The cost-effectiveness of supplemental parenteral nutrition in oncology

- **Hancock E, Source Health Economics, London, UK**
- Trueman D, Source Health Economics, London, UK
- Ghosh S, Source Health Economics, London, UK
- Webb N, Source Health Economics, London, UK
- Winstone J, Vitaccess, Oxford, UK
- Miners A, Department of Health Services Research and Policy, London School of Hygiene and Tropical Medicine, London, UK
- Shepelev J, Baxter Healthcare Corporation, Deerfield, IL, USA

Background

- Malnutrition is common in cancer patients and is associated with poorer outcomes (1).
- Prevalence ranges from about 30% in patients with breast cancer or acute leukaemia to more than 85% in patients with pancreatic or gastric cancer (2).
- Malnutrition can be addressed with various types of nutritional support if provided in a timely manner; however, it is often not sufficiently addressed in cancer patients because screening for malnutrition and risk of malnutrition is not routinely implemented.
- In patients receiving enteral nutrition (EN; tube feeding) for whom nutritional intake remains inadequate, guidelines recommend the use of parenteral nutrition (intravenous feeding) in addition to EN (i.e. supplemental parenteral nutrition; SPN) (3), however, SPN is currently chronically underused in this population.
- To our knowledge, no studies have been undertaken to assess the clinical and economic impact of the use of SPN in cancer patients.

Objectives

- To identify available evidence on the impact of SPN in cancer patients with inadequate nutritional intake despite EN.
- To perform an exploratory cost-effectiveness analysis in this setting, assuming an example cancer population.

Methods

- A targeted literature review (TLR) was performed to identify clinical and health-related quality of life (HRQoL) evidence for SPN in oncology; however, no direct evidence on the effect of SPN was identified.
- A second TLR was therefore conducted to identify:
  - Evidence on the impact of SPN on malnutrition markers; and
  - Evidence linking these malnutrition markers to clinical and HRQoL outcomes.
- Where possible, data identified in the two components of the second TLR were combined to generate indirect estimates of the impact of SPN on clinical and HRQoL outcomes.
- On the basis of these indirect estimates, a partitioned survival model was developed comparing home-based SPN in addition to EN against EN alone in patients with stage IV pancreatic cancer over a lifetime time horizon, from the perspective of the UK National Health Service.
- This population was selected on the basis of the highest quality evidence identified in the second TLR.
- Where potential effects for SPN were identified but could not be quantified (hospitalisation and adverse event costs), exploratory reductions of 20% were considered.
- Wherever possible, the approach and use of data aligned with the most recent National Institute for Health and Care Excellence (NICE) appraisal in Stage IV metastatic pancreatic cancer (TA476 (4)).
- Two scenarios were considered to explore alternative service delivery options: one in which nursing and homecare delivery costs are provided for EN and PN together, and one in which these services are provided separately.
- Sensitivity analyses were performed to determine the impact of key parameters.
- All costs were valued in 2019 UK pounds, and future costs and outcomes were discounted at 3.5%.

Results

- No direct evidence on the impact of SPN was identified.
- Quantifiable indirect evidence on the impact of SPN was identified for survival and utility values:
  - Estimates of the hazard ratio for SPN on survival ranged between 0.80 and 0.99 (Table 1); the base-case estimate was 0.87, which represented the modal value and a reasonable midpoint of the estimated range.
  - The estimated utility increment associated with SPN was 0.29 (5, 6).

Table 1: Indirect estimates of OS hazard ratio associated with SPN

Data sources	Malnutrition marker	Indirect OS hazard ratio†
Cotogni et al, 2017 (7) Deluche et al, 2017 (8)	BMI	0.99
Pelzer et al, 2010 (5) Wallengren et al, 2013 (9)	BMI	0.80
Pelzer et al, 2010 (5) Gupta et al, 2004 (10)	Phase angle	0.87
Pelzer et al, 2010 (5) Gupta et al, 2008 (11)	Phase angle	0.94
Pelzer et al, 2010 (5) Gupta et al, 2009 (12)	Phase angle	0.93
Pelzer et al, 2010 (5) Lee et al, 2014 (13)	Phase angle	0.87

† Indirect OS hazard ratios were calculated by combining data from the sources listed. For example, Pelzer et al, 2010 reported that phase angle increased by 0.3 degrees in malnourished patients, and Gupta et al, 2004 reported that a one degree increase in phase angle is associated with an OS HR of 0.64. The calculation performed was therefore: 0.64^0.3 = 0.87.

Abbreviations: BMI, body mass index; OS, overall survival; SPN, supplemental parenteral nutrition

- Additional indirect evidence was identified suggesting that SPN potentially reduces the rate of adverse events (14) and hospitalisations (15).

Table 2: Disaggregated outcomes

Outcome	EN alone	EN + SPN	Incremental
LYs	0.92	1.02	0.10
Progression-free QALYs	0.28	0.40	0.12
Progressed QALYs	0.17	0.19	0.02

Abbreviations: EN, enteral nutrition; LY, life-year; QALY, quality-adjusted life-year; SPN, supplemental parenteral nutrition.

- Modelling suggests that the use of SPN could be associated with increased life-years (LYs) and quality-adjusted life-years (QALYs) (Table 2); in patients with late-stage metastatic pancreatic cancer, a gain of 0.1 LYs represents an 11% increase in life expectancy.
- The exploratory cost-effectiveness analysis suggests an incremental cost-effectiveness ratio between £43,325 and £93,477 per QALY, depending on whether nursing and homecare delivery for EN and SPN are provided separately (Table 3).
- The results of the sensitivity analyses were relatively consistent with the base-case. The most influential parameters were the SPN-specific utility benefit, the hazard ratio selected and the inclusion of nursing and homecare delivery costs.

Table 3: Base-case results

Nursing and homecare delivery costs	Outcome	EN alone	SPN + EN	Incremental
Excluded	Total costs	£31,644	£37,755	£6,110
	Total QALYs	0.45	0.59	0.14
	ICER	-	-	£43,325
Included	Total costs	£31,644	£44,828	£13,184
	Total QALYs	0.45	0.59	0.14
	ICER	-	-	£93,477

Abbreviations: EN, enteral nutrition; ICER, incremental cost-effectiveness ratio; QALY, quality-adjusted life-year; SPN, supplemental parenteral nutrition.

Conclusions

- Further research is required to generate direct evidence of the impact of SPN on clinical and HRQoL outcomes.
- However, indirect evidence suggests that the use of SPN in cancer patients could lead to improved survival and HRQoL, and reduced hospitalisations and adverse events.
- Exploratory estimates of cost-effectiveness show that the ICER could fall below £50,000 per QALY if homecare delivery and nursing for EN and SPN are consolidated into one service.
- Future economic evaluations of SPN in cancer patients should consider earlier interventions with clinical nutrition and explore how cost-effectiveness differs in cancer populations with a less severe prognosis.

Disclaimer

This study was sponsored by Baxter Healthcare SA.

The authors declared no conflicts of interest.

Corresponding author email: ehancock@source-he.com

Baxter

References

1. Pressoir M, Desné S, Berchery D, Rossignol G, Poiree B, Meslier M, et al. Prevalence, risk factors and clinical implications of malnutrition in French Comprehensive Cancer Centres. British Journal of Cancer. 2010;102(6):966-71.
2. Dewys WD, Begg C, Lavin PT, Band PR, Bennett JM, Bertino JR, et al. Prognostic effect of weight loss prior to chemotherapy in cancer patients. Eastern Cooperative Oncology Group. The American Journal of Medicine. 1980;69(4):491-7.
3. Arends J, Bachmann P, Baracos V, Barthelemy N, Bertz H, Bozzetti F, et al. ESPEN guidelines on nutrition in cancer patients. Clinical Nutrition (Edinburgh, Scotland). 2017;36(1):11-48.
4. NICE. Paclitaxel as albumin-bound nanoparticles with gemcitabine for untreated metastatic pancreatic cancer [ID1058] TA476. 2018.
5. Pelzer U. Parenteral nutrition support for patients with pancreatic cancer. Results of a phase II study. . BMC Cancer. 2010;10: p. 86.
6. O'Gorman P. Impact of weight loss, appetite, and the inflammatory response on quality of life in gastrointestinal cancer patients. Nutrition and Cancer. 2009;32(2), 76-80.
7. Cotogni P. Bioelectrical impedance analysis for monitoring cancer patients receiving chemotherapy and home parenteral nutrition. BMC Cancer. 2018;18(1): p. 990.
8. Deluche E. Assessment of the nutritional status of adult patients with acute myeloid leukemia during induction chemotherapy. Nutrition. 2017;41: p. 120-125.
9. Wallengren O. Diagnostic criteria of cancer cachexia: relation to quality of life, exercise capacity and survival in unselected palliative care patients. Supportive Care in Cancer. 2013;21(6): p. 1569-77.
10. Gupta D. Bioelectrical impedance phase angle as a prognostic indicator in advanced pancreatic cancer. British Journal of Nutrition. 2004;92(6): p. 957-6.
11. Gupta D. Bioelectrical impedance phase angle as a prognostic indicator in breast cancer. BMC Cancer. 2008;8: p. 249.
12. Gupta D. Bioelectrical impedance phase angle in clinical practice: implications for prognosis in stage IIIB and IV non-small cell lung cancer. BMC Cancer. 2009;9: p. 37.
13. Lee S. The Association between Phase Angle of Bioelectrical Impedance Analysis and Survival Time in Advanced Cancer Patients: Preliminary Study. Korean Journal of Family Medicine. 2014;35(5): p. 251-6.
14. Huillard O, Mir O, Peyromaure M, Tlemsani C, Giroux J, Boudou-Rouquette P, et al. Sarcopenia and body mass index predict sunitinib-induced early dose-limiting toxicities in renal cancer patients. Br J Cancer. 2013;108(5):1034-41.
15. Esfahani A, Ghoreishi Z, Abedi Miran M, Sanaat Z, Ostadrahimi A, Eivazi Ziaei J, et al. Nutritional assessment of patients with acute leukemia during induction chemotherapy: association with hospital outcomes. Leuk Lymphoma. 2014;55(8):1743-50.

International Society for Pharmacoeconomics and Outcomes Research Europe, 2-6 November 2019, Copenhagen