A Positive Approach to Nutrition as Treatment

Report of a working party chaired by
Professor JE Lennard-Jones
on
the role of enteral and parenteral feeding
in hospital and at home

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Foreword

In the sophistication of late twentieth-century health care we sometimes miss the obvious. The importance of patients being well-nourished is an example. This working party report sets out in straightforward terms why nutrition is an issue in the NHS today, the benefits to patients and to the NHS as a whole of ensuring patients are well-nourished, and the systems and procedures needed to ensure artificial nutrition is done well. It covers artificial nutrition both in hospital and in the home, the latter becoming increasingly important with the growth of home care.

I hope that the report will bring artificial nutrition to the attention of health professionals as well as providing clear guidance on what needs to be done.

I am grateful to John Lennard-Jones, David Silk and Marinos Elia who suggested the need for a Working Party in the first place, and to all the Working Party for putting so much effort into making it a success.

The Working Party was itself a good model of multidisciplinary working and of partnership with patients.

Barbara Stocking
Director,
King's Fund Centre

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Summary

Many people with severe illness are at risk from an often unrecognised complication — malnutrition.
They starve either because they cannot eat or cannot absorb the nutrients from a normal diet. The resulting malnutrition seriously delays recovery from medical and surgical disorders, and at worst is life threatening. Doctors and nurses frequently fail to recognise under-nourishment because they are not trained to look for it.

Evidence in this report shows the clinical and financial benefits which can result from better diagnosis and treatment of malnutrition. It also explains why, despite the existence of methods for supplementing or replacing normal food to aid recovery, arrangements for coping with clinical malnutrition in the UK are unsatisfactory.

To some extent the problem arises because the patients affected are not a unified group all suffering from the same illness or a disorder of one bodily system. Patients range from the very young to the very old. They comprise temporary or permanent sufferers from malnutrition linked to illness involving any system. Some patients most obviously at risk have had surgery for gut removal, but there are many other disorders which hinder absorption of nutrients such as bowel inflammations or cystic fibrosis. Poor appetite, difficulty in swallowing, or handicaps such as arthritis, motor neurone disease or multiple sclerosis, may limit a person's capacity to prepare, swallow or enjoy meals.

Nutritional support depends on giving a balanced formulation of energy, protein, minerals and vitamins as a drink, as a tube feed directly into the stomach or intestine, or as an infusion into a vein.

The recommendations for improved care in this report concern the recognition of malnutrition at an early stage and the organisation of nutritional treatment in the most cost effective manner. Their successful introduction depends on a new attitude to malnutrition by the caring professions and a new approach to the division of responsibilities between doctors, nurses, dietitians, pharmacists and other staff. Each has a particular contribution to make; a team approach is paramount.

Patients who are already malnourished are at a disadvantage if admitted for hospital treatment. Ideally, malnutrition should be recognised and treated before admission. However, this ideal is impossible to achieve because many patients are first seen as an emergency. However, it is important for GPs and nurses in the community to watch for signs of under-nourishment so that nutritional supplements can be given at home whenever possible. At least 30,000 patients are currently given temporary nutritional support after admission to hospital. One estimate of the potential savings to the NHS of improved recovery rates and shorter stays through nutritional support puts the figure at £266 million per year.

Over 1,000 potential sufferers from malnutrition are currently treated at home after discharge from hospital. These patients free a hospital bed and enjoy the freedom of home after careful training in how to give themselves the nutritional support needed. Their treatment involves close collaboration between carers in hospital and the community.

This report suggests that only a proportion of those who need nutritional support receive it. Published data show that as many as half of certain patient groups are malnourished on admission to hospital. During prolonged hospital stay malnutrition often becomes worse or develops for the first time. Only when the assessment of every patient's nutritional status has become a routine will the full benefits of nutritional treatment be realised.

Aims and Recommendations

To improve the treatment of clinical malnutrition in hospital and at home through adoption of the following recommendations.

1. Education

Improve awareness and understanding by doctors and nurses of under-nutrition and its consequences.

2. Nutritional Assessment

Growth and development are monitored in paediatric practice. These records should be continued if children or adolescents are cared for by other departments. Every adult patient's height should be recorded once in general practice and hospital. Patients should be weighed regularly so that appropriate weight-for-height values can be assessed and changes of weight noted. A note about each patient's nutritional status should be mandatory in medical and nursing admission records.

3. Care Plan

Whenever malnutrition is detected, the cause should be established, a plan of treatment made and its effects monitored.

4. Organisation in Hospital

(a) Every hospital should organise its nutritional services to link management, catering and all the clinical disciplines involved. Quality of nutritional support in acute medical (including the elderly) and surgical wards should be the responsibility of a nutrition team comprising senior clinician, clinical nurse specialist, dietitian and pharmacist. Quality of nutritional support in paediatric departments and intensive care units should be the responsibility of one or more members of their staff.

(b) Records should be kept of the clinical indication for each course of nutritional treatment, its type, duration and clinical outcome, including any complication(s). A budget should be allocated to nutrition support teams based on this audit of their work-load, outcomes and costs. Managers should take account of the potential cost of complications and increased hospital stay due to malnutrition when assessing the cost of nutritional support.

5. Organisation in the Community

(a) Enteral tube feeds at home should be prescribed by the general practitioner and the present regulations should be amended so that the necessary disposable equipment can also be prescribed in the community. The hospital nutrition team should offer the same service to the community health team as it does to ward staff in hospital. It will share responsibility for care by recommending a regimen,
visiting the patient at home as necessary, giving instruction to the patient and all carers on procedures
and possible complications, providing a telephone enquiry service for all members of the community team
and the patient, and giving hospital care as needed either in a clinic or the ward.

(b) The care of' patients who give themselves intravenous infusions at home should be limited to hospitals which have a well organised nutrition team with extensive experience of inpatient parenteral nutrition and which have sufficient staff and facilities to train patients, supervise their treatment at home and provide a 24-hour advisory service. This complex, uncommon and expensive treatment will necessarily be largely initiated and organised by the hospital team. However, as with enteral nutrition, care should as far as possible be shared with the general practitioner and the community team.

Identification of the source of funding should not inhibit the prompt provision of this treatment at home when needed. At present, financial arrangements vary in different places but there is likely to be increased emphasis on funding in the community.

The general practitioner may be asked to prescribe the nutrients and arrange for the supply of equipment. At present, the equipment is not available on prescription and we recommend that this situation should be altered. Alternatively, a district health authority may purchase the treatment which will then be prescribed by the hospital clinician. The nutrients and equipment should

be delivered to the
patient's home either by the hospital or by
a commercial delivery service.

6. National Organisation

(a) Clinical nutrition should be recognised
as a discipline by medical schools, royal
colleges and professional associations.

(b) An academic forum for nutrition
should be established in every medical
school to foster education and research.
Dietitians, nutritionists and nurses should
be involved in the teaching of medical
undergraduates and postgraduates.
Questions on clinical nutrition should be
asked in undergraduate and postgraduate
examinations.

(c) An organisation should be created
which draws together and represents the
common interests of patients, academic
nutritionists, dietitians, nurses, pharmacists,
doctors and the pharmaceutical industry.
his body should set standards for nutritional care,
promote professional training and research,
provide authoritative advice and foster public
awareness of nutritional treatment in illness.

Introduction

Malnutrition prolongs recovery from illness and can lead to death from an unnecessary complication. Hospital admission of a malnourished patient costs more than for one who is well-nourished because length of stay is prolonged and cost per day is increased. Doctors and nurses often fail to recognise malnutrition because they are not trained to look for it. Methods now available for supplementing or replacing normal food speed recovery, reduce the risk of complication and lower costs.

Malnutrition in our Midst

While starvation elsewhere in the world haunts us, healthy people in affluent countries take food and drink for granted.

Yet in the West there are also those who are weak and wasted through lack of food, not because they cannot afford or obtain it, but because they cannot or do not eat or absorb it. These babies, children and adults who starve in the midst of plenty are the subject of this report.

The Extent of Malnutrition in Hospital

A recent survey of nutrition among a multi-racial group of children admitted to the Children's Hospital, Birmingham (1), showed that stunting of growth affected one in six and almost as many were severely wasted. A quarter of children with chronic respiratory or cardiac disorders, and even more with digestive disorders were shorter than most children of their age. Similar surveys have shown a surprisingly high incidence of malnutrition among adults in surgical wards in this country (2), Australia (3) and America (4). Medical wards (5) and wards for the elderly (6) are not exempt. Many patients become malnourished as a consequence of illness and its treatment if admission to hospital is prolonged (2,6,7).

Why Change is Needed

It is 15 years since attention was first drawn to the high prevalence of malnutrition in hospital and yet the problem remains.

The methods exist for effective treatment but are often not used, or used inappropriately or badly.

The situation is illustrated by a National Survey in 1988 which has shown great diversity of nutritional support practices in different health districts (8). Only about a quarter of hospitals had a multi-disciplinary team or group to advise on clinical practice. Among patients receiving least nutritional support were those in orthopaedic wards even though patients with fractured neck of femur have been shown by controlled trial to benefit greatly by supplementary feeding, as judged by rate of mobilisation and reduction in hospital stay (9,10).

An average of one in eight patients treated on general wards by intravenous nutrition developed a catheter infection and the maximum incidence was recorded as nine patients out of ten. Such infections are dangerous, and can be fatal; they are difficult and expensive to treat. Many surveys have shown that the incidence can be reduced to about 3 per cent by staff training, preferably by a specialist nursing sister, and by the creation of a nutrition team (Appendix F). There is an increasing trend to provide nutritional support for patients in the community and a report (11) has shown defects in the organisation of the treatment, and problems with the supply of nutrients and equipment.

What has Retarded Progress?

A principal reason for lack of progress has been slow acquisition and application of knowledge.

Clinical nutrition was not taught to the present generation of doctors and it is still a cinderella subject in undergraduate medical schools (12,13). Teaching has lagged behind nutritional research which has forged ahead, so increasing the gap between knowledge and practice.

Two surveys, one in Scotland (14) and the other in England (15), showed that senior medical students were only able to answer correctly half of a number of factual questions on nutrition topics. Junior doctors were not much better. In both surveys the majority of doctors rated their

own knowledge as poor and felt that more should be taught about the practical application of nutritional support.
Slow progress has also been due to diffusion of responsibility and lack of co-ordination between the disciplines involved in the recognition and treatment of malnutrition.

Financial Provision

At present the financial provision for nutritional support is unstructured. Inappropriate or badly organised treatment leads to waste of nutrients and further increased cost due to expensive complications of treatment. Conversely, failure to give treatment when it would be beneficial leads to increased costs due to increased length of stay in hospital and greater costs per day.

We seek to convince purchasers that nutritional support is an essential need for some patients and that it is well worth the cost provided that its indications, aims and results are defined and documented. We also aim to show that by better training and organisation the money spent will be best used. Budgets need to be identified for provision of the nutrients and equipment in hospital and provision made for both to be available on prescription in the community.

Malnutrition results when a patient's nutrient intake falls short of metabolic requirements. Intake may be reduced because a patient will not, or cannot, eat or because food is poorly absorbed. Metabolic requirements in health depend on physical activity and growth.

During illness, tissue damage activates mechanisms which increase energy needs and lead to further breakdown of tissue.

Social circumstances or handicaps such as arthritis, motor neurone disease or multiple sclerosis may limit a person's ability to prepare or eat meals. Poverty or a chaotic home may limit meals. Food may be unpalatable for a person with loss of taste or poor appetite, or unsuitable for a patient with a painful mouth or difficulty in chewing or swallowing.

Chronic pain, depression or apathy all lead to loss of interest in food. Many patients are already malnourished when they are admitted to hospital because of these factors and other effects of their illness. In hospital, food intake is often insufficient because meals are missed due to multiple procedures requiring temporary starvation, or because meals are served in a way which takes no account of a physical handicap or feeding difficulty.

Lack of nursing supervision at meal times can mean that a patient's poor intake is unnoticed and corrective action is not taken. 'Healthy eating' guidelines should be applied with caution when patients are ill.

Specific causes of poor intake include coma, an inability to swallow, repeated vomiting and any condition which leads to pain, diarrhoea or other symptoms on eating. Reduced absorption of food follows surgical procedures in which a major proportion of the small intestine is removed and may also be a consequence of disorders of the intestinal muscle or mucosa.

The Effects of Starvation or Under-nourishment

When does Death Occur?

Starvation in a previously healthy person leads to death in about two months. The effects of such uncomplicated starvation are seen in prisoners who starve themselves to death. Whereas a normal adult may survive for about 60 days without food, pre-term infants weighing I kg and 2kg can survive for only 4 and 12 days respectively; a normal full-term baby for about 30 days and a one year old child for about 40 days (16). The effects of starvation depend on a person's age and previous state of nutrition. Clearly~ if a person who is already malnourished stops eating, death will follow in a shorter period.

When a person starves after severe trauma, major surgery and/or during infection, weight loss is accelerated and survival without food for a previously healthy adult may be reduced to about a month.

In adults, an acute weight loss of more than one-third of the original bodyweight is often associated with impending death. In premature babies, with little reserve, survival without food is reduced to a few days, and in small children to a period of two to three weeks if there is at the same time infection or injury.

The Effects of Malnutrition in Normal Subjects

A classic experimental study of semi-starvation in healthy adults reduced body weight by one quarter. Besides obvious loss of body tissue and muscle strength, the subjects became depressed, anxious, irritable, apathetic, introverted and lost mental concentration (17). Similar observations have been made in prison camps and during famine (18). In children, under-feeding adversely impairs growth, intellectual development, mother-child interaction, and emotional and social behaviour (18).

Recent research has highlighted how severely muscle function is impaired by under-nourishment(19). If a normal subject limits daily food intake to 400 KCal there is demonstrable impairment of muscle function with increased fatiguability in as short a time as two weeks. The normal respiratory drive caused by lack of oxygen is reduced (20) and cardiac function is decreased (21). All these effects can be rapidly reversed by re-feeding. Low body weight impairs body heat protection leading to risk of low body temperature in winter, particularly in the elderly. This may be a risk factor for incapacity, falls and injury (22).

How does Malnutrition Complicate Illness?

The mental changes seen in normal subjects after semi-starvation are of great clinical importance in the sick patient. Apathy and depression lead to loss of morale and loss of will for recovery. Inability to concentrate means that the patient cannot benefit from instruction about techniques needed for self-care. A general sense of weakness and illness impair appetite and the ability to eat.

Loss of power precedes loss of muscle tissue and return of power is more rapid than replacement of tissue (19,23). Weakness affects the respiratory muscles (24) so that it is difficult for a patient to cough and expectorate effectively with a consequent liability to chest infection (25); this weakness and loss of sensitivity to oxygen lack may also make it difficult to wean a malnourished patient from a ventilator (26). Cardiac muscle function is impaired with reduced cardiac output and a liability to failure (27). Mobility is reduced delaying recovery (9) and pre-disposing to thrombo-embolism and bedsores (28).

The malnourished patient develops impaired immune resistance to infection, which in turn worsens the nutritional status (29). Deprivation of nutrients leads to altered structure and function of the gut with increased liability to entry and spread of intestinal bacteria within the body (30).

Starvation is thus an insidious factor which prolongs recovery, increases the need for high dependency nursing care and sometimes intensive care, increases the risk of serious complications of illness, and at its worst leads to death either from an unnecessary complication or from inanition. In economic terms, the hospital admission of a malnourished patient costs more than one whose nutrition is maintained.

How can malnutrition be detected?

Creating a New Thought Pattern

Malnutrition is often unrecognised. Doctors and nurses are not used to looking for it. They need to develop a habit of instinctively noting under-nourishment and a sensitivity to situations in which it might occur. In paediatric practice, growth and development are kept constantly under review. Once a person is full-grown, a single measurement of height suffices and should be recorded in general practitioner and hospital notes. Adults should be weighed regularly so that appropriateness of weight for height can be assessed and changes of weight noted.

Every ward and clinic should have accurate weighing scales and a device for measuring height.

Initial Assessment

A note about each patient's nutritional status should be mandatory in medical and nursing admission records.

A careful study has shown that a simple clinical assessment of nutritional status gives results comparable with the most sophisticated measurements (31). The assessment should take account not only of weight loss but also muscle power and mental state (32).

Questions to be asked are:

• Has recent food intake been normal in amount?

• Have particular foods been avoided?

• Have there been unusual losses from the body such as chronic diarrhoea or vomiting?

• Has the patient noticed weight loss, (eg. fit of clothes) and over what period?

• What does he/she regard as their normal weight'?

• Do parents think that a baby or young person has been growing normally (records may be available from health visitor or clinic)?

• Has the patient had to reduce activity due to weakness or early fatigue'?

Physical examination should consider:

• Is muscle bulk normal (confirmed by palpation)?

• Is the amount of sub-cutaneous fat normal (confirmed by feeling the thickness of folds of skin)'?

• Is there evidence of dehydration; or, conversely, of oedema'?

• Is the patient's muscle power of expected strength, eg. grip and ability to cough vigorously'?

• Is the patient alert or depressed, apathetic and inactive'?

The most important measurements are body weight and height.

Is weight within the range to be expected for a person's height? More use should be made of the body mass index, which gives a normal range of 19 to 25 when applying the formula:

weight in kilograms
(height in metres)2

Plotting weight and height of babies and young people on standard charts compares the actual values with those expected in the general population.

Development of Malnutrition
While Under Observation

A patient's nutritional state can slide imperceptibly downwards during illness. Awareness of this possibility is the key to recognition.

Whenever a patient can stand or sit, repeated measurements of body weight should be made if illness is prolonged. Beware when patients undergo multiple investigations or recover slowly from operation.

At particular risk is the obese patient who does not eat and loses muscle bulk but still appears fat and overweight.

In appropriate cases, food intake should be recorded and a dietary assessment made for comparison with estimated normal requirements .

Methods Available for Nutritional Support

From the Simple to the Complex

The simplest way of promoting nutrition is to get a patient to eat more. This may mean frequent small meals, or tempting the patient with appetising dishes of favourite foods, or encouraging nutritious meals rather than the patient's usual choice of low calorie items. Centralised hospital catering, working on a tight budget, naturally finds difficulty in providing frequent snacks or individualised meals. The disappearance of the ward kitchen limits the preparation of snacks between meals or the replacement of meals not taken because of investigation or procedures. The serving of meals in an appetising manner no longer appears to have high priority in a ward; it is regarded as a chore, a provision of the hospital 'hotel services', rather than as an essential part of treatment for many patients .

To facilitate the provision of frequent small appetising snacks between meals, a range of liquid or semi-solid preparations, conveniently prepared in sterile portions, and with flavours varying from sweet to savoury is available. These enteral supplements are a most valuable addition to the hospital diet for selected patients whose food intake does not maintain nutrition or who require extra nourishment to replace lost tissue. However, care is needed that they do not decrease appetite for food. Such snacks, organised by the dietetic department, should be readily available when needed. Organisation is needed to make sure that they are delivered to the patient frequently with encouragement to take them.

Only if these simple measures fail or are inappropriate do the techniques of artificial nutritional support become necessary. These methods range from provision of special liquid diets, which are drunk, to the administration of specially formulated liquid nutrients through a tube directly into the gut (enteral tube feeding), to the introduction of nutrients directly into a vein, so by-passing the intestine (parenteral feeding).

Defining the Aim, a Plan, and a Method of Monitoring

The aim of providing nutritional support for each patient should be clearly stated. It may be to maintain current nutritional status or restore lost tissue while a patient cannot eat or cannot eat enough. It may be to provide nutrients of a particular composition, or to reduce the amount or type of food entering the gut because of a fistula between the intestine and the skin, acute pancreatitis, or other reason. A plan should be made jointly by the medical, nursing and dietetic staff to achieve the aim which should be reviewed regularly and modified as necessary. Progress should be monitored by appropriate clinical observation and measurements. Changes of technique may be needed as circumstances alter. Treatment should be continued until the aim is achieved or artificial nutrition i.s no longer appropriate.

Specially Formulated Liquid Enteral Feeds

Certain patients—for example, with partial oesophageal obstruction—can take liquids only in small quantities at a time. A sip feed with a balanced composition similar to a normal diet, can be given with an energy level appropriate to the patient's need in a volume which the patient can drink. A liquid feed composed of amino acids or small peptides, glucose or oligosaccharides, and little fat, reduces the intestinal inflammation in some patients with Crohn's disease. Special liquid feeds are available for use in renal failure or other metabolic disorders.

Enteral Tube Feeds

A liquid feed introduced directly through a narrow, flexible tube into the stomach or intestine can be given if oral intake is inadequate. In this event, a tube feed offers the following advantages:

• it is comfortable and readily accepted by patients;

• o it can be given independent of appetite or difficulty in swallowing;

• it requires no muscular effort on the part of the patient;

• the feed can be given slowly and continuously by day or night, or throughout 24 hours;

• administration of the feed is simple and can be undertaken without difficulty by a patient or attendant at home;

• the feed and associated equipment are relatively inexpensive.

Nasogastric enteral tube feeding is relatively free of complications provided that the stomach empties normally. Incorrect placement of the tube, severe gastroesophageal reflux or delayed passage of the food onward into the intestine can lead to feed entering the lungs. Damage to the pharynx or oesophagus rarely occurs during passage of a tube or as a consequence of acid reflux.

Diarrhoea can complicate feeding, particularly if large boluses are given rather than a slow continuous infusion; the occurrence of diarrhoea is more commonly due to the coincidental use of antibiotics than to the feed (33). Infections can occur from an infected tube or contaminated feed (34,35). When a catheter is passed through the abdominal wall into the stomach or jejunum, complications can occur be associated with introduction of the catheter, such as peritonitis, bleeding, intestinal ileus, and local infection.

Parenteral Nutrition

Infusion of nutrients into a vein should only be undertaken when it is impossible to maintain nutrition using the intestine. When the indications are correct, parenteral nutrition is an extremely valuable technique which can be life-saving. It should be regarded as a potent treatment only to be undertaken by those experienced in its use.

Nutrients can be infused into a peripheral or central vein. The former is less liable to complication but use of a central vein is necessary for long-term treatment.

One of the greatest hazards of parenteral feeding is infection of the line or, rarely, the feed giving rise to septicaemia. Thrombophlebitis with venous occlusion can occur and is a serious complication when the subclavian vein or superior vena cava is involved (36). Damage to the large vessels and nerves at the root of the neck, or a pneumothorax, may complicate introduction of a central venous cannula. Perforation of a large vein, or even the right atrium, occasionally allows escape of nutritional solution into the pleural or pericardial cavities. Metabolic complications include either an excess or a deficit of specific nutrients—for instance, high blood glucose levels with glycosuria or selenium deficiency in the long-term with cardiomyopathy.

Benefits of Nutritional Support

Consequences to the Patient of Malnutrition

Many studies have shown that a patient who is malnourished when admitted to hospital tends to have a longer hospital stay, experiences more complications and has a greater risk of dying than a person with the same illness whose nutritional state is normal. This effect of malnutrition has been shown among medical (37,38,39), surgical (32,37,40,41) and orthopaedic (9,42) patients, and among the elderly (6,43).

Financial Cost of Malnutrition

The introduction of diagnosis related groups (DRGs) in the United States with increased payment for co-morbidity, including malnutrition, has led to analyses of the effects of malnutrition on costs of treatment. In a prospective study of 100 admissions to a general medical unit, 40 patients were regarded as malnourished by multiple criteria. The average length of hospital stay among these patients was 15 days as compared with about 10 days in the remainder and the hospital charges were more than double (44). A retrospective review of 771 patients in three specified medical and three surgical categories found a likelihood of malnutrition among just over half the patients. There was a two-fold increase in minor and a three-fold increase in major complications, associated with an almost four-fold increase in mortality among these patients, which led to an average 50 per cent increase in direct variable cost due to increased length of hospital stay and greater cost-per-day. The admission of a malnourished patient who experienced a major complication cost four times that of a normal patient with an uncomplicated course (37).

Benefits to the Patient of Extra Nourishment

No clinician is in doubt that nutritional support often permits survival in acute disease and allows time for definitive treatments to take effect or for an operation to be undertaken as an elective procedure in a patient whose general condition is improved. Mortality from a variety of conditions such as severe sepsis, large area burns, entero-cutaneous fistulae and severe inflammatory bowel disease has decreased over the last two decades, and improved nutritional support is one of the factors likely to have contributed to the improved outcome.

Two controlled trials have shown the benefit of routine enteral supplements in patients with fractured neck of femur and another trial has shown the effect of a nutritional supplement in care of the elderly.

In one study of fractured neck of femur (9), three groups of patients were distinguished, those who were well nourished on admission, and those who were thin or very thin. The well nourished patients achieved independent mobility at a median time of 10 days after operation and the mortality was about S per cent. The median time to independent mobility in the very thin patients without a dietary supplement was 23 days and the mortality was 22 per cent. The patients with evidence of malnutrition were randomised into two groups: one received a nasogastric enteral feed (1000 KCal, 28G of protein) over night in addition to the ward diet; the other group took the ward diet only. There was a significant decrease in the time to independent mobility among the patients receiving the supplement compared with the control group. Among the very thin patients the median mobilisation time among the former was 16 days and 23 among the latter. A similar study (10) used a smaller dietary supplement (254 KCal, 20G of protein) which was drunk in two portions between meals. The voluntary intake of food was only l lOOKCal and this supplement increased dietary intake of energy by 23 per cent and of protein by 62 per cent. The total length of hospital stay was significantly shorter among supplemented patients, with a median of 24 days as compared with 40 days in the group taking diet alone. At six months the mortality (24 per cent vs 37 per cent) and the incidence of complications (16 per cent vs 37 per cent) were significantly lower in the supplemented group.

In a randomised study (6) among 501 elderly patients, half received a dietary supplement of 400 KCal in addition to the hospital diet. The nutritional state of all patients tended to deteriorate after admission but this was less among the supplemented patients. The mortality in this group over six months was significantly lower (8.6 per cent) than among the group taking diet alone (18.6 per cent).

More trials are needed in similar situations where the patient population is homogeneous, the injury or illness is well defined and of uniform severity, and artificial nutritional support can be given or withheld without ethical difficulty, and without many other confounding variables. The difficulties involved in testing the effects of nutritional support on clinical outcome are evident in those trials undertaken to assess its effect on the outcome of surgery.

Several randomised trials have been performed to show whether nutritional support before and after operation decreases mortality or the frequency of complications. The largest trial conducted in 11 hospitals among 395 patients, all with some evidence of malnutrition, who underwent abdominal or thoracic non-vascular surgery, failed to show overall benefit from parenteral nutrition given for seven to 15 days before operation and at least three days afterwards. The trial confirmed previous findings that mortality and complications tended to be greater - among the most severely malnourished patients and suggested that in these patients the incidence of non-infectious complications was less among those given nutritional support (45). In six other small trials, one has shown a reduction in complications and mortality (46), one has shown a reduction in wound infections (47), the others have not shown an effect on outcome (48, 49, 50, 51). Two studies, one of parenteral nutrition and other of a nasojejunal tube feed, have shown reductions in mean post-operative stay of seven and five days respectively in the groups given extra nutrition (52, 53). Trials of post-operative jejunostomy tube feeds have failed to show benefit but the results are confused by complications of the procedure (54).

Much has now been learned from this experience about the design of such trials. First, it is important to treat an adequate number of patients who are seriously malnourished rather than an unselected group of all patients. Second, nutritional support should be given for long enough to have an effect, and in a manner which minimises complications of the treatment. Third, if possible the treatment should be given for an adequate time before, as well as after, surgery.

If patients are identified as malnourished before elective surgery, a good case can be made for conducting a trial of simple dietary supplementation during the waiting period so that the patient's malnutrition is partially or wholly corrected by the time of the operation.

Until more evidence is available, a reasonable case can be made for giving nutritional support to a patient who has lost more then 10 per cent of body weight in the three months before operation and who is unable or unlikely to resume an adequate oral intake without a week of operation, and to every patient who is unable to resume an adequate oral intake within 10 days of operation.

Cost Saving of Nutritional Treatment

The evidence for cost saving of nutritional treatment is based on the controlled trials described which have demonstrated a reduced complication-rate and decreased hospital stay among surgical and orthopaedic patients. Two analyses of the cost-effectiveness of nutritional support (55,56) have emphasised the importance of a reduction in complication rate, and thus length of stay and costs per day, as a major economic benefit. Appendix G shows an estimate based on a 5-day reduction in hospital stay for 10 per cent of hospital inpatients which illustrates the magnitude of the financial saving possible. In this example, £266 million would be saved annually in Britain, taking into account the cost of nutrients and increased nursing time for their administration.

Artificial Nutrition in Hospital

How Many Need Treatment?

About I in 50 hospitalised patients in Britain receives artificial nutritional support; the proportion of seriously ill patients receiving it is considerably higher. An enteral tube feed appears to be generally used about three times more commonly than parenteral nutrition. It is not known how many patients would benefit from nutritional support but do not receive it.

The results of a complete survey of artificial nutrition in one health district (11), which includes hospitals providing a full range of district services and a teaching hospital which also acts as a referral centre for neurosurgery, other regional services and transplantation, with a population of 340,000, is shown in Appendix D. In total, 811 patients were fed artificially in hospital over 15,549 patient days. At any one time 2.8 per cent of the inpatient population received nutritional support, though the proportion was less than 2 per cent of all admissions. Enteral tube feeding was given to 570 (11,624 patient days) and parenteral nutrition to 311 patients (3,925 patient days); almost 45 per cent of the patients were in the neonatal period. Excluding neonates, both types of feeding were given for a wide range of disorders: neurological conditions, malignancy and gastro-intestinal disorders accounted for the highest proportion of enteral feeds; gastrointestinal tract disorders (including malignancy) for the highest proportion of parenteral feeds.

Figures for the work-load of a nutrition team in a district general hospital over four years are shown in Appendix E. The greatest number of patients were given supplements to their diet, but the use of enteral tube feeds tended to increase over four years until the number was almost as many. Enteral tube feeds were given to eight times as many patients as those given parenteral feeding.

A survey among dietitians, only about half of whom could supply figures, reported 13,465 patients who received an enteral tube feed and 5,235 patients who received parenteral nutrition in hospital during a year(8). It seems likely that the total numbers are at least double these figures.

The prevalence of artificial nutrition, and the ratio of enteral to parenteral nutrition, vary considerably from ward to ward and from hospital to hospital. For example, nutritional support is practiced more commonly in surgical, medical and intensive care wards than obstetric and orthopaedic wards; also more often in teaching than in non-teaching hospitals.

Current Lack of Organisation

Nutritional care of patients in hospital suffers from division of responsibility.

Catering managers do their best on a relatively small budget (£11.00 to 14.50 per patient weekly) but tend to have little direct liaison with the dietetic department.

Doctors tend to regard malnutrition as a nursing problem; nurses tend to refer responsibility for malnourishment to a dietitian. In many hospitals there is no member of either the senior medical or nursing staff with a special interest in clinical nutrition.

Dietitians often tend to work in relative isolation rather than as personal members of a team.

The pharmacy is increasingly involved in the preparation and supply of parenteral nutrition solutions, and sometimes supplies enteral feeds.

Medical equipment or supplies departments provide plastic disposables, such as giving sets, and are responsible for the supply, testing and maintenance of electrical pumps.

There is often little contact between those responsible for acute adult medical and surgical wards, paediatric departments and intensive care units.

The financial provision for nutritional care also tends to be fragmented.

The nutrient solutions and equipment are supplied by different departments and charged to various budgets. The cost of

nutritional care is not at present clearly identified and in most hospitals there is no audit of its use.

The Advantages of Special Knowledge and a Team Approach

The aim of treatment for any patient must be to provide the simplest, safest, cheapest method of nutritional support which achieves the desired goal.

Advice on the most appropriate treatment can be given by a doctor with special experience in nutrition, a clinical nurse specialist or a dietitian. Each has a particular contribution. The doctor is trained to assess the clinical situation, with particular reference to the likely course of the illness, and to understand any metabolic disorder which may be present. The nurse understands the particular problems of day-to-day care in the ward, and the patient's reaction to the illness. The dietitian is interested particularly in dietary quantity and composition and the range of nutrient support which can be provided.

A team of different disciplines with good communication enables nutritional support to be given in the best manner for each patient. Such a team improves the quality of treatment and reduces costs by:

avoiding unnecessary treatments and simplifying the treatments used (57,58,59,60); reducing complications (61-68 and Appendix F);

monitoring use of nutrients and outcome of treatment (60,68,69,70);

reducing waste (for example, solutions prepared but not given or only partially used) (58);

standardising nutrients and equipment to enable bulk purchase and negotiation of competitive rates (57,59,60,68).

Appendix F shows that the cost-saving to an average hospital from a reduction in catheter-related infection after introduction of a nutrition team is likely to be of the order £26 - 80,000 each year. A saving of £80,000 per annum was also calculated after action by a clinical nutrition team to reduce the catheter infection rate at a children's hospital (68).

Proposed Organisation in Hospital

A flexible organisation needs to be created which optimises nutritional care in each department, monitors outcome and the use of resources, and has the confidence of management. A nutritional steering group can be linked to a therapeutics and supplies committee.

A team approach should be built up in adult and paediatric wards, and intensive care. In some hospitals, one team might serve all these departments, in others a team will evolve in each department. Such teams may act in an advisory capacity to their colleagues, but even so tend to have authority because they control the supplies of nutrients and equipment. There is evidence that a team which controls and supervises enteral tube and parenteral feeds leads to better quality of care than a team which advises only (70,71).

A typical team consists of four members with overlapping responsibilities, as follows:

Dietitian —To assess nutritional status and intake of patients who are referred because of malnourishment. To calculate nutritional requirements and design enteral, and sometimes parenteral, feeds with knowledge of the products available. To work with other members in the supervision of enteral, and sometimes parenteral, nutrition and in the training of staff, patients and carers.

Nurse —To prepare, teach and supervise protocols for the care of intravenous lines and other aspects of enteral and parenteral nutrition. To place fine bore nasogastric tubes and assist with the placement of gastrostomy and intravenous lines. To act jointly with the clinician and dietitian in the practical aspects of artificial nutrition in the wards. To train and prepare patients who will continue the treatment at home; to liaise with relatives and the community tea care team who will help the patient after discharge.

Clinician —To liaise with the patient's medical or surgical team. To be responsible for arranging the placement of

gastrostomy or intravenous catheters under sterile conditions by experienced personnel. To prescribe parenteral nutrition solutions. To accept overall responsibility for the nutritional aspects of care for patients referred to the team and to audit the outcome.

Pharmacist —To be responsible for providing enteral feeds and sterile parenteral nutrition solutions, to optimise their composition based on knowledge of the products available, to advise on the compatibility of mixtures of nutrients and on any reactions with drugs.

Each team needs to have close liaison with a member of the departments of chemical pathology and microbiology for advice on the prevention and management of metabolic and infective complications. The primary members of the team may delegate day-to-day duties to colleagues as necessary while maintaining their own areas of responsibility. The team(s) will meet regularly and frequently, and will review together the management of patients with difficult problems. The members will maintain a continuous audit of the efficacy, complications and cost of artificial nutrition in the hospital.

The team will be responsible for the education of medical and nursing staff in their departments in the principles and the details of nutritional support and for the preparation of protocols, guidelines and standards.

Budgetary Control and Audit

There are many advantages to be gained by allocating a budget to each nutrition team which will:

• provide a focus on artificial nutrition;

• reduce unnecessary cost;

• encourage regular monitoring and so ensure that protocols lead to the most cost efficient use of resources.

This regular audit should be discussed with management and form the basis of budgetary allocation.

Artificial Nutrition at Home

Why and Who?

Artificial nutritional support usually begins in hospital and for some patients continues at home. Return home allows the patient to escape from an institution to independence, a familiar environment, increased activity, and more normal relationships. Domiciliary treatment frees a hospital bed which would often otherwise be occupied for many weeks or months. Some children are at present kept in hospital for long periods solely because their nutritional treatment is difficult to organise at home. This situation is unacceptable and very different from that found in America.

A national register of patients receiving enteral nutrition at home (72), and a survey of all patients in one health district (Appendix D) has shown that the indications are very varied and include neurological conditions which interfere with swallowing, cardiac or respiratory disorders which impair food intake, patients with intestinal failure and a few with slowly progressive malignancies (11). Among children, indications include chronic renal failure, cardiac disease, chronic liver disease, malignancy, Crohn's disease, fibrocystic disease and other reasons for failure to thrive due to an inadequate intake (73).

Parenteral nutrition is required only for intestinal failure. A short gut occurs after major resection(s) of small intestine for Crohn's disease, irradiation enteritis, or vascular occlusion, including volvulus in young people. A diseased gut includes disorders of the mucosa, muscle or enteric plexus.

When is Home Treatment Appropriate?

Treatment at home is limited by a patient's or carer's manual dexterity and ability to understand the technique, its potential complications and what to do if things go wrong. The aim of home treatment is to achieve the greatest possible rehabilitation or to maintain nutrition despite a disability or during treatment such as chemotherapy. These treatments are not therefore given to patients whose underlying illness is likely to progress rapidly with deteriorating quality of life unless they relieve symptoms as in carcinoma of the oesophagus. For this reason, patients with such conditions as widespread progressive neoplasia, advanced systemic sclerosis, or elderly patients with generalised vascular disease, are not often regarded as suitable for home tube feeds or parenteral nutrition.

Training

Training begins in hospital and must sometimes wait until the patient is physically and mentally well enough to learn and understand the procedures (74). Staff have to remember that the equipment used, and concepts such as maintenance of sterility, are strange to a lay person. Teaching has to be gradual, repetitive and progressive. It may therefore take two to four weeks for a patient or carer with no previous experience to learn the technique. Children need psychological preparation as play therapy including a special colouring book, or for the older child explanation and meeting other children who are receiving the treatment (73,75). Explanatory leaflets and audio-visual aids should be available.

How Many Patients are Involved?

A national register of patients receiving home enteral tube feeds has provided data for 144 of 218 health districts (72). By the end of 1990, 1274 patients had been registered, one-third of whom were children and two-thirds adults. The mean length of feeding was 188 days for children and 156 days for adults. The number of patients starting treatment during 1990 was 698, including 258 children and 440 adults. A survey in one health district over a period of two years showed that 33 patients received an enteral tube feed at home (76).

During one year patients treated at home contributed about one third of the total patient days of treatment for both inpatients and outpatients in two series (Appendix D and E). These figures suggest that over 1,000 patients are receiving home enteral tube feeding in England and Wales and this figure is likely to increase. Although the total

numbers are small relative to hospital treatment, the financial consequences are large because of the long duration of treatment for each patient.

A national register of patients receiving parenteral feeding at home has been maintained since the treatment was introduced (77). Between 1977 and 1986, 200 patients were discharged home and the number of new patients starting each year plateaued in later years to about 40 each year. About half of these patients are able to stop treatment and the number receiving treatment over the country is estimated as 100 to 150 at any one time. The proportion of children treated in this country is smaller than in America and some other countries. It seems likely that the number of children treated will increase (75).

Quality of Life Achieved

Many adults who receive enteral tube feeds at home are in older age groups and have severe illnesses, often with difficulties in swallowing, which limit physical capacity, and length of life. Overall about one-fifth undertake full activity, three-quarters are restricted to some degree, for example some are confined to a wheel chair, and the remainder (6 per cent) are confined to bed and even semi-conscious (72). The mortality is high and at least one in four of these patients dies each year (72,76).

In contrast, 40 per cent of children treated with an enteral tube feed at home lead a normal active life and the mortality is low, though again a few (5 per cent) are bed-fast or semi-conscious. A survey has been conducted among parents of 70 children with experience of home enteral nutrition over a total of about 11,000 patient days (73). Many said that their child appeared more happy and active than before, and they experienced a sense of freedom because they no longer had to devote time trying to get their child to eat. Sleep disturbance both for children and parents is a problem and most parents get up during the night to check on their child and the accuracy of the pump. Older children tend to be self-conscious about a nasogastric tube when leaving the house and may overcome this difficulty by learning to pass the tube themselves each night and take it up in the morning, or by accepting a gastrostomy.

Those patients who infuse nutrients into a vein mostly do so overnight and close off the venous cannula by day; most of them can eat small meals during the day to maintain social life and contribute to their nutrition. If they eat larger quantities diarrhoea, or an excessive output from an abdominal stoma, becomes a social problem (74). Almost half the patients (43 per cent) are at work full time or able to look after a home and family unaided (77,78). Only a small proportion (7 per cent) are housebound and need major assistance with their parenteral nutrition; the remainder are able to work part time or unable to work but able to cope with their parenteral nutrition unaided.

A Patient's View of Home Parenteral Nutrition

Support should include the psychological aspects of the treatment as well as the practical issues. Until the patient accepts the treatment it is very difficult for him or her to deal with the practical issues, and to cope with the magnitude of change to everyday life. Consideration should be given to training in counselling skills for all nutrition nurses and to the involvement of medical social workers. Good rapport which enables doctor and patient to discuss therapeutic options, and the patient to participate in decisions increases the latter's confidence, sense of independence and self-esteem.

Once discharged from hospital a great responsibility is placed on the patient and on the family. Firstly they have to remember all the procedures and how to deal with serious complications should they arise. There are also problems with everyday life and income. A handbook proves very valuable and all units should ideally provide one. Most general practitioners, district nurses and health visitors express ignorance when asked questions regarding parenteral nutrition, thus emphasising the need for further education in the community on artificial nutrition and the importance of extending the role of the specialised units outside the hospital.

The need for a member of the unit to be always available by telephone and for an emergency admission procedure is

especially important if the patient lives several miles away.

A great deal of improvement is needed in the equipment given to patients for use in the home. With one or two exceptions the equipment is specifically designed for hospital use, where there are flat vinyl floors, lifts and high levels of noise. Put the same equipment into the home and it becomes impossible to get up and down stairs, difficult to push over carpets and often noisy.

For many years individual units in different parts of the country have offered varying levels of support and used different procedures. As a patient, it would be encouraging to see the units uniting to fight for improved standards of patient care, funding and equipment, and also trying to establish uniformity in protocols. We could then have standard packs, avoiding waste and making the procedures easier and quicker to carry out. As one organisation of carers and patients we would carry more weight than acting as individuals or as separate hospital units.

Present Organisation is Unstructured

Since artificial nutrition is usually started in hospital, patients naturally turn to the expertise of the hospital nutrition team in any difficulty. As a result there can be tension between the roles of the hospital staff and that of the general practitioner. The relative rarity of this type of treatment in the community means that the community care team is unfamiliar with it and therefore lacks confidence in prescribing nutrients or dealing with problems. The situation is particularly unsatisfactory because, with present budgeting arrangements, the hospital team has to rely on the general practitioner to prescribe the nutrients, though by an administrative anomaly the GP is unable to order the equipment needed. Administrative responsibility between the hospital and community health teams is thus ill-defined to the detriment of the patient.

Proposed Organisation for Home Enteral Tube Feeds

In hospital, the nutrition team has special experience and advises clinicians in different disciplines on this aspect of treatment; in the community, the hospital nutrition team can have a similar relationship with local health care.

The team can share responsibility for care by recommending a regimen, giving instruction to the patient and all carers on procedures and possible complications, providing a telephone enquiry service for all members of the community team and the patient, and by giving hospital care as needed either in a clinic or the ward. The general practitioner can accept responsibility for treatment at home, prescribe the nutrients and, we hope in the future, the equipment required. It is convenient for the patient to have the nutrients and supplies delivered to the home and prescriptions may be sent to a commercial delivery service.

The hospital and community teams should liaise as closely as possible. When the patient is discharged from hospital, a member of the hospital nutrition team should visit the home to meet the general practitioner or other representative of the community team and explain details of the treatment. A member of the hospital team, often the clinical nurse specialist, may be invited to make further home visits. It is likely that the patient will continue to visit a clinic at the hospital for follow-up, when suggestions about altering the feeding regimen may be made.

The simple infusion pumps and drip stands used should be bought from an identified hospital or community budget and loaned to patients. A reserve stock is needed so that new patients can be supplied quickly, with an allowance for some pumps to be out of use for servicing. Alternatively, commercial firms lease these items of equipment as part of their home supply service.

Proposed Organisation for Home Parenteral Nutrition

The cost of home parenteral nutrition is high for each patient (around £25,000 pa for nutrients and disposable equipment) but the number is small (100 to 150). Some health districts will therefore not have one of these patients and the most is likely to be two or three. Parenteral nutrition is much more complex than enteral nutrition and a scrupulous protocol to avoid line infection is required twice daily when the feed is connected and the empty container is disconnected from the catheter. To avoid metabolic complications a strictly controlled rate of infusion is required, and since infusion occurs during sleep the pump must also incorporate a system of alarms to wake the patient if the line becomes blocked or other malfunction occurs. The pump is therefore expensive and requires regular maintenance.

It is not acceptable to discharge a patient into the community to assume responsibility for this complex technique without first-class training and the most efficient and comprehensive back-up service possible.

Education of patients for self-administered home care is best undertaken in a hospital which already has a well-developed organisation for inpatient parenteral nutrition. Training requires a skilled and experienced teacher and teaching aids. Patients who are giving themselves treatment can also help one another by mutual support and exchange of information. The organisation of treatment at home needs considerable knowledge of the equipment and supplies required, of the facilities needed within the home, and of potential difficulties and complications. A member of the hospital staff who knows the patient and is familiar with the technique should be available for consultation by the patient 24 hours a day. If a complication develops, such as a blocked cannula or line infection, the patient needs admission without delay to a unit which understands the problem.

For all these reasons, the care of patients giving themselves parenteral nutrition at home should be concentrated in relatively few hospitals, each serving more than one health district, but with appropriate back-up in the local district in case of emergency.

As with home enteral nutrition, the hospital nutrition team should, as far as possible, share responsibility for treatment with the general practitioner and community health team. The general practitioner should receive a booklet which describes the treatment, its benefits and complications. The indications for the treatment for his/her patient and any special problems in management should be made clear. Personal contact between the hospital staff and the general practitioner should be maintained.

Present financial arrangements for this expensive and uncommon treatment are often unsatisfactory, and vary from place to place. A clear funding structure is needed either through the community or the hospital.

Supra-regional funding through a limited number of specialised hospital units has not been accepted by the Department of Health. However, for the reasons outlined, many patients are trained for home

Treatment at home entails capital and revenue payments for electrical equipment and its maintenance (unless it is leased), and payment for daily nutrient and associated supplies. The electrical equipment includes the sophisticated pump, its stand and sometimes a refrigerator for storing nutrient solutions. The nutrients for each day are mixed according to the individual prescription for the patient's needs and usually supplied in a plastic bag containing two to three litres of fluid.

The cost of care in the community can be met from one of three sources, the district purchasing authority, the family health services authority, or from the budget of a fundholding general practitioner.

The general practitioner often agrees to prescribe the nutrient solutions advised by the hospital, usually through a commercial pharmacy which provides a sterile compounding service and home delivery. This arrangement has three disadvantages.

First, the general practitioner takes legal responsibility for a prescription using unfamiliar products. Secondly, the general practitioner is at present unable to prescribe the disposable items of equipment which the patient needs every day, though we recommend that this restriction should be removed. Third, a source of funding has to be found for the electrical equipment.

parenteral nutrition at hospitals outside their own health district. The cost of care for the patient while in hospital will be arranged with the patients' district purchasing authority, either as part of an existing contract or as an extra-contractual referral. The hospital has no budget for meeting the cost of care for the patient who returns home, although staff in the hospital are likely to share care with the community services and to provide outpatient and inpatient facilities as necessary.

At present, the disposable and electrical equipment has to be provided from the community budget of the district purchasing authority. A non-fund-holding GP needs to inform the family health services authority about this essential but expensive treatment for a patient so that variation from the indicative drug amount (IDA) is understood. A fund-holding general practitioner may have to negotiate a special arrangement for payment with the regional health authority.

An alternative, and more satisfactory arrangement is that the district purchasing authority, through its purchasing or contract monitoring officer, agrees to purchase the nutrient solutions and disposable items of equipment for the patient either directly from a commercial home-supply firm or from a hospital, in either case on the prescription of the hospital clinician.

The pump, drip stand and, if need be the refrigerator, should be bought from an identified community or hospital budget and loaned to the patient, with provision for immediate replacement if the pump fails or requires servicing. Alternatively, the electrical equipment can be leased from a home-supply firm.

The nutrients and equipment should be delivered directly to the patient's home either by the hospital or by a commercial firm.

Special Problems of Babies and Children

Growth, Intellectual Development and High Energy Needs

Children are not miniature adults and have special problems. Their nutritional reserves are smaller and thus treatment is relatively more urgent and must be started at an earlier stage of illness. This is particularly so for premature infants who have nutritional stores sufficient for only a few days. Furthermore, their energy needs relative to their size are greater, they require nutrition not only to maintain life but also to grow.

These nutritional requirements are increased during stress due to infection or inflammation and, as a consequence, disease may prevent growth and result in malnutrition sooner than in adults. Growth is fastest during early childhood, especially the first year of life, and during adolescence. A special aspect of growth is that during infancy prolonged malnutrition is associated with delayed psychosocial development which may subsequently result in impaired intellectual attainment.

Immaturity of Metabolic Processes

The nutrient requirements of children vary considerably from those of adults both in quantity and composition of nutrients; for example, certain amino acids are not fully metabolised by neonates and an excess of amino acids in the new born can lead to coma, sometimes with irreversible brain damage. Up to the age of six to nine months the infant kidney is unable to excrete sodium and hydrogen ions efficiently: thus inappropriately high sodium loads may lead to an obligatory high urine volume and dehydration, and small children are liable to metabolic acidosis. Lastly, infective complications of treatment such as catheter sepsis may be more common than in adults due to the immunodeficiency of malnourished infants and may present with non-specific illness.

Psychosocial Factors

Psychosocial considerations are specially important in young children. Those who receive long-term parenteral nutrition in hospital frequently suffer impairment of their social and intellectual development. Facilities for parents to live at the hospital are important so that the bond between parent and child is not broken. Play therapists and nurses have specific roles and regular developmental checks are needed to identify those who need special help. It is also important that oral stimulation is not completely removed; games are devised using the mouth and wherever possible small amounts of food are allowed.

Compared with adults, children are especially mobile and inquisitive regarding their treatment. Equipment and catheters must be 'tamper proof' yet must also be light, portable wherever possible and easy to use. In older children special steps are needed to reduce fear and gain collaboration.

Artificial Nutrition in Intensive Care

Frequent Need for Nutritional Support

Intensive care units admit patients of all ages and with a wide variety of life-threatening conditions. Most patients have failure of one or more vital systems and a large number require mechanical ventilation. Many are either unconscious or heavily sedated, some have neurological conditions which impair swallowing and, in some, malnutrition may be a major cause of their critical illness.

A high proportion therefore require artificial nutrition. Little data is available, but figures for individual units suggest that between 10 and 20 per cent of patients receive parenteral nutrition. Enteral feeding is used more frequently, but is precluded by an ileus in many patients. This may be due to sedative drugs given to facilitate mechanical ventilation, or it may be the result of hypoxia or abdominal sepsis or trauma. This greater use of nutritional support compared with other hospital areas is reflected in the fact that total parenteral nutrition consistently features among the most expensive pharmaceutical products when intensive care drug costs are analysed.

Special Problems

Additional factors enter the risk-benefit analysis in the intensive care setting. Vascular access can be difficult in patients with numerous other invasive lines and may be particularly hazardous in the presence of a coagulopathy or heparin administration. Line-related infections are more likely in patients who are already septicaemic, have numerous other intravascular lines or poor immune function .

Respiratory, circulatory, renal or hepatic failure must be taken into account when prescribing nutrition and there may be a-greater need than in other hospital wards to tailor prescriptions to individual patient requirements. Energy and nitrogen requirements may, however, be difficult to estimate in the critically ill and there is no clear idea of their vitamin or trace element needs. Also, because of changes in body composition, body weight ceases to give any useful guide to body cell mass, and other methods for monitoring nutritional state may be equally unsatisfactory.

Unfortunately, hard evidence of any clinical benefit from nutritional support is lacking in these patients and much practice is based on data from the less seriously ill or on considerations of theoretical benefit. What is certain, however, is that if nutritional support is badly provided, recovery may be delayed or threatened.

Organisation

The concept of intensive care as a multidisciplinary specialty applies as much to nutritional support as it does to the support of other failing vital systems. While those working in this area must have a clear understanding of the principles of nutritional support, appropriate use should also be made of other expertise that may be available; a 'nutrition team' for example. Such dialogue will ensure optimal management of these complex cases, and also facilitate continuity of care if the patient still needs nutritional support when transferred to a general ward.

Future needs

Clearly, more information is required about the provision of artificial nutrition in intensive care units with particular regard to the extent of and reasons for its use. Research is also needed to define which patients actually benefit from nutritional support and to improve the ways in which it is given. Work is needed into ways of maintaining or restoring lean body mass in the seriously ill and the place, if any, of specially formulated feeds needs to be defined (79). To study aspects of nutritional support in particular types of patient, much of this research will have to be organised on a multi-centre basis.

Education and Training

Doctors

Clinical nutrition is not a clearly defined subject in the undergraduate curriculum, neither is it a separate discipline in the health service. There are no consultants working exclusively in the field. Knowledge of nutrition, however, is required in many branches of medicine. In 1983, the British Nutrition Foundation set up a task force to study and report on the education of undergraduates (12). It was clear that very little nutrition was taught to medical students and it was rarely presented in a systematic way. It was often not acknowledged as relevant and no attempt was made to co-ordinate basic .science teaching, usually from biochemistry departments, with clinical experience later in the curriculum. The report proposed that an academic unit or department with a special interest in nutrition should be given the responsibility to integrate the teaching of nutrition throughout the curriculum. It further recommended that teaching and training in clinical nutrition .should be essentially practical and cover preventive as well as therapeutic aspects of nutritional care.

A meeting was held at the Royal Society of Medicine in 1989 to review the results of the Nutrition Foundation's initiative (1~). It was clear that relatively little progress had been made when the information on nutritional teaching in the 25 medical schools which responded was studied. For example, questions on nutritional topics were rarely .set in final examinations. Many schools reported no change of emphasis but in a few schools there were signs of increased activity in clinical nutrition. The creation of two new Chairs in human nutrition and one Lecturer post was a welcome development.

The role of the dietitian in medical education has clearly been neglected. Only 16 per cent of a large number of dietitians working in teaching hospitals took part in undergraduate education. More nutrition is now being taught but it is difficult to quantify and more integration and co-ordination is clearly required.

The undergraduate course in clinical nutrition provided at the University of Cambridge as an elective option is a model which other schools should investigate. Some medical students are able to take intercalated science degrees in nutrition but the overall emphasis remains limiting.

Questions on clinical nutrition are not often included by the royal colleges in their postgraduate examinations. Multidisciplinary courses have been organised but these tend not to be well attended because they are often considered irrelevant to individual specialties.

Nurses

Emphasis in basic training at present tends to be placed on the importance of healthy eating rather than on the problems of under-nutrition, it’s assessment, methods of nursing intervention and monitoring. Some continuing education courses, particularly on intensive care nursing, provide comprehensive teaching in clinical nutrition. There are currently two English National Board courses in clinical nutrition. Those hospitals with a nutrition nurse .specialist frequently have structured nurse teaching programmes with frequent updating of information. A system of 'link nurses' in which a ward nurse accepts particular responsibility for nutritional care in that ward and meets the nutrition team for regular teaching and briefing can be very successful.

Dietitians

Dietitians qualify with a degree in nutrition and dietetics. a training which includes teaching in both the theory and practical application of nutritional support. While all dietitians have this basic training, few specialise in this subject. The Parenteral and Enteral Nutrition Group (PEN Group) of the British Dietetic Association was established in 1982 and currently has a membership of 250. It organises a postgraduate course in clinical nutrition each year attended by about 45 dietitians, and similar courses are held for students. The Group has also produced guidelines on nutritional support for college tutors and students to improve the standard and uniformity of undergraduate training.

The Group organises meetings and workshops for its members to share information and skills.

While many dietitians are experienced in enteral nutrition, both in hospital and the community, few are experienced in parenteral nutrition, a technique in which more training is needed.

Dietitians need encouragement to initiate research into nutritional support, publish their work and study for higher degrees.

Pharmacists

Little formal training in clinical nutrition is given at undergraduate or postgraduate levels, though some undergraduate courses in clinical pharmacy do include a module on clinical nutrition. Practical training in aseptic preparation and compatibility should be provided in undergraduate courses and in all pharmacy production units which prepare fluids for parenteral nutrition. Postgraduate training in clinical nutrition for pharmacists is uneven through the country but some regions have well structured courses. It is hoped to establish a 'certificate in nutrition' through the National Total Parenteral Nutrition Group this year, and eventually a diploma. The National Total Parenteral Nutrition Group and the 'All in One Society' cater particularly for pharmacists with an interest in nutrition, and they also develop expertise through multidisciplinary meetings.

The Public

Through a spate of articles in the press, books, and media programmes, the general public is acutely aware of dietary factors which promote health. The benefits of a low calorie diet and an increased fibre intake are widely known. However, the public is not generally aware that malnutrition with weight loss is a major complicating factor in many illnesses. Contrary to current teaching in health, many people who are ill need guidance about how to increase their energy intake by reducing the proportion of low energy foods in what they eat.

The positive role of nutrition as a treatment in illness needs publicity. Increased awareness of this need will in turn bring consumer pressure to bear on hospital catering and the provision of nutritional support when an adequate diet cannot be taken.

Research

Development and Extent of Research

Good teaching and training are fostered by strong research programmes. Advances in patient care and rationalisation of clinical practice depend on research in the basic sciences, the development of new products and equipment by industry, and the critical application of measurement and experimental design to clinical problems.

There is steady growth in nutrition-related research in many universities. Surgery departments have made major contributions to new understanding of the energy demands of the critically ill and the provision of long-term nutritional support. Medical departments have contributed particularly to knowledge of enteral feeding and the management of intestinal failure. The high quality of the scientific papers at the meetings of the Clinical Metabolism and Nutrition Support Group of the Nutrition Society and of the Small Bowel and Nutrition Group within the British Society of Gastroenterology bear witness to this success.

Funding

Research in clinical nutrition is supported mainly by the universities, charitable foundations and industry; increased awareness of the practical importance of the subject would attract further funds. In America, artificial nutritional support is well organised and widely employed. Industrial support for research is correspondingly greater there than in this country. The improved organisation of nutritional support recommended in this report would encourage contribution to research from industry, though it is to be hoped that this would not only be product-oriented but also help basic understanding. Industry is in a good position to undertake multicentre controlled trials to answer questions about possible benefits of nutritional support.

Current Problems

Further basic scientific investigation is needed into the response to injury and infection. Provision of nutrients does not reverse the body's catabolic response to stress so that it is difficult, and often impossible, to improve a patient's nutritional state while these factors persist. Endocrine therapy, or selective prevention of cytokine release or antagonism to one or more of their effects, may alter the response to injury in such a way that nutrients given can be utilised for protein synthesis. Similarly, new nutritional substrates may be found which have the same effect.

Patients who are ill have a poor appetite. Stimulation of appetite so that they eat more would avoid the need for artificial nutritional support in some cases.

Continued research is needed into the effects of nutritional deprivation and replacement on the outcome of illness. Such research would benefit patient care and improve the efficient use of resources. To this end, measurements of body composition and metabolic function, clear definition of patient groups, and the development of both clinical and economic indicators of outcome need further critical study.

The Way Forward

Development of Clinical Nutrition as a Discipline

Clinical nutrition should be recognised as an important part of health care. For this to occur it needs:

• integration of professional groups. There is at present no British organisation which draws together the common interests and expertise of academic nutritionists, dietitians, nurses, pharmacists, doctors and the pharmaceutical industry. Such an organisation could set standards for nutritional care, promote professional training, provide an expert forum for management, government and industry, and co-ordinate research;

• recognition of clinical nutrition in the basic and post-basic training of the relevant professions;

• the creation of more academic departments with staff drawn from the basic sciences and all clinical disciplines to promote teaching and research.

Recognition of Training

The training of dietitians is registered, but there is no mechanism by which specialist postgraduate training in nutrition of nurses, doctors or pharmacists is recognised.

Rationalisation

The wider application of research will show when artificial nutritional support favourably affects clinical outcome and when it does not. Operational research will show which procedures are essential and which are inessential for effective safe administration of nutrition. Uniform protocols and equipment will result which simplify clinical care. Research will show when nutritional solutions can be standardised without detriment to care so that prescription becomes easier and costs are reduced.

The Role of Industry

The pharmaceutical industry is responsive to clinical need and provides a wide range of specialised nutrients. The domiciliary service for enteral and parenteral nutrition which delivers all the nutrients and equipment needed to the patient's home, and integrates the cost of the various items into one account, meets a real need. Purchasers will enter into contracts with industry for provision of these services for which standards will need to be prepared.

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Appendix A: Standards for Artificial Nutritional Support in Hospital

(Modified from standards prepared by the American Society of Parenteral and Enteral Nutrition)

Assessment

Simple criteria will be established for the identification of the malnourished patient and of any patient who may become malnourished. The nutritional status of all patients admitted will be assessed from the history and physical examination, including measured weight and height, and a history of weight change over time. Appropriate laboratory measurements will be made if indicated. These observations and measurements will be clearly recorded in the medical record.

Guidelines for Intervention

Normally nourished patients and malnourished patients who are eating sufficient to replace lost tissue will not be given nutritional support. Well nourished patients with impaired intake limited to one week will not be given artificial nutritional support. Patients with 10 per cent or more loss of usual body weight or those with other evidence of malnutrition who cannot eat normally will be given artificial support, particularly if the anticipated course of the illness. and of any procedures such as surgical treatment, makes it unlikely that normal feeding will be resumed within a week.

Therapeutic Plan

The objective of nutritional support will be defined. The duration of treatment will be estimated. When appropriate, the possible need for treatment at home will be anticipated and the necessary arrangements and training begun. The gastrointestinal tract will be used for nutritional support whenever possible.

Parenteral nutrition will only be used when the gastrointestinal tract cannot be used or absorption is inadequate to supply adequate nutrition. The mode of support will be re-assessed frequently in case change is needed. The nutrition fluid used will be appropriate to correct any metabolic abnormality and to promote tissue replacement. When similarly effective formulations are available the cheapest will be chosen.

Implementation

Access

Access for nutritional support will be achieved in a manner which minimises risk to the patient. The person who places any access device will be properly trained in the technique. Standard techniques and protocols will be established and followed for access procedures. Proper placement of each access device will be confirmed before use. Any complications during the access procedure will be recorded. Protocols will be established for the routine care of access devices.

Feeding preparation

The feeding solution will be accurately prescribed and labelled. The compatibility and stability of the mixture will be confirmed. The preparation will be checked before administration and this fact, together with the date and time of administration, will be entered in the patient's record. Feeding solutions will be sterile. The mode of storage and the expiry date will be specified. Protocols will be prepared controlling additions to the feed on the ward.

Avoidance of infection

Protocols will be established for changing delivery sets to minimise secondary infection of connections and to limit the time for which each delivery set is used.

Appendix B: Standards for Artificial Nutritional Support at Home

(Modified from standards prepared by the American Society of Parenteral and Enteral Nutrition)

Patient Selection and Aims

• The patient who is being considered for home artificial nutritional support should be unable to achieve adequate oral intake.

• Artificial nutritional support should aim to provide benefits to the patient, and these should be defined prior to initiation of therapy, e.g. to produce remission of a disease process, promote healing of a fistula or wound, improve quality of life or prevent deterioration.

• An assessment should be made of the home environment and of the patient's and carer's ability to cope satisfactorily with the treatment.

Organisation

1. Home enteral nutrition will be prescribed and supervised by the general practitioner with the assistance of a community nurse and/or dietitian. A hospital nutrition team will be available for advice and help.

2. Home parenteral nutrition will be based on a hospital with an experienced nutrition team comprising a doctor, specialised nurse, dietitian and pharmacist. The doctor will prescribe the nutrients, or advise the general practitioner about a suitable prescription. The hospital team will accept responsibility for training the patient and supervising the treatment, with the help of the general practitioner and community nurse. Liaison will be maintained not only between the supervising hospital, and the community health team, but also the local hospital if appropriate.

3. Written policies and protocols will cover delivery of feed plus ancillaries, training and education of the patient and carer, and all techniques involved in patient care, monitoring and follow-up.

4. Financial arrangements will be defined at the outset. Policies and procedures will be reviewed and modified as appropriate.

6. Clear written instructions for dealing with problems including emergencies should be established.

Operation

1. All patients and carers will be trained in the technique to a sufficiently high standard to ensure efficacy and safety of the treatment.

2. The GP will be informed of the plans and arrangements for home artificial nutritional support.

3. The patient and/or carer will receive written instructions prior to discharge including instructions about hygienic techniques for changing and administering feeds, changing dressings, how to deal with simple problems, and who to contact (e.g. by telephone) when there are more serious problems, e.g. tube displacement, tever and malaise, inadequate supply of feeds and ancillaries.

4. The patient's nutritional and clinical status and results of investigations will be clearly documented.

5. Home artificial nutritional support will stop when the patient obtains no further advantage from the therapy (e.g. when the aims have been achieved and the patient is able to achieve adequate oral intake, or when the aims are considered to be no longer achievable).

It may also be stopped temporarily as complications demand (e.g.line sepsis).

Patient Monitoring

The patient's clinical status, including fluid input and output, and weight will be monitored regularly. Laboratory determinations will be undertaken regularly, but not more frequently than influences clinical management.

Stopping Treatment

A patient on enteral tube feeding should be able to take and tolerate adequate oral nutrition before the feed is stopped; a period of oral feeding by day and tube feeding by night may provide an intermediate stage. A patient on parenteral feeding should be able to tolerate and absorb oral feeding or enteral tube feeding before the parenteral feed is stopped; a period of oral/enteral feeding by day and parenteral feeding at night may provide an intermediate phase.

Protocols will be developed to indicate when feeding should be stopped due to a definite or possible complication, and to define the other actions to be taken.

Organisation

A nutrition support team or group will be established consisting of a doctor, registered nurse, registered dietitian and pharmacist, each with special interest in and responsibility for the nutritional service. This team will prepare policies and distribute protocols for local use; these policies and procedures will be reviewed and revised periodically to maintain optimum standards.

The nutrition team will maintain records of treatment given and the outcome throughout the hospital. The team will be responsible to management for the proper administration of artificial nutritional

Appendix C: Specimen Standards for a Purchasing Authority Placing a Contract for Artificial Nutritional Support

(Based on draft standards prepared for Salisbury Health Authority)

Scope

Artificial nutritional support covers the activities involved in total parenteral nutrition, peripheral vein nutrition, tube feeding using artificial diets and supplemental feeding. The Authority recognises that appropriate and timely artificial nutritional support is beneficial to patient care but that inappropriate and unjustified use may be both expensive and of little patient benefit.

Principle

All patients have a right to anticipate appropriate nutritional support.

Standards

The purchaser wishes to receive evidence that:

1. An assessment of patients' nutritional status and needs is made by medical and nursing staff on admission.

2. There is a published policy for artificial nutritional support which is agreed by professional groups involved and which is reviewed formally at regular intervals by a group of experts in this field.

3. There is an effective system of referral of patients requiring nutritional support for expert opinion, and agreed indications for the use of artificial nutritional support.

4. The policy covers the needs of adults and children and the range of clinical conditions encountered regularly in the unit.

5. The policy relates not only to the feeding preparations, but also to delivery systems, storage, transport, delivery protocols, avoidance of septic complications.

6. The policy covers not only acute hospitals but also the needs of patients at home and in other care institutions.

7. Standards are agreed with commercial providers of all consumables for delivery times, shelf life, cost.

8. Funding for community based feeding is agreed and explicit.

9. There are formal links with catering departments.

10.Ward, community, patient and carer information is clear and acceptable to the user.

11.There is appropriate training for all staff involved in artificial nutritional support and also for patients and carers to allow them to feel secure in the use of products and equipment.

12.There i s a system of review of prescribing practice, possibly in association with the drug and therapeutics committee.

13.There is a system of audit of appropriate use of artificial nutritional support and of complication such as sepsis, pulmonary problems, line blockage, diarrhoea.

Appendix D: Artificial Nutrition in the Cambridge Health District During One Year (1988/89)

	Number of patients	Patient Days
Enteral Tube Feeds		
Neonatal	279	4654
Non-neonatal:		
Hospital	291	6970
Home	19	4192
Parenteral Feeds		
Neonatal	116	1257
Non-neonatal:		
Hospital	195	2668
Home	3	637

Diagnoses of patients (excluding neonates) receiving artificial nutrition in the Cambridge Health District (1988/89)*

	Enteral Tube Feeds	Parenteral Feeds
Cerebro-vascular accident	57	3
Head injury	55	3
Trauma without head injury	2	6
Malignancy	47	64
Other gastrointestinal disorders	36	75
Other neurological conditions	32	3
Respiratory	24	3
Cardiovascular	5	15
Other and unknown	33	12

* Adapted from Wilcock et al. 1 991 (Ref 11)

Appendix E: Workload of Nutrition Team at Oldchurch Hospital (740 beds) over Four Years

	1987	1988*	1989	1990
Supplements				
Patients	226	334	199	173
Patient days	3913	6222	3045	4507
Enteral Tube				
Patients	140	217	161	172
Patient days	2344	2507	2188	3748
Parenteral				
Patients	23	18	23	21
Patient days	452	194	471	240
Home Enteral Tube				
Patients	2	6	11	11
Patient days	90	613	961	1236

* A nutrition education week was organised in 1988 (data kindly supplied by Dr W R Burnham)

Appendix F: Potential Cost Saving to a Hospital by a Nutrition Team from a Reduction in Catheter Infection Rate in Patients Receiving Parenteral Nutrition

These studies show the proportion of patients receiving parenteral nutrition who developed a catheter related infection before and after the introduction of a nutrition team:

Infection rate per cent

Reference	Before	After
61	21	1.3
62	29	4.7
63	33	3
64	25	1.3
65	33	4
66	24	0
67	24	3.5
Mean	27	2.5

Assumptions

1. An average hospital unit will treat 69 patients with parenteral nutrition each year (8).

2. The introduction of a nutrition team will save 16 episodes of catheter-related infection each year from mean figures above.

3. The cost of each episode of sepsis lies between £1650 and £5,000 derived as follows:

a) 'Best case scenario' (stay in a general ward increased by seven days, organism sensitive to antibiotic, catheter removed and need not be replaced)

Hospital bed @ £250 per day	1400
Bacteriology (cultures, antibiotic sensitivity)	100
Antibiotics	50
IV fluid disposables	50
Repeat bacteriology X2	50
	£1650

b) 'Worst case scenario' (stay in high dependency unit increased by 10 days, resistant organism needing special antibiotics, catheter has to be removed and replaced)

Hospital bed @ £450 per day	4000
Bacteriology	100
Antibiotics	400
Replace intravenous catheter	450
Repeat bacteriology X2	50
	£5000

(Figures estimates from departments at the Central Middlesex Hospital NHS Trust)

Conclusion
Potential cost saving for a reduction of 16 episodes of catheter infection lies between £26,000 and £80, 000.

Appendix G: Potential National Financial Saving from Nutritional Support of Under-nourished Patients in Hospital

Evidence in this shows report that feeding malnourished patients improves recovery rates, decreases complications, reduces length of hospital stay and cost per day.

Assumptions

Ten per cent of UK hospital inpatients could have their hospital stay reduced by 5 days (notes 1 and 2).
Each of these patients is fed for 14 days after admission (note 3)
Average increased cost of feeding is £19/day (note 3).
Average inpatient cost is £150/day (note 4).
Number of admissions is 540,000 (note 5).

Cost Savings

5 days at £ 150/day £750

Increased Cost of Feeding

14 days at £19/day £266

Saving per patient £484

National Saving for 10 per cent of Inpatients

(540,000 admissions) £266 million

Note 1. Number of undernourished in-patients. Reports have shown that up to 50 per cent of surgical patients admitted (4) and 44 per cent of medical admissions (5) are under-nourished. These two patient groups represent 70 per cent of total inpatients. We have assumed 10 per cent of all admissions to ensure that the calculation is based on a conservative assumption.

Note 2. Potential Reduction in hospital stay. Published figures (9,10,45,52,53) show a range between 5 and 16 days, the lower limit is taken as the most conservative number.

Note 3. Average increase in cost of feeding for 14 days. We have assumed that:

65 per cent are sip fed with 1 litre of I .5 Kcal/ml enteral feed per day;

25 per cent are tube fed with 2 litres of 1.0 Kcal/ml enteral feed per day;

10 per cent are parenterally fed for 14 days.

The average cost per day is £19 including an incremental one hour per day of nursing time (nutrients alone £7 per day)

Note 4. The cost per day for an inpatient care. This is usually quoted at between £100-£200 for general wards and between £500-£1000 for critical care units. We assumed an average cost of £150 per day.

Note 5. The number of inpatients. This is based on 2.3 million medical admissions (minus 15 per cent for day cases), 4.0 million surgical admissions (minus 25 per cent for day cases) and 0.5 million geriatric admissions.

Appendix H: Membership of the Working Party

Dr S P Allison MD FRCP	Consultant Physician University Hospital Nottingham	Editor Clinical. Nutrition
Miss P Brown BSc RGN RHV NDN	Manager, Primary Services Riverside Health Authority	
Mr K Cottam	Divisional Manager Abbott Laboratories Ltd	
Dr M Elia MD MRCP	Head, Adult Clinical Nutrition Group Medical Research Council Dunn Clinical Nutrition Centre and Hon. Consultant Physician Addenbrooke's Hospital Cambridge	
Miss J Field RGN	Clinical Nutrition Sister University Hospital Nottingham	Secretary National Nurse Nutrition Group Royal College of Nursing
Miss C Holden RGN RSCN	Clinical Nurse Specialist in Nutrition Birmingham Children's Hospital	
Mrs J P Howard SRD	District Dietitian Bristol Royal Infirmary British Dietetic Association	Chair Parenteral Enteral Nutrition Group
Prof I D A Johnston MCh HonFACS FRCS	Professor of Surgery University of Newcastle	Chair Clinical Metabolism and Nutrition Support Group Of the Nutrition Society
Prof J E Lennard-Jones MD FRCP	(Chair) Consultant Gastroenterologist St Mark's Hospital, London	
Mr M J McMahon PhD ChM FRCS	Consultant Surgeon The General Infirmary Leeds	British Representative of the European Society of Parenteral and Enteral Nutrition
Dr N Melia MSc MRCP	(Observer) Department of Health	
Mr M Mughal ChM FRCS	Senior Lecturer Department of Surgery Hope Hospital Salford	

Dr P Milla MD FRCP	Senior Lecturer Institute of Child Health . Hospital for Sick Children Great Ormond Street London	
Dr M Nielsen FFARCS	Consultant in Charge Intensive Care Unit Southampton General Hospital	Member of Council, Intensive Care Society
Mrs C A Russell SRD	District Dietitian Northampton General Hospital	Chair Parenteral and Enteral Nutrition Group
Dr D B A Silk MD FRCP	Joint Director Dept of Gastroenterology and Nutrition Central Middlesex Hospital London	
Mr T Sizer B Pharm (Hons) MR Pharm S	Director Pharmaceutical Production Cheltenham General Hospital	Sectretary National Total Parenteral Nutrition Group
Mrs C Wheatley	Patient	Secretary Patients on Intravenous and Nasogastric Nutrition Therapy
Miss S Wood RGN Dip N	Clinical Nurse Specialist in Nutrition St Mark's Hospital London	
Ms P Wright B Pharm	Principal Pharmacist West Middlesex University Hospital London	Chair National Total Parenteral Nutrition Group
Administrative Support Miss C Davis	Project Officer King's Fund Centre for Health Services Development	