is 10% - 6% = 4%. Thus by using the new drug instead of the old drug 4% of patients can be prevented from dying. Here the ARR measures the risk reduction associated with a new treatment. See also *Absolute risk.*
Acute Phase Response (APR)	A group of physiologic processes occurring soon after the onset of infection, trauma, inflammatory processes, and some malignant conditions. The most prominent change is a dramatic increase of acute phase proteins, especially C-reactive protein, in the serum. Also seen are fever, increased vascular permeability, and a variety of metabolic and pathologic changes[1].
Ancillaries	The equipment and consumables required for enteral and parenteral nutrition.
Bias	Influences on a study that can lead to invalid conclusions about a treatment or intervention. Bias in research can make a treatment look better or worse than it really is. Bias can even make it look as if the treatment works when it actually doesn't. Bias can occur by chance or as a result of systematic errors in the design and execution of a study. Bias can occur at different stages in the research process, e.g. in the collection, analysis, interpretation, publication or review of research data.
Blinding or masking	The practice of keeping the investigators or subjects of a study ignorant of the group to which a subject has been assigned. For example, a clinical trial in which the participating patients or their doctors are unaware of whether they (the patients) are taking the experimental drug or a placebo (dummy treatment). The purpose of 'blinding' or 'masking' is to protect against *bias*.
Body Mass Index	A measure of body weight relative to height used to determine whether people are underweight, at a healthy weight, over weight or obese.
Bolus/intermittent feeding	The administration of a feed through an enteral tube delivered as a single portion over a short period of time.
Case-control study	A study that starts with the identification of a group of individuals sharing the same characteristics (e.g. people with a particular disease) and a suitable comparison (control) group (e.g. people without the disease). All subjects are then assessed with respect to things that happened to them

	in the past, e.g. things that might be related to getting the disease under investigation. Such studies are also called *retrospective* as they look back in time from the outcome to the possible causes.
Case report (or case study)	Detailed report on one patient (or case), usually covering the course of that person's disease and their response to treatment.
Case series	Description of several cases of a given disease, usually covering the course of the disease and the response to treatment. There is no comparison (*control*) group of patients.
Cohort study	An observational study that takes a group (cohort) of patients and follows their progress over time in order to measure outcomes such as disease or mortality rates and make comparisons according to the treatments or interventions that patients received. Thus within the study group, subgroups of patients are identified (from information collected about patients) and these groups are compared with respect to outcome, e.g. comparing mortality between one group that received a specific treatment and one group which did not (or between two groups that received different levels of treatment). Cohorts can be assembled in the present and followed into the future (a 'concurrent' or 'prospective' cohort study) or identified from past records and followed forward from that time up to the present (a 'historical' or 'retrospective' cohort study). Because patients are not randomly allocated to subgroups, these subgroups may be quite different in their characteristics and some adjustment must be made when analysing the results to ensure that the comparison between groups is as fair as possible.
Combined modality	Use of different treatments in combination (for example surgery, chemotherapy and radiotherapy used together).
Co-morbidity	Co-existence of a disease or diseases in the people being studied in addition to the health problem that is the subject of the study.
Confidence interval	A way of expressing certainty about the findings from a study or group of studies, using statistical techniques. A confidence interval describes a range of possible effects (of a treatment or intervention) that are consistent with the results of a study or group of studies. A wide confidence interval indicates a lack of certainty or precision about the true size of the clinical effect and is seen in studies with too few patients. Where confidence intervals are narrow they indicate more precise estimates of effects and a larger sample of patients studied. It is usual to interpret a '95%' confidence interval as the range of effects within which we are 95% confident that the true effect lies.
Confounder or confounding factor	Something that influences a study and can contribute to misleading findings if it is not understood or appropriately dealt with. For example, if a group of people exercising regularly and a group of people who do not exercise have an important age difference then any difference found in outcomes about heart disease could well be due to one group being older than the other rather than due to the exercising. Age is the confounding factor here and the effect of exercising on heart disease cannot be assessed without adjusting for age differences in some way.
Control group	A group of patients recruited into a study that receives no treatment, a treatment of known effect, or a placebo (dummy treatment) - in order to provide a comparison for a group receiving an experimental treatment, such as a new drug.

Controlled clinical trial (CCT)	A study testing a specific drug or other treatment involving two (or more) groups of patients with the same disease. One (the experimental group) receives the treatment that is being tested, and the other (the comparison or control group) receives an alternative treatment, a placebo (dummy treatment) or no treatment. The two groups are followed up to compare differences in outcomes to see how effective the experimental treatment was. A CCT where patients are randomly allocated to treatment and comparison groups is called a *randomised controlled trial*.
Cost benefit analysis	A type of economic evaluation where both costs and benefits of health care treatment are measured in the same monetary units. If benefits exceed costs, the evaluation would recommend providing the treatment.
Cost-effectiveness	Value for money.
Cost effectiveness analysis	A type of economic evaluation that compares the costs and benefits of different treatments. In cost-effectiveness analysis benefits are measured in clinical outcome units, for example, additional heart attack prevented, life years gained, etc. When a new treatment is compared with current care, its additional costs divided by its additional benefits is called the cost effectiveness ratio.
Cost utility analysis	A special form of *cost effectiveness analysis* where benefit is measured in *quality adjusted life years.* A treatment is assessed in terms of its ability to extend or improve the quality of life.
Cross-sectional study	The observation of a defined set of people at a single point in time or time period – a snapshot. (This type of study contrasts with a *longitudinal study* which follows a set of people over a period of time).
Decision analysis	A systematic way of reaching decisions, based on evidence from research. This evidence is translated into probabilities, and then into diagrams or decision trees which direct the clinician through a succession of possible scenarios, actions and outcomes.
Diagnostic study	A study to assess the effectiveness of a test or measurement in terms of its ability to accurately detect or exclude a specific disease.
Dietary advice	The provision of instructions on modifying food intake to improve nutritional intake.
Double blind study	A study in which neither the subject (patient) nor the observer (investigator/clinician) is aware of which treatment or intervention the subject is receiving. The purpose of blinding is to protect against bias.
Dysphagia	Any impairment of eating, drinking and swallowing.
Economic evaluation	Economic evaluation is a comparative analysis of costs and consequences of each alternative in order to provide an explicit criteria for making choices.
Elective	Name for clinical procedures that are regarded as advantageous to the patient but not urgent.
Enteral nutrition/Enteral Feeding/ Enteral	Nutrition support directly into the gut via a tube (the term as used in these guidelines does not include oral intake).

Tube feeding

Evidence based	The process of systematically finding, appraising, and using research findings as the basis for clinical decisions.
Evidence based clinical practice	Evidence based clinical practice involves making decisions about the care of individual patients based on the best research evidence available rather than basing decisions on personal opinions or common practice (which may not always be evidence based). Evidence based clinical practice therefore involves integrating individual clinical expertise and patient preferences with the best available evidence from research.
Evidence table	A table summarising the results of a collection of studies which, taken together, represent the evidence supporting a particular recommendation or series of recommendations in a guideline.
Exclusion criteria	See Selection criteria.
Focus group	A *qualitative research* technique. It is a method of group interview or discussion of between 6–12 people focused around a particular issue or topic. The method explicitly includes and uses the group interaction to generate data.
Gastrojejunostomy tube	Enteral tube inserted through the abdominal wall which passes through the stomach into the jejunum for the purpose of nutrition support.
Gastrostomy	Enteral tube inserted through the abdominal wall into the stomach for the purpose of nutrition support.
Gold standard	A method, procedure or measurement that is widely accepted as being the best available.
Health economics	The study of the allocation of scarce resources among alternative health care treatments. Health economists are concerned with both increasing the average level of health in the population and improving the distribution of health.
Heterogeneity	Or lack of *homogeneity*. The term is used in *meta-analyses* and *systematic reviews* when the results or estimates of effects of treatment from separate studies seem to be very different – in terms of the size of treatment effects or even to the extent that some indicate beneficial and others suggest adverse treatment effects. Such results may occur as a result of differences between studies in terms of the patient populations, outcome measures, definition of variables or duration of follow-up.
Homogeneity	This means that the results of studies included in a *systematic review* or *meta analysis* are similar and there is no evidence of *heterogeneity*. Results are usually regarded as homogeneous when differences between studies could reasonably be expected to occur by chance.
Inclusion criteria	See Selection criteria.
Intervention	Healthcare action intended to benefit the patient, for example, drug treatment, surgical procedure, psychological therapy.
Jejunostomy	Enteral tube inserted through the abdominal wall directly into the jejunum for the purpose of nutrition support.

Length of stay	The total number of days a participant stays in hospital.
Life year	A measure of health outcome which shows the number of years of remaining life expectancy.
Longitudinal study	A study of the same group of people at more than one point in time. (This type of study contrasts with a *cross sectional study* which observes a defined set of people at a single point in time).
Lumen	Cavity or channel within a tube.
Malnutrition/ Malnourishment	A state of nutrition in which a deficiency of energy, protein and/or other nutrients causes measurable adverse effects on tissue/body form, composition, function or clinical outcome [81] (in these guidelines we do not use the term to cover excess nutrient provision).
Malnutrition, moderate	BMI <18.5 or recent weight loss >10%, with negligible intake for >7 days, or BMI <20 with unintentional weight loss >5% with negligible intake for >7 days.
Malnutrition, severe	BMI <16 and/or recent weight loss of >15%.
Meta analysis	Results from a collection of independent studies (investigating the same treatment) are pooled, using statistical techniques to synthesise their findings into a single estimate of a treatment effect. Where studies are not compatible e.g. because of differences in the study populations or in the outcomes measured, it may be inappropriate or even misleading to statistically pool results in this way. See also *Systematic review* & *Heterogeneity*.
Motility agent	A medication used to aid the movement of food from the stomach into the intestine.
Nasoduodenal (tube) feeding	Nutrition support provided via a tube inserted via the nose, oesophagus and stomach into the duodenum.
Nasogastric (tube) feeding	Nutrition support provided through a tube inserted through the nose via the oesophagus into the stomach.
Nasojejunal (tube) feeding	Nutrition support provided through a tube inserted through the nose via the oesophagus, stomach and duodenum into the jejunum.
Non-experimental study	A study based on subjects selected on the basis of their availability, with no attempt having been made to avoid problems of bias.
Number Needed to Treat (NNT)	This measures the impact of a treatment or intervention. It states how many patients need to be treated with the treatment in question in order to prevent an event which would otherwise occur. E.g. if the NNT=4, then 4 patients would have to be treated to prevent one bad outcome. The closer the NNT is to 1, the better the treatment is. Analogous to the NNT is the Number Needed to Harm (NNH), which is the number of patients that would need to receive a treatment to cause one additional adverse event. e.g. if the NNH=4, then 4 patients would have to be treated for one bad outcome to occur.
Nutrition	A more detailed, specific, and in-depth evaluation of a patient's nutritional

assessment	state, typically by an individual with nutritional expertise (e.g. a dietitian, clinician with an interest in nutrition, or nutrition nurse specialist) or by a nutritional support team[81].
Nutrition screening	A rapid, simple and general procedure used by nursing, medical or other staff, often at first contact with the patient, to detect those with significant risk of nutritional problems, so that clear guidelines for action can be implemented, e.g. simple dietary measures or referral for expert help[81].
Nutrition support	The provision of supplementary nutrition over that already being taken in meals and snacks by oral, enteral or parenteral routes.
Nutrition Support Team	A multidisciplinary team with the dietetic, nursing, pharmacy and medical expertise to provide safe nutrition support.
Observational study	In research about diseases or treatments, this refers to a study in which nature is allowed to take its course. Changes or differences in one characteristic (e.g. whether or not people received a specific treatment or intervention) are studied in relation to changes or differences in other(s) (e.g. whether or not they died), without the intervention of the investigator. There is a greater risk of selection bias than in experimental studies.
Oral nutritional support	The modification of food and fluid by: fortifying food with protein, carbohydrate and/or fat; the provision snacks and sip feeds as extra nutrition to regular meals, changing meal patterns or the provision of dietary advice to patients on how to increase nutrition intake by the above.
Orogastric (tube) feeding	Nutrition support provided by a tube inserted through the mouth via the oesophagus into the stomach
Parenteral nutrition/feeding	Intravenous administration of nutritional substrate: glucose and protein (amino acids, nitrogen) as a minimum, and lipid, vitamin and minerals.
Perioperative	The period from admission through surgery until discharge, encompassing pre-operative and post-operative periods
Pilot study	A small scale 'test' of the research instrument. For example, testing out (piloting) a new questionnaire with people who are similar to the population of the study, in order to highlight any problems or areas of concern, which can then be addressed before the full scale study begins.
Placebo	Placebos are fake or inactive treatments received by participants allocated to the *control group* in a clinical trial which are indistinguishable from the active treatments being given in the experimental group. They are used so that participants are ignorant of their treatment allocation in order to be able to quantify the effect of the experimental treatment over and above any *placebo effect* due to receiving care or attention.
Placebo effect	A beneficial (or adverse) effect produced by a *placebo* and not due to any property of the *placebo* itself.
Power	See Statistical power.
Primary care	Healthcare delivered to patients outside hospitals. Primary care covers a range of services provided by GPs, nurses and other health care professionals, dentists, pharmacists and opticians.

Prospective study

A study in which people are entered into the research and then followed up over a period of time with future events recorded as they happen. This contrasts with studies that are *retrospective*.

***P* value**

If a study is done to compare two treatments then the *P* value is the probability of obtaining the results of that study, or something more extreme, if there really was no difference between treatments. (The assumption that there really is no difference between treatments is called the 'null hypothesis'.) Suppose the *P*-value was *P*=0.03. What this means is that if there really was no difference between treatments then there would only be a 3% chance of getting the kind of results obtained. Since this chance seems quite low we should question the validity of the assumption that there really is no difference between treatments. We would conclude that there probably is a difference between treatments. By convention, where the value of *P* is below 0.05 (i.e. less than 5%) the result is seen as statistically significant. Where the value of *P* is 0.001 or less, the result is seen as highly significant. *P* values just tell us whether an effect can be regarded as statistically significant or not. In no way do they relate to how big the effect might be, for which we need the *confidence interval*.

Qualitative research

Qualitative research is used to explore and understand people's beliefs, experiences, attitudes, behaviour and interactions. It generates non-numerical data, e.g. a patient's description of their pain rather than a measure of pain. In health care, qualitative techniques have been commonly used in research documenting the experience of chronic illness and in studies about the functioning of organisations. Qualitative research techniques such as *focus groups* and in depth interviews have been used in one-off projects commissioned by guideline development groups to find out more about the views and experiences of patients and carers.

Quality adjusted life years (QALYS)

A measure of health outcome. QALYS are calculated by estimating the number of years of life gained from a treatment and weighting each year with a quality of life score between zero and one.

Quantitative research

Research that generates numerical data or data that can be converted into numbers, for example clinical trials or the national Census which counts people and households.

Random allocation or Randomisation

A method that uses the play of chance to assign participants to comparison groups in a research study, for example, by using a random numbers table or a computer-generated random sequence. Random allocation implies that each individual (or each unit in the case of cluster randomisation) being entered into a study has the same chance of receiving each of the possible interventions.

Randomised controlled trial (RCT)

A study to test a specific drug or other treatment in which people are randomly assigned to two (or more) groups: one (the experimental group) receiving the treatment that is being tested, and the other (the comparison or control group) receiving an alternative treatment, a placebo (dummy treatment) or no treatment. The two groups are followed up to compare differences in outcomes to see how effective the experimental treatment was. (Through randomisation, the groups should be similar in all aspects apart from the treatment they receive during the study.)

Relative risk

A summary measure which represents the ratio of the risk of a given event or outcome (e.g. an adverse reaction to the drug being tested) in one group of subjects compared to another group. When the 'risk' of the event is the same in the two groups the relative risk is 1. In a study comparing two treatments, a relative risk of 2 would indicate that patients

	receiving one of the treatments had twice the risk of an undesirable outcome than those receiving the other treatment. Relative risk is sometimes used as a synonym for *risk ratio*.
Retrospective study	A retrospective study deals with the present/ past and does not involve studying future events. This contrasts with studies that are *prospective*.
Sample	A part of the study's target population from which the subjects of the study will be recruited. If subjects are drawn in an unbiased way from a particular population, the results can be generalised from the sample to the population as a whole.
Scottish Intercollegiate Guidelines Network (SIGN)	SIGN was established in 1993 to sponsor and support the development of evidence-based clinical guidelines for the NHS in Scotland.
Secondary care	Care provided in hospitals.
Selection criteria	Explicit standards used by guideline development groups to decide which studies should be included and excluded from consideration as potential sources of evidence.
Sensitivity	In diagnostic testing, it refers to the chance of having a positive test result given that you have the disease. 100% sensitivity means that all those with the disease will test positive, but this is not the same the other way around. A patient could have a positive test result but not have the disease – this is called a 'false positive'. The sensitivity of a test is also related to its 'negative predictive value' (true negatives) – a test with a sensitivity of 100% means that all those who get a negative test result do not have the disease. To fully judge the accuracy of a test, its *Specificity* must also be considered.
Sip feed	A commercially produced liquid product containing a balanced formulation of protein, fat and carbohydrate, vitamins and minerals.
Specificity	In diagnostic testing, it refers to the chance of having a negative test result given that you do not have the disease. 100% specificity means that all those without the disease will test negative, but this is not the same the other way around. A patient could have a negative test result yet still have the disease – this is called a 'false negative'. The specificity of a test is also related to its 'positive predictive value' (true positives) – a test with a specificity of 100% means that all those who get a positive test result definitely have the disease. To fully judge the accuracy of a test, its *Sensitivity* must also be considered.
Standard care	The situation in which a patient is given no supplementary nutrition support but still eats meals and snacks as appropriate for their clinical status and usual practice.
Statistical power	The ability of a study to demonstrate an association or causal relationship between two variables, given that an association exists. For example, 80% power in a clinical trial means that the study has a 80% chance of ending up with a *P* value of less than 5% in a statistical test (i.e. a statistically significant treatment effect) if there really was an important difference (e.g. 10% versus 5% mortality) between treatments. If the statistical power of a study is low, the study results will be questionable (the study might have been too small to detect any differences). By

	convention, 80% is an acceptable level of power. See also *P value*.
Systematic review	A review, in which evidence from scientific studies has been identified, appraised and synthesised in a methodical way according to predetermined criteria. May or may not include a *meta-analysis*.
Systemic Inflammatory Response Syndrome (SIRS)	A systemic inflammatory response to at least two criteria leukocytosis, fever, tachycardia, and tachypnea.
Undernutrition/ Undernourishment	Used interchangeably with malnutrition and malnourishment to refer to the state of nutrition in which a deficiency of energy, protein and/or other nutrients causes measurable adverse effects on tissue/body form, composition, function or clinical outcome [81].

1 Introduction and methods

1.1 The need for guidelines in nutrition support

Malnutrition is a state in which a deficiency of energy, protein and/or other nutrients causes measurable adverse effects on tissue/body form, composition, function or clinical outcome [81] (in these guidelines we do not use the term to cover excess nutrient provision).

Malnourishment is both a cause and a consequence of ill-health. It is common and increases a patient's vulnerability. Providing adequate nutrition support to malnourished patients can improve outcomes but decisions on the most effective and safe means to do so are complex. Currently, knowledge of the causes, effects and treatment of malnourishment amongst UK health professionals is poor. Guidelines are therefore needed to emphasise the following:

1. *Undernutrition is common* - Many people who are unwell at home, in hospital or in the community, are likely to eat and drink less than they need. This impairment of food and fluid intake may be short-lived as part of an acute illness, or prolonged if there are chronic medical or social problems. If impaired food intake persists for even a few days, a patient can become undernourished to a degree that may impair recovery or precipitate other medical problems. This is especially true if the patient was undernourished before they became unwell due to other longstanding medical or psycho-social problems, or a generally poor diet. To compound any disease related reduction in food intake, many patients also have no help with obtaining or preparing meals when they are ill at home, while those in hospital may have further problems relating to poor standards of catering, inappropriate or interrupted meal times, incorrect food consistencies, and the lack of feeding equipment and/or staff to help them eat and drink for themselves. The 'Better Hospital Food' and the 'Protected Mealtimes' plans are welcome government initiatives which try to improve the provision of hospital meals and snacks

2. *Malnourishment increases vulnerability* - The consequences of malnutrition include vulnerability to infections, delayed wound healing, impaired function of heart and lungs, muscle weakness and depression. As a consequence the malnourished consult their general practitioners (GPs) more frequently, go to hospital more often for longer periods, and have higher complication and mortality rates for similar conditions. If poor dietary intake persists for weeks, the resulting malnourishment may be life-threatening in itself.

3. *Decisions on providing nutrition support are complex* - Although it is clear that clinical outcomes in malnourished groups are poor compared to the better nourished (e.g. malnourished surgical patients have complication rates 2 -3 times higher than their better nourished counterparts), the indications for active nutrition support using dietary supplementation, enteral tube feeding or parenteral nutrition are debatable. When individuals are unable or unlikely to meet the majority of their nutrient

needs for prolonged periods (e.g. patients with dysphagia or intestinal failure) the need for appropriate support is absolute unless artificially prolonging the patient's life is inappropriate. However, if nutritional intake is closer to meeting a patient's needs or the likely period of impaired intake is uncertain, decisions on providing nutrition support and the best means to do so are more difficult with multiple criteria for choosing oral, enteral or parenteral modalities which vary with both individual patient needs and the clinical expertise available to ensure that any intervention can be undertaken safely.

4. *Understanding of undernutrition and nutritional support amongst many health care professionals is poor* – The many difficulties relating to the need and best mode of nutrition support are compounded by a lack of knowledge about undernutrition and its treatment amongst many health-care professionals. There has been little emphasis on nutrition education in either undergraduate medical or nursing courses and this in turn has led to poor recognition of both nutritional risks and the dangers of poorly managed nutrition support. Along with the lack of agreed national guidelines, this has also led to wide variation in nutritional care standards. Heyland et al [141] highlighted the difference between evidence in nutritional healthcare and practice when stating that:

   'Approximately 30-40% of patients do not receive care according to present scientific evidence and about 20-25% of care is not needed or is potentially harmful'.

The objective of these guidelines is therefore to improve the practice of nutrition support by providing guidance to assist all health care professionals to correctly identify patients in community, hospital and care home settings who require nutritional intervention, and to help them choose and deliver the most appropriate form of nutrition support at the appropriate time. As such, they are in keeping with other recent publications highlighting the importance of good nutritional care e.g. the Department of Health's Essence of Care document[72] and the Royal College of Physicians' report 'Nutrition and patients: a doctor's responsibility'[276]. They are also about improving people's quality of life by making them feel better through adequate nutrition, and they have been developed with significant input from patient representatives.

1.2 What is a guideline?

Guidelines are recommendations for the care of individuals in specific clinical conditions or circumstances – from prevention and self-care though primary and secondary care to more specialised services. Clinical guidelines are based on the best available evidence, and are produced to assist health care professionals and patients make informed choices about appropriate health care. While guidelines assist the practice of healthcare professionals, they do not replace their knowledge and skills.

Clinical guidelines for the NHS in England and Wales are produced as a response to a request from the Department of Health and the Welsh Assembly Government. They select topics for guideline development and before deciding whether to refer a particular topic to the National Institute for Health and Clinical Excellence (NICE) they consult with the relevant patient bodies, professional organisations and companies. Once a topic is referred, NICE then commissions one of seven National Collaborating Centres to produce a guideline. The Collaborating Centres are independent of government and comprise partnerships between a variety of academic institutions, health profession bodies and patient groups.

1.3 Remit of the guideline

The following remit was received from the Department of Health and National *Assembly for Wales in as part of NICE's 7th wave programme of work:*

"To prepare a guideline on appropriate methods of feeding people who

are still capable of deriving at least some of their nutritional requirements by conventional feeding and/or

have difficulty in swallowing

including the use of nutritional supplements and enteral and parenteral feeding methods."

1.4 What the guideline covers

This guideline is relevant to adults (>18years) in both the hospital and community setting. It provides guidance on the steps required to first identify patients who are potentially at risk of undernutrition, by nutritional screening and then if identified at risk when and how either oral, enteral and/or parenteral nutrition should be initiated, administered and when appropriate, stopped. Guidance on monitoring patients receiving different types of nutrition support is also included. The evidence found has enabled us to produce guidance for patients in general and in some instances, specific guidance related to patients in specific care settings.

1.5 What the guideline does not cover

The guideline does not provide guidance for certain types of patient groups including;

a) Patients requiring specific specialist therapeutic or maintenance nutrition regimens in the context of diseases such as inborn errors of metabolism, diabetes and chronic renal or liver failure.

b) Pregnant women, since the nutritional demands on the mother and baby require specialist considerations

c) Patients with eating disorders, because the aims of intervention differ significantly from those with malnutrition related to disease.

d) Primary prevention of malnutrition in healthy individuals in the general population.

e) Children and adolescents under the age of 18 years.

The guideline also provides no recommendations on:

a) The suitability of individually named oral supplements or enteral and parenteral feeding solutions.

b) The use of novel substrates such as glutamine or arginine although we are aware that there is some evidence suggesting potential benefit from the use of these substrates and believe this should perhaps be addressed when this guideline is updated.

c) Types of tubing and receptacles used for enteral and parenteral nutrition support.

d) The management of infections and infection control related to enteral and parenteral nutrition support although reference is made to the existing NICE guidance on Infection Control where appropriate.

1.6 Who developed the guideline?

A multidisciplinary Guideline Development Group (GDG) comprising professional group members and consumer representatives of the main stakeholders developed this guideline (see Guideline Development Group Membership and acknowledgements).

The National Institute for Health and Clinical Excellence funds the National Collaborating Centre for Acute Care and thus supported the development of this guideline. The GDG was convened by the National Collaborating Centre for Acute Care (NCC-AC) and chaired by Dr Mike Stroud in accordance with guidance from the National Institute for Health and Clinical Excellence (NICE).

The Group met every 6-8 weeks during the development of the guideline. At the start of the guideline development process all GDG members' interests were recorded on a standard declaration form that covered consultancies, fee-paid work, share-holdings, fellowships and support from the healthcare industry. At all subsequent GDG meetings, members declared arising conflicts of interest which were recorded.

Staff from the NCC-AC provided methodological support and guidance for the development process. They undertook systematic searches, retrieval and

appraisal of the evidence and drafted the guideline. The Glossary to the guideline contains definitions of terms used by staff and the GDG.

1.7 Methodology

1.7.1 Outline of methods used

The guideline was commissioned by NICE. The guideline development process involved several steps and was developed in accordance with the guideline development process outlined in *Guideline development methods: information for National Collaborating Centres and guideline developers*[232] .

1.7.2 Development of clinical questions

The Guideline Development Group proposed a list of clinical questions (Appendix Two) related to the initiation and administration of oral, enteral and parenteral nutrition support. With the exception of the nutrition screening, monitoring and refeeding syndrome questions, the remaining questions were developed to investigate the benefit of one type or mode of intervention with another.

1.7.2.1 Types of study interventions

The Guideline Development Group agreed on the definition of terms and the inclusion and exclusion criteria for oral, enteral and parenteral interventions. These were included in the search strategies and considered throughout the process of systematic reviewing.

1.7.2.2 Types of study population

With the exception of children, pregnant mothers and people with eating disorders the Guideline Development Group were interested in identifying the benefit of an intervention for any type of population. The clinical questions and the search strategies did not, therefore specify for any type of population.

1.7.2.3 Types of outcomes

The Guideline Development Group requested that all outcomes should be recorded, with the exception of biochemical outcomes which were not clearly associated with clinical benefit (e.g. changes in nitrogen balance or plasma protein concentrations).

1.7.3 Types of studies

Study design was restricted to systematic reviews, meta-analyses of randomised controlled trials and randomised controlled trials. No other study designs were considered because of the potential bias associated with observational study designs and also, the wide inclusion criteria agreed for populations, interventions and outcomes would have made the task of including observational studies in the systematic reviews too great for the resources available.

1.7.4 Literature search

A literature review was conducted to identify and synthesise relevant evidence from the published literature. Three main search strategies were developed for oral, enteral and parenteral nutrition interventions. Four other search strategies were developed for nutritional screening, monitoring, dysphagia and patient issues.

Search filters to identify systematic reviews (SRs) and randomised controlled trials (RCTs) were applied to the search strategies. No language restrictions were applied to the search; however, foreign language papers were not requested or reviewed.

The following databases were included in the literature search:

- The Cochrane Library up to 2005 (Issue 1)
- Medline (Dialog Datastar) 1966-2005 (week)
- Embase (Dialog Datastar) 1980-2005 (week)
- Cinahl (Dialog Datastar) 1982-2005
- Allied & Complementary Medicine (Dialog Datastar) 1985-2005
- British Nursing Index (Dialog Datastar) 1994-2005

Although literature searching was started in 2003 update searches were run for each search to ensure all reviews included literature up to the same cut-off date. Therefore, each database was searched from its start date up to 3rd March 2005. Papers identified after this date were not considered. Search strategies can be found in Appendix Three.

There was no systematic attempt to search for all the 'grey literature' (conferences, abstracts, theses and unpublished literature). We searched for guidelines and reports from relevant websites, including the following listed below. Bibliographies of identified reports and guidelines were also checked to identify relevant literature.

- National Institute for Health and Clinical Excellence (NICE) (www.nice.org.uk)
- National electronic Library for Health (NeLH) (http://www.nelh.nhs.uk/)
- National Institutes of Health Consensus Development Program (consensus.nih.gov)
- New Zealand Guidelines Development Group (NZGG) (http://www.nzgg.org.nz/)

- Scottish Intercollegiate Guideline Network (SIGN) (www.sign.ac.uk)
- US National Guideline Clearing House (www.guidelines.gov)
- Web sites of relevant members of the Guidelines International Network (http://www.g-i-n.net/)
- Google (www.google.com)

1.7.5 Study selection

One reviewer independently scanned the titles and abstracts of the literature searches. Full publications were obtained for any studies considered relevant or where there was insufficient information from the title and abstract to make a decision.

1.7.6 Data extraction and quality assessment

A team of reviewers individually applied the inclusion/exclusion criteria to determine all potentially relevant studies. The reviewers also assessed the quality of eligible studies by using a modified version of the SIGN quality checklists for systematic reviews/meta-analyses and randomised control trials. Of all the relevant studies data on the type of population, intervention, comparator and outcomes was summarised onto evidence tables (Appendix Four). In the instances where there was missing data we did not attempt to contact the authors because of limited resources.

1.7.7 Absence of literature

The GDG proposed a number of clinical questions which either did not lend themselves to standard systematic reviewing methods (section 1.7) or for which there were too few randomised controlled trials identified to make substantive recommendations. In these instances, alternative approaches were used to develop guidance.

Nutritional screening: a formal consensus development process was followed to assist with development of recommendations.

Indications for oral, enteral and parenteral interventions: recommendations were proposed and agreed by informal consensus amongst all GDG members.

Ethical and Legal issues: *The brief but important comments on the ethical and legal issues of nutrition support contained within these Guidelines were derived directly from previous expert treatises on these topics*

Dysphagia: a specialist group was convened to determine appropriate recommendations.

Prescription of nutrients: recommendations were proposed by GDG members with relevant expertise and agreed by informal consensus among all GDG members.

Refeeding syndrome: recommendations were formulated by members of the group based on previous published reviews and there own expertise, and agreed by informal consensus among all GDG members.

Monitoring: a survey with the participation of the guideline development group who had both patient and clinical expertise was conducted. Two GDG members with expertise in this area considered the outcomes of the survey and proposed the guidance/recommendations which the GDG agreed by informal consensus.

Nutritional assessment: two GDG members with expertise in this area proposed the guidance/recommendations which the GDG agreed by informal consensus.

Nutrition support teams: both randomised and non-randomised trials were considered for this section as some observational study designs were also appropriate for this question.

Patients' and carers' views: We sent letters requesting evidence on patients' and carers' views of nutrition support to twenty stakeholders. A literature search was conducted to identify relevant evidence for any study design. The following databases were included:

- Medline (1951-2005)
- Embase (1980-2005)
- Cinahl (1982-2005)

Three sub-group meetings with patient representatives on the GDG were held. Patient representatives were involved in the sifting of the abstracts retrieved from the literature search. A systematic reviewer summarised the evidence from the studies. The text was included in discussion with patient representatives at sub-group meetings and in consultation with GDG members at GDG meetings.

1.8 Hierarchy of clinical evidence

There are many different methods of ranking the evidence and there has been considerable debate about what system is best. A number of initiatives are currently under way to find an international consensus on the subject, but until a decision is reached on the most appropriate system for the NICE guidelines, the Institute advises the National Collaborating Centres to use the system for evidence shown in Table 1.

Table 1: Levels of evidence for intervention studies (reproduced with permission of the Scottish Intercollegiate Guidelines Network)

Level of evidence	Type of evidence
1++	High-quality meta-analyses, systematic reviews of RCTs, or RCTs with a very low risk of bias
1+	Well-conducted meta-analyses, systematic reviews of RCTs, or RCTs with a low risk of bias
1-	Meta-analyses, systematic reviews of RCTs, or RCTs with a high risk of bias
2++	High-quality systematic reviews of case-control or cohort studies High-quality case-control or cohort studies with a very low risk of confounding, bias, or chance and a high probability that the relationship is causal
2+	Well-conducted case-control or cohort studies with a low risk of confounding, bias, or chance and a moderate probability that the relationship is causal
2-	Case-control or cohort studies with a high risk of confounding bias, or chance and a significant risk that the relationship is not causal
3	Non-analytic studies (for example, case reports, case series)
4	Expert opinion

The ranking system described above covers studies of treatment effectiveness and is less appropriate for studies reporting diagnostic tests of accuracy.

1.9 Health economics methods

It is important to investigate whether health services are both clinically effective and cost-effective (that is, value for money). If a particular diagnostic or treatment strategy was found to yield little health gain relative to the resources used, then it could be advantageous to re-deploy resources to other activities that yield greater health gain.

To assess the cost-effectiveness of each recommendation, a comprehensive systematic review of the economic literature was conducted. In addition an original cost-effectiveness analysis was performed for malnutrition screening.

The primary criteria applied for an intervention to be considered cost-effective were either:

a) the intervention dominated other relevant strategies (that is, it is both less costly in terms of resource use and more clinically effective compared with the other relevant alternative strategies); or

b) the intervention cost less than £20,000 per quality-adjusted life-year (QALY) gained compared with the next best strategy (and compared with best supportive care). Between £20,000 and £30,000 per QALY, judgments about the acceptability of the intervention as an effective use of NHS resources have to make more explicit reference to such factors as the degree of uncertainty surrounding the calculation of cost-effectiveness, the innovative nature of the intervention and the particular features of the condition and the population receiving it.

1.9.1 Literature review for health economics

We obtained published economic evidence from a systematic search of the following databases:

- Medline (Dialog Datastar) (1966-2005)
- Embase (Dialog Datastar) (1980-2005)
- Health Economic Evaluations Database (HEED)
- NHS Economic Evaluations Database (NHS EED)

For those clinical areas we reviewed, the information scientists used the same search strategy as for the clinical questions, using an economics filter in the place of a systematic review or randomised controlled trial filter. Although literature searching was started in 2003 update searches were run for each search to ensure all reviews included literature up to the same cut-off date. Therefore, each database was searched from its start date up to 3rd March 2005. Papers identified after this date were not considered. Search strategies can be found in Appendix Three.

Each search strategy was designed to find any applied study estimating the cost or cost-effectiveness of some aspect of nutrition support. A health economist reviewed abstracts. Relevant references in the bibliographies of reviewed papers were also identified and reviewed.

Given the diversity of economic studies, it was not possible to determine a general exclusion criterion based on study quality. Hence, all studies were included in the evidence tables and study quality and applicability are discussed in the review. Papers were only excluded from the evidence tables and review if:

- The study did not contain any original data on cost or cost-effectiveness (i.e. it was a review or a clinical paper).

- The analysis was not incremental and was not described adequately to allow incremental analysis (so studies reporting only average cost-effectiveness ratios were excluded unless they provided data to allow the calculation of incremental cost-effectiveness ratios).

- Cost analyses were excluded if the results were not presented in a way that would allow the incremental cost per patient to be extracted or derived.

For one topic – nutrition support teams – it was decided to exclude studies which had only a single cohort and used conjecture to assess the incremental cost. These studies were excluded since there was other evidence that was deemed to be more rigorous, comparing two cohorts, one of which was randomised.

Included papers were reviewed by a health economist. In the evidence tables costs are reported as given in the paper. However, where costs were in a currency other than pounds sterling, US dollars or euros, the results were converted to pounds sterling using the relevant purchasing power parity for the study year.

Each study was categorised as one of the following: cost analysis, cost-effectiveness analysis, cost-utility analysis (i.e. cost-effectiveness analysis with effectiveness measured in terms of QALYs), or cost consequences analysis. Many of the studies in this review were labelled 'cost consequences analyses' because they present many different health outcomes (in addition to cost) without a single overall measure health gain. Often these studies report complications. Where complications averted appears to be the main clinical outcome we have estimated cost-effectiveness by calculating the incremental cost per complication averted. We did not find any 'cost benefit analyses' (studies that put a monetary value on health gain).

1.9.2 Cost-effectiveness modelling

Screening was selected for original economic analysis because it was likely that the recommendations under consideration would substantially change clinical practice in the NHS and have important consequences for resource use.

The details of the model are reported in chapter 3 and Appendix Five. The following general principles were adhered to:

- The GDG was consulted during the construction and interpretation of the model.

- The model was based on the best evidence from the systematic review.

- Model assumptions were reported fully and transparently.

- The results were subject to thorough sensitivity analysis and limitations discussed.
- Costs were calculated from a health services perspective.

1.10 Forming and grading the recommendations

NICE guideline recommendations are graded according to the strength of the supporting evidence, which is assessed from the design of each study (see Table 1). The grading system currently used is presented in Table 2.

The Guideline Development Group was presented with summaries (text and evidence tables) of the best available research evidence to answer the clinical questions. Recommendations were based on, and explicitly linked to, the evidence that supported them. With the exception of the nutrition screening recommendations the Group worked on an informal consensus basis. The recommendations were then graded according to the level of evidence upon which they were based.

Table 2: Grading of recommendations**

Grade	Evidence
A	• At least one meta-analysis, systematic review, or RCT rated as 1++, and directly applicable to the target population, or • A systematic review of RCTs or a body of evidence consisting principally of studies rated as 1+, directly applicable to the target population, and demonstrating overall consistency of results • Evidence drawn from a NICE technology appraisal
B	• A body of evidence including studies rated as 2++, directly applicable to the target population, and demonstrating overall consistency of results, or • Extrapolated evidence from studies rated as 1++ or 1+
C	• A body of evidence including studies rated as 2+, directly applicable to the target population and demonstrating overall consistency of results, or • Extrapolated evidence from studies rated as 2++
D	• Evidence level 3 or 4, or • Extrapolated evidence from studies rated as 2+, or • Formal consensus
D (GPP)	A good practice point (GPP) is a recommendation for best practice based on the experience of the Guideline Development Group

The usefulness of a classification system based solely on the level of evidence has been questioned because it does not take into consideration the importance of the recommendation in changing practice and improving patient care. It is worth noting that NICE is currently assessing the best way of presenting recommendations for future guidelines.

1.11 Specific problems with evidence relating to the development of nutrition support guidelines

Literature searching, appraising the evidence and developing recommendations for this guideline proved to be particularly challenging. In part, this was due to a shortage of randomised controlled trials relating to some of the clinical questions, but the GDG also observed problems with the types of patients entered into many of the selected controlled trials. Providing adequate nutrition is usually seen as a part of basic care, and this creates obstacles to good quality research in nutrition support. For example, although it is obvious that inadequate provision of nutrition for prolonged periods eventually lead to death, no randomised trials support this statement and any recommendation that patients should not be allowed to die of starvation is therefore grade D.

Other fundamental problems with available evidence include:

a. In trials of nutritional intervention it is often neither feasible nor ethical to have 'no nutrition' as the control.

b. Patients who are malnourished and therefore eligible to be recruited for trials of nutrition support have very variable diagnoses and come from a wide variety of settings. Trial populations are therefore very heterogeneous with wide potential variation in outcomes of interest. Large scale studies are therefore needed to demonstrate any potential benefits on outcome but most nutritional trials have been small.

c. When performing trials on invasive means of nutrition support such as enteral and parenteral feeding, it is usually considered unethical to randomize patients who have an 'undoubted' need for such support. Trials therefore recruit patients who are at lower nutritional risk than those conventionally fed by these methods and so their results may be inapplicable to normal clinical practice.

d. Developments in the formulations and delivery of enteral and parenteral nutrition support and consequent reductions in risk have made many older studies less relevant. For instance, in recent years it has been recognised that too much additional nutrient provision can sometimes be more harmful than no nutrition support, yet much of the literature pre-dates this change in thinking.

The GDG also encountered methodological problems with the available nutritional research, including:

a. Significant heterogeneity in the outcomes reported e.g. for one type of intervention, 5 separate studies may use 5 different indicators to report change in nutritional status.

b. Lack of information on the period prior to starting nutrition support despite the fact that the duration and intensity of starvation before intervention is clearly pertinent to any outcome.

c. Study periods which were often too short to determine the true effect of any intervention (e.g. reporting change in body weight two weeks after prescribing a sip feed may not be long enough to establish whether the patient benefits in the long term).

d. Weak characterisation of patient populations in terms of underlying diagnosis, illness severity or degree of malnutrition.

e. Lack of information on the amount of feed actually received by patients and/ or the wide variation in the amount received (a particular weakness of older enteral feeding studies).

f. The presence of many potentially confounding issues when reporting outcomes attributed by authors to nutritional intervention in small trials (e.g. infection rates and mortality).

g. The predominance of evidence from limited acute or chronic care settings with complete absence of evidence from other settings makes generalisation of conclusions difficult.

In view of the above, many questions related to nutritional support may be better addressed by study designs other than RCTs but the broad scope of these Guidelines and limitations of resources prevented the GDG from formally searching for sources of non-RCT evidence. Many of the clinical questions have therefore been addressed using expert opinion and consensus techniques.

1.12 Patient-centred care

This guideline offers best practice advice on the care of people with, or at risk from malnutrition.

Treatment and care should take into account patients' individual needs and preferences. People with, or at risk from malnutrition should have the opportunity to make informed decisions regarding their care and treatment in partnership with healthcare professionals. Unless specifically excluded by the patient, carers and relatives should also have the opportunity to be involved in decisions about the patient's care and treatment and should be provided with

the information and support they need. Where patients lack sufficient capacity to make decisions, healthcare professionals should follow ethical principles outlined in section 4.7 and Department of Health Guidelines.

Good communication between healthcare professionals and patients is essential, supported by the provision of evidence-based information offered in a form that is tailored to the needs of the individual patient. Provision of treatment, care and information should be culturally sensitive and provided in a form that is accessible to people who have additional needs, including people with physical, cognitive or sensory disabilities, and people who do not speak or read English.

1.13 Summary of the recommendations and the algorithms

1.13.1 Key recommendations for implementation

The following recommendations have been selected from the full list (section 1.13.2) as priorities for implementation.

1.13.1.1 Nutritional assessment and screening

1.13.1.1.1 Ideally all hospital inpatients should be screened for (risk of) under-nutrition on admission using a simple screening tool that includes BMI, percentage weight loss and considers the time over which nutrient intake has been reduced (e.g. MUST). Screening should be repeated weekly in acute settings. Departments with low risk of under-nutrition may opt-out of screening. Opt-out decisions should follow explicit an process via the local clinical governance structure involving experts in nutrition support.

1.13.1.1.2 All hospital 'out-patients' should be screened for (risk of) under-nutrition at the first clinic, using a simple screening tool (e.g. MUST). Departments with low risk of under-nutrition may opt-out of screening. Opt-out decisions should follow an explicit process via the local clinical governance structure involving experts in nutrition support.

1.13.1.1.3 All residents or patients in care homes should be screened for (risk of) under-nutrition on admission using a simple screening tool (e.g. MUST), and whenever there is clinical concern and risk of under-nourishment.

1.13.1.2 Indications for nutrition support

1.13.1.2.1 Nutrition support should be considered in patients when:

- **the patient has not eaten or is very unlikely to be eating for more than 5 days (whatever their current nutritional status and BMI), or**
- **the patient's BMI is <18.5, or**
- **the patient has unintentionally lost >10% body weight over the previous 3-6 months, or**
- **the patient has a BMI <20 with unintentional weight loss >5%, or**
- **when the patient has poor absorptive capacity, is catabolic and/ or has high nutrient losses.**

1.13.1.3 Prescription of nutrition support

1.13.1.3.1 In most patients starting enteral or parenteral nutrition support, particularly the very sick, full electrolyte, fluid and micronutrient needs should be provided from the outset but energy and nitrogen should be cautiously introduced according to metabolic and gastrointestinal tolerance over the first 24-48 hours, e.g. in intensive care patients this may mean commencing 50% of normal energy and nitrogen requirements.

1.13.1.4 Oral nutrition support

1.13.1.4.1 Interventions to improve oral intake should be offered to hospital patients who can potentially swallow safely but who are either malnourished (unintentional weight loss >10% over the last 3 to 6 months, BMI <18.5, or BMI <20 and unintentional weight loss >5% over the last 3 to 6 months) or who are at risk of malnourishment (not eaten for >5 days or unlikely to eat for >5 days).

1.13.1.4.2 Interventions to improve oral intake such as additional food or supplements should also be considered for appropriate elderly patients in long term care with unintentional weight loss, who can swallow safely.

1.13.1.5 Enteral nutrition support

1.13.1.5.1 Enteral tube feeding should be considered in patients who need nutrition support (unintentional weight loss >10% over the last 3 to 6 months; BMI <18.5; BMI <20 and unintentional weight loss >5% over the last 3 to 6 months; not eaten for >5 days or unlikely to eat for >5 days) who have a functional, accessible gastrointestinal tract but an inadequate or unsafe oral intake.

1.13.1.5.2 In the acute setting e.g. following dysphagic stroke, patients unable to safely swallow or take sufficient energy and nutrients orally should have an initial 2 week trial of nasogastric tube feeding while assessing the prognosis.

1.13.1.6 Parenteral nutrition support

1.13.1.6.1 Patients prescribed standardised parenteral nutrition need their nutritional requirements to be determined before selection of a particular parenteral nutrition product. The addition of vitamins and trace elements is always required and occasionally electrolytes and other nutrient supplements are needed. Additions must be made under appropriate pharmaceutically controlled environmental conditions before administration.

1.13.2 Clinical practice recommendations

Recommendations are graded A, B, C, D or D (GPP) according to the level of evidence of effectiveness that they are based upon.

1.13.2.1 Nutritional assessment and screening

1.13.2.1.1 Ideally all hospital inpatients should be screened for (risk of) under-nutrition on admission using a simple screening tool that includes BMI, percentage weight loss and considers the time over which nutrient intake has been reduced.(e.g. MUST). Screening should be repeated weekly in acute settings. Departments with low risk of under-nutrition may opt-out of screening. Opt-out decisions should follow an explicit process via the local

clinical governance structure involving experts in nutrition support. [D(GPP)]

1.13.2.1.2 All hospital 'out-patients' should be screened for (risk of) under-nutrition at the first clinic, using a simple screening tool (e.g. MUST), Departments with low risk of under-nutrition may opt-out of screening. Opt-out decisions should follow an explicit process via the local clinical governance structure involving experts in nutrition support. [D(GPP)]

1.13.2.1.3 All residents or patients in care homes should be screened for (risk of) under-nutrition on admission using a simple screening tool (e.g. MUST), and whenever there is clinical concern and risk of under-nourishment. [D(GPP)]

1.13.2.1.4 Nutritional screening for under-nutrition should be undertaken on registering at general practice, and where there is clinical concern of (risk of) under-nutrition, and should be considered at other screening opportunities. [D(GPP)]

1.13.2.1.5 Nutritional assessment and screening should be carried out by healthcare professionals with appropriate training and skills to help generate the confidence of patients and enable accurate data collection. [D (GPP)]

1.13.2.2 Indications

1.13.2.2.1 Nutrition support should be considered in patients when:

- ***the patient has not eaten or is very unlikely to be eating for more than 5 days (whatever their current nutritional status and BMI), or***
- ***the patient's BMI is <18.5, or***
- ***the patient has unintentionally lost >10% body weight over the previous 3-6 months, or***
- ***the patient has a BMI <20 with unintentional weight loss >5%, or***
- ***when the patient has poor absorptive capacity, is catabolic and/or has high nutrient losses. [D(GPP)]***

1.13.2.2.2 Healthcare professionals should ensure that ethical and legal issues are considered when any decisions regarding the nutrition support of patients are made. [D(GPP)]

1.13.2.2.3 Healthcare professionals should ensure that there is a regular review of the need for and route of nutrition support for all patients. [D(GPP)]

1.13.2.2.4 Patients having treatment for malnutrition should be kept fully informed and have access to appropriate sources of information and/or the opportunity to discuss diagnosis and treatment options. They should also be given contact details for appropriate voluntary organisations, such as support groups and charitable organisations. [D(GPP)]

1.13.2.2.5 Information on nutrition support should be provided in formats, languages and ways that are suited to an individual's requirements. Consideration should be given to the developmental age, gender, physical needs, culture and stage of life of the individual. [D(GPP)]

1.13.2.2.6 Treatment options and plans should be discussed with the patient and decisions on treatment and care should be jointly made with the patient and carers. Treatment plans must be tailored around the patient's needs and wishes and his or her capacity to make decisions. [D(GPP)]

1.13.2.3 Prescription of nutrition support

1.13.2.3.1 Patients receiving nutrition support should have a prescription devised that considers all energy, protein, fluid, electrolytes, minerals and micronutrients needs. [D(GPP)]

1.13.2.3.2 In most patients starting enteral or parenteral nutrition support, particularly the very sick, full electrolyte, fluid and micronutrient needs should be provided from the outset but energy and nitrogen should be cautiously introduced according to metabolic and gastrointestinal tolerance over the first 24-48 hours, e.g. in intensive care patients this may mean commencing 50% of normal energy and nitrogen requirements. [D(GPP)]

1.13.2.3.3 In patients at risk of refeeding syndromes e.g. BMI <18.5 or recent weight loss>10% and very inadequate nutritional intake for >5 days, nutrition support should be introduced with caution and additional supplementation of potassium, phosphate and magnesium may be required. Close clinical and biochemical monitoring before and during treatment is essential. [D(GPP)]

1.13.2.4 Monitoring

1.13.2.4.1 A suggested monitoring protocol for nutritional, anthropometric, clinical and biochemical measures is listed below (Table 5). [D (GPP)]

1.13.2.4.2 Patients receiving different types of nutrition support will require the frequency and extent of this protocol to be adapted appropriately. [D(GPP)]

1.13.2.4.3 Acutely ill and unstable patients should be considered for a more frequent and extensive monitoring protocol. [D (GPP)]

1.13.2.4.4 Patients on home parenteral nutrition should be reviewed at least every 3-6 months, and the full range of tests as outlined above should be performed. [D(GPP)]

1.13.2.4.5 Patients receiving home enteral nutrition should be reviewed annually and/or if there is any change in their clinical condition since the last annual review. A limited range of tests from those outlined above should be performed, usually omitting the trace element and vitamin analyses, unless there is cause for concern. [D(GPP)]

1.13.2.4.6 Where long-term nutritional support is required patients should be trained to recognise and respond to adverse changes in both their well-being and in the management of their nutritional delivery system. [D(GPP)]

1.13.2.5 Oral nutrition support

1.13.2.5.1 Interventions to improve oral intake should be offered to hospital patients who can potentially swallow safely but

who are either malnourished (unintentional weight loss >10% over the last 3 to 6 months, BMI <18.5, or BMI <20 and unintentional weight loss >5% over the last 3 to 6 months) or who are at risk of malnourishment (not eaten for >5 days or unlikely to eat for >5 days). [A]

1.13.2.5.2 Interventions to improve oral intake such as additional food or supplements should also be considered for appropriate elderly patients in long term care with unintentional weight loss, who can swallow safely. [D]

1.13.2.5.3 The snacks or supplements offered to patients should aim to ensure that overall nutrient intake contains a balanced mixture of protein energy, vitamins and minerals. [D(GPP)]

1.13.2.5.4 A complete multi vitamin and mineral supplement providing the reference nutrient intake for all vitamins and trace elements should be considered for patients where there is concern about the adequacy of micronutrient intake. [D (GPP)]

1.13.2.5.5 Pre- and post-operative oral nutrition support should be considered for malnourished surgical patients (BMI<18.5 or weight loss>10% usual body weight, or BMI<20 and wt loss >5%). [B]

1.13.2.5.6 Resumption of some oral intake within 24 hours of abdominal surgery is recommended and is likely to reduce lengths of hospital stay. [A]

1.13.2.5.7 Any modification of nutrition and hydration methods should be based on a risk/ benefit analysis of clinical indicators relevant to that patient (Figure 1), the results of clinical/instrumental examinations and consideration of the factors in Figure 2. [D(GPP)]

1.13.2.5.8 Patients with dysphagia may require medication via a different route from nutrition and hydration and the risks and benefits of any medication should be given separate consideration. Alternative medications and timing may be indicated. [D(GPP)]

1.13.2.5.9 Regular monitoring and reassessing by appropriate specialists is needed to ensure that modified diets are only used for patients who still need them. [D (GPP)]

1.13.2.6 Enteral nutrition support

1.13.2.6.1 Enteral tube feeding should be considered in patients who need nutrition support (unintentional weight loss >10% over the last 3 to 6 months; BMI <18.5; BMI <20 and unintentional weight loss >5% over the last 3 to 6 months; not eaten for >5 days or unlikely to eat for >5 days) who have a functional, accessible gastrointestinal tract but an inadequate or unsafe oral intake. [D(GPP)]

1.13.2.6.2 Elective enteral tube feeding outside of this guideline's general indications for nutrition support is not recommended. [B]

1.13.2.6.3 General medical, surgical and intensive care patients should be fed intragastrically unless there is upper gut dysfunction. [A]

1.13.2.6.4 Patients with impaired upper GI function should be considered for post-pyloric feeding. [D(GPP)]

1.13.2.6.5 Gastrostomy/Jejunostomy feeding should be considered in patients needing long-term enteral tube feeding. [D(GPP)]

1.13.2.6.6 In the acute setting e.g. following dysphagic stroke, patients unable to safely swallow or take sufficient energy and nutrients orally should have an initial 2 week trial of nasogastric tube feeding while assessing the prognosis. [A]

1.13.2.6.7 For most patients on intragastric feeding, either bolus or continuous methods can be used, taking into account patient preference, convenience and drug administration. [B]

1.13.2.6.8 Nasogastric tube feeding should usually be delivered continuously over 16-24 hours daily for acutely ill patients in intensive care. [D (GPP)]

1.13.2.6.9 It is safe to start feeding through a PEG tube four hours after insertion in uncomplicated cases. [A]

1.13.2.6.10 A motility agent should be considered for patients in intensive care with delayed gastric emptying who are not tolerating enteral feeding unless there is suspicion of

gastrointestinal obstruction or a pharmacological cause. [A]

1.13.2.6.11 Patients in other acute care settings with delayed gastric emptying not tolerating enteral feeding should also be offered a motility agent unless there is suspicion of gastrointestinal obstruction or a pharmacological cause. [D (GPP)]

1.13.2.6.12 Patients with delayed gastric emptying which severely limits nasogastric feeding despite the use of motility agents should be considered for other methods of nutritional support. [D (GPP)]

1.13.2.6.13 A motility agent should be considered for patients in intensive care with delayed gastric emptying who are not tolerating enteral feeding unless there is suspicion of gastrointestinal obstruction or a pharmacological cause. [A]

1.13.2.6.14 Patients in acute care settings with delayed gastric emptying, not tolerating enteral feeding should also be offered a motility agent unless there is suspicion of gastrointestinal obstruction or a pharmacological cause. [D (GPP)]

1.13.2.6.15 Pre-operative supplementary enteral tube feeding should be considered in malnourished (weight loss>10% usual body weight, BMI<18.5) surgical patients who are to undergo major abdominal procedures. [B]

1.13.2.6.16 Early supplementary post-operative enteral tube feeding should not be used routinely in general surgical patients. [A]

1.13.2.6.17 Enteral tube feeding should be considered for all surgical patients who have not eaten for 5 days or who are unlikely to do so, along with those who have a BMI<18.5 or who have unintentionally lost >10% body weight. [D]

1.13.2.7 Parenteral nutrition support

1.13.2.7.1 Parenteral nutrition should be considered for patients who need nutrition support and who cannot be fed adequately by oral and/or enteral methods. [B]

1.13.2.7.2 Whenever possible enteral nutrition should be considered as the first option. In the presence of inadequate intestinal tolerance enteral nutrition should be supported with supplementary parenteral nutrition. [B]

1.13.2.7.3 Parenteral nutrition should be considered for malnourished patients who have a BMI<18.5 and or weight loss>10% and or have not eaten or are not anticipated to eat for > 5 days and who cannot be fed adequately by any other means. [D(GPP)]

1.13.2.7.4 Supplementary pre- and/or post-operative parenteral nutrition should be offered to surgical patients who have a non functioning gut and who are already malnourished. [B]

1.13.2.7.5 Early peri-operative supplementary parenteral nutrition should not be offered to well-nourished or mildly malnourished patients. [B]

1.13.2.7.6 For hospitalised patients requiring parenteral nutrition, where a centrally placed central venous catheter is not otherwise required or in situ a peripherally inserted central catheter (PICC) can be a suitable alternative. [B]

1.13.2.7.7 For patients requiring short term, <14 days parenteral nutrition who do not need central access for other reasons, peripheral venous access should be considered. Attention to parenteral nutrition formulation is essential to ensure the absence of complications and length of successful parenteral nutrition. [B]

1.13.2.7.8 Tunnelling subcutaneous catheters for long-term use (>14 days) is recommended. [D(GPP)]

1.13.2.7.9 Tunnelling catheters is not recommended for short-term use (<14 days). [B]

1.13.2.7.10 Patients prescribed standardised parenteral nutrition need their nutritional requirements to be determined before selection of a particular parenteral nutrition product. The addition of vitamins and trace elements is always required and occasionally electrolytes and other nutrient supplements are needed. Additions must be made under appropriate pharmaceutically controlled environmental conditions before administration. [D (GPP)]

1.13.2.7.11 Continuous administration of parenteral nutrition should be offered as the preferred method for infusion in most acutely ill intensive care and surgical patients. [B]

1.13.2.7.12 Cyclical delivery of parenteral nutrition should be considered when using peripheral venous catheters with planned routine change. [B]

1.13.2.7.13 Gradual change from continuous to cyclical parenteral nutrition administration should be considered in patients requiring parenteral nutrition support for periods of more than 2 weeks. [D(GPP)]

1.13.2.8 Organisation of nutrition support

1.13.2.8.1 Parenteral nutrition should be provided within a care setting which has multidisciplinary staff who have had specific training in nutritional support e.g. a nutrition support team, and with agreed protocols for indications, practice, monitoring and audit. [C]

1.13.2.8.2 All patients receiving enteral tube feeding should also be supported by a team of multidisciplinary staff who have had specific training in nutritional support e.g. a nutrition support team, and with agreed protocols for indications, practice, monitoring and audit. [D(GPP)]

1.13.2.8.3 Prior to discharge patients receiving home nutrition support and their carers should:

- ***be provided with an instruction manual (and visual aids where appropriate) outlining procedures***
- ***be provided with both contact and emergency telephone numbers***
- ***be aware of when and how follow up will take place. [D(GPP)]***

1.13.2.9 Nutrition support at home

For recommendations that would apply to patients on home enteral nutrition, please see 1.13.2.8.2, 1.13.2.8.3, 1.13.2.4.5, 1.13.2.4.6 and 1.13.2.6.5.

For recommendations that would apply to patients on home parenteral nutrition, please see 1.13.2.8.1, 1.13.2.8.3, 1.13.2.7.8 and 1.13.2.4.6.

Recommendations on the provision of information for patients and carers can be found in sections 1.13.2.2.4, 1.13.2.2.5 and 1.13.2.2.6.

1.13.3 Research recommendations

The guideline group made a number of recommendations for research in areas where evidence is lacking. They selected 5 of these that were considered to be the highest priority. These are:

1.13.3.1 What are the benefits to malnourished surgical patients who have indications for enteral tube feeding being offered enteral tube feeding only compared to enteral tube feeding and parenteral nutrition if they fail to tolerate >60% of their target nutritional needs two days after starting enteral tube feeding in terms of survival, complications and hospital costs?

1.13.3.2 What are the benefits of nutritional screening (using a simple tool such as MUST) compared to not screening patients in; a) primary care (attending GP clinics), b) care homes c) hospital inpatients d) hospital outpatients in terms of determining the number of patients at risk of malnutrition, complications, survival, length of stay, quality of life and cost effectiveness?

1.13.3.3 What are the benefits of patients (in hospital or community and including the elderly) identified as high risk of malnutrition by a screening tool such as MUST being offered oral sip feeds compared to a) dietary modification and or food fortification, or b) dietary modification and or food fortification and dietary counselling in terms of determining complications, survival, length of hospital stay, quality of life and cost effectiveness?

1.13.3.4 What are the benefits to patients in primary care identified as high risk of malnutrition by a screening tool such as MUST being offered oral sip feeds compared to being offered; a) combined micro and macronutrient supplement or b) micronutrient supplementation alone c) standard care (no specific dietary intervention) or d) placebo in terms of survival, hospital admissions, quality of life and cost effectiveness?

1.13.3.5 What are the benefits to patients who present with the indications for parenteral nutrition being fed only 50% of

estimated nitrogen and energy needs but with full micronutrient and electrolyte provision for first 5 days, followed by feeding at full needs compared to being fed 100% of estimated needs from the first day of feeding in terms of; metabolic complications, infection rates, duration of parenteral feeding, mortality, length of hospital stay, and time to 'medically fit for discharge.

The following research recommendations were also made:

1.13.3.6 What are the benefits to Intensive care patients likely to stay for >5 days, who are offered ETF only compared to ETF and PN if they fail to tolerate >60% of their target nutritional needs 2 days after starting ETF in terms of survival, complications and hospital costs?

1.13.3.7 What are the benefits to Intensive care patients likely to stay for >5 days who have contraindications to ETF being offered standard PN compared to either PN with additional glutamine, PN with additional selenium, or PN with additional glutamine and selenium in terms of survival, complications and hospital costs?

1.13.3.8 What are the benefits to patients who need short-term parenteral nutrition support being offered standard PN compared to either PN and minimal EN (<25ml/hr) or PN with Glutamine and minimal EN (<25ml/hr) in terms of survival, complications and hospital costs?

1.13.3.9 What are the benefits to patients who have indications for PN due to acute but reversible intestinal failure (e.g. prolonged ileus) being commenced on PN within 6 days of developing that failure compared to not commencing until 12 days after the development of that failure if the feeding problem has not resolved in terms of; metabolic complications, infection rates, duration of PN feeding, mortality, duration of hospital stay, time to 'medically fit for discharge

1.13.3.10 Further research is needed into whether thickened liquids or standard/ unthickend liquids improve low mood and reduce dehydration, mortality, the need for enteral feeding and the number of aspiration incidents in patients with oro-pharyngeal dysphagia (as assessed by a trained practitioner).

1.13.3.11 Further research is needed into whether pureed food or standard/ soft food improves nutritional levels, the safety

and efficiency of swallow, and the number of aspiration incidents in patients with oro-pharyngeal dysphagia (as assessed by a trained practitioner).

2 Malnourishment and the principles of nutrition support

2.1 Introduction

The purpose of this guideline is to present evidence and guidance related to nutrition support but in view of the problems related to studies of nutritional intervention (described in section 1.11), the Guideline Development Group (GDG) agreed to base some of the recommendations on principles derived from understanding the causes and effects of malnutrition in patients. This chapter covers these issues.

2.2 The causes of malnutrition

The main causes of malnutrition can be categorised under four headings (summarised in Table 3):

- impaired intake;
- impaired digestion and or absorption;
- altered metabolic nutrient requirements; and
- excess nutrient losses.

The relative importance of each class of problem varies and multiple factors often occur simultaneously. Physical factors, usually associated with illness, are the predominant cause of malnourishment in UK adults, although psychosocial issues have significant effects on dietary intake in some groups (e.g. the socially isolated, the bereaved, and some elderly subjects). Since malnutrition both predisposes to disease (Table 3) and is simultaneously an outcome of disease, patients may enter a downward spiral of ill-health due to malnutrition-disease interactions.

Table 3: Factors contributing to disease related malnourishment

Problem	Cause
Impaired intake	Poor appetite: illness (a major and common cause); pain/nausea when eating; depression/anxiety; food aversion; drug addiction Inability to eat: diminished consciousness; confusion; weakness or arthritis in the arms or hands Lack of food: poverty; poor quality diet at home, in hospital or in care homes; problems with shopping and cooking Restricted dietary intake for investigation or surgery

	Dysphagia or vomiting
Impaired digestion &/or absorption	Medical and surgical problems effecting stomach, intestine, pancreas and liver
Altered requirements	Increased or changed metabolic demands related to illness, surgery, organ dysfunction, or treatment
Excess nutrient losses	Gastrointestinal losses: vomiting; diarrhoea; fistulae; stomas; nasogastric tube and other drains. Other losses: e.g. skin exudates from burns

2.3 The effects of malnutrition

Malnutrition detrimentally effects physical function, psychosocial well-being and the outcome of disease. It can affect every system and tissue of the body, see Table 4.

Table 4: Some physical and psycho-social effects of undernutrition

Adverse effect	Consequence
Impaired immune responses	Predisposes to infection and impairs recovery when infected
Impaired wound healing	Surgical wound dehiscence, anastamotic breakdowns, development of post-surgical fistulae, failure of fistulae to close, increased risk of wound infection and un-united fractures. All can then lead to prolonged recovery from illness, increased length of hospital stay and delayed return to work
Reduced muscle strength and fatigue	Inactivity, inability to work effectively, and poor self care[83,97,175,312]. Abnormal muscle (or neuromuscular) function may also predispose to falls or other accidents
Reduced respiratory muscle strength	Poor cough pressure, predisposing to and delaying recovery from chest infection. Difficulty weaning malnourished patients from ventilators
Inactivity, especially in bed bound patient	Predisposes to pressure sores and thromboembolism
Water and	Malnourished individuals are usually depleted in whole body

Adverse effect	Consequence
electrolyte disturbances	potassium, magnesium and phosphate, while simultaneously overloaded in whole body sodium and water. They also have reduced renal capacity to excrete a sodium and water load. This leads to vulnerability to re-feeding syndrome (see section 5.5) and iatrogenic sodium and water overload.
Impaired thermoregulation	Hypothermia and falls, especially in the elderly
Vitamin deficiencies	Specific vitamin deficiency states e.g. scurvy and vitamin related re-feeding risks e.g. Wernike-Korsakoff syndrome (see section 5.5.2)
Menstrual irregularities/amenorrhoea	Infertility and osteoporosis
Impaired psycho-social function	Even when uncomplicated by disease, patients who are undernourished may experience apathy, depression, self-neglect, hypochondriasis lack of self esteem, poor body image, possible confusion about slow recovery, lack of interest in food, loss of libido and deterioration in social interactions[175,312]. Undernutrition may also affect behaviour and attitude [see section 11.3]

2.4 The prevalence of malnutrition

There are many different anthropometric, clinical and biochemical criteria that have been used to assess malnutrition and these have resulted in widely varying reports of its prevalence. One of the simplest criteria is current weight status (e.g. body mass index; BMI). The proportion of underweight adults (BMI<20 kg/m^2) in the UK varies considerably according to care setting: 10-40% in hospitals and care homes; $\leq$ 5% in the general population at home, and >10% in those at home with chronic diseases of the lung and gastrointestinal tract, or those who have had surgery in the previous 6 weeks. The 'Malnutrition Universal Screening Tool' (MUST)[81], which incorporates both current weight status and unintentional weight loss, has identified more than 10% of the general population aged 65 years and over as being at medium or high risk of malnourishment[81-83,313]. In hospitalised patients, the same degree of risk is seen in 10-60% depending on ward and patients' age. Similar very high prevalence's of nutritional risk are seen in residents of care homes but although most malnutrition is found in the community (>95%), most malnutrition related expenditure is in hospital.

The prevalence of individual nutrient deficiencies is also disturbing, especially in older subjects. For example, in people aged 65 years and over[97], folate deficiency affects 29% of those who are free living (8% in severe form) and

35% of those in institutions (16% in severe form). Similarly, vitamin C deficiency in such people affects 14% of those who are free living (5% in a severe form) and 40% of those in institutions (16% in severe form). Nutrient deficiencies and protein-energy malnutrition commonly coexist[312].

2.5 Principles underlying intervention

The difficulties inherent in nutritional support mean that there is little hard evidence to assist with decisions on how and when to treat patients who are either undernourished or at risk of becoming so. However, sensible approaches can be derived from understanding 3 types of observations:

1. Cross-sectional studies suggest that nutritionally related problems are likely to occur in individuals who are thin or who have recently lost weight e.g. those with BMIs of <20 and especially <18.5 and/or those who have lost >5% of their usual body weight, especially those who have lost >10%.

2. Studies in healthy volunteers show that measures such as muscle strength and white cell function decline within 72 hrs of complete starvation and by 7 days of little or no intake there is significant detriment in most of the nutritionally influenced factors listed in Table 4. These ill effects reverse promptly with the provision of adequate feeding.

3. Studies in malnourished patients show rapid functional benefits when adequate feeding is provided and these changes occur well before the weight lost has been regained (e.g. malnourished patients have low collagen deposition rates in surgical wounds but show improved deposition within days of receiving nutritional support).

With these observations in mind, good nutrition should benefit both those who are already overtly malnourished in terms of BMI or recent weight loss *and* those who are developing nutritional risks by having eaten little or nothing for approaching 7 days. In addition, nutrition support can often provide simple direct benefits by :

- Keeping patients who are eating inadequately, alive for long enough for specific medical or surgical interventions to take effect.

- Making malnourished patients feel better, improving their ability to cope with ill-health.

- Maintaining strength through patients' illnesses so that their recuperation is shortened and they are less susceptible to further problems.

- Providing long-term support for those patients with chronic inability to eat, drink or absorb adequately.

The principles above underlie many of the recommendations proposed in these Guidelines. They are also in keeping with reports from patients on the benefits of becoming better nourished which were found in a literature search on patients' experiences of long-term nutritional support.

> "With every passing day I felt stronger. I began getting up and walking in the hallways"[32]
>
> "….my general health had improved as a result of being better nourished by the total parenteral nutrition….I had gained back all of the weight that I had originally lost….I savoured every moment of standing on the scale and hearing that I had gained weight every day as much as I once had loathed and feared the experience"[356].

3 Nutritional assessment and screening

3.1 Nutritional assessment

Early identification of patients who are nutritionally depleted (or likely to become so) is vital if you are to provide help and achieve the most effective use of resources. Although biochemical measurements can contribute to nutritional assessment, none are specific for nutritional risk e.g. a low serum albumin is almost always a marker of an acute phase response or saline overload rather than a marker of malnourishment. There is therefore no alternative to measurements of weight and height, along with other anthropometric measures in specialist circumstances. These measurements are then combined with consideration of the following:

- Has the patient been eating a normal and varied diet in the last few weeks?

- Has the patient experienced voluntary or involuntary weight loss recently? *Obesity or fluid balance changes and oedema may mask loss of lean tissue. Rapid weight loss is a concern in <u>all</u> patients whether obese or not.*

- Can the patient eat, swallow, digest and absorb enough food safely to meet their likely needs?

- Does the patient have an unusually high need for all or some nutrients? *Surgical stress, trauma, infection, metabolic disease, wounds, bedsores or history of poor intake may all contribute to such a need.*

- Does any treatment, disease, physical limitation or organ dysfunction limit the patient's ability to handle the nutrients needed to meet current or future requirements?

- Does the patient have excessive nutrient losses through vomiting, diarrhoea, surgical drains etc.?

- Does a global assessment of the patient suggest undernourishment? *Low body weight, fragile skin, poor wound healing, apathy, wasted muscles, appetite, taste sensation, altered bowel habit. Discussion with relatives may be important.*

- In the light of all the above, can the patient meet all of their requirements by voluntary choice from the food available?

Considering all the above takes time and expertise and so simple, repeatable non-expert screening tools have been developed to identify those in need of more careful assessment.

3.2 Why and how to screen

3.2.1 Introduction

Several studies have found that undernutrition is widespread among hospital in-patients and common in some community settings [81,314]. Many screening tools have been developed to help identify such individuals[93,163] and given the high prevalence of undernutrition and lack of proper management of patients in various settings, routine nutritional screening should result in early identification of patients who might have otherwise been missed. It may also help in establishing reliable pathways of care for patients with undernutrition which could include provision of support, advice for junior clinicians, access to dieticians and provision of adequate follow-up.

Routine assessment of weight and height in hospitals as well as in high-risk groups in the community has been recommended by many expert panels [81,193,207,276,299]. However, despite these efforts and publicity, recent studies suggest that weight and height of patients are still not systematically recorded in hospitals, making it difficult to estimate BMI, change in weight and risk of undernutrition[48]. It is also known that many nutritional screening tools were developed with no reference to defined methodological criteria [8,163]. Recently, however, an easy to use, well defined nutritional screening tool the Malnutrition Universal Screening tool - 'MUST'- was developed [81] and this or an equivalent has been widely recommended in an attempt to improve quality of nutritional care in hospitals and other care settings[236]. MUST can be used for the screening of both undernutrition and obesity.

Introducing any screening programme, however, can invoke costs to health systems (personnel time and treatment costs) and problems for patients (e.g. because of false negatives, false positives, and side effects from potential treatments). It is therefore important to try and assess the effectiveness of nutritional screening programmes in similar fashion to studies that have established screening programmes in other areas of care [279].

A nutritional screening programme refers to the application of a screening tool in a group of patients or apparently healthy individuals, for whom the level of undernutrition risk is unknown, in order to establish the level of risk.

3.2.2 Methods

In view of the above, a systematic review of evidence for the benefits of screening for malnourishment was conducted, taking care to distinguish between screening and assessment (as discussed previously, assessment is more detailed and targets patients already considered to be 'at risk' of undernutrition, whilst screening targets patients for whom the risk of under-nourishment is unknown). In practice, however, the line between the two is often blurred and so careful attention is needed when examining the relevant literature. Furthermore, nutritional screening can be offered as a stand alone intervention or as part of a wider strategy (e.g. a multi-component screening and/or interventional strategy for quality improvement). Such a 'multiple

screening and intervention package' is more likely to be seen in primary care settings, for example in the elderly population.

3.2.3 Studies considered for this review

The systematic review aimed to examine the (cost) effectiveness of nutritional screening in improving quality of care (professional practice) and patient outcomes compared with usual care.

Because of a perceived lack of good quality evidence it was decided *a priori* that all experimental and quasi-experimental studies in which nutritional screening is compared with a control intervention (e.g. usual care) would be eligible for inclusion in the review. In line with the guideline scope, studies from different settings (including hospitals, long term care institutions, community and primary care) were considered eligible.

3.2.4 Clinical evidence

Three primary studies were considered eligible for inclusion (Table 14). The studies were heterogeneous in their designs, settings, interventions and outcomes. Therefore, no quantitative synthesis was conducted.

The first study, a cluster randomised trial, had been conducted in a US primary care setting[227]. The intervention practices offered screening for eight ailments (including malnutrition) to patients older than 70 years on their first visits to the practices. The study found participating physicians were receptive to the intervention; but it did not result in any improvement in detection rate, nutritional intervention rate or patients' quality of life. However, the study was underpowered and there were concerns about the quality of the screening tool used in the study.

The other two studies had been conducted in hospitals. One UK controlled study offered nutritional screening to patients admitted to two hospital wards and used a further two wards as controls. The control wards received usual care. The mean age of the hospitalised patients was 67. As a result of the intervention, patients' weight recording in the intervention wards increased from 26% to 72% while it decreased in the control wards. The study observed no change in meal-time observation for the 'at risk' patients, and referral to the dieticians decreased in both intervention and control wards. The study did not report patient outcomes. This study suffered from weak design and lack of measurement of appropriate outcomes.

The third study was conducted in three hospitals in the Netherlands[278]. The intervention was screening patients older than 60 years for malnutrition (using the MNA-sf), dysphagia and dehydration followed by immediate treatment, including menu modification or supplements. The intervention was offered in one hospital and the other two acted as controls. The study reported statistically significant weight gain and reduction in hospital acquired infection rate in the intervention hospital. It observed no change in pressure ulcer rates

and length of hospital stay. The study concluded that targeted nutritional screening improved quality of care for elderly patients. For some of the outcomes (e.g. length of stay, hospital infection rate) the study did not report the 'before' rates.

3.2.5 Cost-effectiveness evidence

Only one of the above studies evaluated cost or cost-effectiveness[278]. The study found a significant reduction in complications and a significant weight gain in the intervention arm (Table 15 and Table 16). In their base case they found that the weight gain was achieved at a cost of 56 euros (£39) per kg gained. As a sensitivity analysis, hospital costs associated with length of stay were included and the result was that screening was cost-saving; however, length of stay was highly variable and not statistically significant. Alternatively, the worst case scenario suggested a cost of 530 euros (£369) per kg gained.

It is difficult to judge whether this represents good value for money since weight gain is not easily converted into patient outcomes and since there is no accepted threshold of cost per kg gained. Cost-effectiveness modelling on this topic could provide a clearer answer and could utilise broader evidence on the effectiveness of oral nutritional interventions. An original model was therefore developed for these guidelines to explore the cost-effectiveness or malnutrition screening and intervention.

3.2.6 Cost-effectiveness model

A cost-utility analysis was undertaken from the perspective of the NHS and personal social services. Expected costs and health outcomes (quality-adjusted life-years) were calculated using decision analysis, with life expectancies being estimated by life-table analysis. Full details are given in Appendix Five.

A screening strategy ('Screen') was compared with a strategy of ward nurses selecting patients for oral nutrition support using sip feeds with later dietetic input if this was unsuccessful ('Nurse'), and with a strategy of no oral nutrition intervention ('Don't Treat'). The target population chosen for the base case was elderly inpatients. This population was chosen because it is known to have a high prevalence of malnutrition and because there have been a number of RCTs evaluating oral nutrition interventions for this group.

Screen was more effective but more costly than the other two strategies. The incremental cost per QALY gained for Nurse compared with Don't treat was £9,335 per QALY gained and £6,773 for Screen compared with Nurse. Since both are below the £20,000 per QALY threshold, it suggests that malnutrition screening would be cost-effective for the NHS. The Screen strategy was no longer cost-effective when:

- the mortality relative risk was high (i.e. the relative risk reduction was small), or
- the baseline mortality rate was low (and therefore the *absolute* risk reduction from intervention was small), or
- mortality does not revert back to the general population level after the trial follow-up period.

The model shows that a strategy of nurses giving out sip feeds in hospital, without the use of a systematic screening tool, is unlikely to be cost-effective compared with screening. Furthermore, the average clinical effectiveness estimated for this strategy may be an overestimate because we have not incorporated the negative impact of giving oral intervention in those patients which do not need intervention. In particular, we would expect side-effects in patients with undiagnosed diabetes.

The model found that screening (the Screen strategy) is likely to add to hospital and health service costs, since the clinical trial evidence on oral nutrition intervention did not indicate substantial reductions in complication rates or length of stay from the use of oral nutrition intervention. This increase in cost is consistent with the findings of the one published cost-effectiveness analysis of malnutrition screening described above[278]. However the incremental cost per QALY gained for Nurse compared with don't treat was £9,335 per QALY and for Screen compared with Nurse was £6773 per QALY. Since both were below the £20,000 QALY threshold, it suggests that malnutrition screening would be cost-effective for the NHS. The model shows that a strategy of nurses giving out sip feeds in hospital without the use of a systematic screening tool, is unlikely to be cost-effective compared with screening.

The model suggested that investment in screening would be cost-effective (<£20,000 per QALY gained), using the base case assumptions. However, the results were highly sensitive to the assumptions made with regard to the baseline mortality rate, the relative risk and the proportion of patients that would revert back to the age-specific population-level mortality rate after the trial follow-up period.

It is unlikely that the mortality rate for the patients in the trials would have returned to the level of the general population since many would have been chronically or terminally ill, however, it is also unlikely that their mortality would have continued at the rate observed in the trials since many of the patients would have been acutely ill for at least part of this period. The reality is difficult to determine but would be somewhere in between and the sensitivity analysis indicates that cost-effectiveness of malnutrition screening is sensitive to this assumption.

The model's base case assumptions were deliberately conservative in the following ways. We assumed that the risk reduction observed in the trials did not continue beyond the observation period. Also, we assumed that a proportion of patients would have enteral tube-feeding, even though this

guideline does not advocate tube-feeding, except where oral nutrition is not possible.

There are a few assumptions that might bias the model in favour of screening. Most importantly, the meta-analysis of oral interventions in the at risk elderly shows a likely but not definite reduction in mortality. Furthermore, the level of compliance achieved and clinical effect observed in the trials might be greater than that achievable in normal clinical practice, where protocols might be less rigorously enforced and patients less well selected. Certainly, it has been observed that the wastage of sip feeds in NHS hospitals can be very high[119], but this might well be reduced if proper screening protocols led to better selection of patients and more rigorous application of interventions.

In our model, we also estimated that the cost per patient of training and quality assurance was rather low; however, the published cost-effectiveness analysis[278] based on a real intervention showed these costs to be rather high because they were averaged over only 140 patients. We would argue that such costs can be kept low if screening is conducted at a hospital-wide level, and would urge implementers to take this into consideration.

3.2.6.1 Transferability to other settings

We believe that the model reflects with a reasonable level of accuracy the costs and benefits of screening, given the particular intervention strategies specified and the populations covered by the clinical trials included. However, with alternative strategies or alternative settings/populations the cost-effectiveness could be quite different.

The nutrition intervention that was costed in our model comprised of sip feeds, nurse time and dietician time (and tube-feeding for a small minority of patients). If alternative intervention strategies are used the cost-effectiveness could be different – less labour-intensive interventions might be less costly but they might also be less effective. Nor can we be sure that screening is as cost-effective in non-elderly populations, especially, if the prevalence of malnutrition is lower.

In general practice, screening could be less cost-effective than in hospital if patients at risk are more likely to be identified without the use of a screening tool because their co-morbidities are known to practice staff or if the incidence of malnutrition is lower than in hospital. Furthermore, the paucity of evidence about risk reduction, and the likelihood that risk reduction from intervention would be less in a lower risk population makes it even more difficult to assess. In the community, sip feeds would also be purchased at the full market price rather than the heavily discounted hospital price.

Similar arguments are likely to apply in care homes, and residents in such settings may also be less amenable to intervention or to risk reduction from intervention (e.g. those with multiple and severe comorbidities or dementia). In addition, screening may be less cost-effective if the mortality rate (not malnutrition-related) is high and therefore the potential benefits from

intervention are less. There are also increased costs of care with added days of life.

3.2.7 Conclusions

Using the evidence from the literature and expert opinion, we found that malnutrition screening in elderly hospital inpatients could be cost-effective. However, there is great uncertainty about some of the variables that determine cost-effectiveness and crucially it is dependent on the estimated survival benefit during the intervention period and the survival rates of patients beyond the follow-up periods of the relevant clinical trials.

The cost-effectiveness of screening in other settings is even harder to determine.

3.2.8 Consensus development methods

Because of weaknesses in the methodologies and designs of the identified studies, no firm conclusion could be made and the cost-effectiveness model also highlighted uncertainties in the value of screening. The group therefore conducted a consensus development exercise to utilise the expertise of the GDG for making recommendations.

We used a modified Delphi approach for consensus development[28,231]. It comprised three stages: two rounds of Delphi questionnaire surveys (plus an in-group discussion meeting), and then a nominal group technique meeting. It was decided a priori that if 80% of the members agreed on a recommendation, then the consensus had been achieved. After each Delphi round, the results were quantitatively summarised and fed back to the group in meetings. The views expressed in the surveys were anonymised and presented to all the members. In the nominal group technique meeting, all the members expressed their views, in rounds, about all potential recommendations. Final votes were obtained privately. The results of the consensus development exercises demonstrated the existence of consensus for all four pre-defined settings.

3.3 Recommendations for nutrition screening

3.3.1 Ideally all hospital inpatients should be screened for (risk of) under-nutrition on admission using a simple screening tool that includes BMI, percentage weight loss and considers the time over which nutrient intake has been reduced (e.g. MUST). Screening should be repeated weekly in acute settings. Departments with low risk of under-nutrition may opt-out of screening. Opt-out decisions should follow an explicit process via the local clinical governance structure involving experts in nutrition support. [D(GPP)]

3.3.2 All hospital 'out-patients' should be screened for (risk of) under-nutrition at the first clinic, using a simple screening tool (e.g. MUST). Departments with low risk of under-nutrition may opt-out of screening. Opt-out decisions should follow an explicit process via the local clinical governance structure involving experts in nutrition support. [D(GPP)]

3.3.3 All residents or patients in care homes should be screened for (risk of) under-nutrition on admission using a simple screening tool (e.g. MUST), and whenever there is clinical concern and risk of under-nourishment. [D(GPP)]

3.3.4 Nutritional screening for under-nutrition should be undertaken on registering at general practice, and where there is clinical concern of (risk of) under-nutrition, and should be considered at other screening opportunities. [D(GPP)]

3.3.5 Nutritional assessment and screening should be carried out by healthcare professionals with appropriate training and skills to help generate the confidence of patients and enable accurate data collection. [D (GPP)]

3.4 Impact of nutritional assessment on the patient

Patient representatives on the GDG recognised the importance of nutritional assessment and screening as being in the patient's interest. Health care professionals should communicate to the patient how and why assessment and screening are being undertaken. These need to be carried out by competent healthcare professionals to ensure accuracy of the information obtained.

Good communication skills and a non-judgemental attitude by healthcare professionals will help to create a suitable environment in which the patient will feel comfortable to be open and provide accurate and helpful information.

Aspects of nutritional assessment and routine measurements of weight, height and other anthropometric measurements may be perceived by the patient as an invasion of personal space and information. Healthcare professionals

should be aware of this and respect the patient's dignity. Upon conclusion of assessment and screening this information should be documented and stored both for future reference and to minimise unnecessary repetition.

3.5 Research recommendations

3.5.1 What are the benefits of nutritional screening (using a simple tool such as MUST) compared to not screening patients in; a) primary care (attending GP clinics), b) care homes c) hospital inpatients d) hospital outpatients in terms of determining the number of patients at risk of malnutrition, complications, survival, length of stay, quality of life and cost effectiveness?

There is no clear evidence available as to whether screening is really beneficial or how it should be carried out. With the lack of evidence the GDG have considered in detail this problem and have instead carefully developed consensus statements to support recommendations for screening. As a priority it is important that we determine the need for screening and intervention in the community.

4 Indications for nutrition support

4.1 Introduction

Since adequate nutrition is fundamental to good health and resistance to disease, all patients' nutritional needs should be met unless prolongation of life is not in their best interest (section 4.7) or the risks of trying to provide nutrition outweigh the potential benefits. In the majority of cases, adequate nutrition can be achieved by providing good food, as long as care is taken to ensure that the appropriate consistency of food is used and physical help with eating is provided when necessary. In hospitals, it is also important that meals are not missed and that intake restrictions related to investigations or surgical procedures are minimized.

Nutrition support involves the provision of nutrition *beyond* that provided by normal food intake using oral supplementation, or enteral tube and parenteral feeding. The overall aim of nutrition support is to try to ensure that total nutrient intake (food + support) provides enough energy, protein, fluid and micronutrients to meet all the patients' needs. When feasible, it should be given via the gastrointestinal (GI) tract, which is generally effective and relatively inexpensive. The following methods can be used:

- Modified food and menus
- Food fortification
- Oral nutrition supplements e.g. sip feeds
- Enteral tube feeding

Feeding via the GI tract is also relatively safe although there are some risks if ETF is needed (Chapter 8).

If the GI tract cannot be accessed or there is either partial or complete intestinal failure (e.g. with obstruction, ileus, extensive surgical resection or malabsorption), some or all of a patient's nutritional needs may have to be met using an intravenous infusion parenteral nutrition (PN). This entails significant risks (Chapter 9) and costs but should always be considered if it is the only way to feed a patient effectively.

4.2 Methodology

Decisions on when and to whom nutrition support should be offered can be difficult and require careful consideration. Oral, enteral and parenteral methods of nutrition support are not mutually exclusive and although we carried out a number of reviews on the benefits and risks of oral, enteral and parenteral interventions, the literature does not yield data that provide hard evidence on the indications for nutrition support for the reasons outlined in Section 1.11. Instead the GDG with their expertise knowledge of clinical

practice agreed by informal consensus on the appropriate guidance when considering whether a patient needs oral, enteral and or parenteral nutrition support. They agreed that consideration of the following is needed:

- The extent to which the patient is meeting their nutritional needs through ordinary eating and drinking.
- The length of time that intake has been inadequate and/or is likely to remain inadequate.
- The patient's current nutritional status in terms of BMI, recent weight loss and evidence of any specific nutrient deficiencies.
- The patient's current medical conditions and the appropriateness of increasing levels of nutritional and other medical intervention.
- Any ethical considerations regarding the patient's best interests (Section 4.7) The ethics of nutrition support).
- The potential means for providing nutrition support and whether this would entail any risks.

Many of the above are also not mutually exclusive e.g. patients may be taking anything between 0% and 100% of their needs and have had their particular level of deficit for variable lengths of time.

4.3 Rationale for recommendations

Since it is impossible to make firm recommendations to cover all circumstances, ideally decisions on instigating nutrition support should involve individuals with expertise in clinical nutrition. Nevertheless, the principles of nutrition support outlined in Chapter 2 permit the following broad recommendations on when to consider active nutritional intervention.

4.4 Recommendations

4.4.1 Nutrition support should be considered in patients when:

- **the patient has not eaten or is very unlikely to be eating for more than 5 days (whatever their current nutritional status and BMI), or**
- **the patient's BMI is <18.5, or**
- **the patient has unintentionally lost >10% body weight over the previous 3-6 months, or**
- **the patient has a BMI <20 with unintentional weight loss >5%, or**

- **when the patient has poor absorptive capacity, is catabolic and/or has high nutrient losses. [D(GPP)]**

For specific guidance on when oral, enteral and parenteral nutrition support may be required please see the recommendations in sections 7.7, 8.4 and 9.2.8.

4.4.2 Healthcare professionals should ensure that ethical and legal issues are considered when any decisions regarding the nutrition support of patients are made. [D(GPP)]

4.4.3 Healthcare professionals should ensure that there is a regular review of the need for and route of nutrition support for all patients. [D(GPP)]

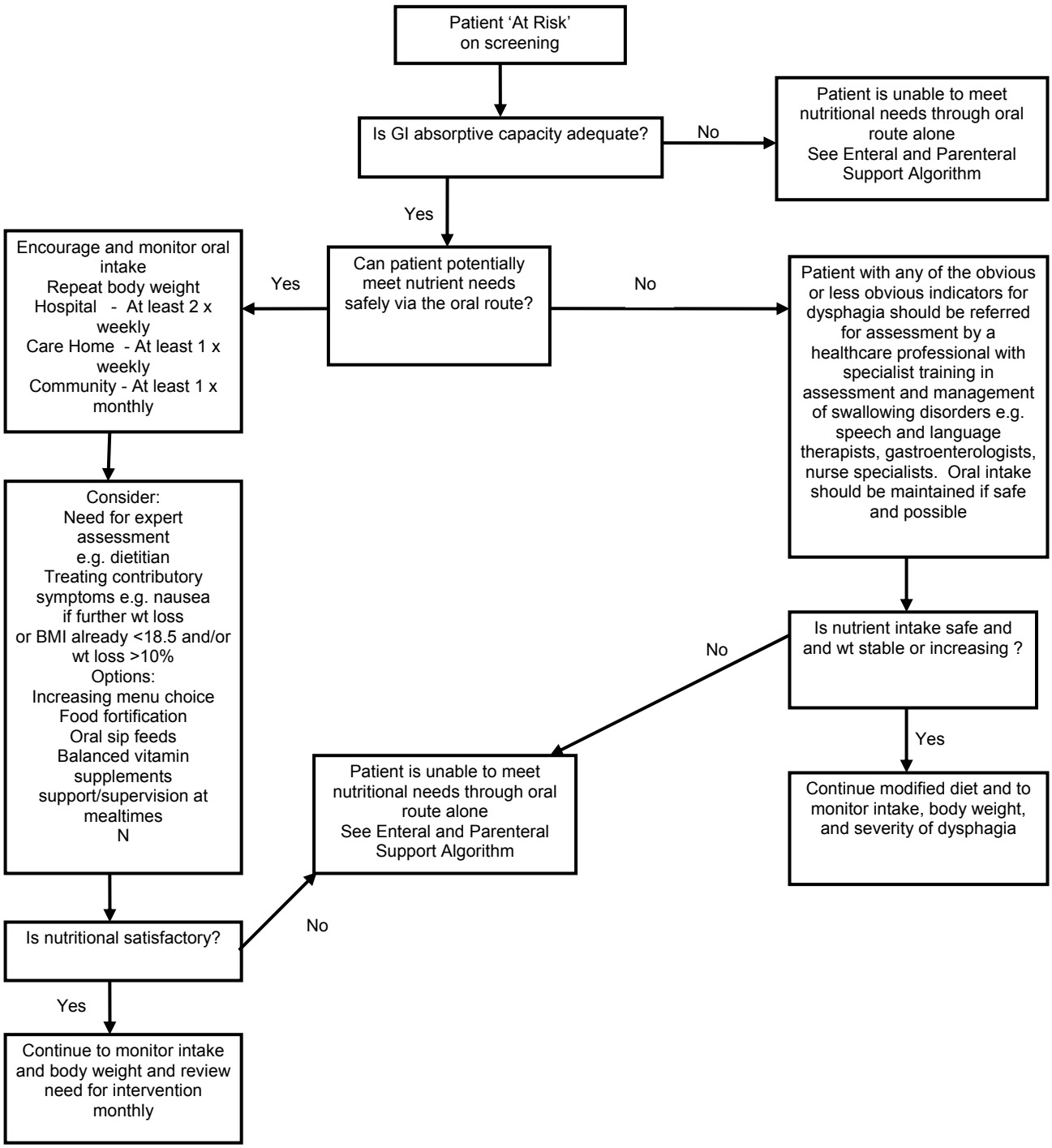
4.4.4 Patients having treatment for malnutrition should be kept fully informed and have access to appropriate sources of information and/or the opportunity to discuss diagnosis and treatment options. They should also be given contact details for appropriate voluntary organisations, such as support groups and charitable organisations. [D(GPP)]

4.4.5 Information on nutrition support should be provided in formats, languages and ways that are suited to an individual's requirements. Consideration should be given to the developmental age, gender, physical needs, culture and stage of life of the individual. [D(GPP)]

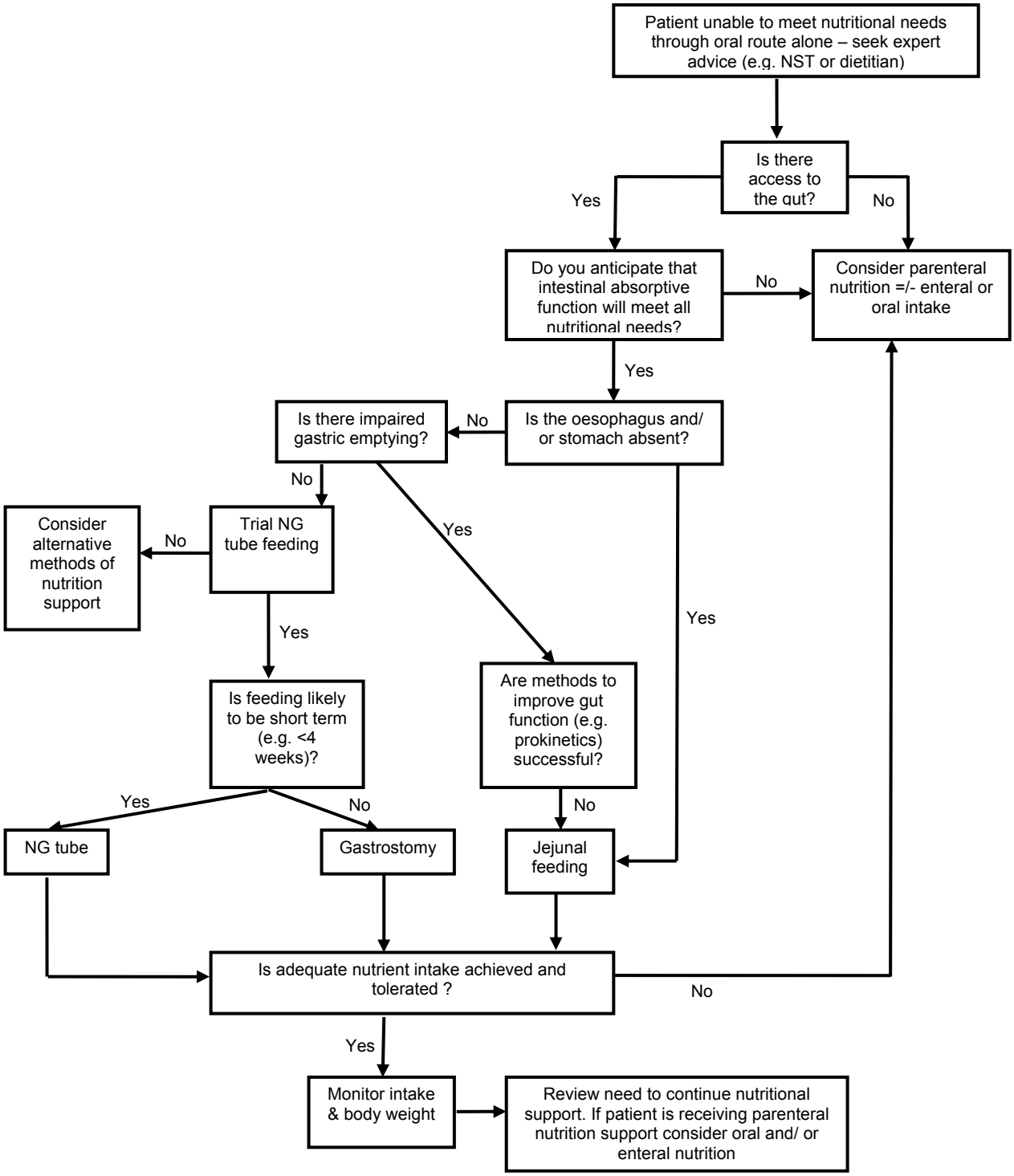
4.4.6 Treatment options and plans should be discussed with the patient and decisions on treatment and care should be jointly made with the patient and carers. Treatment plans must be tailored around the patient's needs and wishes and his or her capacity to make decisions. [D(GPP)]

These recommendations have been incorporated into the algorithms in Section 4.5 and 4.6

4.5 Algorithm for Oral Nutrition Support



4.6 Algorithm for Enteral and Parenteral Nutrition Support



4.7 Ethical and legal issues in nutrition support

The provision of artificial nutrition is fraught with ethical and legal difficulties and all those involved in nutrition support should be familiar with these. The following points are taken from reports and guidance issued by the British Association for Parenteral and Enteral Nutrition (BAPEN) and the BMA.

a. Offering adequate food and water to the sick represents a basic duty of care and whilst a patient can swallow and express the desire or willingness to drink or eat, fluid and nutrients should be provided unless there is a medical contraindication.

b. Treatment plans for patients should include decisions on fluid and/or nutrient provision, especially when there are either existing or possible future deficits in fluid or nutrient intake.

c. Whenever the treatment plan is to maintain adequate intakes, the ethical duty is to take appropriate measures to achieve this aim. In the United Kingdom, most of Europe and America it is now accepted that artificial nutrition support should be regarded as a medical treatment. Artificial nutrition support includes both enteral and parenteral nutrition.

d. If an illness is regarded as being in a terminal phase and the treatment plan is to provide only compassionate and palliative care, ethical considerations indicate that an artificial supply of nutrients or fluid need only be given to relieve symptoms and such provision should not necessarily be used to prolong survival.

e. In cases where the benefits of artificial nutrition/fluid support are in doubt, a planned 'time-limited' trial may be useful. Consent of a competent adult patient must be sought for such treatment and a patient's competent refusal is binding.

f. Medical attendance and other carers should make all efforts to assess a patient's competence. This will often necessitate frequent consultations to evaluate a patient's ability to understand questions, respond appropriately and reason adequately.

g. In England and Wales and other countries where decisions are not legally binding by proxy, the doctor undertaking care is responsible for decisions to withhold or withdraw medical treatments. It is the doctor's duty to act in the patient's best interest. The best interest may not necessarily be the simple achievement of a physiological goal but rather is the achievement of those ends that the patient would have wished were they able to express a view. Any relevant opinion written or expressed by the patient previously must therefore be taken into account, but in the absence of such information, the doctors must make a decision, trying where possible to determine from the patient's relatives what they think would have been the patient's view.

h. All decisions on tube provision of food and/or fluids should involve full consultation with the family and all members of the health care team from the outset. However, under current English Law, relatives or a nominated proxy

cannot make a decision on behalf of an adult patient and so cannot override the doctor's decision (special considerations apply in relation to children). An application to the court should be made regarding the legality of withdrawing artificial hydration and nutrition from a patient in a persistent vegetative state.

i. Under specified circumstances, it can be legal to enforce nutritional treatment for an unwilling patient with mental disorders. This includes patients with a confirmed diagnosis of anorexia nervosa who have been sectioned under the Mental Health Act and in whom their attending clinicians feel that nutrition support is part of their overall medical therapy. The rationale for this is that patients sectioned under the Mental Health Act are deemed in law to be incompetent.

5 What to give and when

5.1 Introduction

Individual patients' nutritional needs vary with their current and past nutritional history and the nature of their condition. Since either inadequate or excessive feeding can be harmful, it is important to estimate nutritional requirements before instigating nutritional support. The guidance for this aspect of the guideline is based on evidence derived from physiological laboratory studies and cannot be derived from interventional studies that investigate and consider the impact of interventions applied in clinical practice. A number of GDG members with expertise in this area have provided their expert opinion on the guidance for this chapter. The recommendations were agreed with the GDG by informal consensus.

5.2 Methods for estimating requirements

The usual approach to estimating energy needs is to calculate basal metabolic rate (using equations accounting for age, sex and body weight) before adding additional increments to allow for any physical activity and increases in metabolism caused by illness and feeding itself (section 5.5). Protein requirements are estimated from body weight with additional increments dependent on likely metabolic stress and hence catabolism. Nutrition support is then instigated at levels designed to meet the estimated energy and nitrogen requirements, to exceed them if body weight recovery is indicated or to give less if weight loss is required. All likely micronutrient, electrolyte and fluid needs must also be met, taking into account any unusual demands or likely losses.

A key principle is that the aims and objectives of nutritional support should be clearly defined at each stage of a patient's clinical progress and the nutritional support tailored accordingly e.g. limitation but not prevention of lean tissue loss in acutely ill patients, maintenance in stable patients who still have increased catabolism, and anabolism in patients once the catabolic phase has passed.

5.2.1 Calculating requirements

5.2.1.1 Energy

There are various equations available to calculate basal metabolic rate (BMR) e.g. Schofield 1985[286]. The increase in energy requirements caused by metabolic stress varies depending on the disease state. Some useful tables which summarise these figures[80,322].

For most patients, 30 kcal/kg/day (30ml/kg/day of standard feeds) is likely to be adequate although patients who are severely malnourished or severely ill should probably start at lower rates (section 5.5.1.3).

5.2.1.2 Protein

For most patients 1g/kg/day will provide sufficient protein (corresponding to approximately 0.15g N from amino acids in intravenous nutrition). However in situations of metabolic stress, requirements may be higher.

5.2.1.3 Fluid

Fluid needs are usually a total of 30-35 ml/kg body weight with allowance for extra losses from drains, fistulae etc. All sources of fluid must be considered to stop over-prescription in patients receiving enteral/parenteral feeds including their intravenous fluids and drugs. This is a particular problem for surgical patients since excess fluid and sodium is a common cause of oedema, prolonged ileus and other complications.

5.2.1.4 Electrolytes and minerals

Most feeds contain adequate electrolytes to meet the daily requirements of sodium, potassium, calcium, magnesium and phosphate although specific requirements vary enormously.

5.2.1.5 Micronutrients

Since someone who is eating inadequately is likely to be depleted of some or all nutrients the aim of any form of nutrition support prescribed to a patient should be to provide to the patient's complete macro and also micronutrient requirements. Micronutrients are required for the prevention or correction of deficiency states and maintenance of normal metabolism and anti-oxidant status. Standard oral, enteral and parenteral feeds have enough vitamins and trace elements to ensure that micronutrient needs are met, but this is only if the patient is meeting all their energy needs through the feed alone. Since many patients do not receive full nutrition and many have pre-existing micronutrient deficits, poor absorption or increased demands, additional balanced micronutrient supplements may be needed for those at high nutritional risk and those during early nutrition support when full-feeding is not yet tolerated.

Patients prescribed PN will need vitamins and minerals added to premixed PN bags and the provision of PN without any micronutrients should be avoided.

5.3 Concerns with prescribing levels

Although the approach described in Section 5.2.1 is similar to that advocated by national and international organizations such as the BDA, BAPEN, ESPEN and ASPEN, there is a risk that these calculations may result in providing very

high levels of energy and protein to patients who are severely ill. Several members of the GDG felt that more caution is required during initial feeding of patients who are either nutritionally depleted or metabolically unstable due to severe illness, trauma or surgical insult. They cited as support the observation that most trials of short-term nutrition showing outcome benefits, do so despite *'too little nutrition'* being given for *'too short a time'* for that benefit to accrue from maintaining or improving body energy and protein stores[156]. Meeting estimated nutritional needs is not necessarily therefore the initial aim and there are several potential risks in attempting to provide very high levels of energy and nitrogen in very sick patients. The potential concerns about high energy provision include:

- Feeding at levels above actual requirements is known to adversely affect clinical outcome

- The very high energy requirements seen early in severe illness usually decline swiftly so that initial estimates of nutritional needs rapidly become over-estimates.

- Sicker patients are often insulin resistant and high levels of feeding may produce relative hyperglycaemia (a particular concern since a large intensive care trial demonstrated outcome benefits from tight blood glucose control). [337].

- Higher levels of feeding increase oxygen consumption and carbon dioxide production and hence may worsen respiratory failure[9].

The potential concerns about high nitrogen provision in sick patients include:

- very high levels of nitrogen provide no additional lean tissue sparing and studies showing reduced lean tissue loss at moderately high levels of nitrogen provision do not show better clinical outcomes.

- the amino acids (aa) needed for synthesis of acute phase proteins differ from those provided in most feeds which are aimed to meet the needs of normal protein synthesis. High levels of nitrogen provision may therefore lead to an excess of free aa and these are toxic unless they oxidised or utilised by 'normal' protein synthetic pathways. Studies of higher vs. lower protein feeding in both malnourished adults following famine and animal models of sepsis show higher mortalities in the high protein groups.

In the light of all the considerations above, the GDG decided to make the following recommendations.

5.4 Recommendations

5.4.1 Patients receiving nutrition support should have a prescription devised that considers all energy, protein, fluid, electrolytes, minerals and micronutrients needs. [D(GPP)]

5.4.2 In most patients starting enteral or parenteral nutrition support, particularly the very sick, full electrolyte, fluid and micronutrient needs should be provided from the outset but energy and nitrogen should be cautiously introduced according to metabolic and gastrointestinal tolerance over the first 24-48 hours, e.g. in intensive care patients this may mean commencing 50% of normal energy and nitrogen requirements. [D(GPP)]

5.5 Feeding very undernourished patients

5.5.1 Re-feeding problems

Starvation is accompanied by adaptive changes and micronutrient deficiencies such that malnourished individuals have abnormalities including:

- deficiencies of vitamins and trace elements;
- whole body depletion of intracellular potassium, magnesium and phosphate;
- increased intracellular and whole body sodium and water;
- low insulin levels and a partial switch from carbohydrate metabolism to ketone metabolism to provide energy.

Organ function may be impaired and starved individuals may have poor cardiac reserve and an inability to excrete an excess salt and water load.

Giving nutrients and fluid to malnourished patients will reverse these changes leading to an increase in demands for electrolytes and micronutrients, and a simultaneous shift of sodium and water out of cells. Over-rapid or unbalanced nutrition support can therefore precipitate acute micronutrient deficiencies and dangerous changes in fluid and electrolyte balance.

These problems of refeeding are less likely to arise with oral feeding since starvation is usually accompanied by a ‘protective’ loss of appetite. Enteral or parenteral feeding can precipitate refeeding problems since excessive feeding levels can be achieved easily and exaggerated if the products do not include adequate vitamins, phosphate or electrolytes.

The two widely recognized problems of re-feeding are those of the classical *‘Re-Feeding Syndrome’* and the ‘*Wernicke-Korsakoff Syndrome’*. Since the nature of refeeding precludes randomised trials of treatment, recommendations are derived from expert opinion.

5.5.1.1 The 'Re-Feeding Syndrome'

5.5.1.2 Clinical description

'Re-Feeding Syndrome' occurs on feeding when a range of life-threatening clinical and biochemical abnormalities arise:

- Cardiac failure, pulmonary oedema and dysarrhythmias
- Acute circulatory fluid overload or circulatory fluid depletion
- hypophosphataemia
- hypokalaemia
- hypomagnesaemia and occasionally hypocalcaemia
- hyperglycaemia

Patients can be categorised as moderate and high risk:

Moderate risk: anyone with a BMI <18.5 or recent weight loss >10%, with negligible intake for >7 days e.g. post-operative patients with persistent ileus, alcoholics and patients on some drugs including insulin, chemotherapy, antacids or diuretics.

High risk: Patients with more than any of the above listed risk factors and those with a BMI <16 or recent weight loss of >15%. These patients may have already low levels of potassium, phosphate or magnesium prior to any feeding but the absence of low levels does not mean there is no risk.

5.5.1.3 Clinical management of moderate and high risk patients

Moderate and high risk patients should be fed reduced amounts for the first few days with generous electrolyte and phosphate supplementation given concomitantly to anticipate expected increased requirements.

For moderate risk patients aim to:

- Restore and monitor circulatory volume, fluid balance and electrolytes
- Commence calorie intake at less than 50% of estimated requirements for the first 2 days gradually increasing to meet estimated needs by 4 - 6 days
- If PN is required only use complete formulations. DO NOT use incomplete PN products which lack important micronutrients and electrolytes

- Give oral, enteral or IV supplements of potassium (likely requirement 2 – 4 mmol/kg/d), phosphate (likely requirement 0.3 – 0.6 mmol/kg/d) and magnesium (likely requirement 0.1 – 0.2 mmol/kg) routinely

- Monitor levels of sodium, potassium, phosphate, magnesium, calcium and glucose daily during first week along with liver function at least twice weekly (normal initial levels DO NOT exclude risk of re-feeding syndrome)

- Give thiamine, other B vitamins and balanced multi-vitamin/trace element supplements.

For High risk patients aim to:

- Start feeds at a maximum of only 25% estimated requirements with even more gradual incremental increases

- Monitor patients' ECGs continually during the first few days of feeding

- Involve suitably experienced nutrition experts at an early stage.

5.5.2 The Wernike-Korsakoff syndrome

5.5.2.1 Clinical description

The Wernike-Korsakoff syndrome is caused by acute thiamine deficiency when re-feeding of malnourished patients precipitates increased thiamine demand as starving cells switch back to carbohydrate metabolism. The syndrome of acute neurological abnormalities comprises of one or more of the following:

- apathy and disorientation

- nystagmus, opthgalmoplegia or other eye movement disorders

- ataxia

- severe impairment of short-term memory often with confabulation.

It is seen particularly frequently in alcoholics who may have low liver stores of thiamine and it can also occur in any patient with chronic vomiting including those with hyperemesis gravidarum and gastric outlet obstruction.

5.5.2.2 Clinical management

Patients should be managed as for "re-feeding syndrome" but in addition they should be given daily thiamine and other B vitamins intravenously for 3 days (e.g. pabrinex 1 + 2 o.d) along with daily oral thiamine (100mg every 6hrs) and other B vitamins (e.g. Vit B Co strong 1 b.d.). The eye signs and

impairment of consciousness usually resolve but the loss of short-term memory may be permanent.

5.5.3 Other re-feeding syndromes

Other re-feeding issues may occur that are less easily characterized on clinical or biochemical grounds. Some experts believe that these may arise in less obviously malnourished patients when significant metabolic stress, redirection of metabolic processes or organ dysfunction acutely alters fluid distribution and the levels/demands of vitamins and electrolytes.

5.5.4 Recommendation

5.5.4.1 In patients at risk of refeeding syndromes e.g. BMI <18.5 or recent weight loss>10% and very inadequate nutritional intake for >5 days, nutrition support should be introduced with caution and additional supplementation of potassium, phosphate and magnesium may be required. Close clinical and biochemical monitoring before and during treatment is essential. [D(GPP)]

6 Monitoring nutritional support

6.1 Introduction

The main objectives of monitoring nutritional support are:

1. To ensure nutritional support is provided safely, and to detect and treat clinical complications as early and effectively as possible.

2. To assess the extent to which nutritional objectives have been reached.

3. To alter the type of nutritional support, or the components of the regimen, to improve its effectiveness and to minimise or prevent metabolic complications.

To achieve these objectives monitoring protocols (Table 5, Table 6) which integrate a variety of observations and measurements, are required. These will usually include:

- Basic clinical signs (temperature, pulse, oedema)

- Signs specifically relating to the feeding technique and its possible complications

- Measures of nutritional intake (appetite, oral food intake and total intake, gastrointestinal function).

- A measure of body composition (usually weight)

- Fluid balance charts (in hospital)

- Laboratory data

- Outcome data (complications, improvements in aspects of nutritional status, length of stay)

The type and frequency of monitoring will depend on the nature and severity of the underlying disease state, the type of nutrition support used, the setting of the nutritional care, and the expected duration of nutritional support.

Laboratory tests usually involve analyses of serum or plasma, but may also require tests on whole blood or blood cellular components. Tests of urinary loss are rarely required (although urinary sodium may be useful in patients with complex electrolyte problems). Most tests are non- specific, and abnormalities can be caused by factors other than the nutritional component of interest, and especially by aspects of the disease process. Care must therefore be exercised in interpretation of results, particularly when patients are subject to the effects of the Acute Phase Response (APR), or Systemic Inflammatory Response Syndrome (SIRS) such as after surgery, trauma or infection, in the critically ill, or if they have a chronic inflammatory disease state.

6.2 Methods

We conducted a literature search to identify studies that looked at the impact of monitoring nutritional support compared with no monitoring. Since no trials that prospectively investigated the diagnostic efficacy or cost- effectiveness of monitoring could be identified, we conducted a survey within the GDG to try to identify current best practice. The recommendations on monitoring provided here were then developed by members of the GDG with specific clinical expertise in this area and were agreed by the GDG using informal consensus.

The above approach recognises that the guidelines for monitoring patients on nutrition support given in Table 5, Table 6 will need to be agreed by local Nutrition Support Teams or other experts in nutritional care, and that final protocols will therefore vary depending upon local clinical experience and local availability of particular tests. They will also be modified in individual cases according to clinical progress of the patient.

6.3 Recommendations

6.3.1 A suggested monitoring protocol for nutritional, anthropometric, clinical and biochemical measures is listed below (Table 5). [D(GPP)]

6.3.2 Patients receiving different types of nutrition support will require the frequency and extent of this protocol to be adapted appropriately. [D(GPP)]

6.3.3 Acutely ill and unstable patients should be considered for a more frequent and extensive monitoring protocol. [D (GPP)]

Table 5: Nutritional, Anthropometric and Clinical Monitoring for patients receiving oral, enteral and parenteral nutrition support.

Parameter	Frequency	Rationale
Nutritional		
- nutrient intake from oral, enteral or parenteral feeding +/or normal diet (including any change in conditions that are affecting food intake)	Daily initially, reducing to 2x/week when stable, and then monthly for long term feeding in the community	To ensure that patient is receiving nutrients to meet requirements and that current method of feeding is still the most appropriate. To allow alteration of feed/diet as indicated by monitoring
- actual volume of feed delivered	Daily initially, reducing to 2x/week when stable, and then monthly in long term feeding in the community	To ensure that patient is receiving correct volume of feed. To allow troubleshooting of any

Parameter	Frequency	Rationale
		problems
- fluid balance charts	Daily initially, reducing to 2x/week when stable	To ensure patient is not/is not becoming over/under hydrated
Anthropometric - Weight	2x/week initially (may need to be more frequent if there are fluid balance problems) reducing to monthly	To assess ongoing nutritional status, determine whether nutritional goals are being achieved and take into account both body fat and muscle
- BMI/	Start of feeding	
- Mid arm circumference	Monthly- in patients where weight cannot be obtained or is difficult to interpret	
- Triceps skinfold thickness	Monthly- in patients where weight cannot be obtained or is difficult to interpret	
GI function - nausea/vomiting	Daily initially reducing to 2x/week	To ensure tolerance of feed
- diarrhoea	Daily initially reducing to 2x/week	To ensure tolerance of feed. To rule out any other causes of diarrhoea
- constipation	Daily initially reducing to 2x/week	To ensure tolerance of feed
Enteral Tube – nasally inserted - tube position (length at nose)	Before each feed begins	To ensure tube in correct position
- nasal erosion	Daily	To ensure tolerance of tube
- fixation (is it secure)	Daily	Help prevent tube becoming dislodged
- is tube in working order (all pieces intact, tube blocked/kinked)	Daily	Ensure tube is in working order
Tube - Gastrostomy or		

Parameter	Frequency	Rationale
jejunostomy		
- stoma site	Daily	To ensure site not infected/red
- tube position (length at external fixation)	Daily	To ensure tube has not migrated from/into stomach
- tube rotation (gastrostomy only)	Daily	Prevent internal over granulation
Parenteral Feeding		
- line site	Daily	Signs of infection/inflammation
- skin over position of line tip (peripherally fed patients)	Daily	Signs of thrombophlebitis
Clinical condition		
- general condition	Daily	To ensure that patient is tolerating feed and that feeding and route continue to be appropriate
- temperature	Daily initially	Sign of infection
- Drug therapy	Daily initially reducing to monthly when stable	Appropriate preparation of drug (to reduce incidence of tube blockage). To prevent/reduce drug nutrient interactions
Long/short term goals		
- are goals being met - are goals still appropriate	Daily initially reducing to 2x/week and then monthly?	To ensure that feeding is appropriate to overall care of patient

Table 6: Laboratory monitoring for patients on parenteral nutrition support (this could be selectively applied to certain patients receiving enteral or oral nutrition support).

Parameter	Frequency	Rationale	Interpretation
Sodium, Potassium, urea, creatinine	- Baseline. - Daily till stable. - Then 1-2 X weekly.	Assessment of renal function, fluid status, and Na and K status	Interpret with knowledge of fluid balance .Urine Na may be helpful in complex cases with gastrointestinal fluid loss.
Glucose	- Baseline - 1-2Xdaily (or more if required) till stable - Then weekly	Glucose intolerance is common	Good glycaemic control is necessary
Magnesium, phosphate	- Baseline. - Daily if risk of refeeding syndrome. - 3 X weekly till stable - Then weekly.	Depletion is common and under recognised	Low concentrations indicates poor status
Liver function tests	- Baseline - 2X weekly till stable - Then weekly	Abnormalities common during IVN	Complex. May be due to sepsis, other disease or nutritional intake
Calcium, albumin	- Baseline. - Then weekly.	Hypocalcaemia or hypercalcaemia may occur	Correct measured serum calcium concentration for albumin. Hypocalcaemia may be secondary to Mg deficiency. Low albumin reflects

Parameter	Frequency	Rationale	Interpretation
			disease not protein status
Prealbumin	- Baseline - Then weekly	Short half life marker of protein status	Affected by APR Especially useful in HPN
C-reactive protein	- Baseline - 2-3X weekly till stable	Assists interpretation of protein, trace element and vitamin results	Trend of results is important
Zinc, copper	- Baseline - Then every 2-4 weeks, depending on results	Deficiency common, especially when increased losses	Patients most at risk when anabolic. APR causes Zn ↓, and Cu ↑
Selenium	- Baseline if risk of depletion. - Further results dependent on baseline	Se deficiency likely in severe illness or long term nutrition support	APR causes Se↓. Long term status better assessed by glutathione peroxidase
Manganese	- Every 3-6months	Excess provision to be avoided- more likely if liver disease	Red blood cell or whole blood better measure of excess than plasma
Full blood count	- Baseline - 1-2X weekly till stable - Then weekly	Anaemia due to iron or folate deficiency is common	Effects of sepsis may be important. Iron status difficult if APR (Fe↓, ferritin↑)
Folate, B12	- Baseline - Then every 1-2 weeks	Folate deficiency is common	Serum folate/B12 sufficient, with FBC
25-OH Vit D	- Long-term support	Low if house-bound	Requires normal kidney function for effect
Bone densitometry	- On starting HPN - Then every 2	Metabolic bone disease diagnosis	Together with lab tests for metabolic bone disease

Parameter	Frequency	Rationale	Interpretation
	years		

Recommendations for monitoring patients receiving long-term nutritional support:

6.3.3.1 Patients on home parenteral nutrition should be reviewed at least every 3-6 months, and the full range of tests as outlined above should be performed. [D(GPP)]

6.3.3.2 Patients receiving home enteral nutrition should be reviewed annually and/or if there is any change in their clinical condition since the last annual review. A limited range of tests from those outlined above should be performed, usually omitting the trace element and vitamin analyses, unless there is cause for concern. [D(GPP)]

6.3.3.3 Where long-term nutritional support is required patients should be trained to recognise and respond to adverse changes in both their well-being and in the management of their nutritional delivery system. [D(GPP)]

7 Oral Nutrition Support

7.1 Introduction

When a patient is taking inadequate food and fluid to meet requirements, it is important to consider options for oral nutrition support unless he or she cannot swallow safely or does not have adequate gastrointestinal function. Oral options include the addition of ingredients (high in energy and or protein e.g. butter, cream, milk, sugar) to suitable foods; adaptation of meal structures (e.g. 3 meals and 3 snacks); sip feeds which are often nutritionally complete pre-packed drinks; and or vitamin/mineral tablets. The aim of the oral nutrition support is to improve the patient's overall food and fluid intake and hence prevent the need for more invasive nutrition support such as enteral or parenteral feeding. It is important that the total intake still provides a balanced mix of energy, protein and micronutrients.

7.2 Methods

We conducted a number of reviews to investigate the beneficial effects of one or more oral interventions e.g. dietary advice, sip feeds, modified consistency for improving the nutritional intake of patients with poor nutritional status. We also conducted literature reviews to identify patients views on some of these interventions.

7.3 Dietary advice in malnourished patients

7.3.1 Studies considered for this review

One systematic review[13] investigated the impact of dietary advice(Table 17). The purpose of dietary advice given by a dietitian or health care professional was to provide instruction on modifying food intake (e.g. food fortification, meal plan adaptation) to improve nutritional intake. 'No dietary advice' as used in this context meant patients received no other specific oral intervention.

Two of the sub-group comparisons were of interest; dietary advice versus no advice and dietary advice plus supplements (if required) versus no advice and no supplements.

7.3.2 Dietary advice versus no dietary advice

This review considered 5 RCTs including 888 elderly, cancer and Crohn's disease patients (Table 17). However, only three of these studies reported outcomes of interest; mortality, hospital admission, nutritional status and clinical function. Another small RCT [101] also looked at this comparison. The third group in this study were normal weight patients we therefore did not include them in our analysis.

7.3.2.1 Clinical Evidence

The review [13] found no significant difference in mortality at six months (two studies), hospital admission (one study), weight change and BMI (one study) or measures of clinical function (one study). The study by Forli et al.[101] did not show any difference for the outcomes reported i.e. weight gain and energy intake in our groups of interest.

7.3.3 Dietary advice plus sip feeds (if required) versus no dietary advice and no sip feeds

The Baldwin et al. systematic review[13] also compared patients receiving dietary advice plus sip feeds (if required) with those receiving no advice and no sip feeds(Table 17). Seven RCTs including 665 cancer, surgical and chronic obstructive pulmonary disease patients were included. However, only two of these provided data on the outcomes of interest which were mortality and change in nutritional status. One further study which examined 83 elderly people living in the community [254] also fulfilled the criteria for this comparison and was included.

7.3.3.1 Clinical Evidence

There was no significant difference for any of the outcomes for this comparison in the systematic review. The study by Payette et al.[254] showed a significant advantage of supplementation and advice over standard care. The intervention group gained more weight and had a higher energy intake.

7.3.4 Patient's satisfaction with dietary advice

We performed a literature search to assess patient's views on dietary advice. We identified two studies: one conducted in Canada [331] and the other in Australia [94].

The studies included hospitalised patients for a minimum stay of 5 days [331] (n=55) and acute hospital patients [94] (n=49). Patients consumed a therapeutic diet and used dietary counselling during their hospital stay.

A survey questionnaire was used to evaluate patients' satisfaction with four components of dietary counselling. One study [331] looked at the following components:

- knowledge: "patient's perception of the dietician's knowledge of his or her medical condition, dietary therapy, and food composition of meals served in the hospital."

- cognitive communication skills: “dietitian’s use of simple language in verbal and written communications and in answering patient’s questions”

- affective communication skills: “interpersonal qualities of the dietitian (e.g., courtesy, warmth, and attentiveness) that help build a positive relationship with the patient”

- facilitation skills: “dietitian customization of the diet, inclusion of the patient in decision making, and dispensation of advice to the patient about adapting the diet after discharge from the hospital”

The other study [94] assessed the following elements:

- Staff interpersonal skills: These included staff communication skills and understanding of patients’ needs.

- Nutrition supplements: Temperature, taste, smell and appearance of nutritional supplements

- Perceived health benefits of nutrition care: Effect of dietary advice on patient’s health

- Staff presentation skills: These included whether staff were polite, courteous and friendly.

The result from the studies indicated that staff facilitation skills, knowledge [331] and interpersonal skills [94] were the most important factors of patient satisfaction with dietary advice.

7.3.5 Conclusions

Staff facilitation skills was the most important determinant of patients’ satisfaction with dietary advice.

7.3.6 Cost-effectiveness Evidence

No study reporting cost or cost-effectiveness was found.

7.3.7 Conclusions

We were unable to demonstrate any evidence of effect for dietary advice. This may be due to the small sample size and heterogeneous populations of the studies identified which meant that they were underpowered. Many also failed to reported outcomes of interest.

7.4 *Oral nutritional supplements versus standard care in malnourished patients*

7.4.1 Studies considered for this review

We conducted a review to look at the effects of nutritional supplementation in malnourished patients and patients at risk of malnutrition in both hospital and community settings (Table 18). Our definition of malnutrition was the poorly nourished with BMI ≤ 20 or weight loss of 5% or more. We also included papers that mentioned that the patients recruited to the study were malnourished despite not providing data on their nutritional status.

The review identified 27 RCTs comparing patients who received oral supplements (most patients were given a pre-packed sip feed) with patients who received standard care/no intervention[21,26,31,54,76,77,85,109,110,176,184,187,188,195,215,233,245,261,264,266,281,321,325,338,340,341,350]. There was no form of dietary advice in either arm. The most frequently reported outcomes were: anthropometric measurements (such as weight change), wound healing/ complications, quality of life, functional status, length of hospital stay and death. The majority of the studies were too underpowered to produce significant results for outcomes of clinical relevance in their very heterogeneous study populations, especially since so many factors influence complications, length of stay and mortality.

7.4.2 Clinical Evidence

Twenty studies [21,26,54,76,77,109,110,176,184,187,188,195,215,245,261,281,325,338,341,350] provided information on weight change. Ten of these studies [54,187,188,215,245,261,281,350] showed significant weight gain in the supplemented group. The twelve remaining studies,[21,26,76,77,109,110,176,184,195,325,338,341] six of them [76,77,110,195,325,341] showed non-significant weight gain/less weight loss in the supplemented group. Change in BMI as an outcome was reported in 3 studies. Two of these [54,350] documented significant change favouring the supplemented group but the third [188] demonstrated an increase in BMI in the control, this difference was non-significant. Other anthropometric measurements such as Triceps skin fold (TSF), Mid-arm muscle circumference (MAC), were not reported consistently in all studies contained in our review. However, where significance was shown, it favoured the intervention.

Energy and protein intake was higher in the supplemented group in some studies [31,54,109,176,187,195,281,338] and where significant benefit was identified it was in favour of the intervention. No study demonstrated a better intake in the control for this outcome.

There were no significant differences reported in the five studies providing data on length of stay [76,109,110,320,340], the four studies reporting quality of life [26,76,320,325], or the five studies reporting mortality [85,109,186,320,340]. Functional outcomes reported differed from study to study but where benefit was identified, it favoured the supplemented group.

A meta-analysis (Table 7 and Appendix Six) showed that there was a statistically significant increase in weight for the patients in the intervention arms and a statistically significant decrease in the number of patients with complications. Overall, there was a probable reduction in mortality of around 10% but relative risk confidence intervals crossed 1 and it is possible that there is no mortality benefit (RR 0.9, CI 0.77 – 1.05). There was no significant effect on length of hospital stay.

Table 7: Summary of meta-analysis of oral intervention vs. standard care

	No. patients (Intervention/ standard care)	Pooled effect [95% CI]	P value from test for heterogeneity
Mortality reported in 18 studies 31,76,85,107,109,110,129,146,184,186,198,241,261,320,325,340,341,350	1699/1801	**RR (fixed)** 0.90 [0.77, 1.05]	0.17
Length of stay (days) reported in 7 studies 109,110,129,261,264,281,340	512/499	**WMD (fixed)** -0.01 [0.27, 2.06]	0.25
Complications reported in 6 studies 31,85,109,264,281,325	402/490	**RR (fixed)** 0.80 [0.69, 0.94]	0.65
Weight gain (kg) reported in 16 studies[54,76,109,110,187,188,215,245,254,261,281,325,338,350]	461/479	**WMD (random)** 1.18 [0.70, 1.65]	0.01

These studies mainly looked at sip feed interventions in the hospital setting. For outcomes where evidence was available from a community setting there was a probably a similar magnitude of effect (see Appendix Six).

7.4.3 Cost effectiveness evidence

We found five studies that compared the cost of oral supplements with standard care – four studies were conducted in the UK from an NHS hospital perspective and the other study was French.

One cost-effectiveness analysis [76] was based on an RCT to determine whether nutritional supplementation reduced health care costs and improved quality of life in elderly malnourished patients post-discharge. They found no significant difference in quality of life of patients. However, the short course of the intervention (8 weeks) made it unlikely that improvements to quality of life would be evident. Patients in the oral supplement arm had significantly increased cost due to re-admissions (£3034 vs. £1854).

A French study also evaluated the resource and cost implications of using supplements in elderly patients[7]. The study was based on a prospective comparison of cohorts of patients, one cohort in a region that has a high rate of prescribing supplements and the other with a low rate. Patients in the high frequency arm had a significantly improved MNA score. Costs were also lower, although not significantly so. In contrast to the RCT[76], there was a reduction in admissions. There was no significant difference in mortality and other patient outcomes, such as quality of life were not recorded.

Another study[189] looked at the effect of post-operative oral supplements on complication rates and hospital costs in adult orthopaedic patients, using a cross-over trial. Despite low compliance with the intervention there was a significant reduction in the complication rate in the oral supplemented group (16.6 % vs. 35.1%, p=0.005). There were cost savings from the reductions in both length of stay and specific treatment interventions (£2,068 vs. £2,199) although it was not stated whether this difference was statistically significant.

Stratton et al.[312] conducted a systematic retrospective cost analysis of nine RCTs from an NHS hospital cost perspective. The results suggested cost savings per patient between £352 and £832 for surgical patients, between £3842 and £8179 for orthopaedic patients, £4424 in stroke patients and £452 in elderly patients due to reduced length of stay and fewer complications.

We estimated the cost-effectiveness of oral supplementation versus standard care for elderly inpatients in the context of a malnutrition screening programme (Section 3.2.6). The model suggested that screening followed by intervention using sip feeds would be cost-effective (<£20,000 per QALY gained), using the base case assumptions. However, the results were highly sensitive to the assumptions made with regard to the baseline mortality rate, the relative risk and the proportion of patients that would revert back to the age-specific population-level mortality rate after the trial follow-up period.

7.4.4 Conclusions

It was difficult to demonstrate a consistent pattern towards improvement for the patients supplemented with sip feeds because studies have been too small and there has been marked heterogeneity amongst study populations and the outcomes reported. However, pooled results (Appendix Six) showed a statistically significant improvement in weight as well as a reduction in complications in supplemented patients. It is also likely that they reduce motility by about 10% (although the studies did not report this) but larger studies are needed to confirm or refute this effect. Overall, it appears that

supplements are beneficial in improving some health outcomes if used in malnourished patients.

7.4.5 Patient's satisfaction with nutritional supplements

The literature search conducted to identify patient's views retrieved four studies looked at patients' preferences for nutritional supplements [75,131,212,301].

In one US study [301]20 patients and 20 staff members of a large teaching hospital rated a variety of brands of liquid nutritional supplements. Each participant sampled four brands of vanilla product and four brands of an alternate flavour (either chocolate or strawberry, based on their personal preference). The first round of sampling was blinded (participants did not know the brand of the supplemented) and in the second round the brand was disclosed. The results of the study indicated that staff member ratings of acceptability were lower (in some cases significantly lower) than ratings given by patients. In general, staff member acceptability ratings did not change significantly once the brand name was known. Patient acceptability ratings appeared to be impacted to a much greater degree by knowing brand name; significant increases were seen in four ratings.

Another study [75] also looked at differences in preferences of oral nutritional supplements between patients and dietitians. There were significant differences between patients and dietitians in their evaluation of 7 of their 13 products.

The palatability of sip-feed nutritional supplements and other high-energy foods to elderly medical inpatients was assessed in one study [131]. 49 malnourished subjects rated the taste of a previously selected sip-feed supplement and five other high-energy foods: cheese biscuit, plain potato crisps, chocolate, cherry-flavored cereal bar and stout beer. Subjects rated the taste of sip-feeds as favourable as all other offered foods, with the exception of stout beer which had a lower rate.

Another study [212] examined whether sip-feeds are less preferred and less likely to be selected than other energy-dense foods in healthy elders; and whether eating alone further reduces intake relative to eating in a social setting.

Twenty-one healthy older adults (aged 60-79) were included. Subjects rated six different flavours of sip-feed (three fruit juice flavours: apple, orange and fruit punch and three milkshake flavours: vanilla, strawberry and chocolate) and then rated the pleasantness of the taste of the flavour against five other energy-dense familiar foods/drinks (cheese cracker, cereal bar, potato chip, chocolate button, and beer). Two drinks, two salty foods, and two sweet foods were offered to the participants. Intake was measured when participants ate alone or in a group. Pleasantness ratings were made on a 7-point Likert scale, where 1 represented 'extremely unpleasant' and 7 represented 'extremely pleasant'.

The results from the study showed that the mean pleasantness of sip-feeds was above neutral (rating of 4) in all but one case (chocolate). Sip-feed was rated as the third most pleasant (5.0 +/- 0.3). Favourite flavour of sip-feed compared well with other more familiar foods and was selected as part of a snack. Snack intake increased by 60% when consumed in a group setting compared with eating alone.

7.4.6 Conclusions

Patients found sip feeds an acceptable form of nutritional support.

7.5 Comparisons of different methods of oral nutrition support in malnourished patients

7.5.1 Studies considered for this review

We looked for studies that compared one type of oral nutrition support with another, for example three meals per day versus six meals per day, snacks or dietary advice to improve nutritional status versus sip feed, sip feed versus placebo multivitamin pills, in undernourished patients or patients at risk of under-nutrition(Table 19). One systematic review and one RCT met the inclusion criteria. The systematic review compared the effects of dietary advice to no advice or other oral interventions [13], and the RCT compared dietary advice with oral supplements and also standard care [266].

7.5.2 Dietary advice or snacks versus sip feeds

One systematic review[13] which comprised of 4 RCTs including 173 elderly, HIV and cystic fibrosis patients, and an additional RCT[266] that included 111 colorectal cancer patients undergoing radiotherapy treatment, compared dietary advice or snacks with sip feeds. Ravasco et al.[266] included patients regardless of nutritional status but also provided some results for the 42 patients considered malnourished. The reported outcomes were mortality, hospital admission, nutritional status, nutritional intake and clinical function.

7.5.2.1 Clinical Evidence

There was no significant difference in mortality at three months (5 studies), hospital admission (1 study), or measures of clinical function at three months (1 study investigating elderly people living at home). Energy intake at three months was significantly greater in the sip feed group compared to the dietary advice group (4 studies) and although different effects were found for weight change the systematic review reported a significantly greater weight gain in the sip fed patients.

7.5.2.2 Cost-effectiveness evidence

No study reporting cost or cost-effectiveness was found.

7.5.3 Conclusions

Sip feeds may be more effective in increasing energy intake and increasing weight. Neither intervention appears to have a better effect on mortality or clinical function but have been too small to determine benefit or disbenefit.

7.6 Conclusions - Oral Interventions in malnourished patients

The evidence suggests that the use of sip feeds in malnourished hospital populations improves energy intake and weight gain when compared to no action, dietary advice alone or additional snacks. They also reduce complication rates and may reduce mortality. Economic modelling suggests that they are probably cost -effective in terms of cost per QALY <£20,000. However, although there have been considerable numbers of RCTs, nearly all are underpowered and there is therefore too little evidence to determine the effect of dietary advice, the true effect of sip-feeds, or the effect of other oral interventions aimed at improving nutritional status.

7.7 Recommendations

7.7.1 Interventions to improve oral intake should be offered to hospital patients who can potentially swallow safely but who are either malnourished (unintentional weight loss >10% over the last 3 to 6 months, BMI <18.5, or BMI <20 and unintentional weight loss >5% over the last 3 to 6 months) or who are at risk of malnourishment (not eaten for >5 days or unlikely to eat for >5 days). [A]

7.7.2 Interventions to improve oral intake such as additional food or supplements should also be considered for appropriate elderly patients in long term care with unintentional weight loss, who can swallow safely. [D(GPP)]

7.7.3 The snacks or supplements offered to patients should aim to ensure that overall nutrient intake contains a balanced mixture of protein energy, vitamins and minerals. [D(GPP)]

7.8 Oral multivitamin and mineral supplementation in malnourished patients

7.8.1 Introduction

Oral multivitamin and mineral supplements should help individuals who are eating poorly to meet their vitamin and mineral requirements and in some circumstances, apparently healthy people may also have suboptimal multivitamin/mineral status. In the National Diet and Nutrition Survey, many elderly individuals living at home and a great many living in residential care were found to have biochemical deficiencies of vitamins or minerals despite the fact that their food supply appeared to contain sufficient amounts. This raises the possibility, that vitamin/mineral supplementation might be valuable in individuals who are not overtly malnourished or ill, but this situation falls outside the scope of this guideline.

7.8.2 Clinical evidence

Our review identified RCTs that studied the effects of multivitamins/minerals on patients who were potentially malnourished. Studies included individuals, who were either hospitalised or in elderly care homes and HIV infected patients.[112-114,148,257,339]. The included studies were categorised into two groups according to the type of supplement provided i.e. multivitamin *and* mineral supplement v placebo[112-114] (Table 20) and multivitamin supplement v placebo [148,257,339] (Table 21).

7.8.3 Multivitamin and mineral v placebo/standard care

7.8.3.1 Studies considered for this review

Four studies were included in this category[6,112-114,160] (one study was reported in two papers[112,114]).Three studies included elderly patients in nursing homes and one study included HIV infected patients.

7.8.3.2 Elderly patients in nursing homes

Two studies with identical methodology included elderly patients in nursing homes. One was a large multicentre study[113] and the other[112,114] and the other reported in two papers, was a study in one of the centres in the multi-centre study but provided additional data. Patients in both studies were randomised into four groups: vitamin group (Vitamins A,C and E) mineral group (zinc, selenium), vitamin and mineral group (vitamins A,C, E and zinc and selenium) and a placebo group (calcium phosphate). Immunological data were reported in the large multi-centre study[113].

7.8.3.2.1 Clinical Evidence

No differences were observed in delayed hypersensitivity responses. A sub-group of patients received influenza vaccine towards the end of the two-year supplementation period and the humoral response to the vaccine strain was assessed before and after vaccination. Results overall for the three influenza vaccines showed an improvement in antibody titre in trace element and trace element/vitamin groups relative to placebo or vitamins alone, but the mineral group had significantly higher numbers of serologically protected patients compared to the vitamin, vitamin/mineral, and placebo groups, for one of the three vaccines ($p<0.05$).The authors concluded that zinc and selenium supplementation improves the humoral response, and that vitamin supplementation led to a weaker response, but chance variation is another explanation.

Infectious morbidity, respiratory and urogenital infections were reported in both of these studies. In the smaller study[112,114] (n=81) patients in the mineral and (mineral/vitamin) groups had significantly fewer respiratory and urogenital infections($p<0.01$). In the larger multicentre study[113] (n=725) no significant difference between the groups was observed. However, there are some limitations with this last result. A subgroup of 140/725 patients in this study received influenza vaccine to assess immunological outcomes. Infections were reported for the total number of patients and not extracted for the group that received the vaccine. These two trials[112-114] also reported mortality and both found no significant differences between the groups.

In a further small study in the UK [6], a two month period of supplementation with a complete vitamin/trace element mixture was not associated with any significant alteration in antibody response to influenza vaccination.

7.8.3.3 HIV-infected patients

7.8.3.3.1 Studies considered for this review

A single study was identified [160] which included 481 HIV-infected patients randomised to receive either a high dose multiple micronutrient or a placebo for a period of 48 weeks. Patients were examined clinically 12-weekly and tested for CD4 cell count 24-weekly.

7.8.3.3.2 Clinical Evidence

There were no statistically significant differences in overall mortality or changes in CD4 cell count.

7.8.4 Multivitamin v placebo/standard care

7.8.4.1 Studies considered for this review

Three studies were included in this category[148,257,339] and although there was a variation in the content of the intervention supplement, most were composed of vitamins C,+/- A, B and E. Two studies included elderly long-stay stroke patients[257] and acute medical or surgical patients[339] (Table 21). The other study[148] included elderly medical patients who received in addition to the intervention/placebo either a glucose energy or placebo drink.

7.8.4.2 Clinical Evidence

One study [257]reported changes in absolute number of lymphocytes and T cells sub-types. This showed a significant increase in the intervention group ($p<0.05$). Mental test score and Barthel score (activity score) were reported in one study[148] with no significant differences between the groups. Change in body weight was reported in two studies[148,257]. In one there was no significant change whilst in the other [257], the supplemented group lost weight compared to placebo($p<0.05$). There were no differences reported for mortality or length of stay [148,339]. .

(Note: The most commonly reported outcome was biochemical assessment of plasma vitamins and minerals. This data was not extracted.)

7.8.4.3 Cost-effectiveness evidence

We did not find any relevant economic studies.

7.8.4.4 The National Diet and Nutrition Survey

The National Diet and Nutrition Survey presented findings on biochemical indices of nutritional status and nutrient intake in elderly people living in nursing homes. Results from the survey indicate that although the food supply appears to contain sufficient amounts of vitamins and trace elements, in general the status of vitamins and minerals is poor in this population, suggesting that intake and absorption from food was inadequate. The reasons for this are not clear, but possibilities include the presentation and timing of the food, the need for assistance in eating, changes in absorptive function of the gut, and general medical condition.

7.8.5 Conclusions

There is no evidence to support the routine use of vitamin and mineral supplements in either acute hospitalised patients or elderly residents of nursing homes. However, in view of the National Diet and Nutrition Survey findings, large scale trials are needed and a vitamin/ mineral supplement may

be beneficial in the elderly when there is concern about the adequacy of total food intake.

7.8.6 Rationale for recommendation

The National Diet and Nutrition Survey has shown biochemical deficiency of vitamins and or minerals is common in the elderly population, particularly those in residential care. Studies to determine whether there is definite benefit of providing vitamin supplements to patients have been inadequate, but balanced micronutrient supplements providing the reference nutrient intake for all vitamins and trace elements, have been shown to improve biochemical deficiencies.

7.8.7 Recommendation

7.8.7.1 A complete multi vitamin and mineral supplement providing the reference nutrient intake for all vitamins and trace elements should be considered for patients where there is concern about the adequacy of micronutrient intake. [D(GPP)]

7.9 Oral nutrition support in surgical patients

7.9.1 Introduction

Many surgical patients are malnourished prior to their operation or become so after it. During the time leading up to diagnosis, the underlying problem (especially if gastrointestinal) often leads to deteriorating nutritional status and in some patients, coincidental illness or psycho-social issues may also contribute. To add to these nutritional risks, many of the investigations used to diagnose surgical problems, require patients to be 'nil by mouth' and following operations, patients usually have some degree of intestinal failure (e.g. due to ileus) and variable catabolic responses which can increase or change nutrient demands. There may also be abnormal post-surgical nutrient losses via drains, stomas etc.

In view of the above, there will always be some surgical patients (especially in gastro-intestinal practice) in whom the basic principles and recommendations made in Chapter 2 indicate a need for nutrition support. For example, some will develop very prolonged but potentially reversible post-operative intestinal failure (due to complications such as sepsis, anastamotic leaks, or GI fistulae) and will need support until recovery. Others will end up with essentially irreversible intestinal failure (due to extensive gut resection etc.) and so may need long-term enteral or parenteral nutrition support (Chapters 11).

In the majority of surgical cases, however, pre- and post-operative nutritional threats are less serious or less prolonged and hence many surgical patients

have no definite indications for nutrition support. Nevertheless, it is possible that additional nutrition might help outcomes.

7.9.2 Elective nutritional support in surgery

Cross-sectional studies show that malnourished patients have very high complication and mortality rates. Pre-operative nutritional support for malnourished patients could therefore reduce risks of infection or poor wound healing, whilst early post-operative nutrition support might limit the nutritional risks that arise from the standard practice of keeping patients 'nil by mouth' for several days with a view to protecting gastro-intestinal anastamoses and allowing any ileus to resolve. Furthermore, there is some evidence to suggest that early post-operative engagement of the GI tract might reduce the metabolic effects of injury and limit infections caused by the spread of gut organisms to other parts of the body. In view of the above, it is possible that the 'elective' use of nutrition support might be of benefit in surgical patients, particularly those who are already malnourished.

7.9.3 Methodology

We conducted literature searches to identify studies on the 'elective' use of nutritional support around the time of surgery. The studies identified were grouped to examine the possible benefits of this elective use of oral nutrition support pre- and/or post-operatively under the following circumstances:

- Pre-operative oral nutrition support versus no additional pre-operative supplementary nutrition (i.e. normal hospital diet, placebo drink, fasting or simple IV fluids)

- Pre- and post-operative oral nutrition support vs. no additional nutrition support (i.e. normal hospital diet, placebo drink, fasting or simple IV fluids)

- Pre-operative oral nutrition support versus post-operative oral nutrition support

- Early post-operative oral nutrition (<24 hrs after surgery) versus no additional post -operative nutrition (i.e. normal post-operative fasting with simple IV fluids until clinically-judged return of GI function)

They were also grouped according to the type of surgery undertaken.

7.9.4 Elective pre-operative oral nutrition support versus no pre-operative nutritional support

7.9.4.1 Studies considered for this review

We identified 5 RCTs[126,137,199,303,353] which examined pre-operative oral nutritional supplements versus no pre-operative nutritional support (Table 22). One study[353] specifically looked at carbohydrate drink as the intervention instead of a complete supplement.

7.9.4.2 Clinical evidence

Two RCTs[126,137] found no differences in any of the outcomes between the intervention and control groups whilst one [303] reported a decrease in postoperative complications following pre-operative nutritional supplementation and another [199]reported increased problems. The carbohydrate study [353] also found no significant differences between groups.

7.9.5 Elective pre- and post-operative oral nutrition support vs. no nutrition support

7.9.5.1 Studies considered for this review

Two RCTs [199,303] were identified (Table 22).

7.9.5.2 Clinical evidence

One RCT[303] reported a decrease in the total number of postoperative minor complications in patients receiving pre- and post-operative nutrition support ($p<0.05$) and the fed group also lost significantly less weight than controls ($p<0.05$), however, the other RCT [199] found no significant differences between intervention and control groups.

7.9.6 Elective preoperative oral nutritional support versus postoperative oral nutritional support

7.9.6.1 Studies considered for this review

Two RCTs [199,303] were identified(Table 22).

7.9.6.2 Clinical evidence

No significant differences were found in any of the outcomes.

7.9.7 Elective post operative oral nutrition support versus standard care

7.9.7.1 Post-operative oral nutrition support in GI surgery (at the time of or after return of GI function)

7.9.7.1.1 Studies considered for this review

Five RCT's [18,157,171,264,281] compared patients undergoing abdominal surgery who received standard care/no intervention with patients who received oral supplements at or after the return gastrointestinal function judged clinically (Table 23). Two studies included patients undergoing elective and emergency GI surgery [157,281], two studies included patients undergoing elective GI surgery only [171,264] and one study included patients undergoing elective GI and vascular surgery [18]. Two of these studies [264,281] are also included in the oral vs. standard care section for malnourished patients (section 7.4.1) while another study [18] was included in the our systematic review on dietary counselling (section 7.3.1).

7.9.7.1.2 Clinical evidence

Post-operative oral supplements led to significant increase in BMI and mid-arm circumference reported in 1 study [171] and weight gain reported in 3 studies [171,264,281]. In one study[171] the intervention group had significantly less complications than the control group ($p< 0.05$) but in the three studies that reported wound infections [18,264,281], no significant differences were found. The only study that reported pneumonia [264] showed a lower incidence in the supplemented group ($p<0.02$). Quality of life was significantly higher in the intervention for the single study [18] reporting this outcome. There were no significant changes in length of stay [264,281] or mortality [18,264] in the studies reporting these outcomes.

7.9.7.2 Orthopaedic Surgery

A systematic review (8 RCT's) [10] and 2 additional RCT's [42,150] provided data on the effects of elective post-operative oral nutrition support in patients undergoing orthopaedic surgery for hip fracture (Table 24). The systematic review reported mortality, complications, and unfavourable outcomes. Potential biases resulting from inadequate sample size, allocation and concealment as well as limited outcome data mean results must be interpreted cautiously.

Pooled data from for 3 RCTs [70,129,307] in the systematic review demonstrated a statistically significant reduction in adverse outcomes in the supplemented groups and the review also showed reduced complications (borderline significance) in patients receiving supplementation. None of the studies in the systematic review demonstrated a difference between the study groups for functional outcomes and the other 2 RCTs [42,150] in this review did not show any difference for outcomes reported.

7.9.8 Early post-operative oral nutrition (<24 hrs after surgery) versus post-operative 'nil by mouth'.

7.9.8.1 Introduction

In most centres, it is routine practice for post-surgical patients to be kept nil by mouth until there are clinical signs of return of GI function e.g. for two to three days after a major abdominal operation. This delay in nutrient intake may have significant consequences on a patients nutritional state and potential recovery whilst conversely, very early oral intake might cause problems with nausea and vomiting, or leakage from vulnerable anastamoses. We therefore conducted a review to investigate the benefits and harms of delaying the start of food and fluid intake in post surgical patients.

7.9.8.2 Studies considered for the review

The review identified RCTs conducted on patients given oral feeding within 1-24 hours post operatively compared to no nutrition (i.e. intravenous dextrose and/or clear fluids only) until clinical evidence of returning bowel function. Twenty studies were identified[27,43,64,92,115,116,124,128,133,181,204,243,253,255,267,270,285,308,311,345] and we extracted data on seven outcomes: vomiting, anastomotic dehiscence, pneumonia, death, intra-abdominal abscess, wound infection and hospital length of stay (LOS) (Table 25,Table 26,Table 27). Where appropriate we pooled the data for these outcomes but we were unable to pool data for LOS as the studies reported this outcome in different units and information needed to convert these units was lacking.

Studies fell into two groups, those including patients undergoing general abdominal surgery for gastrointestinal problems, vascular problems of trauma, and those including patients undergoing gynaecological or obstetric surgery . There was also one study of early oral intake in pancreatitis patients who did not undergo surgery, this is reported separately.

7.9.8.3 Clinical evidence

7.9.8.3.1 General surgical patients

We identified eight studies. Six included patients undergoing lower GI surgery [27,92,133,243,270,311], one included patient undergoing lower GI and transabdominal central vascular reconstruction [128] and one included emergency or elective intra-peritoneal surgery of all types[267] (Table 25). A combined analysis of these eight studies showed that patients in the early feeding group had a statistically higher incidence of vomiting compared to patients in the later feeding group. There were no statistically significant differences in any of the other outcomes in this pooled analysis (Table

8)(Appendix Seven). LOS was reported in six studies [27,92,128,133,270,311] with no statistically significant differences between groups.

Table 8: Outcomes reported in studies of patients undergoing GI surgery

	No. patients (early feeding/late feeding)	RR (fixed) 95% CI
Vomiting (reported in six studies [27,92,133,267,270,311]	262/261	1.43 [1.07, 1.92]
P value from test for heterogeneity	0.52	
Anastomotic dehiscence (reported in five studies [128,133,243,270,311]	300/294	0.74 [0.27, 2.06]
P value from test for heterogeneity	0.75	
Pneumonia (reported in five studies [128,133,243,270,311]	300/294	0.98 [0.32, 3.00]
P value from test for heterogeneity	0.92	
Intra-abdominal abscess (reported in four studies [133,243,270,311]	244/245	1.01 [0.14, 7.06]
P value from test for heterogeneity	P=1.0	
Wound infection (reported in six studies [92,128,133,243,270,311]	350/344	0.62 [0.29, 1.34]
P value from test for heterogeneity	P=0.48	
Death (reported in six studies [92,128,133,243,270,311]	350/344	1.21 [0.29, 4.96]
P value from test for heterogeneity	P= 0.29	

7.9.8.3.2 Caesarean and gynaecological surgery

We identified twelve studies in this group: seven studies included patients undergoing caesarean section [43,115,116,124,181,253,345] and five studies [64,204,255,285,308] included patients undergoing gynaecological surgery (Table 26,Table 27).

We initially analysed the two surgical groups (caesarean and gynaecology) separately. The results of the analyses showed no significant differences between the groups in vomiting, pneumonia and wound infection in either surgical group. The P value from test for heterogeneity was greater than 0.1

for all outcomes in either surgical group. LOS was reported in 10 studies. The early feeding group spent fewer days in hospital (p< 0.001) in two[116,253] out of six studies[43,115,116,181,253,345] on caesarean section and four[64,255,285,308] out of four studies on gynaecological surgery (p<0.05).

In a combined analysis including both surgical groups there were no statistically significant differences in any of the outcomes extracted (Table 9).

Table 9: Outcomes of studies of patients undergoing caesarean and gynaecological surgery

	No. patients (early feeding/late feeding)	**RR (fixed) 95% CI**
Vomiting (reported in five studies[43,64,181,204,255])	361/395	1.07[0.73, 1.58]
P value from test for heterogeneity	0.71	
Wound infection (reported in five studies [64,115,116,255,308]	358/356	0.94 [0.58, 1.52]
P value from test for heterogeneity	0.65	
Pneumonia (reported in 4 studies [64,255,285,308])	249/260	0.42 [0.08,2.17]
P value from test for heterogeneity	0.74	

7.9.8.3.3 Pancreatitis with no surgery

Only one study included patients who had clinical features of acute pancreatitis and did not have any surgical procedure[185] (Table 28). Fifty patients were included in the study. Patients in the early feeding group (n=50) were given liquids, such as tea, water and juice, orally without restrictions immediately after admission. Patients in the late feeding group had a nasogastric tube placed in the stomach for suction. Continuous suction was applied and maintained until the tube was removed.

Results were available for mortality and LOS. There were three deaths in the early feeding group and two deaths in the late feeding group. There were no statistically significant differences in LOS.

7.9.8.4 Cost effectiveness evidence

Two studies evaluated the cost-effectiveness of pre- and post-operative oral nutrition supplements. An RCT (n=152), based in the UK compared four arms (pre-operative, post-operative, peri-operative and no nutritional supplementation) in patients undergoing elective major to moderate lower GI surgery[303]. There were significantly fewer *minor* complications in the intervention arms and no significant differences with respect to major complications. Costs were lower by £300 per patient although not significantly. The results favour intervention but the trial was inadequately powered.

An unpublished UK-based decision analysis [251] evaluated preoperative assessment, dietary advice and oral intervention (mixture of fortification and/or supplements) versus no preoperative assessment or intervention in patients undergoing GI surgery. Data was elicited from the expert opinion of a sample of NHS consultants. Incremental cost per patient (excluding cost savings due to complications averted) was estimated to be between £17 and £48. They found that preoperative assessment and ONS would be cost saving if averting a complication saves three or more bed-days.

Only one study was found that evaluated the costs (and consequences) of early post-operative oral nutrition versus nil by mouth[4]. It was performed in Japanese patients undergoing oncological colorectal surgery and reported that early post-operative feeding significantly reduced length of stay and hence medical costs with no significant differences in complication rates. However, the difference in length of stay in this study was much greater than that observed in studies within the clinical review and patients did not appear to be randomized. This, in combination with small sample size and considerable variation in the types of surgery included within different arms, gave a large potential for bias. Furthermore, the costs appear to be expressed as medians and hence might not reflect true differences in mean cost and the feeding protocol was based on rice gruel, which may not be replicable in a UK setting.

7.9.9 Conclusions - oral nutrition support in surgical patients

There is little evidence that pre-operative oral nutrition support is of benefit in surgical patients although trials are small and underpowered. Cost-benefit model does suggest that pre-operative oral supplementation might be cost saving for some patient groups but the models were sensitive to assumptions about the number of complications averted.

There is some evidence that post-operative oral nutrition supplements, introduced at or after recovery of GI function may reduce some complications but once again, studies have been small and underpowered. The evidence

applies to both general surgery patients and patients with hip fracture requiring orthopaedic surgery.

There is evidence that early introduction of oral intake following abdominal surgery is generally well tolerated and will reduce lengths of hospital stay.

7.9.10 Rationale for recommendations

The evidence above suggests that some surgical patients do benefit from post-operative oral nutrition support, especially if it is introduced early. There is little evidence of any harm from this practice, despite some patients experiencing more nausea and vomiting. Nutritional principles would also suggest that by targeting more malnourished patients, greater benefits might be accrued by this practice although larger, targeted trials are needed to prove this point.

7.9.11 Recommendations

7.9.11.1 Pre- and post-operative oral nutrition support should be considered for malnourished surgical patients (BMI<18.5 or weight loss>10% usual body weight, or BMI<20 and wt loss >5%. [B]

7.9.11.2 Resumption of some oral intake within 24 hours of abdominal surgery is recommended and is likely to reduce lengths of hospital stay. [A]

7.10 Nutrition support in dysphagia

7.10.1 Introduction

Dysphagia is the term used to describe any impairment of eating, drinking and swallowing. It is …' not a disease in itself, but rather a symptom of one or more underlying pathologies…' [183].. As a result it is not always obvious that a patient has dysphagia and thus a knowledgeable and skilled team needed to manage this condition appropriately.

The cause of dysphagia can be either a single medical problem (e.g. acute cerebral conditions, progressive neurological disorders and trauma, disease or surgery to the upper aero digestive tract [194]) or a part of a combination of conditions (e.g. sepsis, respiratory conditions, dependency for feeding, and cognitive disorders).

If the dysphagia is not diagnosed, it can lead to inadequate food and fluid intake and impaired nutritional status. It can also cause chest infections/sepsis/pneumonia and avoidance of eating may lead to social isolation. Ultimately dysphagia has a 'high morbidity, mortality and cost'[60,239].

7.10.2 Prevalence of dysphagia

The prevalence of oropharyngeal dysphagia is estimated to be 60% in nursing home residents and 12-13% of patients in hospital[60]. The prevalence for the general population over 50 years is cited as 16-22%[183], and in stroke patients as 27-100% [183]. (depending on the time assessed post stroke). Between 48-100% of patients with Motor Neurone Disease (MND) are dysphagic[183]. However, there is considerable variation in prevalences cited, possibly attributable to variation in the timing of assessment (e.g. in stroke the incidence of presentation with aspiration risk is 51% on admission, 27% at day 7, 6.8% at 6 months, and 2.3% after 6 months) [306] and problems with accurately diagnosing the condition.

Patients with dysphagia are seen in hospitals, the community and in nursing/care homes, with varying degrees of severity and impact on individuals' lives. Up to 41% of elderly patients complaining of dysphagia, living either in nursing homes or attending clinics, reported anxiety or panic attacks during mealtimes, 44% reported weight loss over the last year, and 50% reported eating less[79]. There is therefore a close link between dysphagia and nutritional compromise. Indeed, one study showed that by offering swallowing therapy to dysphagic patients post stroke, they could improve nutritional parameters [84].

7.10.3 Identifying patients with dysphagia

Patients may present with a range of symptoms of dysphagia, which can be divided into obvious and less obvious indicators.

Obvious Indicators:

- Patient reports difficulty and/ or painful chewing and/ or swallowing.
- Regurgitation of undigested food stuffs
- Difficulty controlling food and/ or liquid in the mouth
- Drooling
- Hoarse voice
- Coughing and/ or choking before, during, or after swallowing
- Globus sensation
- Nasal regurgitation
- Feeling of obstruction

- Unexplained/ involuntary weight loss

Less Obvious Indicators:

- Change in respiration pattern
- Unexplained temperature spikes
- Wet voice quality
- Tongue fasciculation (may be indicative of motor neurone disease)
- Xerostomia
- Heartburn
- Change in eating – for example, eating slowly or avoiding social occasions
- Frequent throat clearing
- Recurrent chest infections
- Atypical chest pain

Patients with any of the obvious or less obvious indicators for dysphagia should be referred for assessment by a healthcare professional with specialist training in assessment and management of swallowing disorders e.g. speech and language therapists, gastroenterologists, specialist nurses. Healthcare professionals should be aware that patients with acute cerebral conditions, degenerative disorders, trauma, disease, or who have undergone surgery or radiotherapy to the upper aero-digestive tract, are at high risk of developing dysphagia.

7.10.4 Nutritional intervention strategies

There are a number of possible treatment strategies that may help to maintain or improve the nutritional status of patients with oro-pharyngeal dysphagia. These include modification of the consistency, temperature and/or taste of liquids and food but in some situations, modification of texture and consistency may compromise hydration status, nutritional intake, and swallowing safety\ efficiency for patients [346]. All oral and non-oral options to ensure safe and effective nutrition must therefore be considered [98].

7.10.5 Methods

We searched for systematic reviews and randomised control trials that investigated the effectiveness of modified foods, fluids and enteral feeding in dysphagic patients. No studies or systematic reviews were found, probably because randomised studies are not really feasible in this patient group. The Guideline Development Group therefore appointed a sub-group of experts to develop recommendations on the management of feeding patients with dysphagia. These were then ratified by the GDG through informal consensus.

7.10.6 Rationale for Recommendations

Due to the complex nature of dysphagia and the range of its presentations our recommendations offer a framework to make decisions based on individual patients' symptoms rather than any specific diagnosis. The recommendations must be considered in relation to ethical issues (section 4.7) and decisions based upon them should always involve the patient, family and managing medical/surgical teams. The dysphagia specialists involved with swallowing management should advise the medical / surgical team on dietary modification.

7.10.7 Recommendations

7.10.7.1 Any modification of nutrition and hydration methods should be based on a risk/ benefit analysis of clinical indicators relevant to that patient (Figure 1), the results of clinical/instrumental examinations and consideration of the factors in Figure 2. [D(GPP)]

Figure 1: Obvious and less obvious indicators for dysphagia

Obvious Indicators	Less Obvious Indicators
• Patient reports difficulty and/ or painful chewing and/ or swallowing.	• Change in respiration pattern
• Regurgitation of undigested food stuffs	• Unexplained temperature spikes
• Difficulty controlling food and/ or liquid in the mouth	• Wet voice quality
• Drooling	• Tongue fasciculation (may be indicative of motor neurone

Obvious Indicators	Less Obvious Indicators
	disease)
• Hoarse voice	• Xerostomia
• Coughing and/ or choking before, during, or after swallowing	• Heartburn
• Globus sensation	• Change in eating – for example, eating slowly or avoiding social occasions
• Nasal regurgitation	• Frequent throat clearing
• Feeling of obstruction	• Recurrent chest infections
• Unexplained/ involuntary weight loss	• Atypical chest pain

Figure 2: Factors to be considered before any modification of nutrition and hydration methods:

- Recurrent chest infections
- Mobility
- Dependency on others for feeding
- Perceived palatability for the patient
- Level of alertness
- Compromised physiology
- poor oral hygiene
- Compromised medical status
- Metabolic and nutritional requirements
- Vulnerability (immuno- compromised?)
- Co-morbidities

7.10.7.2 Patients with dysphagia may require medication via a different route from nutrition and hydration and the risks and benefits of any medication should be given separate consideration. Alternative medications and timing may be indicated. [D(GPP)]

7.10.7.3 Regular monitoring and reassessing by appropriate specialists is needed to ensure that modified diets are only used for patients who still need them. [D (GPP)]

7.11 Research recommendations

7.11.1 What are the benefits of patients (in hospital or community and including the elderly) identified as high risk of malnutrition by a screening tool such as MUST being offered either oral sip feeds compared to a) dietary modification and or food fortification, or b) dietary modification and or food fortification and dietary counselling in terms of determining complications, survival, length of hospital stay, quality of life and cost effectiveness?

This is an essential recommendation for research since there is insufficient evidence on the benefits of intervention used for oral nutrition support in particular the benefits of often first line treatment e.g. food fortification and or dietary counselling. It is essential to know this so that the indications on who to treat can be further supported.

7.11.2 What are the benefits to patients in primary care identified as high risk of malnutrition by a screening tool such as MUST being offered either oral sip feeds compared to being offered; a) combined micro and macronutrient supplement or b) micronutrient supplementation alone c) standard care (no specific dietary intervention) or d) placebo in terms of survival, hospital admissions, quality of life and cost effectiveness?

This is an essential recommendation for research since there is insufficient evidence on the benefits of intervention used for oral nutrition support. It is essential to know this so that the indications on who to treat can be further supported.

7.11.2.1 Further research is needed into whether thickened liquids or standard/ unthickend liquids improve low mood and reduce dehydration, mortality, the need for enteral feeding and the number of aspiration incidents in patients

with oro-pharyngeal dysphagia (as assessed by a trained practitioner).

There is not enough/satisfactory research into whether thickened fluids used with patients with oro-pharyngeal dysphagia improves their swallow function/safety, and/or allows patients to receive adequate hydration. There are also cost implications this question.

7.11.2.2 Further research is needed into whether pureed food or standard/ soft food improves nutritional levels, the safety and efficiency of swallow, and the number of aspiration incidents in patients with oro-pharyngeal dysphagia (as assessed by a trained practitioner).

There is not enough/adequate research to make an informed decision about whether puree diets are either safe or offer adequate nutritional support for patients with oro-pharyngeal dysphagia (these diets are often offered to patients with poor nutritional reserve initially, and a compromised swallow).

8 Enteral nutrition

8.1 Introduction

Enteral nutrition (EN) usually refers to the delivery of a nutritionally complete feed (containing protein or amino acids, carbohydrate, fat, water, minerals and vitamins) directly into the gut via a tube (enteral tube feeding -ETF). The tube usually delivers nutrients into the stomach, duodenum or jejunum. Most enteral feeding tubes are introduced at the bedside but some are placed surgically, at endoscopy or using radiological, fluoroscopic or ultrasound guidance. Whenever possible the patient should be aware of why this form of nutritional support is necessary, how it will be given and for how long.

8.2 Methodology

Reviews were conducted to provide guidance on the indications for ETF, the benefits of ETF compared to oral or parenteral feeding and on the technical aspects of delivering enteral feeds. However, nearly all studies on the indication for ETF (rather than timing, type of tube, type/amounts of nutrients etc) have excluded patients with a strong indication for EN (i.e. those with a functional GI tract but unsafe swallow). The findings from such studies do not therefore provide much help with decision making in patients who most commonly need EN (i.e. patients with dysphagia) . Instead these studies apply to the 'elective' use of EN to provide supplementary nutrition under circumstances of less definite clinical need (e.g. post operatively).

8.3 Indications for enteral tube feeding

Enteral tube feeding (ETF) is indicated when oral intake is insufficient (even with supplements) or unsafe (even when feed consistency has been altered). The GI tract must be accessible and functioning adequately to absorb the feed administered. Common indications for ETF are listed in Table 10.

If there are any contra-indications to ETF (e.g. inaccessible GI tract, severe malabsorption, excessive gastrointestinal losses), parenteral feeding should be considered.

Table 10: Indications for enteral tube feeding

Indication for enteral tube feeding	Example
Unconscious patient	Head injury, ventilated patient
Neuromuscular swallowing disorder	Post-CVA, multiple sclerosis, motor neurone disease, Parkinson's disease
Physiological anorexia	Cancer, sepsis, liver disease
Upper GI obstruction	Oro-pharyngeal or oesophageal stricture or tumour
GI dysfunction or malabsorption	Post-operative ileus, short bowel
Increased nutritional requirements	Cystic fibrosis, renal disease
Psychological problems	Severe depression or anorexia nervosa
Specific treatment	Inflammatory bowel disease,

8.4 Recommendations

8.4.1 Enteral tube feeding should be considered in patients who need nutrition support (unintentional weight loss >10% over the last 3 to 6 months; BMI <18.5; BMI <20 and unintentional weight loss >5% over the last 3 to 6 months; not eaten for >5 days or unlikely to eat for >5 days) who have a functional, accessible gastrointestinal tract but an inadequate or unsafe oral intake. [D(GPP)]

8.5 Supplementary enteral feeding versus standard care?

8.5.1 Introduction

The aim of enteral nutrition support is to improve the patient's nutritional intake and/or prevent further deterioration in cases where the oral route is considered insufficient or unsafe. A review was conducted to identify RCTs that compared patient groups who received standard care (e.g. normal hospital diet and/or oral nutrition supplements) with patients who received ETF (with or without oral intake). The review therefore examined the effectiveness of ETF in patients at risk of undernutrition due to inadequate food and fluid intake rather than patients in whom ETF was essential because oral intake was clearly inadequate or unsafe.

8.5.2 Studies considered for this review

The review conducted identified 9 RCTs[15,44,132,170,208,217,291,316,317] (Table 31). Four of these compared the effect of patients receiving 12 to 24 hours of nasogastric tube feeding plus continued normal hospital diet with patients receiving a standard hospital diet only[132,217,316,317]. Two studies compared nasogastric/ asoduodenal feeding with standard hospital diet[44,170] and one study compared nasogastric feeding with standard hospital diet plus ad lib snacks[15]. A further study had two intervention arms where patients received a nasogastric feed with amino acids alone and the second arm received amino acids plus carbohydrates[208]. The control group continued on a normal hospital diet. The final study compared tracheo-eosophageal tube feeding with a clear liquid diet advancing to a normal diet as tolerated[291].

The patients included in the studies were orthopaedic hip fracture patients (four studies covering 337 patients)[15,132,316,317], generally malnourished (one study covering 86 patients)[217], total laryngectomy patients (one study covering 67 patients)[291]. and patients with alcoholic liver disease (three studies covering 86 patients)[44,170,208].

8.5.3 Clinical evidence

The main outcomes reported were nutritional intake achieved, changes in nutritional status, mortality, length of stay and complications associated with tube feeding (e.g. tolerance of the feeding tube).

The difference in nutritional intake (usually reported as energy and/or protein intake) between the enterally tube fed patients and those receiving standard care was reported in six studies[44,132,170,217,316,317].In all six studies, the enterally fed group achieved a significantly greater nutritional intake (range $p<0.0001$ to 0.012).

Four studies reported changes in measures of nutritional status[15,170,208,217]. In three of these studies the patients who were fed via an enteral tube experienced improvement in nutritional status (range $p=0.001$ to $p=0.05$). In the fourth study[170] there was no observed difference between the two groups.

Mortality was reported in 6 studies[15,44,132,170,316,317]. In three of these studies[15,316,317], no difference between those fed by enteral tube and the standard care group was detected. However, in one study[44], the enterally fed group had a significantly lower death rate ($p=0.02$) and in another[170], mortality at two and five weeks after the start of the study was reported as lower in the ETF patients but no p-values were reported. One study, [132] noted a higher mortality rate for the patients who were tube fed but again no p-value was reported.

There were no significant differences reported for postoperative complications reported in three studies[291,316,317]; the incidence of pressure sores reported in one study[132]; the incidence of diarrhoea reported[170] or the incidence of

infection rates reported in one study [44]. Four studies reported that supplementary ETF had no influence on length of hospital stay [170,291,316,317], although in one study[15], median time to independent mobility was lower in the ETF group (p 0.02 -0.04).

Two studies[15,217] provided information on patients tolerance of enteral tube feeding but no p-values were reported. In these studies 22%[15] and 30%[217] of study participants experienced problems with tolerating the nasogastric tube.

8.5.4 Cost-effectiveness evidence

Three studies were found that reported a cost comparison[92,200,224]: two RCTs and one retrospective cohort study (Table 46). One RCT[200] evaluated insertion of double-lumen gastrojejunostomy tube compared with routine care by the surgeon after pancreatico-duodenectomy. Half the patients in the routine care arm received PN; and the other group probably received NG feeding (but the route of feeding was unclear). The study found significant reductions in gastro-paresis and in costs. The second RCT[92] compared early nasogastric enteral feeding with early oral feeding after colorectal resection in cancer patients. They found that early oral intervention was safe but there were no cost savings or improvements in clinical outcomes.

The aim of the retrospective study [224] was to test whether there were cost savings if using tube-feeding rather than hand-oral feed (which requires expensive staff time) for patients with advanced dementia. The results showed that the total costs were higher for the patients with feeding tubes compared with those without tubes ($9373 vs. $5178, p=0.04). The difference was due to tube feeding placement cost and hospital costs arising from complications that were directly related to tube feeding. However, the sample size of this study was small (11 patients in each group) and potentially biased since it was a convenience sample. Costing was also made using Medicaid and Medicare reimbursement rates, which may not be applicable to the UK NHS setting.

8.5.5 Conclusions

Enteral tube feeding in patients where there is some doubt about the adequacy of oral intake is effective in increasing nutritional intake over and above the intake observed with standard care and/or oral supplements and this does usually lead to an improvement in nutritional status. However, this does not seem to reduce length of stay or have an important impact on mortality rate and tube tolerance is sometimes a problem in these patients. The evidence of benefit related to complications, quality of life, costs and cost-effectiveness is very limited and enteral feeding of elderly demented patients could be more expensive than hand feeding. Gastrojejunostomy tube feeding after pancreaticoduodenectomy may result in cost savings. Larger well-designed trials are required to examine all of these areas properly.

8.5.6 Rationale for recommendation(s)

Although enteral tube feeding does increase the nutritional intake in patients the evidence that this intervention has on long term outcomes such as length of hospital stay and mortality is not clear.

8.5.7 Recommendation

8.5.7.1 Elective enteral tube feeding outside of this guideline's general indications for nutrition support is not recommended. [B]

8.6 Enteral feeding routes of access

Many types of enteral feeding tubes can be used to deliver nutrition to the stomach or upper GI tract. Choices depend on proposed/expected period of feeding, clinical condition, and anatomy. NG tubes are used most frequently but other tube types include nasoduodenal and nasojejunal tubes and gastrostomies or jejunostomies placed by endoscopic, fluoroscopic, radiological or surgical means.

8.6.1 Nasogastric tubes

Nasogastric tubes are used for short-term support except when there are problems such as vomiting, gastro-oesophageal reflux, poor gastric emptying, ileus or intestinal obstruction. They are potentially dangerous in patients with an unsafe swallow and those who need to be nursed prone or flat (unless an endotracheal tube is in place to prevent refluxed food entering the bronchi). Fine bore (5 – 8 FrG) NG tubes should be used for ETF unless there is a need for repeated gastric aspiration or administration of some drugs via the tube. Most fibre enriched feeds can be given via fine bore tubes.

NG tubes should be placed by appropriately qualified staff in the hospital or community and once in place their position ***must*** be checked by aspiration of stomach contents and use of pH paper before every use. If acid is detected (by pH is <5) the tube is in the stomach. If pH testing is not possible or >5 the feed should not be started but left for one hour and aspirated again. If no aspirate or pH remains more than 5.5 an X-ray is generally needed to confirm position and discussions with senior medical staff to determine how to determine tube position in the future. In the sick, ventilated intensive care patient the tube position should be confirmed radiologically.

8.6.2 Nasoduodenal and nasojejunal tubes

The position of a NJ tube should be confirmed by an abdominal X-ray after placement.

8.6.3 Gastrostomy and jejunostomy

Gastrostomy and jejunostomy tubes pass through the abdominal wall into the stomach or jejunum. They are used for those requiring long-term feeding or when NG access is difficult. Gastrostomies are usually placed endoscopically (Percutaneous Endoscopic Gastrostomy - PEG) but radiological or surgical placement may be needed. Gastrostomy feeding may still cause aspiration although risks are probably lower than with NG tubes. In high-risk patients, gastrostomies can have post-pyloric extension tubes or tubes can be put directly into the jejunum.

8.7 Nasogastric (NG) versus nasoduodenal (ND) or nasojejunal (NJ

8.7.1 Introduction

Patients receiving enteral tube feeds via the naso/oro gastric route can have problems tolerating their enteral feeding regime due to gastro-oesophageal reflux or delayed gastric emptying. As a result, patients may experience reflux or vomiting which may cause aspiration pneumonia and also result in a reduced nutrient intake. When these problems occur despite drug intervention, an alternative approach is to insert a tube through the nose into the duodenum or jejunum.

8.7.2 Studies considered for this review

We identified 14 RCTs (707 patients) that compared nasogastric feeding with nasoduodenal or nasojejunal feeding (Table 32).
[29,67,68,86,121,139,143,169,180,191,225,226,234,315]. 12 studies included intensive care patients[29,67,68,86,121,139,143,169,180,225,226,234], one study malnourished neurological patients[315] and one study was in healthy people [191]. In five of these studies the intervention and comparison arms used the naso/oro gastric route but did not specify the number of patients for each.

The main outcomes reported included aspiration[86,143,169,234], pneumonia[67,68,169,180,225,226,315], vomiting[68,225,226,234], diarrhoea[67,68,169,225,226] and percentage of target energy received[29,68,86,121,225]. Other outcomes reported included: length of stay in ICU and in hospital, mortality and change in nutritional status.

8.7.3 Clinical evidence

No significant difference was found for mortality, length of stay in intensive care or hospital, incidence of pneumonia, vomiting or diarrhoea. Two studies reported the mean weight change, one showed no significant difference[169] while the other reported a significant weight gain for the nasogastric group[235]. However, the weight change for the latter study was only recorded for 21 of the 38 patients entered into the study. Four out of the five studies reported no

significant difference in the percent of prescribed calorie intake[29,68,86,121]. The other study showed the nasojejunal patients achieving a significantly higher percent of their daily goal caloric intake than the nasogastric patients[225].

8.7.4 Cost-effectiveness evidence

No study reporting cost or cost-effectiveness was found.

8.7.5 Conclusions

Feeding patients with a nasogastric tube is usually as effective as a post-pyloric tube (nasoduodenal/nasojejunal) for delivering nutrients to patients (especially to patients on intensive care). The expected problems of gastric feeding in patients with gastro oesophageal reflux and delayed gastric emptying are not apparent in these studies.

It must be noted, however, that for ethical reasons randomised studies have not been performed in the patient groups usually considered for post pyloric feeding, although some information about the effectiveness and safety of post pyloric feeding in these patients may be gained from trials that compare post-pyloric feeding to parenteral nutrition.

8.7.6 Rationale for recommendation(s)

The gastric route is usually technically simpler and in most circumstances achieves similar nutrient delivery with similar risks. Clinical studies have failed to show any clear advantage in feeding post-pylorically.

8.7.7 Recommendations

8.7.7.1 General medical, surgical and intensive care patients should be fed intragastrically unless there is upper gut dysfunction. [A]

8.7.7.2 Patients with impaired upper GI function should be considered for post-pyloric feeding. [D(GPP)]

8.8 Percutaneous endoscopic gastrostomy (PEG) versus nasogastric (NG) feeding

8.8.1 Introduction

For some patients with acute or chronic conditions requiring enteral feeding there is the option of feeding through a nasogastric tube or a gastrostomy (usually a PEG). Nasogastric tube feeding is usually successful but problems

include dislodgement of the tube with the need for replacement which can be invasive and uncomfortable. For some patients the location and securing by tape of the nasogastric tube can also be irritating and may raise ethical issues. For some patients the tube itself may also cause discomfort in the back of the throat and occasionally swallowing problems

In contrast, a gastrostomy is not dislodged easily and is more comfortable, although there are potential difficulties and risks in placement, feed aspiration can still occur and there can be difficulties around any decision to withdraw gastrostomy feeding although from the ethical stand-point this is not really different to deciding not to instigate it in the first place (section 4.7). Since gastrostomy feeding is increasingly considered for patients likely to require long-term ETF we undertook a review of studies comparing the two access techniques.

8.8.2 Studies considered for this review

Our review compared percutaneous endoscopic gastrostomy with nasogastric feeding (Table 33). Three small published RCTs (BAETEN1992, NORTON1996, PARK1992) and a large multi-centre randomised controlled trial [320] met the inclusion criteria. One study looked at neurological, surgical and ear, nose and throat (ENT) patients [11], while the multi-centre study and the other two studies focused on stroke patients with accompanying dysphagia [235,252,320].

The main outcomes reported in the studies were absolute risk of death and risk of death or poor outcome (using the Modified Rankin Scale - MRS), treatment failure, amount of feed received, weight change, mortality GI haemorrhage and pressure sores. Other outcomes reported were: the time needed for tube insertion, length of hospital stay, convenience of care, quality of life, fixation of tube to patient and the incidence of aspiration or pneumonia.

8.8.3 Clinical evidence

There were some methodological problems with two of the smaller studies. One [11] had more sick patients in the PEG group than did the NG group suggesting a possible allocation bias between groups. While in another [252], most of the patients in the NG arm crossed over to the PEG arm less than halfway through, and by day 28 of the study period 18 out of the 19 patients had switched to PEG feeding.

Two studies [235,252] reported significantly greater intake of prescribed feed and consequently significantly greater weight gain in PEG patients. In three studies [11,235,252] there was a non-significant increase in treatment failure in the nasogastric group.

Mortality was reported for all of the trials. One of them [252] showed no difference between study groups, one showed significantly higher mortality in the nasogastric arm than the PEG arm [235] and two [11,320] reported higher

mortality in the PEG group especially if inserted within the first two weeks following a stroke. In addition to the small increase in risk of death demonstrated by the large multi-centre randomised trial (FOOD,2005), this study also showed an increased risk of poor outcomes, although for secondary outcomes such as GI haemorrhaging, PEG patients fared better.

8.8.4 Cost-effectiveness evidence

We did not find any study reporting cost or cost-effectiveness.

8.8.5 Conclusions

The results of the largest multi-centre trial showed that significant benefit of a PEG over an NG tube is very unlikely and there is a significant mortality/morbidity from PEG insertion. However, patients generally prefer a PEG to a NG tube for long term treatment as it less likely to displace, it can remain unseen and it is more comfortable. A PEG should usually be considered after a patient has been shown to tolerate gastric feeding via a nasogastric tube for 2-4 weeks after an acute neurological event such as a stroke, when the prognosis/QOL/ of the patient can be better predicted. If the patient cannot decide for themselves, the patient's carer and an appropriate multidisciplinary health team should aim to act in the patient's best interest, deciding on the type and duration of treatment needed. A similar group should decide whether feeding should be stopped. In clinical practice it is more difficult to stop feeding through a PEG than though a nasogastric tube although the same ethical/ moral considerations apply as a NG tube is easier to remove.

8.8.6 Recommendations

8.8.6.1 Gastrostomy/Jejunostomy feeding should be considered in patients needing long-term enteral tube feeding. [D(GPP)]

8.8.6.2 In the acute setting e.g. following dysphagic stroke, patients unable to safely swallow or take sufficient energy and nutrients orally should have an initial 2 week trial of nasogastric tube feeding while assessing the prognosis. [A]

8.9 Types of enteral feeds

Most enteral feeds come as a standard ready to use liquid microbial free preparations that contain energy, protein, vitamins, minerals, trace elements and fluid +/- fibre. They are usually nutritionally complete. A ready to use standard feed will usually contain 1 kcal and 0.4g protein per ml but many

other types of enteral feed preparations are available with differing energy: protein ratios and types of fat or protein.

Administering an enteral feed into the stomach rather than small intestine permits the use of hypertonic feeds, higher feeding rates and bolus feeding. Enteral feeding pumps are also available so that the rate of feed can be altered (see mode of delivery for further guidance). In patients with doubtful GI motility, the stomach should be aspirated every 4 hours and if aspirates are high (e.g. exceed 200mls), the feeding pump rate should be reduced in line with local policy. Enteral feeding delivery is usually increased gradually over the first 24 hours (or slower if the patient is very undernourished, see section 5.5.1).

8.10 Mode of delivery; bolus v intermittent v continuous

8.10.1 Introduction

Enteral feeds can be delivered continuously over a variable number of hours or intermittently as boluses, and there are potential advantages and disadvantages of both methods. We therefore identified studies that compared different modes of delivering enteral feeds. The RCTs found were categorised into continuous v bolus and continuous (24hr) v continuous (16-18hr).

8.10.2 Studies considered for this review

8.10.2.1 Continuous v bolus

Nine studies compared continuous v bolus regimens in neurological dysphagic patients, patients with injuries to the head, post-operative cancer patients, critically ill patients[290], elderly patients and healthy adults[19,30,58,144,177,192,258,309] (Table 34). Most regimens described in the studies compared 24hour continuous feeding with 3-6 hour bolus feeds (250 -500ml). The main outcomes reported were: abdominal discomfort, aspiration pneumonia, change in nutritional status, clogged tubes, nurse preference and biochemical changes.

8.10.2.2 Clinical evidence

For abdominal discomfort, aspiration pneumonia and nurse preference there was no evidence of benefit between the continuous and bolus fed group[46,58,192,309.] However, in one study[258] the continuous group were found to have a significant improvement in nutritional status (body weight and arm circumference) compared to the bolus fed group ($p<0.01$), while in another [58] there was less clogging of nasogastric tubes with bolus feeding ($p=0.01$).

8.10.2.3 Continuous v continuous

Five studies compared continuous ETF (24hours) v continuous ETF (16 - 18hours) with daily breaks (2 – 4 hours). Studies were undertaken in critically ill, ventilated patients and post surgical patients[30,47,121,300,335]. The main outcomes reported were; length of hospital stay, duration of enteral feeding, mortality, ventilator associated pneumonia, gastric pH and rate of gastric colonisation.

8.10.2.4 Clinical evidence

There were no significant differences between the 24 hour continuous feeding groups and the 16-18 hour feeding groups in either mortality or ventilator associated pneumonia; [30,121,335], and rates of gastric colonisation and levels of gastric pH were also similar[30,300] In one study however [335] there was a significant reduction in hospital stay for a 16 hour fed group compared to a 24 hour continuous group (p=0.04).

8.10.2.5 Cost-effectiveness

No study reporting cost or cost-effectiveness was found.

8.10.3 Conclusions

Bolus feeding is as effective as continuous feeding and is probably less likely to cause tube blockage. Overall, however, the mode of feed delivery can be dictated by practical issues. For example, in patients who pull or dislodge nasogastric tubes regularly, bolus feeding can be used as a practical safe alternative to continuous feeding, while in intensive care the severity of illness and issues of gastric emptying, metabolic stability and control of glucose levels may well favour continuous feed administration.

8.10.4 Recommendations

8.10.4.1 For most patients on intragastric feeding, either bolus or continuous methods can be used, taking into account patient preference, convenience and drug administration. [B]

8.10.4.2 Nasogastric tube feeding should usually be delivered continuously over 16-24 hours daily for acutely ill patients in intensive care. [D (GPP)]

8.11 Commencing enteral feeding after insertion of a percutaneous endoscopic gastrostomy?

8.11.1 Introduction

Percutaneous endoscopic gastrostomy (PEG) is a relatively common procedure but it has a significant mortality/morbidity (NCEPOD report). The length of time one should wait before commencing feeding after insertion of the tube has been subject to controversy. The traditional practice has been to delay feeding for 24 hours post insertion but recently some clinicians used PEGs much earlier. Delays in starting PEG feeding could result in unnecessary prolongation of hospital stay and costs. A review was therefore performed to assess the safety of early PEG feeding (within four hours of installation) compared with delayed feeding (more than 24 hours after installation).

8.11.2 Studies considered for this review

Four published RCTs (including 290 patients) met the inclusion criteria[39,55,213,310](Table 36). The more recent studies were of higher methodological quality. The mean age of patients in all studies was more than 60 years.

8.11.3 Clinical evidence

No significant differences were reported for mortality (three studies) or complication rates (4 studies), although two studies reported more gastric distension which had resolved by day three after insertion.

8.11.4 Conclusion

Since none of the studies detected a significant difference or trend between the early or late groups it can be assumed that in an uncomplicated patient there is no reason to delay the start of feeding for more than 4 hours after insertion of a new PEG tube.

8.11.5 Recommendation

8.11.5.1 It is safe to start feeding through a PEG tube four hours after insertion in uncomplicated cases. [A]

8.12 Enteral motility agents

8.12.1 Introduction

If patients with impaired gastrointestinal motility are fed enterally they may develop symptoms of abdominal distension vomiting, gastro oesophageal reflux, pulmonary aspiration, pneumonia or sepsis. They may also have large gastric aspirates and impaired fluid and nutritional intakes. One treatment strategy for these problems is to administer prokinetic agents to promote gastric emptying and improve intestinal motility. We therefore conducted a review to identify studies that compared patients receiving enteral feeds with and without motility agents.

8.12.2 Studies considered for this review

Ten studies were identified and were categorised into 5 groups according to the type of prokinetic agent administered; erythromycin, metaclopromide and or cisapride (Table 37 and Table 38). However, since cisapride has now been withdrawn, the studies using that drug are not reported here. Most of the studies included patients on intensive care in whom gastrointestinal feed intolerance is associated with a worse outcome and the development of aspiration pneumonia. However, this association is not considered to be causal and the inclusion of these high risk patients in the studies makes interpretation difficult.

8.12.3 The effectiveness of motility agents vs. placebo

8.12.3.1 Erythromycin v placebo

5 studies were included in which erythromycin was administered intravenously either as a single dose [53,202] or every six hours for a minimum of five days[25,269,352](Table 36). Four studies included intensive care patients and one pancreatico-duodenectomy patients. In 2 studies patients were only recruited if they demonstrated intolerance to enteral feeding[53,202]. The outcomes assessed included mortality, pneumonia, length of stay, complications, gastric emptying, residual gastric volume and feed tolerance.

One study[25] detected no significant differences in mortality, pneumonia or length of stay between the intervention and control group and two studies [25,352] reported similar complication rates. Gastric residual volumes were lower with erythromycin in one study[269] but there were no differences reported in another [352]. Improved tolerance to enteral feeds in the intervention group, was observed in one study[25], p=0.001 during the first 48 hours of feeding but there were no significant differences by the end of the study period. In another study[53] enteral feeding was more successful in the intervention group after 1hour, p=0.05 and 12 hours, p=0.01 of a single initiating dose of erythromycin but there were no significant differences 24 hours after the dose.

8.12.3.2 Metoclopramide v placebo

Three studies were included[166,202,351] one of which also had an additional arm for erythromycin[202](Table 37). All the studies included intensive care patients who were tube fed, with one study [202] only recruiting patients who were not tolerating enteral feeds. The metoclopramide was administered intravenously in one study[166] and via a naso/orogastric tube in the other two[202,351]. No differences were found in intensive care mortality or nosocomial pneumonia. Gastric emptying rates were higher with metaclopramide (p=0.04) in one study [166] but similar in another [202].

8.12.4 Cost-effectiveness

No study reporting cost or cost-effectiveness was found.

8.12.5 Additional considerations

Prior to administration of motility agents healthcare professionals should review the patient's need for drugs with known effects in delayed gastric emptying, such as opiates. A reduction in the dose of these drugs may itself improve intolerance to enteral feeds. Within intensive care elevating the head of the patient above 30 degrees is recommended at all times for ETF also turning on the right side may improve gastric emptying.

Patients with moderate to mild gastric motility problems should be offered oral erythromycin unless there is a high probability of intolerance. Patients with severe gastric problems and those who do not respond to oral agents after 48 hours, should be offered IV motility agents and alternative methods of nutrition support such as post-pyloric ETF or PN may be needed.

8.12.6 Conclusions

Metaclopromide and erythromycin appear to be effective in improving gastric motility and may improve tolerance to enteral feeds for a limited period. However, the studies do not provide evidence of benefit for important long term clinical end points. In the intensive care population care should be taken to consider the risk of drug interactions and side-effects (e.g. dystonic reactions in the elderly with metoclopramide).

8.12.7 Recommendations

8.12.7.1 A motility agent should be considered for patients in intensive care with delayed gastric emptying who are not tolerating enteral feeding unless there is suspicion of gastrointestinal obstruction or a pharmacological cause. [A]

8.12.7.2 Patients in other acute care settings with delayed gastric emptying not tolerating enteral feeding should also be

offered a motility agent unless there is suspicion of gastrointestinal obstruction or a pharmacological cause. [D (GPP)]

8.12.7.3 Patients with delayed gastric emptying which severely limits nasogastric feeding despite the use of motility agents should be considered for other methods of nutritional support. [D (GPP)]

8.12.7.4 A motility agent should be considered for patients in intensive care with delayed gastric emptying who are not tolerating enteral feeding unless there is suspicion of gastrointestinal obstruction or a pharmacological cause. [A]

8.12.7.5 Patients in acute care settings with delayed gastric emptying, not tolerating enteral feeding should also be offered a motility agent unless there is suspicion of gastrointestinal obstruction or a pharmacological cause. [D (GPP)]

8.13 Enteral Tube feeding in Surgical patients

8.13.1 Introduction

Many surgical patients are either malnourished before surgery or at risk of becoming so following their operation (see Section 7.9). In some cases, ETF will be indicated according to basic principles i.e. the patient requires nutrition support, is unable to take this safely or adequately by mouth, yet has an accessible functioning GI tract that could absorb enteral nutrition. However, as with oral peri-operative nutrition support, patients can also be given elective supplementary nutrition using ETF. We therefore conducted a review to examine whether this practice is of potential benefit.

8.13.2 Methodology

The review identified studies that fell into three subgroups:

1. Patients receiving pre-operative supplementary ETF versus no pre-operative nutrition support (i.e. normal hospital diet, placebo drink, fasting or simple IV fluids).

2. Patients receiving pre- and post-operative supplementary ETF versus patients receiving no peri-operative nutrition support (i.e. normal hospital diet, placebo drink, fasting or simple IV fluids)

3. Patients receiving elective early post-operative supplementary ETF vs. no early post operative nutrition (i.e. standard nil by mouth post-

surgical dietary care with simple IV fluids until clinical signs of returning GI function)

8.13.3 Pre-operative supplementary ETF versus no pre-operative nutrition support

8.13.3.1 Studies considered for this review

Three RCTs[190,294,342] investigated the benefits of pre-operative supplementary ETF versus no preoperative support in malnourished general surgical patients, GI cancer patients requiring surgery and patients undergoing liver transplantation (Table 40).

8.13.3.2 Clinical evidence

One study [294] reported loss of weight in the control group after 10 days compared to weight gain in the intervention group ($p<0.001$). There were also more wound infections, nausea and vomiting and higher mortality rates in controls although no p values were reported. The second study [342] reported that pre-operative ETF significantly reduced rates of intra-abdominal sepsis compared to controls ($p<0.05$) but there was no difference in other complication rates or length of hospital stay between groups. The third study [190] found that although there were more deaths in the control group (seven deaths before and two deaths after liver transplant) than there were in the supplemented group (two deaths before and three deaths after transplant), there was no significant difference in overall survival ($p=0.075$).

8.13.4 Elective Pre and post-operative supplementary ETF vs. no nutrition support

8.12.4.1 Studies considered for this review

One RCT[336] examined the use of pre- and post-operative supplementary ETF in malnourished head and neck cancer patients (Table 40).

8.13.4.2 Clinical evidence

No differences were found between the groups.

8.13.5 Elective early post-operative supplementary ETF vs. no early post-operative nutrition

8.13.5.1 Studies considered for this review

We identified 23 RCTs which examined the benefits of early ETF after surgery. These were analysed according to the type of surgical patients included in the studies.

Five studies included patients undergoing upper GI surgery [38,138,248,318,343] (Table 41).

Three studies included patients undergoing lower GI surgery [205,280,287] (Table 41).

Six studies included both upper and lower surgery [22,50,149,277,298,305] (Table 43)

Three studies included patients undergoing hepatobiliary surgery [105,134,153] (Table 44) and six studies [57,88,165,206,228,263] included acute trauma patients (Table 45).

We extracted data on seven outcomes: vomiting, anastomotic dehiscence, pneumonia, death, intra-abdominal abscess, wound infection and hospital length of stay (LOS) where available. Where appropriate we pooled the data for these outcomes. We were unable to pool the data for LOS as the studies reported the data in different units and information needed to convert these units was not available.

8.13.5.2 Clinical evidence

Analyses for each of the surgical subgroups showed no statistically significant differences in any of the outcomes extracted. The P value from test for heterogeneity was greater than 0.1 for all outcomes in all the groups.

We also conducted a combined analysis which included all the surgical studies (Appendix Eight: Meta-Analyses Enteral versus Nil Post Operative Nutrition Support). This identified no statistically significant differences in any of the outcomes extracted which included vomiting, anastomotic dehiscence, pneumonia, intra-abdominal abscess, wound infection and mortality (Table 11). The data on lengths of hospital stay reported in fourteen studies [50,88,105,134,138,206,228,248,263,280,298,305,318,343] were not adequate to permit a combined analysis but statistically significant differences were only detected in two studies with one showing that early feeding led to fewer days in hospital ($p< 0.05$)[280] whilst the other showed that late feeding led to fewer days in hospital ($p< 0.01$)[305]

Table 11: Outcomes reported in studies of early enteral tube feeding

	No. patients (early	RR (fixed) 95%

	feeding/late feeding)	CI
Vomiting (reported in four studies[22,138,165,206]	298/280	1.27 [0.92, 1.75]
P value from test for heterogeneity	P= 0.21	
Anastomotic dehiscence (reported in 10 studies[22,138,205,248,280,287,298,305,318,343]	257/264	0.60 [0.33, 1.10]
P value from test for heterogeneity	P= 0.79	
Pneumonia (reported in 9 studies[22,88,138,206,228,248,287,298,305]	355/361	0.76 [0.53, 1.08]
P value from test for heterogeneity	P= 0.36	
Death (reported in 10 studies[22,88,138,206,248,263,280,287,298,305]	368/375	0.72 [0.45, 1.15]
P value from test for heterogeneity	P=0.37	
Intra-abdominal abscess (reported in eight studies[22,88,138,228,280,287,298,305]	250/256	0.60 [0.32, 1.14]
P value from test for heterogeneity	P=0.69	
Wound infection (reported in 12 studies[22,88,105,138,152,206,248,263,280,298,305,318]	402/408	0.92 [0.68, 1.23]
P value from test for heterogeneity	P= 0.26	

8.13.6 Cost effectiveness evidence

One study evaluated the cost of preoperative enteral nutrition[240]. ETF (10-21 days) was compared with no ETF. The study was a sensitivity analysis based on the two small trials with the largest reduction in complication rate. Incremental cost per complication averted was between £9,000 and £94,500 with hospital preoperative ETF, depending on the assumptions made. However, they found that home preoperative ETF is more likely to be cost saving.

We identified three cost-effectiveness analyses for ETF compared to nil nutrition postoperatively[22,134,136]. In each study the hospital costs and number of infections after surgery were calculated for both groups. All three studies reported a lower number of infections in the ETF groups compared to the nil groups.

A non-randomised prospective US study of patients undergoing bowel resection[136] showed a cost saving (the magnitude and statistical significance is unclear due to poor reporting) with jejunal feeding tube placed during surgery and feeding initiated within 12 hours of surgery compared with usual care (which was not detailed). The cost savings were due to a reduction in infections.

A small Danish RCT[22] reported a non-significant difference in (median) cost of about £1,500 for a 4 day naso-duodenal intervention compared with placebo after major abdominal surgery. Mean costs, which are more relevant than median costs, were not reported.
A small US RCT comparing naso-jejunal tube feeding from 12 hours after surgery with maintenance iv fluid after liver transplantation[134] found a non-significant incremental cost of $2,000 despite a 50% reduction in infections. Control patients that were moved to tube feeding were excluded.

The three studies evaluating early postoperative ETF had inconsistent results, small sample size and were potentially biased due to methodological weaknesses.

There were no economic studies evaluating pre and post-operative ETF.

8.13.7 Conclusions

The small number of studies that examined elective supplementary ETF in malnourished patients prior to surgery suggest that they benefit in terms of nutritional status and have reduced rates of intra-abdominal sepsis. However, much larger trials are needed to determine whether there are any benefits in lengths of hospital stay or mortality. The much larger number of studies that have examined early post-operative ETF compared to standard practice of nil by mouth until return of GI function, do not support the practice, although the studies did not focus on very malnourished patients who might benefit from this approach.

The cost-effectiveness of preoperative enteral nutrition is unclear but might be improved if administered in the patients' home.

8.13.8 Recommendations

8.13.8.1 Pre-operative supplementary enteral tube feeding should be considered in malnourished (weight loss>10% usual body weight, BMI<18.5) surgical patients who are to undergo major abdominal procedures. [B]

8.13.8.2 Early supplementary post-operative enteral tube feeding should not be used routinely in general surgical patients.[A]

8.13.8.3 Enteral tube feeding should be considered for all surgical patients who have not eaten for 5 days or who are unlikely to do so, along with those who have a BMI<18.5 or who have unintentionally lost >10% body weight. [D(GPP)]

8.14 Research recommendations

8.14.1 What are the benefits to Intensive care patients likely to stay for >5 days, who are offered ETF only compared to ETF and PN if they fail to tolerate >60% of their target nutritional needs 2 days after starting ETF in terms of survival, complications and hospital costs?

This is an area of common practice but where the benefits of these interventions are unclear and poorly reported.

8.14.2 What are the benefits to malnourished surgical patients who have indications for ETF being offered ETF only compared to ETF and PN if they fail to tolerate >60% of their target nutritional needs two days after starting ETF in terms of survival, complications and hospital costs?

Currently patients who present with the indications for enteral feeding are being given PN early when it seems that they are not tolerating enough enteral feed to meet requirements, however the benefits of fairly early intervention with PN are unclear.

8.14.3 What are the benefits to Intensive care patients likely to stay for >5 days who have contraindications to ETF being offered standard PN compared to either PN with additional glutamine, PN with additional selenium, or PN with additional glutamine and selenium in terms of survival, complications and hospital costs?

Although the use of novel substrates such as glutamine were not included in the scope of this guideline the GDG believed that over the last 10 years, two important nutritional observations from clinical trials are the improved survival

rates of ICU patients administered these novel substrates via parenteral nutrition. However further RCT's are required to confirm this and furthermore the benefits of novel substrates should perhaps be addressed when this guideline is updated.

9 Parenteral nutrition

9.1 Introduction

Parenteral nutrition (PN) refers to the administration of nutrients by the intravenous route . It is usually administered via a dedicated central or peripheral placed line and is mostly used when a patient has intestinal failure to a degree that prevents adequate gastrointestinal absorption of nutrients. However, occasionally it is used when a functional gastrointestinal tract cannot be accessed. The use of PN is invasive and a relatively expensive form of nutrition support (equivalent to most 'new generation' IV antibiotics daily). It is also associated with significant risks from line placement, line infections, thrombosis and metabolic disturbance. Careful consideration is therefore needed when deciding to who, when and how this form of nutrition support should be given. Whenever possible, patients should be aware of why this form of nutrition support is needed and the potential risks and benefits.

In view of the complex issues surrounding PN administration, we conducted a number of reviews in an attempt to provide evidence based guidance on the indications and benefits/risks of PN versus enteral, oral and no nutritional intervention. The reviews also aimed to provide guidance on some technical issues of delivering parenteral feeds. The GDG, however, were acutely aware of the limitations of PN studies identified for two important reasons:

a. the studies do not examine the use of PN in patients with a definite indication for such feeding (i.e. those who definitely need nutrition support by some means but who have intestinal failure to a degree that prohibits feeding by oral or enteral tube methods). Results may therefore be inapplicable for the patients to whom PN is usually administered).

b. most studies comparing PN to ETF have been undertaken in surgical and intensive care settings with patients who are only able to tolerate small amounts of enteral feed. The studies are therefore not only examining different routes of nutrient provision but often very different amounts with the PN patients getting much higher levels of support (levels that in sick patients raise some concern amongst GDG members – see Section 5.5.1).

The general recommendations for PN use are therefore based upon the principles elucidated in Chapter 2 of these guidelines, taking into account the results of the studies reviewed where possible.

9.2 Parenteral versus enteral nutrition

9.2.1 Introduction

Many patients who are either severely ill who have undergone major surgery are unable to meet their nutritional needs by mouth for many days or longer and hence require nutrition support. PN is usually reserved for those in whom support is essential but it is impossible or unsafe to utilise the gut. In such cases, therefore, the choice of PN versus EN is not an issue and indeed there are no means of conducting meaningful RCTs to examine this primary indication for PN. In some cases, however, there may be debate about whether gut function is adequate to permit ETF and in such cases, RCTs of PN versus EN are possible. However, a search for studies on this point identified only one RCT [348](included in 2 systematic reviews[142,297]) with all other studies examining the use of PN in patients whose GI tract was both accessible and functional to a degree that at least made ETF potentially feasible. They studies therefore describe the 'elective' use of PN as either a supplementary or sole source of nutrition in patients who would NOT usually receive it until ETF had been shown to fail.

9.2.2 Studies considered for this review

In addition to the single study of EN vs. PN in patients of uncertain GI function[348], we identified many RCTs examining elective PN use (Table 49,Table 50,Table 51,Table 52,Table 53,Table 54,Table 55,Table 56,Table 57,Table 58,Table 59). These included 16 RCTs[12,33,35,37,118,123,151,154,229,246,271,282,289,293,354,355] and 3 systematic reviews[142,209,297]. These 3 systematic reviews and 14 of the RCTs[12,33,35,37,118,123,140,142,151,154,209,271,282,289,293,355] compared patients who received PN alone with patients on ETF alone(Table 49,Table 50,Table 51,Table 52,Table 53,Table 54,Table 55), but three compared the effects of PN alone with a combination of PN and ETF[229,246,354] (Table 57,Table 58,Table 59)and one of the systematic reviews [142] (Table 56)compared ETF alone with a combination of ETF and PN.

Studies were grouped into disease populations and looked at patients with liver disease, Crohns disease, ulcerative colitis, acute pancreatitis, abdominal trauma, bone marrow transplant, cancer, critically ill GI patients and surgical patients.

9.2.3 Clinical evidence

In the single study that selected patients for EN or PN on the grounds of likely gastrointestinal function [348], 237 patients were considered to have GI function adequate to try enteral nutrition, 267 patients were felt to have intestinal failure to a degree that required parenteral nutrition, and 64 were considered to have marginal intestinal failure at a level which made the decision of whether to use ETF or PN genuinely equivocal. This last group was therefore

randomised to either ETF or PN support. The study showed that in the elective, non randomised ETF and PN groups there was no difference in septic morbidity but a higher non-septic complication rate in the ETF group associated with a significant increase in mortality. A similar higher mortality was also seen in the group randomised to ETF within those with questionable GI function. ETF patient groups, both randomized and selected also had significantly lower nutritional intakes than those who were randomized or selected for PN.

The RCTs on elective PN use showed the following results in different patient groups.

9.2.3.1 Critically ill patients

Two systematic reviews [142,297] compared the effects of EN v PN in the critically ill (Table 55). Heyland et al. [142] showed a significant reduction in infectious complications for the enteral group. There were no significant difference in mortality between groups. However, the other systematic review [297] which had a few studies in common with Heyland et al. [142] concluded that there was a greater risk of mortality in the patients receiving EN although this was only evident in studies where initiation of ETF had been delayed.

9.2.3.2 Cancer patients

Many RCTs studied the use of supplementary PN vs. ETF in cancer patients, mostly in the peri-operative period. The six RCTs[12,35,37,154,271,282] that we identified were classified into three groups according to the nutritional status of the patients that they included (Table 51).

Two studied (BRAGA2001, BOZZETTI2001) included GI cancer patients undergoing elective surgery with a weight loss ≥ 10% of the usual body weight in the past 6 months. In one of these studies [35], 158 patients received PN whilst 159 received ETF via a jejunostomy catheter or nasojejunal tube. Results showed that overall post-operative complications were significantly fewer for patients in the ETF group ($p<0.005$) [35]. However, in a sub-group of malnourished patients analyzed separately within the second study [37] (48 PN fed patients versus 43 ETF patients fed by jejunostomy or nasojejunal tube), no significant differences were observed. Adverse effects of artificial nutrition (abdominal distension, cramps, diarrhoea and vomiting) were reported in one study[35] with the ETF group showing a significantly higher incidence ($p<0.0001$). Both studies reported no significant difference in hospital length of stay and mortality.

Three studies included malnourished (only one study [37] provided definition for malnourished patients: involuntary weight loss > 10% with respect to their usual body weight in the preceding 6 months) and non-malnourished GI cancer patients undergoing surgery[12,37,271]. Patients were randomised to receive TPN or EN by jejunostomy catheter.

One study reported the number of patients achieving their nutritional goal within four days postoperatively[37]. There was a significantly greater number

of patients achieving this in the PN group than the EN group (p<0.001). The same study[37] reported time to first flatus and bowel movement. The first flatus and bowel movement occurred earlier in the EN group than the PN group (p=0.001). One study reported catheter-related complications and non-catheter related complications[12]. For catheter-related complications, there was no significant difference between the groups. However, the PN group had a significantly greater number of non-catheter related complications (p<0.05). These included life-threatening and non-life threatening complications. Length of hospital stay was reported in one study[37] and there was no significant difference between the groups. Mortality was reported in the three studies and there were no significant differences between the groups.

Two studies were included PN vs. ETF in cancer patients with exclusion of those who were severely malnourished [154,282]. One study[154] included patients undergoing total laryngectomy (n=48). Severely malnourished patients were excluded. Patients were randomised to receive PN (n=24) or EN (n=24) by percutaneous endoscopic gastrostomy.

The EN group had a significantly shorter hospital length of stay than the PN group (p< 0.05). There were no significant differences between the groups in wound infections and surgical complications. The other study[282] included patients undergoing curative total gastrectomy (n= 29). Patients were randomised to receive PN (n=16) or EN by nasojejunal tube (n=13). The study did not report the patients' nutritional status.

9.2.3.3 Pancreatitis

A systematic review of studies in patients with acute pancreatitis[209] (Table 49) showed significant reductions in length of hospital stay, infections and the need for surgical interventions in the ETF group, although in individual studies on this topic it is unclear whether the advantage is due to the route of feeding or due to the PN fed patients receiving high levels of support which made many of the PN fed patients hyperglycaemic.

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9.2.3.4 Inflammatory bowel disease

Two studies on patients with Crohn's disease or ulcerative colitis [118,123] (Table 54)showed a significant reduction in post-operative infections and complications from nutrition support in the ulcerative colitis population only. There were no other significant differences in these studies.

A few of studies have reported changes in nitrogen balance with equivocal findings. A study of patients undergoing major GI surgery [33] and demonstrated significantly higher nitrogen balance for the ETF group, whereas a study in patients with abdominal trauma [289] showed significantly higher nitrogen balance in the PN group. The study reported no significant differences in postoperative complications and hospital length of stay.

9.2.4 Clinical evidence PN versus (PN+EN)

Three studies compared the effects of PN versus the combination of PN and ETF in different patient groups. One studying patients with pancreatitis [354] (Table 57)showed that those receiving combined PEN and ETF had greater weight gains compared to those on PN alone. A similar study design, in patients having bone marrow transplantation[229] (Table 58)showed that combination feeding reduced the days of diarrhoea but no other significant differences were seen. A study in patients who had abdominal surgery [246] (Table 59) demonstrated no differences between PN fed and combination PN and ETF fed patients.

9.2.5 Clinical evidence EN versus (PN+EN)

The one systematic review[142] comparing ETF to PN feeding with simultaneous commencement of ETF in critically ill patients contained data from 5 RCTs. No significant difference for any outcomes were demonstrated but all of the RCTS were small, low quality studies.

9.2.6 Cost-effectiveness evidence

Fifteen cost analyses were found – ten from the USA and one each from Canada, China, Finland, France and Italy (Table 69 and Table 69). One study compared EN and PN with EN and placebo and the rest compared total PN with EN. The studies varied in terms of both setting and patient group: post-operative (10), acute pancreatitis (2), home (1), ICU (2). There were also varied study designs: RCT (10), retrospective cohort (4), meta-analysis (1). A major problem was that ten studies only included the cost of nutrition therapy and support, with only five studies including the costs of treating complications or extended hospitalisation. It is doubtful if even these included all the costs. Direct comparison of the cost savings was also complicated by the studies reporting in different currencies, in different years, in different health care systems and varied techniques were used to provide ETF. Nevertheless, it is very likely that ETF is cheaper than PN and Table 12 indicates the relative size of the hospital cost savings.

Table 12: Cost savings attributable to enteral feeding compared with parenteral feeding (RCT evidence)

Study	Year	Country	Patient group	Reduction in cost	p-value
McClave	1997	USA	Pancreatitis	76.9%	0.001
Sand	1997	Finland	GI surgery (cancer)	76.5%	N/R
Bower	1986	USA	GI surgery	73.6%	0.001
Braga	2001	Italy	GI surgery (cancer)	72.5%	N/R
Adams	1986	USA	Laparotomy (trauma)	63.9%	N/R

Trice	1997	USA	Surgery (trauma)	62.9%	N/R
Hamaoui	1990	USA	Abdominal surgery	56.9%	0.001
Bauer	2000	France	ICU (not surgery)	48.0%	0.0001
Barzotti	1994	USA	Head injury	46.4%	N/R
Abou-Assi	2002	USA	Pancreatitis	23.4%	0.0004
Zhu	2003	China	GI surgery (cancer)	11.8%	<0.05

N/R=not reported

9.2.7 Conclusions

Evidence from the enteral versus parenteral review is difficult to interpret since the use of PN in the majority of patients included in the trials was out of line with routine UK clinical practice (PN is only used when other feeding methods are impossible, unsafe or ineffective). In the one study that was in line with routine practice [348], results showed that PN was just as safe as ETF, and indeed was probably a safer when patients have gastrointestinal function that is so marginal that the likelihood of tolerating EN is very uncertain (PN fed patients in this group had lower mortality and achieved higher feeding rates with lower non-septic complication rates than ETF patients). However, from all the other studies, it is possible to conclude that routine clinical practice is correct. There are no significant advantages in using PN when ETF can be used and indeed ETF patients often do significantly better for outcomes such as weight gain, length of stay and infections. There are no definite advantages of combinations of feeding but studies are small and too underpowered to make firm conclusions. Working from first principles, however, the GDG felt that the use of combination feeding makes sense, using the GI tract to supply as much of the patient's nutrient needs as GI tolerance and function allows, with PN used as necessary to provide the remainder.

The cost-effectiveness evidence varied with methods and reporting but support the widely recognized notion that ETF is a cheaper option.

9.2.8 Recommendations

9.2.8.1 Parenteral nutrition should be considered for patients who need nutrition support and who cannot be fed adequately by oral and/or enteral methods. [B]

9.2.8.2 Whenever possible enteral nutrition should be considered as the first option. In the presence of inadequate intestinal tolerance enteral nutrition should be supported with supplementary parenteral nutrition. [B]

9.3 PN versus no PN

9.3.1 Introduction

PN is most likely to be considered where there is:

a. severe failure of gut function due to problems such as obstruction, ileus, dysmotility, fistulae, surgical resection or severe malabsorption

and

b. the consequent intestinal failure has either persisted for several days (e.g. >5) or if recent, is likely to persist for many days before significant improvement.

In some cases, however, it is also used when a reasonably functioning gut cannot be utilised because the patient cannot eat and access with an enteral feeding tube is impossible or impractical.

In the sorts of cases above, PN is started in order to prevent or minimize the adverse effects of malnutrition in patients who would otherwise have no significant nutritional intake. However, the length of time that a patient can tolerate complete or near complete starvation without harm is unknown and is probably variable. It may be many days in those who are well nourished at the outset of problems, but early 'elective' PN support might still be helpful and indeed, pre-emptive PN support (e.g. PN given to malnourished patients before they have even had surgery which will cause temporary intestinal failure) could also be of value. We therefore conducted reviews of studies that randomized patients to the elective use of early PN versus standard care of simple IV fluids with oral intake as tolerated or as dictated by routine clinical practice (e.g. restricted for a few days after surgery).

9.3.2 Studies considered for this review

One general review identified a systematic analysis [179] that looked at the efficacy of PN compared with no nutritional support on clinically important parameters such as mortality, morbidity and length of hospitalisation (Table 48). This systematic review included randomised studies in patients with a variety of conditions such as pulmonary disease, liver disease, oncological, peri-operative, acute pancreatitis, Inflammatory Bowel Disease (IBD) and Acquired Immunodeficiency Syndrome (AIDS). In addition to the systematic review, four RCTs[168,275,283,349] (Table 48) were identified: one [275] including 55 well-nourished, females with stage II-IV breast cancer undergoing high-dose chemotherapy and haematopoietic cell transplantation (HCT); one [349] including 122 patients following major thoracic-abdominal procedures; one [283] including 300 patients undergoing major general surgical procedures; and one [168] including patients with gastric cancer undergoing total gastrectomy.

Independently from the above, a second review examined the elective use of PN around the time of surgery. These surgical could be subdivided into two further groups:

a. Pre-operative supplementary PN versus no pre-operative supplementary nutrition: . Two RCTs [24,304] (Table 66)studied the effect of pre-operative PN vs. no pre-operative nutrition support in malnourished GI surgical patients defined by weight loss (>10%) or a Prognostic Nutritional Index (PNI score >30%).

b. *Pre and post-operative PN versus no supplementary peri-operative nutrition.* Seven RCT's[36,89,90,230,323,324,342] (Table 66)examined various periods of pre- and post-operative PN versus no peri-operative nutrition support in groups of surgical patients who were also malnourished at the time of surgery, most with gastro-intestinal malignancy.

9.3.3 Clinical evidence

9.5.3.1 Elective PN in all patients

The combined data from all patient groups in the Koretz systematic review [179] showed no benefit for giving early PN compared to no early nutrition support, and in the group of oncology patients (including 19 trials of 1050 patients) PN use resulted in an increase in infectious complications, although there was no change in mortality. However, all results from the review have a major limitation in that the RCTs included in the review, excluded severely malnourished patients. Furthermore, several of the studies came from a period during which very high levels of PN support were given to patients, often resulting in significant hyperglycaemia which is known to increase risks. The findings are therefore inapplicable to any usual current UK PN practice.

In addition to the overall findings of the Koretz review, most studies contained within the review or other studies we identified showed little or no benefit from early elective PN usage in various patient sub groups. Although in some, PN improved nutritional status and/or nitrogen balance, clinical outcomes were no better with PN in most instances and in some they were worse. For example, in two trials of patients with acute pancreatitis (subgroup analysis within the Koretz review) and one trial in gastric cancer resection patients [168], PN resulted in significantly more complications and longer hospitalisation compared to standard therapy of IV fluids only. However, in some trials conducted in surgical patients, elective PN use.

9.3.3.1 Elective PN in surgical patients

The studies in patients receiving only pre-operative PN [24,304] showed no significant differences in mortality or length of hospital stay between PN fed and control groups, although Bellatone reported increased septic complications in controls ($p<0.05$). However, the studies in patients receiving both pre-and post-operative PN support did suggest benefits form this approach. Four of these studies [36,90,230,323] showed lower mortality in patients given PN compared to controls although only in one[230] did this reach significance ($p<0.05$). The same four studies [36,90,230,323] also showed reduced complications in severely malnourished patients given peri-operative PN,

although in only 2 studies[36,230] did this reach significance (p<0.05). Two RCTs[90,324] showed greater weight gain for patients receiving peri-operative nutrition with one [324] reaching significance (p<0.01. In addition to these findings, one study[342] also reported lower intra-abdominal abscess rates in malnourished PN supported patients versus malnourished controls (p<0.05) and whilst another [323] found that borderline or mildly malnourished patients given PN had increased rates of infections, severely malnourished PN supported patients had reduced non-infectious complications with no increase in infectious problems.

9.3.4 Cost-effectiveness evidence

Six cost studies and one cost-utility study were found (Table 66). Three were evaluating the preoperative use of parenteral nutrition and four its postoperative use.

A US cost analysis [78] based on a relatively large well-conducted RCT[323] compared pre and post-op PN (16 days) vs. No pre-op and post-op PN at clinician's discretion. The patients were malnourished (mainly men) and were undergoing laparotomy or thoracotomy. They found overall no difference in complications. For the intervention group, who were admitted early for pre-operative PN, there was a longer length of stay and an incremental cost of $3,200 per patient (significance not stated). However, for high-risk patients (identified using Standard Global Assessment) there was a significant reduction in non-infectious complications with an associated cost-effectiveness of $7,100 per complication averted.

A smaller US RCT[319] compared PN over 28 days with individualised oral, enteral parenteral nutrition support for patients in early recovery stage after bone marrow transplantation. PN patients had a longer length of stay, increased infections and increased complications, but the patients receiving PN were probably sicker than those in other groups. There was an incremental cost of $1,400 per patient. A Spanish study[45] based on a single cohort also estimated the incremental cost of PN in this patient group but compared it with a programme of intensive monitoring – it too found an incremental cost associated with the use of PN.

A Spanish RCT [49] compared early PN over five days with IV fluids alone in patients undergoing total gastrectomy for gastric cancer. This reported substantial cost savings through the use of PN, although a Japanese RCT[168] in very similar patients, found that early oral intake was less costly than early PN.

A decision analysis[333], again in a US context compared 10 days preoperative PN with no PN for patients undergoing surgery for gastrointestinal cancer. They assumed reductions in length of stay and complication rates and hence estimated an incremental cost saving of $1,700 per patient. In contrast, a Canadian decision analysis[117] comparing PN (10 days) with both selective PN and no PN in patients undergoing major upper GI surgery with and without cancer, suggested that both cancer and non-cancer groups would have

increased life expectancy but at increased cost. The use of PN was relatively cost-effective (<$50,000 per QALY gained) in the following groups:

- Non cancer – high and moderate risk
- Localised stomach cancer - high risk and moderate risk
- Regionalised stomach cancer - high risk
- Localised oesophageal cancer - high risk

Benefits of PN were small for patients with low life expectancy i.e. those with more advanced cancer. The fact that the US model assumed a greater reduction in major complications and a greater cost per complication was the reason why the US model suggested cost savings whilst the Canadian model did not (Table 13).

Table 13: Comparison of model assumptions

	Twomey		Goel	Goel
			Not cancer	Cancer
Patients with a major complication averted (a)	19%		2%	11%
Cost per major complication (b)	£26,000		£6,500	£6,500
Cost savings per patient (a x b)	£5,000		£130	£740

9.3.5 Conclusions

Evidence from these reviews of elective PN use is difficult to interpret since, once again, the use of PN in the majority of patients included in trials was out of line with routine UK clinical practice. Nevertheless, it is possible to conclude that in certain targeted patient groups elective, supplementary PN can reduce complications and mortality. For well nourished patients there is no evidence that pre or post-operative PN support is of benefit but for malnourished GI and thoracic surgical patients preoperative/perioperative and postoperative parenteral feeding there is evidence of benefit.

There is no evidence that peri-operative PN is cost-effective generally (indeed if given to all general surgery patients there could be increased health service costs with no health gain). However, elective supplementary PN probably is cost-effective in high risk groups (as demonstrated by both decision analysis and RCT evidence). It should usually be avoided in patients with short life expectancy.

9.3.6 Recommendations

9.3.6.1 Parenteral nutrition should be considered for malnourished patients who have a BMI<18.5 and/ or weight loss>10% and/ or have not eaten or are not anticipated to eat for > 5 days and who cannot be fed adequately by any other means. [D(GPP)]

9.3.6.2 Supplementary pre- and/ or post-operative PN should be offered to surgical patients who have a non functioning gut and who are already malnourished. [B]

9.3.6.3 Early peri-operative supplementary parenteral nutrition should not be offered to well-nourished or mildly malnourished patients. [B]

9.4 Venous access for delivering PN

9.4.1 Introduction

All PN solutions should be administered via dedicated intravenous catheters, through electronic volumetric pumps/controllers with occlusion and air in line alarms. 1.2 micron filtration should be considered for long term patients and those with complex PN formulations. The catheters can be either peripherally or centrally inserted and GDG investigated whether there are advantages of one route over the other. The decision to commence intravenous nutrition is never an emergency. Catheter insertion should be planned and performed using optimum aseptic precautions. When considering the need for intravenous access, the most appropriate site should be obtained by assessing the risk of infection against the risk of mechanical complications[71].

9.4.1.1 Peripheral access

Full intravenous feeding using low osmolality lipid containing feeds can be given via a peripherally placed small cannula ((22 – 23 Fr with 48 hourly change of cannula site), a fine bore, mid length catheter inserted peripherally but running up into larger veins, or a peripherally inserted central catheter. All should be considered as alternatives to subclavian and jugular venous placement[71]. Catheters can be put in on the ward but only when using a strict aseptic technique with adequate skin preparation e.g. 0.5% chlorhexidine in 70% methylated spirits), sterile field, and sterile gloves.

9.4.1.2 Indications for insertion of central venous (CV) lines

Central venous access

The insertion of CV lines for PN is associated with greater risks than peripheral feeding lines and therefore should be undertaken by experienced personnel, where other access is not available or feasible, or where multiple lumen CV lines are needed as part of the patient's clinical management. Where multiple lumen CV lines are used a lumen should be dedicated for the use of PN only. CV lines need to be considered in patients with no peripheral access and in those requiring some specialised feeds. Indications for CV lines include:

- Patients identified as likely to require PN for a period of more than 2 weeks
- Patients already having suitable central venous access with a lumen which can be used solely for feeding (e.g. post-op from theatre)
- Patients with no suitable veins for peripheral feeding
- Patients requiring specialised PN feeds that cannot be given into smaller peripheral veins (e.g. hypertonic feeds (>1300-1500 mosmol/l such as lipid free or restricted volume solutions).

All central venous access devices should be inserted in optimum sterile conditions, using full aseptic conditions including sterile drapes, gown and gloves[71].

9.4.2 Methodology

We conducted three reviews that looked at the effect of delivering PN via different venous lines:

- peripherally-inserted central catheters versus standard central venous catheters
- central versus peripheral venous catheters
- tunnelled versus non-tunnelled venous catheters

9.4.3 Peripherally- inserted central catheters (PICC) versus standard central venous catheters (CVC)

9.4.3.1 Introduction

PN solutions can be very hypertonic and some specialised formulations can only be infused into veins with high blood flow such as the superior vena cava. Central venous catheters (CVC) inserted into subclavian veins are commonly used for PN delivery but traumatic insertion problems are common and, as

with all central lines, there are risks of sepsis and thrombosis[122]. Peripherally inserted central venous catheters (PICCs) can be used as an alternative to central venous catheterisation. PICCs are inserted into the basilic or cephalic veins and the tip is advanced into the superior vena cava. The potential benefits of PICCs might include the reduction of complications (it has been suggested that PICCs are associated with a lower rate of infection compared with other non-tunnelled CVCs[71]) and cost-saving as PICCs can be inserted by non-physicians.

A review was therefore conducted to identify studies which compared the efficacy of PN delivered through PICCs compared to CVCs. We identified only one RCT[62] (Table 60).

9.4.3.2 Study considered for this review

The RCT included 102 hospitalised adult patients who required PN. The patients were all GI suffering from pancreatitis, post-operative ileus and primary abdominal malignancy among other diseases. Fifty-one patients were randomised to receive PN through a PICC (catheters were inserted into the basilic vein in most cases, other vessels used were the cephalic and median antecubital veins), while fifty-one had PN via a CVC (subclavian vein).

9.4.3.3 Clinical evidence

The use of both access techniques was often successful. The main outcome reported was the completion of therapy without complication. The CVC group had significantly higher percentage of patients that completed the therapy without complication than the PICC group ($p<0.05$). PICC lines were associated with greater number of difficult insertion attempts (required more than two but less than five needle sticks) ($p<0.05$), clinically-evident thrombophlebitis ($p<0.01$) and mal-position on insertion ($p<0.05$). There were significantly higher incidence of falsely suspected line infection in the CVC group ($p<0.05$). No significant difference was noted between the two groups in aborted insertion attempts, insertion time, pneumothorax, line occlusion, catheter infection, dislodgement or mortality.

9.4.3.4 Cost-effectiveness evidence

A US study[62] compared the cost of CVC with the cost of PICC. It included hospital costs for inserting catheters and costs of diagnosing and treating complications arising from catheter insertion. It was expected that PICCs would have lower hospital costs, because nurses can insert them. However, the results of the analysis showed that PICCs were more costly by £39 per patient because PICC insertion and maintenance was more difficult and associated with higher rates of thrombophlebitis.

9.4.3.5 Conclusion

Findings from this study suggest that PICCs are associated with higher incidence of placement and mechanical complications than CVCs but nevertheless, their use is often successful . The relative costs of PICCs versus CVCs depends upon insertion success rates and rates of line complications. Studies were limited because changes in health status or quality of life were not measured or reported and results may not be transferable to specific patient subgroups.

9.4.3.6 Recommendation

9.4.3.6.1 For hospitalised patients requiring parenteral nutrition, where a centrally placed central venous catheter is not otherwise required or in situ a peripherally inserted central catheter (PICC) can be a suitable alternative. [B]

9.5 Peripheral PN versus central PN

9.5.1 Introduction

Many PN solutions are very hypertonic and can only be administered into veins with high blood flow (central veins) since peripheral vein infusion is likely to result in thrombophlebitis, characterised by redness, a severe burning sensation and rapid thrombosis[122]. However, there are also complications associated with central venous PN particularly catheter insertion trauma, sepsis and thrombosis. An alternative to central PN is the infusion of peripheral intravenous nutrition using a fine-bore silicone catheter delivery system. Lipid-based solutions are used in peripheral intravenous nutrition as these generally have a lower osmolarity and some have a pH better tolerated by small vessels. Peripheral delivery systems may avoid some of the complications associated with central venous catheterisation and the fact that they are easier to place may provide overall cost savings[178].

A review was conducted to assess the potential benefits of peripheral PN compared with central PN. The review identified three RCTs[61,178,211] (Table 61).

9.5.2 Studies considered for this review

One study[178] included adult surgical inpatients requiring PN. These were GI patients who underwent pancreatic, oesophageal and gastric surgery among other procedures. Patients who received PN in the intensive care unit and those who required multiple-lumen venous access were excluded. This exclusion affects a considerable number of potential PN patients.

Patients were randomised to receive peripheral PN (n= 23) or central PN (n=23). The peripheral group received a lipid-based nutrient solution through

a paediatric fine-bore silicone catheter inserted into the deep median basilic vein. The catheters were not tunnelled subcutaneously or sutured to the skin for fixation. The central group received a glucose-based nutrient solution through a single-lumen silicone catheter inserted into the subclavian vein.

The other two studies[61,211] included gastroenterological patients requiring PN. The total number of patients included in these studies was 91: 42 received peripheral PN and 49 received central PN infused into the superior vena cava.

9.5.3 Clinical evidence

In one study[178], the peripheral group had higher total patient treatment days (426 d compared to 322), spontaneous catheter retraction (3 cases vs. no cases in the central group) and cases of non-infective thrombophlebitis (4 vs. no cases). The central group had higher insertion-site infection (2 vs. 1), problems with venous access (1 vs. 0) and catheter-related bacteraemia (3 vs. 0); however only one of the three cases of bacteraemia was thought to be due to a primary catheter infection. The main outcome reported was probability of a complication-free system function with time. There was no significant difference in the risk of overall complication. The incidence density of complication ratio was 0.66 (95% confidence interval 0.24-1.82).

Another study[61] reported no significant differences between the groups regarding median duration of feeding. However, morbidity occurred more frequently in the central PN group (one catheter related sepsis and two pneumothoraces) than in the peripheral PN group (severe phlebitis was not encountered).

In the other study[211] 80% of patients in the central PN group completed their course of PN compared with 56% in the peripheral group. Four patients in the peripheral PN group were immediate failures because inadequate forearm veins and six were converted to central feeding as peripheral access became difficult. There were six line fevers (23%) in the central PN group compared with 3 (13%) in the peripheral group. There were two pneumothoraces in the central group.

9.5.3.1 Cost effectiveness evidence

A UK study[211] compared the cost of CVC with the cost of peripheral PN. Their analysis was based on a prospective trial. The study group was all hospitalised patients who required PN. PN delivered peripherally was found to be cost-saving by £125 per patient compared with using the CVC route. This was because peripheral PN had a lower cost associated with insertion and CVC was associated with higher rates of complications (line fevers and pneumothoraces).

9.5.3.2 Conclusion

The studies reviewed were limited by their small sample size and because changes in health status or quality of life were not measured or reported. The overall results from this analysis suggest that there is little significant difference in the risk of complication between peripheral and central PN and only marginal savings in cost, with the analysis dependent on assumptions regarding successful insertion and rates of line complications. The formulation of the PN, in particular its volume and use of lipids and hypertonic concentrated electrolytes, will make a major difference to the complication rates and length of feeding achieved via the peripheral route, but it has not been possible to ascertain these factors from these studies. Similarly the use of drug therapy might ameliorate the thrombophlebitic complications and thombosis, but their inclusion may detrimentally affect the stability of the PN solutions used. The results may not be generalisable to specific patient subgroups.

9.5.3.3 Recommendation

9.5.3.3.1 For patients requiring short term, <14 days parenteral nutrition who do not need central access for other reasons, peripheral venous access should be considered. Attention to parenteral nutrition formulation is essential to ensure the absence of complications and length of successful parenteral nutrition. [B]

9.6 PN via a tunnelled catheter versus PN via a non-tunnelled catheter

9.6.1 Introduction

A practice used widely in the 1980s to potentially reduce the risk of central catheter related infection was the use of tunnelled catheters. These catheters are inserted through the skin and advanced subcutaneously before the tip is inserted into the vein. It has been suggested that this technique reduces the risk of infection by increasing the distance between the potentially contaminated skin entry site and the venous entry site[265]. A tunnelled catheter also grants practical advantage to ambulant patients in that they allow easier dressing of the catheter entry site and provide more stability, reducing the risk of dislodgement[108].

9.6.2 Studies considered for this review

A review was conducted to assess the benefits of PN through tunnelled catheters compared to non-tunnelled catheters (Table 62). One systematic

review was identified that looked at the efficacy of tunnelling short-term central venous catheters to prevent catheter-related infections. The inclusion criteria for this review were RCTs on adult or paediatric patients with catheters in place for an average of <30 days. Catheters were placed using a subcutaneous tunnel. The review identified seven RCTs on adult patients[65,69,108,125,173,220,327] but two [65,327] were excluded from our analysis since the catheters were not placed for PN. Five studies were therefore included in tour assessment. The population of these studies were: surgical (n=150[220] and n=38[108]), medical and surgical (n=83[173]) and cancer patients (n=74[125] and n=109[69]). In all the studies catheters were inserted into the subclavian vein.

The systematic review extracted data from each study for three outcomes: catheter colonisation, clinical sepsis and catheter-related bacteraemia. These data were used in the review (excluding data from the two studies mentioned above) to conduct a meta-analysis for these three outcomes.

9.6.3 Clinical evidence

9.6.3.1 Catheter colonisation

Four studies reported catheter colonisation[69,125,173,220]. The pooled effect showed that tunnelling decreases the risk of infection (relative risk 0.46; 95% confidence interval 0.26- 0.80).

9.6.3.2 Catheter-related septicaemia:

Four studies reported catheter related sepsis[69,108,125,220]. The overall result showed no significant difference between the groups (relative risk 0.63; 95% confidence interval 0.29-1.38).

9.6.3.3 Clinical sepsis

Two studies reported clinical sepsis[108,220]. The overall result showed no significant difference between the groups (relative risk 1.25; 95% confidence interval 0.63-2.48).

9.6.3.4 Conclusion

Results from this analysis indicate that tunnelled catheters reduce the risk of catheter colonisation compared with non-tunnelled catheters. However, there are no significant differences in the risk of catheter related septicaemia and catheter sepsis. In long-term catheter use the tunnelling of a short segment of line with a cuff that allows fibrosis to occur avoids external fixation and improves comfort.

9.6.3.5 Recommendation

9.6.3.5.1 Tunnelling subcutaneous catheters for long-term use (>14 days) is recommended. [D(GPP)]

9.6.3.5.2 Tunnelling catheters is not recommended for short-term use (<14 days). [B]

9.7 Tailored PN preparations versus standard PN preparations

9.7.1 Introduction

Patients requiring PN can either receive a standardised fixed feeding regimen, or a PN regimen compounded to meet individual nutritional, electrolyte and fluid requirements. Both methods should always have the addition of vitamins and trace elements and standardised PN may also need the addition of electrolytes and other nutrients to ensure it is complete and appropriate. Additions must be made under controlled pharmaceutical conditions and not at ward level. The stability of either means of providing PN needs to be known to avoid serious complications resulting from unstable PN formulations. One of the disadvantages of fixed regimens is that in order to achieve a positive nitrogen balance, patients may receive calorie intakes in excess of their energy expenditure (excess energy intake may worsen respiratory) difficulties and may lead to hyperglycaemia). Furthermore, standardised PN may not be appropriate for patients with special prescription needs such as the critically ill, those with organ failure, or those who have high electrolyte losses.

9.7.2 Studies included in this review

A review was performed to assess the efficacy of tailored (individualised) PN preparations compared with standard preparations (Table 63) . Only one real RCT was identified. The study included twenty hospital inpatients requiring PN after abdominal surgery. The mean age of patients was 46 (3 patients where under 18: two 17 and one 15 years old). Patients were randomised to receive either a constant regimen containing 2600 calories and 15.55g Nitrogen (n=10) or a varied regimen with fixed calorie: Nitrogen ratio of 167:1 but with the calorie intake adjusted according to the previous days metabolic expenditure (n=10).

9.7.3 Clinical evidence

The study reported calorie and nitrogen intake, RQ, production of CO2, body fat and body mass change and nitrogen intake. There were no significant differences in any of the outcomes.

9.7.4 Cost-effectiveness evidence

No studies were found that estimated the incremental cost or cost-effectiveness of standard vs. tailored PN.

9.7.5 Conclusion

Findings from the included study suggest that there are no differences in outcome from either form of PN. However, the study is nowhere near large enough to identify possible clinical advantages of one or other approach, or to assist in identifying which patient groups are suitable for standardised as opposed to individualised PN regimens.

9.7.6 Recommendation

9.7.6.1.1 Patients prescribed standardised parenteral nutrition need their nutritional requirements to be determined before selection of a particular parenteral nutrition product. The addition of vitamins and trace elements is always required and occasionally electrolytes and other nutrient supplements are needed. Additions must be made under appropriate pharmaceutically controlled environmental conditions before administration. [D (GPP)]

9.8 Delivery of PN cyclically versus continuously

9.8.1 Introduction

PN can be administered as continuous infusion (24 h) or cyclically (intermittently over shorter periods). Cyclical PN allows patients periods of free movement, periods when the line is available for other therapeutic purposes, and potential metabolic benefits (a period of 'rest' for processing and assimilating nutrients). However, controversy persists as to the optimal method of PN administration and a review was therefore conducted to compare PN given cyclically with PN given continuously.

9.8.2 Studies considered for this review

The review conducted identified six RCTs [5,103,174,210,249,284] (Table 64).

9.8.3 Clinical evidence

In three studies patients received peripheral PN only[174,210,249]. The main outcome reported was incidence of infusion phlebitis. The population included

in these studies were patients requiring PN excluding those in whom central venous catheterisation was necessary. Continuous PN was delivered as a constant 24 h infusion and cyclic PN as a 12 h infusion with a 12 h break (Table 64).

In one study[174], patients on cyclical PN had significantly lower Daily Madox Score (Criteria used for assessing phlebitis. There are 6 score levels from 0 mild phlebitis to 5 severe phlebitis) ($p< 0.001$-0.05) and incidence of severe phlebitis ($p<0.05$) compared to patients on continuous PN with or without elective cannula change. In another study[210], patients on cyclical PN with elective cannula change had significant lower phlebitis score compared to patients on cyclical PN with cannulas left *in situ* ($p<0.05$) and patients on continuous PN with fine-bore catheter left *in situ* ($p<0.01$). The same study showed significantly lower phlebitis score with 18 G Teflon cannulas (4-5 cm) comparing with 18-G Silastic (15 cm) cannulas in patients on cyclical PN when cannulas were left *in situ* ($p<0.05$). Another RCT[249] reported significantly lower incidence of PN failures in patients on cyclical PN group with elective change of 18G Teflon cannulas compared with patients on continuous PN group with 23G Teflon cannulas (15 cm) left *in situ* ($p<0.05$). The same study recorded patients' signs of anxiety and depression. There were no significant differences between the groups for these two outcomes.

The other three studies included patients receiving central venous PN (one study did not report the infusion site) in post bone marrow transplant patients[5], traumatised or infected patients on mechanical ventilation[103] and post major surgery patients[284]. Continuous PN was administered as a constant 24 h infusion in all three studies but there were variations in the cyclic PN regimens. In one study[5] the patients received 12h cyclical infusions, in another[103] patients were infused PN for 12h and low energy glucose for the following 12 hours, and an the third study [284] patients received bolus PN infusions for 1h followed by h without infusion over 1h, followed by no infusion for 12h.

The outcomes reported were also varied and included both clinical and metabolic parameters. The study in bone marrow transplant patients[5] showed no significant differences in duration of PN, energy provided, plasma level of glucose and proteins, neutropenia time, change of weight , hepatic parameters, use of haematopoietic growth factors, incidence of hepatic veno-occlusive disease, incidence of catheter infection, or post-transplantation length of stay. The study on trauma or infected patients on mechanical ventilation[103] showed no differences in clinical parameters including length of artificial ventilation, length of stay in ICU and in hospital mortality , but patients in the cyclic group had statistically significant higher: energy expenditure ($p< 0.05$), O_2 uptake ($p< 0.05$), CO_2 elimination ($p< 0.05$), and nutrient induced thermogenesis ($p< 0.05$). They also had lower positive energy balance ($p< 0.05$) and hence the authors concluded that continuous PN resulted in a more efficient utilisation of nutrients.

The study on major surgery patients [284] also showed slight metabolic advantages from continuous PN administration in terms of less negative

"minimum" nitrogen balance (p< 0.01) and higher "maximum" nitrogen balance (p< 0.05).

9.8.4 Conclusions

The three studies comparing patients receiving peripheral PN continuously with those receiving peripheral PN cyclically showed that patients in the cyclical PN group with elective cannula change had lower rates of phlebitis compared with the continuous PN group but this may well reflect catheter management rather than PN administration times. The three studies of continuous versus cyclical centrally administered PN show that continuous PN group grants better nutrient balance than cyclical administration. None of the studies apply to longer term PN when cyclical administration becomes very important to help maintain patients' free movement and quality of life. There may also be metabolic advantages for longer term patients to have nutrient free 'breaks'.

9.8.5 Recommendation

9.8.5.1 Continuous administration of parenteral nutrition should be offered as the preferred method for infusion in most acutely ill intensive care and surgical patients. [B]

9.8.5.2 Cyclical delivery of parenteral nutrition should be considered when using peripheral venous catheters with planned routine change. [B]

9.8.5.3 Gradual change from continuous to cyclical parenteral nutrition administration should be considered in patients requiring parenteral nutrition support for periods of more than 2 weeks. [D(GPP)]

9.9 Research recommendations

9.9.1 What are the benefits to patients who need short-term parenteral nutrition support being offered standard PN compared to either PN and minimal EN (<25ml/hr) or PN with Glutamine and minimal EN (<25ml/hr) in terms of survival, complications and hospital costs?

This is an area of untested yet advocated practice and requires a number or a large randomised control trial.

9.9.2 What are the benefits to patients who present with the indications for PN being fed only 50% of estimated nitrogen and energy needs but with full micronutrient and electrolyte provision for first 5 days, followed by feeding at full needs compared to

being fed 100% of estimated needs from the first day of feeding in terms of; metabolic complications, infection rates, length of PN feeding, mortality, length of hospital stay, and time to 'medically fit for discharge.

In the absence of evidence on the management of feeding very sick patients with marked metabolic disturbance research in this area is essential to support/refute concerns about early feeding in sick patients.

9.9.3 What are the benefits to patients who have indications for PN due to acute but reversible intestinal failure (e.g. prolonged ileus) being commenced on PN within 6 days of developing that failure compared to not commencing until 12 days after the development of that failure if the feeding problem has not resolved in terms of; metabolic complications, infection rates, duration of PN feeding, mortality, duration of hospital stay, time to 'medically fit for discharge.

A randomised control trial is required to further support the rationale for the timings proposed in the PN nutrition support recommendations.

10 Organisation of Nutrition Support

10.1 Nutrition support teams

10.1.1 Introduction

All patients requiring nutritional support are likely to need care from a range of health care professionals including dietitians, pharmacists, GPs, nutrition nurses, district nurses, gastroenterologists and surgeons, Multidisciplinary team working as a well coordinated nutrition support team (NST) with good communication across all settings is the ideal. The aim of a NST should be to ensure that high quality, safe, cost-effective artificial nutritional support is given to patients who are undernourished or at risk of becoming undernourished. The composition and organisation of multidisciplinary teams for nutrition support will differ in community, care homes and hospital settings.

For people in their own homes the 'nutrition support team' is likely to comprise a dietitian, GP, district nurse, other allied healthcare professionals (e.g. speech therapist, physiotherapist), carer(s) and the patient. Patients having home enteral or parenteral nutrition have particularly complex needs with demands for a coordinated supply of feeds and ancillaries, along with the need for regular expert review. Close liaison between key personnel including the community dietitian, the GP, the hospital staff and any commercial supply company is essential.

Care homes

A dietitian usually coordinates the nutritional care of patients in care homes. This may include the transfer of nutritional care from hospital to care home (especially for patients on ETF) and following up referrals from the care home GP or from other care home staff. Input will depend on local protocols and agreements but will involve liaison with care home staff, the GP and other allied healthcare professionals (e.g. S&LT). This is not as cohesive, nor is it recognised in the same way as a hospital Nutrition Support Team (NST).

Hospital

Within the hospital setting a NST is likely to be more formally recognised and should ideally be comprised of dietitians, nutrition nurses, gastroenterologists and surgeons with good chemical pathology and microbiology laboratory support. BAPEN have formally proposed that, in addition to a NST, all hospitals should have a multidisciplinary Nutrition Steering Committee [295] to coordinate nutritional screening/assessment, catering and administration of nutrition support, working within the Governance framework. This steering committee should report directly to the chief executive or Trust Board.

Hospital NSTs may take on total responsibility for the nutritional care of patients or act in an advisory (consultative) role. The GDG recognised the potential advantages of multidisciplinary NSTs including:

- reduction of unnecessary treatments
- prevention of complications (mechanical, infective and metabolic)
- production or support of existing guidelines
- education and training of staff, patients and carers
- cost savings through better nutrition and avoidance of nutrition support complications leading to earlier discharge
- audit/research
- acting as advocates for patients
- point of contact for patients and carers, especially for those on home parenteral nutrition (HPN).

However, the breadth of benefit from NSTs in any setting is open to debate. We therefore conducted a review to identify studies which have investigated such benefits.

10.1.2 Methods

Our review included randomised and non-randomised controlled trials, since we were aware that this type of question is not easily addressed by controlled trials. The studies included patients cared for by a NST and patients receiving the standard regimen used in the care setting without an NST. In the intervention arm patients had to be receiving nutrition support (oral, ETF or PN excluding home nutrition support) and had to have nutritional management from a NST composed of two or more relevant health care professionals. In the comparison arm patients had no intervention from nutrition support teams.

10.1.3 Studies considered for this review

The literature search identified two RCTs[161,161,288] and four non-randomised comparative studies: two on ETF[41,262] and two on PN [95,172] one of which was a systematic review [95] including 11 studies (Table 73,Table 74, Table 74). All studies were set within hospitals. A number of studies were excluded due to poor methodological quality, the main reason being studies with no control group.

10.1.4 Clinical evidence

10.1.4.1 Randomised controlled trials

One RCT included 212 patients at nutritional risk[161] (Table 74). Three Danish hospitals participated in the study. The NST consisted of a nurse and a dietitian. Patients were randomised to receive nutrition support managed by the NST (n= 108) or by usual departmental procedures (n= 104). The NST provided motivation for patients and staff, detailed a nutritional plan, assured delivery of prescribed food and gave advice on ETF and PN when appropriate.

The primary outcome was length of stay considered to be sensitive to nutritional support. When a patient fulfilled the following three criteria, hospital stay was no longer considered to be sensitive to nutritional support:

- patient is able to manage toilet visit without assistance
- absence of fever (temperature < 38^{o}C)
- patient is without intravenous access

Other outcomes reported were total length of stay with a maximum of 28 days (LOS_{28}), minor and major complications and quality of life (QoL).

There were no statistically significant differences between the two groups in any of the outcomes. In a subgroup analysis, patients with complications but no operation had shorter length of stay sensitive to nutritional support (p=0.015) and shorter overall LOS_{28} (p=0.028) if managed by the NST. .

The other RCT included 101 patients referred and accepted for a PEG[288] (NST group n= 47, Control group n= 54) (Table 74). The NST consisted of a nurse and a dietitian. Patients were followed up for 12 months. The team provided weekly visits while in acute hospital and at least monthly after discharge, regular liaison with ward and primary care professionals and counselling to patients and carers including telephone contact for support. There were no statistically significant differences between the two groups in mortality, complications, time to removal of PEG, LOS or readmissions. For QoL there was an improvement in the social functioning element of the SF36 with NST group over control group (p=0.05). There were no differences in other elements of the SF36.

10.1.4.2 Non-randomised controlled trials

Enteral nutrition

Two studies from the same American university teaching hospital looked at the effect of a NST in surgical, medical and ICU patients who were started on EN support (n^{262}= 101; n^{41}= 102). The comparative group were concurrent controls managed by their primary physician (Table 73).

In both studies patients in the NST group had fewer untreated metabolic complications ($p<0.05$) such as hyperglycaemia ($p<0.05$) and hypophosphataemia ($p<0.05$). More NST group patients also attained adequate feeding (1.2x basal energy expenditure ($p<0.05$) One study[262] reported fewer total complications (pulmonary, mechanical, GI and metabolic) in the NST group ($p<0.05$) but in the other study[41] the difference was not significant. Neither study found significant differences in mortality.

Parenteral Nutrition

One systematic review[95] looked at the effect of a NST in patients receiving PN (Table 74). The review included 11 studies but there was a lot of heterogeneity in study methodology, patients included, the members and roles of the NSTs and outcome measures and length of follow up. In four of the studies the NST groups were compared with concurrent controls[66,96,106,329] whilst in seven the NST groups were compared with historical patients[56,99,145,155,242,260,332]. Sample sizes in the studies were generally small ranging from 28 to 285 and five studies had unequal sample sizes between the groups. Both medical and surgical patients were included.

In most studies the NST was composed of a physician, pharmacist, nurse and a dietitian. Two studies included a gastroenterologist[96,99], another included a biochemist[96] and another a surgeon[260]. In some studies the NST provided a consultative service whilst in others it assumed total responsibility for the nutritional management of the patient.

Due to the heterogeneity of the studies it was not possible to pool the results, however, a general summary of outcomes reported is provided below:

Catheter related complications:

- There were no significant differences in mechanical complications between the groups although there was a trend towards fewer pneumothoraces in the NST group.

- Most studies reported no significant differences in septic complications between the groups. However a retrospective study[172] which reported data on 54 medical and surgical patients who received PN before the NST was formed, compared with 75 who received PN after, found that patients in the NST group had significantly fewer incidents of catheter related sepsis: 29% compared to 71% ($p<0.05$).

Metabolic complications:

- NST groups had significantly fewer metabolic complications in five studies[66,96,99,106,332].

Mortality

- Most studies reported no significant differences in mortality but the retrospective study[172] which reported lower catheter sepsis rates also reported lower mortality in the NST managed patients: 24% compared to 43% ($p<0.05$).

10.1.5 Cost effectiveness evidence

It has been hypothesised that NSTs can achieve cost savings through:

- Reduced complications associated with PN such as catheter-related sepsis and metabolic disturbance
- Reduced use of inappropriate PN
- Reduced length of stay
- Reduced PN wastage
- Use of lower cost materials

We found a number of studies that evaluated the cost of nutrition support teams. One was based on an RCT[288] and four were based on comparisons of cohorts[56,172,332,344]. Two studies were excluded because the NST existed during the control period and therefore the nature of the comparison was unclear [59,238]. One study was excluded because it was poorly reported and used an obscure method of controlling for severity [135]. A further eight studies were not included because they used a hypothecated comparison arm[14,91,111,222,223,237,274,292] and two were excluded because they reported total costs only and the denominator was not stated [17,164].

One RCT[288] evaluated the follow-up of patients after insertion of a PEG (as reported in section xxx above). All hospital and community care costs were measured over 12 months. There were (non-significant) incremental cost *savings* per patient of £3,538 (-£2,790, £9,847) but there were no apparent differences in complication rates.

A US evaluation based on a prospective cohort study [56] compared automatic referral to NST with ad hoc referral for patients who were on PN for at least two days. They estimated hospital pharmacy & biochemistry costs although NST costs were not included. They found incremental cost *savings* (p=0.41)*:* $1,784 vs. $2,107 (£934 vs£1103).

A retrospective cohort study [344] evaluated NSTs in the management of patients referred for serious burns compared with physician management.

They found hospital costs *savings* $17,800 vs. $24,200 (£9,300 vs. £12,700) but the statistical significance is unclear. There were statistically significant reductions in minor complications but no differences in major complications.

A second US retrospective cohort study [332] compared metabolic support service consultation with no MSS consultation for inpatients beginning PN. For both cohorts they estimated avoidable PN charges using the ASPEN guidelines. They found incremental cost *savings* (significance is unclear)*:* $350 vs. $1,038 (£180 vs. £540) and a substantial reduction in complications: 34% vs. 66% (p=0.004). However, it is possible that patients referred to NST could be very different to those not referred and it is unclear who was deciding which costs were avoidable. NST costs were also not included.

A UK-based retrospective cohort study [172] estimated cost savings of £227 per patient referred for PN due to prevention of catheter-related sepsis (cost of staff time and bed occupancy costs not included). Substantial cost savings were also estimated through the avoidance of unnecessary PN (£777 per patient referred). However this does not take into account the observation that total PN days were increased, and the authors were unable to determine the extent to which this was due to the presence of the NST or due to changing workload and practices within the hospital.

10.1.6 Conclusion

Based on the studies included in this review, the clinical effectiveness of NSTs is unclear. This is due to the high level of heterogeneity between the studies, small sample size and weaknesses in study design. However there is some evidence of decreased complications and cost savings with NSTs although few statistically significant differences were demonstrated (potentially due to lack of statistical power). Only one study was truly randomised and there was therefore potential for bias.

The cost-effectiveness of NSTs is likely to be highly dependent on the context including:

- the role of the team,
- the constitution of team,
- the target patient group, and
- the practices of the non-NST system.

10.1.7 Recommendation

10.1.7.1 Parenteral nutrition should be provided within a care setting which has multidisciplinary staff who have had specific training in nutritional support e.g. a nutrition support team, and with agreed protocols for indications, practice, monitoring and audit. [C]

10.1.7.2 All patients receiving enteral tube feeding should also be supported by a team of multidisciplinary staff who have had specific training in nutritional support e.g. a nutrition support team, and with agreed protocols for indications, practice, monitoring and audit. [D(GPP)]

10.1.7.3 Prior to discharge patients receiving home nutrition support and their carers should:

- ***be provided with an instruction manual (and visual aids where appropriate) outlining procedures***
- ***be provided with both contact and emergency telephone numbers***
- ***be aware of when and how follow up will take place. [D(GPP)]***

11 Nutrition Support at Home

11.1 Home enteral nutrition

11.1.1 Introduction

Long term home enteral nutrition (HEN) is usually required in patients who are unlikely to be able to eat and drink adequately for an indefinite period. The commonest reasons for prolonged failure of oral intake are dysphagia caused by neurological problems (e.g. CVA, MND, MS) or partial intestinal failure that either prevents enough from being eaten or limits its absorption. Anorexia which can also cause prolonged failure of oral intake is a very uncommon indication for HEN. The estimated prevalence of patients receiving HEN in 1998 was 200-267/1 million of the UK population[219].

Patients requiring HEN will normally have their ETF regimen established in hospital from where they will be discharged home. The organisation required to successfully discharge and establish a patient on HEN needs a multidisciplinary team approach usually involving a doctor, nutrition nurse specialist, GP and dietitian. In the first instance patients will require the organisation of supplies of feeds and ancillaries and regular support and monitoring.

11.1.2 Methods

No specific reviews were undertaken for HEN although we did identify information on patients perspectives about this aspect of care (section 11.3). Nevertheless, the GDG recognised that several of its recommendations applied specifically to patients receiving long term nutrition support. Whilst these recommendations are mentioned in various other aspects of the guideline they are also repeated below.

11.1.3 Recommendations

Recommendations that would apply to patients on home enteral nutrition are found throughout this guideline, please see sections 10.1.7.2, 8.8.6.1, 10.1.7.3, 6.3.3.2 and 6.3.3.3.

11.2 Home parenteral nutrition

11.2.1 Introduction

Prolonged PN is needed for patients with chronic intestinal failure; where oral or enteral feeding is either ineffective or unsafe. If the intestinal failure is considered to be irreversible within the foreseeable future the feasibility of home parenteral nutrition (HPN) should be considered. The number of patients receiving HPN in the UK in 1998 was estimated to be 6-8 patients/1 million of the UK population and the most frequent diagnostic indications for patients needing HPN in Europe are Cancer, Crohns and Vascular disease[219].

Patients requiring HPN will have their parenteral feeding regime established in hospital from where they will be discharged home. The organisation required to successfully discharge and establish a patient on HPN requires a multidisciplinary team approach with a minimum of; a gastroenterologist, pharmacist, nutrition nurse specialist, dietitian, GP and community nurses. Specialist nursing services from pharmaceutical companies contracted to provide ongoing care in the home setting are also involved in many cases. In the first instance patients will require the organisation of all equipment as well as supplies of feeds and ancillaries which will need to continue on a regular basis. There is an essential need for continuing close support and monitoring by a hospital based team who are experienced in looking after these complex patients.

11.2.2 Methods

No specific reviews were performed for home parenteral nutrition although we did identify information on the patients perspectives about this aspect of care (Chapter 10). Nevertheless, the GDG recognised that several of its recommendations applied specifically to patients receiving long term nutrition support. Whilst these recommendations are mentioned in various other aspects of the guideline they are also repeated below.

11.2.3 Recommendations

Recommendations that would apply to patients on home parenteral nutrition are found throughout this guideline, please see sections 10.1.7.1 9.6.3.5.1 10.1.7.3 6.3.3.1 and 6.3.3.3.

11.3 Working in partnership with patients, families and carers

Patients may use nutrition support in the long or short term and be based in hospital or the community (at home or in residential care homes). This section addresses general issues to facilitate working in partnership with patients (and their carers) who are using short and long term nutrition support.

11.3.1 Patients on short and long-term nutrition support

Suffering from malnutrition can be a distressing experience for both the patient and their family or carers. It is important that appropriate information and support for the patient and carer(s) is provided so that informed choices can be made. Information should include diagnosis, treatment options, and sources of support such as social security benefits, where appropriate. Checklists can be used to remind both healthcare professionals and patients about information that should be discussed during consultations.

When delivering information, consideration should be given as to whether short or long-term nutrition support is required, and the method to be used (oral, enteral and/or parenteral), as this has very different implications for both patients and carers. The format and language of the information provided should be tailored to the individual's requirements. Consideration should be given to the developmental age, gender, physical needs, culture and stage of life of the individual.

Wherever possible, patients and/or carers should be involved in the decision-making process regarding the method(s) of feeding and any cultural and/or ethnic needs and/or preferences should be taken into account. Whenever possible patients and carers should be aware of why nutrition support is necessary, how it will be delivered and the effect it will have on the patient.

Once the patient has been diagnosed and is using nutrition support, it is likely that care from a range of different health care professionals will be needed depending on the different setting: hospital (emergency/inpatient) or the community (care homes). It is very important that everyone providing care or treatment for patients using nutrition support is familiar with the management of the different forms of such support and is able to provide essential information.

11.3.1.1 Methods

We conducted a literature search to identify patients' and carers' views on nutrition support. The majority of the studies included in the review focussed on patients using long-term enteral or parenteral nutrition support. These were qualitative (surveys and questionnaires) and personal accounts. We did not find any studies that looked at patients on short-term enteral or parenteral nutrition. BUT YOU DID FIND IT FOR SHORT TERM ORAL AND THE STUFF IN 10.1 5 BELONGS HERE Below is a summary of the review.

11.3.1.2 Findings from studies of patients using long-term nutrition support

A predominant feature in the literature was the need for counselling:

- Living with the reality of what it means not to eat was reported in five studies[32,87,201,296,356]. Not being able to eat was a major adjustment for

the patients. A survey conducted in the United States on patients receiving home PN [296] reported that patients felt hungry while receiving PN and found it difficult to cope with the temptation to eat. Patients also explained how this had affected their social lives as they were reluctant to join social events[32,201,273,296,356]. In one survey [196] some carers of patients on home enteral feeding reported they found it uncomfortable to eat in the presence of the patient.

- Feelings of guilt and low self-esteem: this was reported in three studies[32,201,296]. Patients found it difficult to accept the physical limitations of their body and body image[32,273]. Patients also experienced guilt and personal responsibility in relation to their illness.

- How to cope with the reaction of friends or the community at large

> "Probably the most difficult aspect of enteral feeding is the emotional side. Once again there was never any discussion with either medics or family as to how one coped with the reaction of friends or the community at large and this for patients is equally as important as the practical aspect."[201]

> "[….]When patients come home they will meet with differing reactions from others. They may be surprised to find that some former friends or acquaintances do not come to visit them, some will come with almost overwhelming sympathy, some will perform a very hurried visit, and there are the most wonderfully sensitive people who put a hand on one's arm and ask if there is anything they can do to help. Patients need to be aware of these varying reactions as soon as possible so they can be mentally prepared to deal with them." [201]

> [….] "there was no discussion at all about the varying emotions that may be experienced and how to cope with perhaps anger and a feeling of isolation or being ostracized by society"[201]

- A need to talk to someone who is on EN or PN: In two studies[201,296] patients expressed the importance of sharing their experiences with someone who is also receiving nutrition support.

> "My friends have been very helpful [..] but they really don't get what it is like to live TPN-dependent. I need to talk to other adults who have been through what I am going through."[296]

- Fear of death/fear of liver damage from prolonged PN: this was reported in one survey conducted in the United States[296]. Patients expressed their fear of death from their underlying disease or the use of PN.

- Disturbed sleeping patterns were reported in two studies[273,296].

It is therefore very important that healthcare professionals are aware of all these issues when dealing with patients on long-term nutrition support. This is summarised in the following conclusion from a study on patients on home parenteral nutrition:

"Health professionals involved in the home care of this group of patients (or indeed considering the use of this therapy even on a short-term in-patient basis) need to recognise the impact that this therapy can have on the individual. An understanding of the life of the chronically ill patient in the community can assist healthcare practitioners to '…gauge the intended as well as unintended effects of clinical measures'" (Gerhardt1990)[216]

It is also important to involve patients in the decision-making process about methods of feeding. A study conducted in a single NHS trust area offering a community-based support advice service to patients choosing home enteral tube feeding[196], looked at decision-making around enteral tube feeding. Patients and carers reported that the decisions were varied depending on whether or not it had taken place at a time of medical emergency. For example, in a sudden deterioration in swallowing, patients and carers reported that the advice of professionals was taken without hesitation. In general patients appreciated having time to consider proposals and being able to decide for themselves.

> "Patients and carers generally perceived professional advice as a recommendation rather than an option for them to consider. One person reported that his consent had been influence by discussion with the dietician who had left the decision more open.
>
> […] Another patient reported that it would have helped to have some opportunity to see the tube before surgery.
>
> […] A number of patients revealed their reluctance to commence tube feeding, and that the opinion and influence of their family were important factors in their weighing up of the decision, as well as professional advice."[196]

Another important area is the information needs for patient and carers particularly at discharge. Two surveys in the UK including patients on home enteral and parenteral nutrition[51,259] revealed some areas of concern:

> "21% of patients were not provided with an instruction manual to undertake procedures (e.g. connecting up) when first discharged. 14% were not issued with emergency telephone numbers. In the event of an emergency, patients were advised to contact their hospital (75%), the local hospital (16%), or the general practitioner (14%). Four patients were advised to contact a combination of these.
>
> "[..] Overall impression of home nutrition services was assessed [..]. Just over half the respondents had no comment to make (51%). 22% had positive comments to make (e.g. 'fine', 'always satisfied', 'homecare company excellent', 'service very good', 'excellent local hospital service'. 18% had negative comments: 'total lack of support', 'a pain to get dry goods', 'communication poor at times', 'tied by delivery service', 'would prefer additives already mixed', 'homecare service omits items'."[51]

An audit of adult patients on home enteral tube feeding in a region of Northern Ireland [87] looked at whether patients and carers were satisfied with the training received to prepare for home enteral feeding.

> "Patients and carers felt that more emphasis should have been placed on the causes of pump alarming, preventing leaks, how to run feed properly through the giving set, preventing and treating tube blockages, and on stoma care. Further training was received by five of the patients and carers at home (26%); 12 (35%) of those who had not received further training felt it would have been useful".[87]

In three qualitative studies in the UK[87,196,259] patients expressed their concerns about the lack of experience of health professionals with home nutrition support:

> "Whilst 12 (63%) of the patients and carers at home expressed satisfaction with the level of support received since coming home, seven (36%) were not satisfied. The issues of concern included: not being weighed regularly, lack of district nurse experience with home enteral tube feeding, stoma care and lack of emotional support for not being able to eat"[87]
>
> "This rapid building of expertise enabled patients and carers to recognise the inexperience of some of the health professionals whom they encountered. [..] One patient commented that the community nurse was 'very nice but didn't seem to know as much as me'. Conversely, recognition of inexpert practice by a health professional was a matter of concern. Some distress was reported when health professionals did not meet carers' or patients' standards."[196]
>
> "We had a vast array of comments in relation to emergency visits with the common factor being that parenteral nutrition was not commonly known about and the methods for dealing with such patients and

> related issues was commonly only known by the patient themselves or their carers."[259]

One of the surveys mentioned above[259], also looked at patients' and carers' opinion about accessibility to nutrition support services. The majority of respondents preferred to have access closer to home in preference to a remote centre.

11.3.2 Recommendations

Recommendations on the provision of information for patients and carers can be found in sections 4.4.4, 4.4.5 and 4.4.6.

12 Audit criteria

Criterion	Exception	Definition of terms
Hospital inpatients are screened for risk of under-nutrition on admission and repeated weekly in acute settings, using a simple screening tool that includes BMI, percentage weight loss and considers the time over which nutrient intake has been reduced. (e.g. MUST).	Hospital wards considered to have patients at low risk of under-nutrition. They will have specifically opted out of screening having followed an explicit process to do so via the local clinical governance structure involving experts in nutrition support.	Use of a simple screening tool such as the MUST malnutrition universal screening tool is recommended.
Hospital outpatients are screened for risk of under-nutrition when attending their first hospital outpatient clinic using a simple screening tool that includes BMI, percentage weight loss and considers the time over which nutrient intake has been reduced.(e.g. MUST).	Departments with low risk of under-nutrition. They will have opted out of screening having followed an explicit process via the local clinical governance structure involving experts in nutrition support.	Use of a simple screening tool such as the MUST malnutrition universal screening tool is recommended.
Residents or patients in care homes are screened for risk of under-nutrition on admission to care homes using a simple screening tool that includes BMI, percentage weight loss and considers the time over which nutrient intake has been reduced.(e.g. MUST).	Subsequent screening of residents or patients in care homes where there is no clinical concern about risk of under nutrition.	Use of a simple screening tool such as the MUST malnutrition universal screening tool is recommended.

Criterion	Exception	Definition of terms
Documentation in patient records that options of oral, enteral or parenteral nutrition support have been considered for patients who are either; 1)not eating or are unlikely to be eating for more than 5 days or 2)who have a BMI<18.5 or who have unintentionally lost >10% body weight over the previous 3-6 month or 3) who have a BMI <20 and unintentional weight loss >5% or 4) who have poor absorptive capacity are catabolic and/or have high nutrient losses.	Patients who are eating well are well nourished, BMI >20 and do not appear to have high nutrient losses. A record that no action is required with reasons should also be documented.	The documentation should include information about which of the indications criteria listed led the clinician to consider nutritional intervention was required and whether oral, enteral or parenteral nutrition support was instigated after consultation with the patient and or carer and if not why not.
Very sick patients starting enteral or parenteral nutrition support are provided with full electrolyte and micronutrient needs from the outset and then energy and nitrogen requirements introduced gradually according to tolerance over the first 24-48 hours, e.g. in intensive care patients this may mean commencing 50% of normal energy and nitrogen requirements.	The patient who is either not critically ill or who has a BMI >20 and has not had an inadequate nutritional intake for >5 days.	Information on estimating a patients requirements are detailed in Chapter 5.
Documentation in patient records that options of oral interventions to improve intake have been considered in	Patients who are eating well and are not at nutritional risk e.g. BMI >20.	Consider the above criteria with this one also.

Criterion	Exception	Definition of terms
patients who can eat safely but who are either: 1)malnourished (unintentional weight loss >10% over the last 3 to 6 months, 2) BMI <18.5, or 3) BMI <20 and unintentional weight loss >5% over the last 3 to 6 months or 4) at risk of malnourishment and have not eaten for >5 days or are unlikely to eat for >5 days)	Patients who are unable to swallow safely. Patients who present with indications for enteral and parenteral nutrition	
The elderly person in long term care who has experienced unintentional weight loss and who is able to eat safely is offered interventions to improve oral intake such as additional food, fortified food or sip feeds.	The patient who is not in a long term care home for the elderly and is well nourished. The patient who is not considered to have a safe swallow or adequate absorptive capacity. The patient who for reasons intervening with nutritional support is not considered ethical.	
Documentation in patient records that enteral tube feeding has been considered in patients who either have 1) unintentional weight loss >10% over the last 3 to 6 months or 2) BMI <18.5 or 3) BMI <20 and unintentional weight loss >5% over the last 3 to 6 months or 4) who have not eaten for >5 days or unlikely to eat for >5 days and who have a functional, accessible	Patients who are eating well and are not at nutritional risk e.g. BMI >20. Patients who are receiving and responding to the benefits of oral nutrition support.	

Criterion	Exception	Definition of terms
gastrointestinal tract but an inadequate or unsafe oral intake and there are no ethical contraindications for ETF.		
Patients unable to safely swallow due to acute dysphagic stroke , who have a functional, accessible gastrointestinal tract with no ethical contraindications to being offered nutrition support should have an initial 2 week trial of nasogastric tube feeding while further assessing the prognosis.	Patients who are eating well and are not at nutritional risk e.g. BMI >20. Patients who present with indications for parenteral nutrition	
Patients on PN are prescribed a regimen which has been devised to deliver appropriate energy and nitrogen for that individual with the additions from the outset of appropriate vitamins, trace elements, electrolytes and other nutrient supplements added under appropriate pharmaceutical controlled environmental conditions. .	Patients not prescribed PN	

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