OPTIMAL NUTRITION SUPPORT: A COST-EFFECTIVE AND CLINICALLY BENEFICIAL INTERVENTION – IN THE CONTEXT OF PMBS

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Market Access/Health Economics Manager
NUTRITION

Healthy: death after approx. 70 days

Ill: death after approx. 28 days

Loss of muscle mass $\geq 40\%$ = death

“Let food be thy medicine and medicine be thy food”
– Hippocrates
THE VIRTUOUS CYCLE OF CATABOLISM..…

Illness (metabolic stress)

Complications

Nutrients:
- Intake
- Need
- Abnormal losses

Malnutrition

Cost of illness – malnutrition (DRM)

(DISEASE RELATED) MALNUTRITION

Morbidity
- wound healing
- infections (+3x)
- complications (+3x)
- convalescence

Mortality (+12x) ↑
Treatment (+30%) ↑
Hospitalisation (+30%) ↑

In Europe: 33 million people

In Europe: €170 billion per year

COSTS ↑
QUALITY OF LIFE ↓

Break vicious circle - intervention (medical) nutrition

“Let food be thy medicine and medicine be thy food”  – Hippocrates

THE VIRTUOUS CYCLE OF CATABOLISM...

Illness (metabolic stress)

Nutrients: Intake
Need
Abnormal losses

Complications
Malnutrition

Early identification is key to effective management of malnutrition.

Screening using validated tools should be routine practice.

A range of strategies can be used to manage malnutrition, e.g. dietary advice and/or medical nutrition.

1. Lochs H et al. 2006; Cederholm T et al. 2015;
Medical Nutrition

1. Enteral

To meet specific nutritional needs

- Nutrients
  - In general combination of nutrients tested in clinical trials (safety, tolerance, efficacy)
  - National registration/notification
  - For patients use; part of total medical treatment (medical supervision)
  - Frequently reimbursed

Medical nutrition products are regulated in Europe by Commission Directive 1999/21/EC on dietary foods for special medical purposes.
Management of DRM

- **Early identification** is key to effective management of malnutrition

- **Screening** using validated tools should be routine practice

- A range of strategies can be used to manage malnutrition, e.g. *dietary advice and/or medical nutrition*

Home enteral nutrition reduces complications, length of stay, and health care costs: results from a multicenter study\textsuperscript{1–3}

Stanislaw Klek, Adam Hermanowicz, Grzegorz Dziwiszek, Konrad Matysiak, Kinga Szczepanek, Piotr Szybinski, and Aleksander Galaś

\textbf{TABLE 1}

Primary (underlying) diagnosis

\begin{tabular}{|l|l|}
\hline
Type of disease & Patients \\
\hline
Neurovascular & 137 (30.0) \\
Cerebral palsy & 74 (16.2) \\
Abdominal cancer & 19 (12.2) \\
Inherited disease & 51 (11.2) \\
Digestive tract diseases & 26 (5.7) \\
Head and neck cancer & 23 (5.0) \\
Head/spinal injury & 22 (4.8) \\
Dementia & 18 (3.9) \\
SLA\textsuperscript{7} & 17 (3.7) \\
Sclerosis multiplex & 17 (3.7) \\
Neurodegenerative & 13 (2.9) \\
Alzheimer disease & 11 (2.4) \\
Parkinson disease & 7 (1.5) \\
Cystic fibrosis & 6 (1.3) \\
Huntington disease & 4 (0.9) \\
Crohn disease & 4 (0.9) \\
Muscular dystrophy & 3 (0.7) \\
Miscellaneous & 2 (0.4) \\
Psychological & 1 (0.2) \\
Epilepsy & 1 (0.2) \\
Overall & 456 (100) \\
\hline
\end{tabular}

\textsuperscript{7} SLA, amyotrophic lateral sclerosis.

• N = 456
• 4 Polish medical centers
• Self blendered tube feed vs medical nutrition
Medical nutrition – economics

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- N = 456
- 4 Polish medical centers
- Self blended tube feed vs medical nutrition

Out of hospital treatment with medical nutrition results in reductions of:
- Infectious complications 37% vs 15% (p<0.001)
- Hospital admissions with 26% (p<0.001)
- LOS 40 days vs 12 days (p<0.001)

Reduction of hospitalization costs:
$ 4426 (68%) per patient per year
$ 6500 vs $ 2074 (p<0.001)
Cost-benefit optimal nutrition in ICU

A clinical and economic evaluation of enteral nutrition

Michael J. Cangelosi, Hannah R. Auerbach & Joshua T. Cohen
Pages 413-422 | Accepted 03 Dec 2010, Published online: 30 Dec 2010

Syst Review & meta analysis¹:
48 articles (mostly EN vs PN)

AIM:
Comprehensively characterise the clinical and economic implications that may result from the greater use of EN to treat critically ill patients

Enteral vs Parenteral nutrition

Intestinal Adaptation

Influence of Luminal Nutrients

Fed enterally

TPN

Mid-jejunal glucose uptake
nmol/mg protein/min

Am J Physiol 1980; G238:219
Cost-benefit changing from Parenteral to Enteral

## Significant reduction infections

### Table 3. Impact of enteral nutrition on clinical outcomes.

<table>
<thead>
<tr>
<th>Outcome Categories</th>
<th>Median Results^a</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Relative Risk</td>
</tr>
<tr>
<td>EN vs. PN</td>
<td></td>
</tr>
<tr>
<td>Death</td>
<td>0.70 (0.45, 1.09)^b</td>
</tr>
<tr>
<td>Major infections</td>
<td>0.58 (0.44, 0.77)</td>
</tr>
<tr>
<td>Minor infections</td>
<td>0.75 (0.52, 1.10)</td>
</tr>
<tr>
<td>Major non-infectious</td>
<td>0.73 (0.59, 0.91)</td>
</tr>
<tr>
<td>Minor non-infectious</td>
<td>0.97 (0.61, 1.56)</td>
</tr>
</tbody>
</table>

Total Cost Saving from Adverse Events reduction: $1496

### Cost-benefit changing from Parenteral to Enteral

#### Reduction LOS

Table 5. Impact of EN compared to PN on resource use.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Per Patient</th>
<th>Nationally</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of nutritional treatment</td>
<td>1.18 (0.02 to 2.33)</td>
<td>27,300 (500 to 53,800)</td>
</tr>
<tr>
<td>Length of stay in ICU</td>
<td>1.61 (0.72 to 2.49)</td>
<td>37,200 (16,600 to 57,500)</td>
</tr>
<tr>
<td>Length of stay in hospital excluding ICU</td>
<td>1.75 (1.05 to 2.93)</td>
<td>40,200 (15,400 to 64,900)</td>
</tr>
<tr>
<td>Total hospital length of stay</td>
<td>1.66 (0.95 to 2.37)</td>
<td>38,300 (22,000 to 54,700)</td>
</tr>
</tbody>
</table>

\(^a\)Negative values represent ‘negative savings’ – i.e., an *increase* in length of stay.

\(^b\)The estimated population reductions in resource consumption are based on an assumed annual population of 231,000 PN patients and the assumption that 10% of these patients can be switched to EN (23,100 patients).

\(^c\)Random effects model was used for length of nutritional treatment (row 1) due to significant \((P < 0.10)\) heterogeneity among studies. Fixed effect models were used for all other outcomes in this table because in all three cases, \(I^2 < 25\% \) and \(P > 0.10\).

Cost saving from hospital stay @ $1490 per day = $2473

Potential economic benefits of EN vs PN

Per suitable patient switched to EN

Cost saving
(Reduced AEs) + (Reduced LOS)

$1496 + $2473 = $3969

Improve ICU efficiency
Save hospital costs
Quicker patient recovery

Type of medical nutrition can make difference

Cost savings attributable to enteral tube feeding compared with parenteral nutrition (RCT evidence)

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>Country</th>
<th>Patient group</th>
<th>Reduction in cost</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>McClave</td>
<td>1997</td>
<td>USA</td>
<td>Pancreatitis</td>
<td>76.9%</td>
<td>0.001</td>
</tr>
<tr>
<td>Sand</td>
<td>1997</td>
<td>Finland</td>
<td>GI surgery (cancer)</td>
<td>76.5%</td>
<td>N/R</td>
</tr>
<tr>
<td>Bower</td>
<td>1986</td>
<td>USA</td>
<td>GI surgery</td>
<td>73.6%</td>
<td>0.001</td>
</tr>
<tr>
<td>Braga</td>
<td>2001</td>
<td>Italy</td>
<td>GI surgery (cancer)</td>
<td>72.5%</td>
<td>N/R</td>
</tr>
<tr>
<td>Adams</td>
<td>1986</td>
<td>USA</td>
<td>Laparotomy (trauma)</td>
<td>63.9%</td>
<td>N/R</td>
</tr>
<tr>
<td>Trice</td>
<td>1997</td>
<td>USA</td>
<td>Surgery (trauma)</td>
<td>62.9%</td>
<td>N/R</td>
</tr>
<tr>
<td>Hamaoui</td>
<td>1990</td>
<td>USA</td>
<td>Abdominal surgery</td>
<td>56.9%</td>
<td>0.001</td>
</tr>
<tr>
<td>Bauer</td>
<td>2000</td>
<td>France</td>
<td>ICU (not surgery)</td>
<td>48.0%</td>
<td>0.0001</td>
</tr>
<tr>
<td>Barzotti</td>
<td>1994</td>
<td>USA</td>
<td>Head injury</td>
<td>46.4%</td>
<td>N/R</td>
</tr>
<tr>
<td>Abou-Assi</td>
<td>2002</td>
<td>USA</td>
<td>Pancreatitis</td>
<td>23.4%</td>
<td>0.0004</td>
</tr>
<tr>
<td>Zhu</td>
<td>2003</td>
<td>China</td>
<td>GI surgery (cancer)</td>
<td>11.8%</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

N/R = not reported
PN, only if EN is not possible/insufficient

**Figure: Proposed framework for starting parenteral nutrition in acutely ill patients**

REE = resting energy expenditure. EN = enteral nutrition. PN = parenteral nutrition.
A systematic review of the cost and cost effectiveness of using standard oral nutritional supplements in the hospital setting

This review suggests that use of standard ONS in the hospital setting generally produce cost savings and are cost effective in patient groups with variable age, nutritional status and underlying conditions.

<table>
<thead>
<tr>
<th>Studies</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical: abdominal</td>
<td></td>
</tr>
<tr>
<td>Beattie et al. [34] (Scotland)</td>
<td>101</td>
</tr>
<tr>
<td>Keele et al. [32] (England)</td>
<td>86</td>
</tr>
<tr>
<td>Rana et al. [31] (England)</td>
<td>40</td>
</tr>
<tr>
<td>MacFie et al. [33] (England)</td>
<td>52</td>
</tr>
<tr>
<td>Smedley et al. [26] (England)</td>
<td>89</td>
</tr>
<tr>
<td>Surgical: orthopaedic</td>
<td></td>
</tr>
<tr>
<td>Delmi et al. [35] (Switzerland)</td>
<td>59</td>
</tr>
<tr>
<td>Lawson et al. [27] (England)</td>
<td>181</td>
</tr>
<tr>
<td>Non-surgical</td>
<td></td>
</tr>
<tr>
<td>Potter et al. [36] (Scotland)</td>
<td>381</td>
</tr>
<tr>
<td>Gazzotti et al. [37] (Belgium)</td>
<td>80</td>
</tr>
<tr>
<td>Gariballa et al. [38] (England)</td>
<td>40</td>
</tr>
<tr>
<td>Mixed:</td>
<td></td>
</tr>
<tr>
<td>Vlaming et al. [39] (England)</td>
<td>281</td>
</tr>
</tbody>
</table>
Economic evaluation – meta analysis

Meta-analyses

A systematic review of the cost and cost effectiveness of using standard oral nutritional supplements in the hospital setting

This review suggests that use of standard ONS in the hospital setting generally produce cost savings and are cost effective in patient groups with variable age, nutritional status and underlying conditions.

Meta analysis - reduction of:

- Mortality (RR 0.650 p<0.05) & complications by 35% (p<0.001)
- LOS by ~2 days → 13% (p<0.05)

Mean net cost saving: 12% (£746) per patient
Economic evaluation – meta analysis

Patient population:
• Mainly elderly (≥ 65+)
• Ischaemic heart disease, COPD, chest infections, CVA, falls, elective surgery, gastrointestinal diseases (IBD, liver disease, biliary disease, pancreatic disease, gastritis)

A systematic review and meta-analysis of the impact of oral nutritional supplements on hospital readmissions

Rebecca J. Stratton a,⁎, X. Hébuterne b, M. Elia a

This systematic review shows that ONS significantly reduce hospital (re)admissions, particularly in older patient groups, with economic implications for health care.
Economic evaluation – meta analysis

A systematic review and meta-analysis of the impact of oral nutritional supplements on hospital readmissions

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This systematic review shows that ONS significantly reduce hospital (re)admissions, particularly in older patient groups, with economic implications for health care.

Meta analysis - reduction of:

(Re)admission - 29% (OR 0.59, 95% CI 0.43–0.80, P = 0.001)

Duration ONS 1:
Minimum 6 weeks–3 months

Meta-analyses

A systematic review of the cost and cost effectiveness of using standard oral nutritional supplements in community and care home settings

This systematic review with meta-analysis suggests that use of standard ONS in the community, with and without additional use in hospital, can produce favourable financial outcomes and can be cost effective.

**Patient population:**
Chronic kidney disease, elective surgery for head and neck cancer, colorectal cancer, gastrointestinal, cardiovascular, mixed conditions in elderly
Economic evaluation – syst reviews


Meta-analyses

A systematic review of the cost and cost effectiveness of using standard oral nutritional supplements in community and care home settings

This systematic review with meta-analysis suggests that use of standard ONS in the community, with and without additional use in hospital, can produce favourable financial outcomes and can be cost effective.

Meta analysis - reduction of:

• Complications (infections)
• Falls
• Functional limitations

Hospitalization by 16.5% (p<0.001)

Mean cost saving: 9% (< 3 months)
5% (> 3 months)
The use of medical nutrition with sick and malnourished elderly persons results in net benefits between €1,433 and €3,105 per person. For each euro that is invested in the treatment of a malnourished person society saves €1.90 to €4.20.
Biggest Cost is Consequences of Untreated Condition, Not Its Management

- Costs of Medical Nutrition are a small proportion of healthcare budgets
  - 1-3% in Europe

- Biggest cost is due to the consequences of DRM
  - Hospital (re-)admissions and LOS
  - Complications (e.g. infections)
  - Healthcare professionals
  - Medical treatments
Medical Nutrition - a part of the cost containment

Integrating enteral medical nutrition can deliver...

Maximum health

✓ Reduced mortality
✓ Reduced complications
✓ Better recovery
✓ Shorter ICU stay
✓ Shorter hospital stay
✓ Fewer hospital (re)admissions

... Optimal (minimize) costs of care
Value tools

ICU

- TUBE NUTRITION
  - The key to reducing ICU length of stay

ONS value tool community

Decubitus

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