

Cost and benefit of hospital, hospital-in-the-home and ambulatory care nutrition support services

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The instigation of nutrition support, either via the enteral or parenteral route, in individuals unable to maintain adequate nutrition via oral means is based on the premise that such an intervention will reduce both morbidity and mortality and improve quality of life. While there is evidence that active nutrition support improves biochemical and physiological parameters, health professionals are being called upon to demonstrate the cost, benefits and outcomes of nutrition support in the face of budget constraints and increasing demands on health care. Cost savings have been made in hospital nutrition support through increased use of enteral rather than parenteral nutrition support, particularly in Intensive Care Units, and careful use of resources when planning enteral nutrition support. Nutrition support of critically ill and malnourished individuals can reduce morbidity and length of stay. Benefits of home nutrition support programs include avoidance of hospital bed costs and improved lifestyle and psychological well-being. Our experience and that of the literature will be reviewed.

Key words: nutrition support, cost, ambulatory care nutrition, hospital, hospital-in-the-home, enteral, parenteral.

Introduction

Enteral Nutrition Support (ENS) involves the delivery of liquid nutritional formula directly into the gastrointestinal tract via a feeding tube. Home Enteral Nutrition (HEN) is the use of enteral nutrition in a home setting. Usually HEN is a long-term therapy lasting more than 30 days. The use of ENS has increased dramatically due to advances in delivery systems and enteral formulations, and growing evidence that optimal nutrition provided via the gastrointestinal tract has a positive effect on treatment outcomes in individuals unable to meet nutritional requirements orally. Home Enteral Nutrition is believed to reduce costs by reducing lengths of hospital stays and improving quality of life and independence.

Parenteral Nutrition Support (PNS) is the provision of essential nutrients intravenously, potentially improving the survival of individuals who would otherwise succumb to the effects of malnutrition while unable to digest and absorb adequate nutrients. Home Parenteral Nutrition (HPN) is one of the most expensive home therapies. It allows individuals who would otherwise require lengthy and/or repeated admissions to hospital to function independently at home. Advances in parenteral solutions, medical techniques, long-term catheters, and suitably experienced support teams have facilitated an increase in the number of individuals receiving this therapy.^{1–3}

Cost-benefit analyses

A nutrition support team with experience in the long-term management of patients who require enteral or parenteral feeding in hospital or at home is vital to decision-making on the likely costs and benefits to the individual.

Measurement of costs and benefits of interventions are used by economists to investigate systematically the relative

worth of alternatives available to society as well to achieve economic efficiency.^{3–5}

Costs are the resources used to conduct an intervention. The most commonly analysed costs are direct costs, which consist of the dollar value of the resources required to provide a service.⁶ Economic analyses of direct costs are often incomplete due to difficulties in data collection. Indirect costs are the costs to the clients, such as transportation and time for receiving services. Intangible costs include changes in relationships and self-esteem. These can be measured subjectively but are not usually included in cost-benefit analyses.

Benefits are the outcomes realised from a specific intervention. Direct benefits are dollars saved through reduced length of stay, medications, physician visits and laboratory tests, and improved clinical indicators. The dollar value of 'negative benefits' such as the cost of complications of an intervention are also included. Indirect benefits are those which reduce the cost of disease to society by reducing morbidity and mortality, and improving quality of life and productivity of individuals. Intangible benefits are the reduction in pain, suffering and grief from instigation of a therapy.

Ethical issues regarding the morality of commencing, continuing, withholding or withdrawing nutrition support should also be considered. Attitudes to nutrition support in individuals with a poor prognosis, those unable to provide informed consent, or those who refuse nutrition support are

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likely to vary from country to country because of differences in beliefs concerning the preservation of life.

Cost-utility analysis

Quality Adjusted Life Years (QALY) are units of measurement resulting from the data on survival and quality of life. They are the measurement of outcome used in a cost-utility analysis. Richards *et al.* looked at costs in the UK for home PNS and QALY, incremental costs and marginal costs per QALY gained for a range of survival times.⁷ They concluded that individuals younger than 44 years of age had a significantly better quality of life and survival than those over 55 years, which significantly reduces the cost per QALY; the longer an individual survives on HPN, the more cost-effective it becomes. They compared total costs of inpatient PNS and HPN with home therapy, which was found to be 65% more cost-effective than keeping patients in hospital.

Profile of individuals requiring nutrition support

Data on 456 adults at Monash Medical Centre (MMC) requiring ENS and 54 adults receiving PNS has been collated. Indications for ENS are shown in Table 1. Generally, the main indications for enteral feeding were swallowing difficulties and an inability to meet nutritional requirements orally.

Indications for PNS, shown in Table 2, were predominantly an inability to use the gastrointestinal tract due to bowel surgery and obstruction, or bowel rest for management of neutropenic enterocolitis and pancreatitis. The data on

Table 1. Monash Medical Centre indications for Enteral Nutrition Support 1997

	Inpatient		Outpatient	
	<i>n</i>	%	<i>n</i>	%
Anorexia	24	6	6	14
Aspiration pneumonia	8	2		
Confusion/stupor	24	6		
Dysphagia	135	33	22	54
Head injury/tumour, cerebral haemorrhage, hypoxic brain damage	51	12		
Increased needs/malnourished	28	7		
Intubated	95	33		
Obstruction (upper gastrointestinal)	17	4	9	22
Other	10	2		
Post surgery	22	5		
Short Bowel Syndrome	1		4	10
Total	415	100	41	100

Table 3. Monash Medical Centre cost of consumables for nutrition support (A\$)

	No. patients	No. patient days	Total cost consumables	Average no. patients/day	Cost patient/day
PNS 1996					
Hospital	52	670	103 101	1.8	153.88
Home	2	499	61 423	1.4	123.88
Total	54	1169	164 524	3.2	138.88 (average)
ENS 1997					
Hospital	415	5660	71 173	15.3	12.71
Home	41	5782	53 611	15.8	9.72
Total	456	11 442	124 784	31.1	10.99 (average)

PNS, Parenteral Nutrition Support; ENS, Enteral Nutrition Support.

indications for nutrition support from Monash Medical Centre (MMC) reflect that of other researchers.⁸⁻¹²

Costs of nutrition support

Direct costs

Data from MMC is shown in Table 3.

The cost of consumables for ENS per patient day is 8% of that of PNS for inpatients and 7% for home patients. International cost comparisons,^{13,14} converted to \$US, are shown in Table 4.

Indirect and intangible costs

Data on indirect and intangible costs of nutrition support have been collected through use of surveys on home patients. A review of current literature did not reveal any data for inpatients receiving PNS or ENS. Elia reported on physical problems encountered by 19 patients on HEN in the UK over a one-year period. Instances over the year of pathological disturbances including flatulence (13), constipation (11) and regurgitation (11) were reported.¹⁵ Other problems including difficulty obtaining feeds and equipment, tube blockage, stomal irritation and equipment malfunction were investigated. Medical help was sought in some cases and residual problems remained for some individuals. The author concluded that HEN may impose major changes in lifestyle and produce emotional, social and financial difficulties. Attempts to prolong life in the terminally ill may be inappropriate.

In a survey by Herfindal *et al.* of 347 HPN patients in the USA, the occurrence of physical complaints while on HPN and the effect of HPN on daily routine were examined.¹⁶ Frequent urination disturbing sleep (58%) and hand/feet cramps (40%) were common problems. Home Enteral Nutrition was

Table 2. Monash Medical Centre indications for Parenteral Nutrition Support 1996

	Inpatient		Outpatient	
	<i>n</i>	%	<i>n</i>	%
Bowel obstruction	7	13		
Gastrointestinal surgery	17	33		
Inflammatory bowel disease	1	2		
Intestinal fistula	3	6		
Malignancy (neutropenic enterocolitis)	6	12		
Malnutrition (includes SBS)	4	8	2	100
Other	6	11		
Pancreatitis	7	13		
Peritonitis	1	2		
Total	52	100	2	100

SBS, short bowel syndrome.

Table 4. International cost comparisons

	Cost per patient	
	\$US/day	\$US/per annum
Australia		
1996/97 Monash Medical Centre		
PNS Inpatient	102.57	37 440
PNS Outpatient	82.58	30 141
ENS Inpatient	8.47	3092
ENS Outpatient	6.18	2255
United States ¹³		
PNS	75–350	27 375–127 750
ENS	18–30	6570–10 950
United Kingdom ¹⁴		
PNS	134–178	49 000–65 000
ENS	21.90	8000

PNS, Parenteral Nutrition Support; ENS, Enteral Nutrition Support.

most disruptive to travelling and going to the bathroom, and was perceived to disrupt most aspects of the daily routine to some extent.

Benefits of nutrition support

Direct benefits

Howard *et al.* reported on data in the USA on survival of HPN patients in seven disease categories and rehabilitation status of surviving patients.⁹ Individuals with Crohn’s disease, ischaemic bowel disease, motility disorders, radiation enteritis and congenital bowel disorders showed relatively good long-term survival and rehabilitation status over a period of 3 years, whereas those with AIDS and neoplasm had shorter survival prospects and a poor outlook, demonstrating that clinical outcome on HPN is determined chiefly by the underlying disease.

Negative benefits and complications

Incidence of complications of enteral and parenteral nutrition support is affected by the use of standardised protocols, the underlying disease, prognosis and the nutrition support teams’ expertise in patient care, monitoring and education.¹⁷ For individuals requiring nutrition support at home, the safety of their home environment, home supports, ability to cope and provision of appropriate monitoring and follow-up also affect the complication incidence.¹⁸

Inpatient complications for ENS and PNS for one year at MMC are shown in Tables 5 and 6.

The majority of patients experienced no complications. Commonly reported complications of ENS included pulled out feed tubes, large gastric aspirates, and diarrhoea, while PNS complications included line infections. The incidence of complications at MMC may be under-reported due to our data collection methods. No data have been collected on the incidence of complications among home nutrition support

Table 5. Monash Medical Centre complications of inpatient Total Parenteral Nutrition

Inpatient TPN	1996 (no.)
Line infections	2
Line infection rate	1 in 330

TPN, Total Parenteral Nutrition.

patients at our institution; however, various studies have looked at this issue. Messing *et al.* reported on technical complications during HPN leading to catheter change and metabolic complications.¹⁰ Johnston reported on falling rates of complications with increased experience.¹² O’Hanrahan *et al.* documented episodes per annum of septic (0.473%), mechanical (0.442%), thrombotic (0.063%) and metabolic complications (0.122%) in 221 HPN patients in the United Kingdom.¹¹ A large study in the USA by Taylor *et al.* that focused on individuals requiring ENS with endoscopically placed tubes found a 20% incidence of wound infection (reduced to 7% by using cephazolin) and a 41% incidence of tube dislodgment.¹⁹

Indirect and intangible benefits

Data on the outcome of inpatient and home ENS and PNS at MMC is shown in Table 7.

Of 415 inpatients on ENS in 1997, a quarter died, reflecting the severity of their underlying illness rather than problems associated with providing enteral nutrition support. Oral diet was resumed in the majority of patients, a few changed to PNS and 29% remained on enteral nutrition, either transferring to other institutions or being discharged home or to

Table 6. Monash Medical Centre complications of inpatient enteral nutrition

Enteral inpatient	1997 (n = 415)	
	n	%
Anastomotic leak	3	1
Aspiration	2	< 1
Diarrhoea	23	6
Distended abdomen	5	1
Electrolyte imbalance	8	2
Hyperglycaemia	2	< 1
Incorrect tube position	1	< 1
Large gastric aspirates	46	11
Nausea	6	1
None	266	64
Refeeding syndrome	17	4
Tube blocked	16	4
Tube leakage	3	1
Tube pulled out	48	12
Tube site infected	3	1
Vomiting	19	5

Table 7. Monash Medical Centre outcome of nutrition support

	Patient numbers			
	TPN inpatients	TPN home patients	Enteral inpatients	Enteral home patients
Death	1		104	6
Oral/enteral	51			
Home parenteral		1		
Home enteral			34	25
Oral		1	173	7
Hospice			2	2
Nursing home ENS			35	
Parenteral			15	
Transfer			52	1
Total	52	2	415	41

ENS, Enteral Nutrition Support; TPN, Total Parenteral Nutrition.

nursing homes. The majority of the 42 HEN patients remain on this therapy although 15% have died, all due to underlying malignancy. Seventeen percent have resumed an oral diet.

Data collected on 52 inpatients on PNS showed that there was only one death while the remaining individuals resumed oral or enteral nutrition. Of the two HPN patients, one has resumed oral intake and the other remains on PNS.

Criteria for appropriate patient selection should be considered and is vital when looking at assessment of specific therapeutic interventions. Elia recommends that, in assessing the suitability of a patient for HEN, their clinical state, home environment and care givers must be determined as suitable.¹⁵ Elia further recommends that appropriate consent be obtained and that clear indications for HEN be evident (i.e. an inability to meet requirements orally for > 1 month; a need of at least 2–3 months treatment using HEN; and that HEN would be likely to prevent deterioration).¹⁵

Limitations of cost/benefit analysis of nutrition support

Cost-benefit data is usually expressed in terms of direct financial cost and money saved. Collation of all direct costs is difficult. Costs included depend on the relevance to those calculating them. In data on direct costs there is often no information on what particular items have been included in the calculation of that cost. It is difficult to compare sets of data on costs between countries, as well as between periods of time (e.g. from several years ago to today).

There is limited data on indirect and intangible costs, especially of inpatient PNS, ENS and HEN, and a lack of documentation on nursing home HEN patients. Negative benefits (complication) rates need to be considered and may add to the overall costs of the therapy. Complication rates vary enormously between institutions depending on patient selection criteria, degree of experience, the existence of specialised nutrition support teams and reporting of complications.^{20,21} Benefits realised from an intervention will be affected by patient selection criteria and the degree of support and infrastructure existing to provide safe, effective follow-up.

Conclusion

Nutrition support in hospitalised patients saves money through reduced morbidity and mortality as malnutrition is associated with negative health outcomes, greater utilisation of resources and increased costs.²² Parenteral nutrition support is a more expensive therapy than enteral nutrition support. Nutrition support at home saves money through reduced hospital associated bed costs. Costs and benefits of nutrition support need to be assessed in terms of direct costs (i.e. money spent) and direct benefits (i.e. money saved). Cost-utility analysis using QALY can be used to provide a measurement of outcome from data on survival and quality of life. The ability of the individual to manage the nutrition support therapy and associated physical complaints and lifestyle inconveniences will vary. Complications experienced and indirect and intangible benefits gained may be determined by patient selection criteria, the resources available, degree of experience and expertise of the nutrition support team, and follow-up arrangements to support the individual and their carers.²³

The development of a nutrition support multicentre research consortium has been proposed to assist in gaining insight into what works in nutrition support and what does not.^{24–26} Analyses of such data will assist health professionals to assess costs and benefits in the rapidly expanding nutrition support services.

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