Malnutrition: what is it and why does it matter?

_Niamh Rice_

_ISPEN_
Learning Objectives

1. What is malnutrition?
2. Malnutrition and disease
3. Effects of malnutrition
4. Impact of health outcomes
5. Economic impact
6. Nutritional support - who benefits?
WHAT IS MALNUTRITION?
It all started out so well....... 

- “In the face of illness, thin people do badly”  
  – Hippocrates

- “thousands of patients are annually starved in the midst of plenty from want of attention to the ways which make it possible for them to take food. I say to the nurse, have a rule of thought about your patient's diet”

_Florence Nightingale, 1859_
Unfortunately, we lost the advantage....

“Clinical nutrition has become the ‘cinderella of modern medicine’….not least because of a failure of its practitioners to define it in a way that engages doctors and causes them to take it seriously”

Professor Simon Allison,
Chairman of ESPEN 2002
The problem with definitions..

“Malnutrition is a state of nutrition in which a deficiency (or excess) of energy, protein and micronutrients causes measurable adverse effects on tissue/body form (body shape, size and composition) and function, and clinical outcome.”

Marinos Elia
Defining malnutrition syndromes (according to aetiology)

- **Starvation-related malnutrition**
  - *Eg. Anorexia nervosa*

- **Acute Disease-related malnutrition**
  - *Eg. sepsis, burns, trauma or closed head injury.*

- **Chronic disease-related malnutrition**
  - *Eg rheumatoid arthritis, organ failure, pancreatic cancer, chronic diseases in older patients, sarcopenic obesity.*
...and a few more malnutrition syndromes

- **Sarcopenia**
  - Loss of muscle mass and function

- **Sarcopenic obesity**
  - Above in presence of obesity ie “fat frail”

- **Cachexia**
  - Severe loss of weight, fat and muscle and increased protein catabolism due to underlying disease

- **Pre-cachexia**
  - Underlying chronic disease weight loss of <5%, chronic systemic inflammatory response and anorexia.
Why it helps to differentiate ....

Starvation related malnutrition

Disease related malnutrition
Decay of body weight (% body weight) over time in days (0-70) for different types of starvation.

- **Catabolic** (red line): Rapid weight loss due to protein breakdown.
- **Complete starvation** (green line): Steady weight loss primarily due to fat breakdown.
- **Partial starvation** (yellow line): Moderate weight loss.

Reproduced from presentation given by Professor M Stroud, 2009.
NICE criteria (2006)

- a body mass index (BMI) of \(<18.5\) kg/m\(^2\)

- unintentional weight loss \(>10\%\) within the last 3–6 months

- a BMI of \(<20\) kg/m\(^2\) and unintentional weight loss \(>5\%\) within the last 3–6 months
Those at risk:

those who have:

- eaten little or nothing for more than 5 days and/or are likely to eat little or nothing for 5 days or longer

- a poor absorptive capacity and/or high nutrient losses and/or increased nutritional needs from causes such as catabolism
EFFECTS AND CONSEQUENCES OF MALNUTRITION
Effects of Undernutrition

- Ventilation - loss of muscle & hypoxic responses
- Immunity – Increased risk of infection
- Impaired gut integrity and immunity
- Decreased Cardiac output
- Renal function - loss of ability to excrete Na & H2O
- Hypothermia
- Impaired wound healing
- Loss of strength
- Psychology – depression & apathy
- Liver fatty change, functional decline, necrosis, fibrosis
- Hypoventilation – loss of muscle & hypoxic responses
- Anorexia?
- Micronutrient deficiency
- Loss of strength
- Liver fatty change, functional decline, necrosis, fibrosis

Reproduced from presentation given by Professor M Stroud, 2009
Starvation causes reductive adaptation/conservation.

Reduced food intake

- Reduced Mass
- Changed body composition

- Reduced work, increased efficiency
- Changed metabolism

Metabolically stable BUT loss of reserve and functional capacity ‘Marasmus’
REDUCED FOOD INTAKE

- Reduced Mass
- Reduced work, increased efficiency
- Changed body composition

Marasmus

Infection, trauma, small bowel overgrowth, specific deficiency, abnormal losses, excessive intake, unbalanced intake

Loss of homeostasis
Complications after abdominal surgery for malignant disease
Malnourished patients have 2 to 3 times more complications

Frequency of complications in at risk vs not at-risk patients

EuroOOPS Study: \( n = 5051 \), mean age 59.8 years (±0.3 SEM), 12 countries, 26 hospital departments. \( P<0.001 \).

...more frequent hospital admissions

Malnourished patients experience a significantly higher total re-admission rate than well-nourished patients

<table>
<thead>
<tr>
<th>Nutritional Status</th>
<th>Re-admission rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malnutrition</td>
<td>30.7%</td>
</tr>
<tr>
<td>Normal nutrition</td>
<td>20.7%</td>
</tr>
<tr>
<td>Over nutrition</td>
<td>17.7%</td>
</tr>
</tbody>
</table>

\[ n = 400, \text{mean age} 57.3\text{years (±17.5)}, \text{P<0.05} \]

Use more healthcare resource.

No. of visits or hospital admissions per subject (>65y) per year (Elia et al 2006)

<table>
<thead>
<tr>
<th></th>
<th>No MN*</th>
<th>MN</th>
<th>% increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP visits</td>
<td>4.31</td>
<td>7.10</td>
<td>+65%</td>
</tr>
<tr>
<td>Hospital OP visits</td>
<td>1.02</td>
<td>1.36</td>
<td>+33%</td>
</tr>
<tr>
<td>Hospital admissions</td>
<td>0.28</td>
<td>0.50</td>
<td>+80%</td>
</tr>
</tbody>
</table>

*Low risk according to ‘MUST’

** Length of hospital stay increased by > 30% - 70% in malnourished and less likely to be discharged home.
...and are more likely to die

EuroOOPS Study: $n = 5051$, mean age 59.8 years ($\pm 0.3$ SEM), 12 countries, 26 hospital departments. Follow-up period of 28 days, $P<0.001$.

Malnutrition is associated with increased mortality in older hospital patients

Mortality according to malnutrition risk category

Patients at risk of malnutrition (‘MUST’ categories medium and high). P = 0.01.

Hospital costs for malnourished patients
% increase above normally nourished

* A review in the USA (1996) suggested 35-75% increase in costs
Hospital costs for malnourished patients in UK

% increase above normally nourished

* A mean increase of 40%

Stratton et al 2004

(n= 138)  (n= 150)  (n= 194)  (n= 380)
Costs of malnutrition (and associated disease)

• Affects 20 million in the EU at an estimated annual cost of €120billion
  Conference held in EU Parliament, Tuesday 9 November 2010

• 3 million in the UK, at an estimated cost of £13billion stg
  BAPEN 2009 Report

• 140,000 in ROI, at an estimated cost of €1.5billion
Estimated cost of DRM in Ireland in 2007

- Health care
  - Hospital inpatients (92%) & outpatients (8%)
  - Primary care
- Social care
  - Adult care homes (88%) & home care (12%)
  - Other

Nutritional support products, adults:
(Tube feeds, ONS, other €32 million (community)
The malnutrition carousel

1 in 4 patients admitted to hospital malnourished

Home
More GP visits
More hospital admissions

Up to 70% of patients discharged from hospital weigh less than on admission

Hospital
More deaths
Longer length of stay
More support post discharge
More deaths post discharge
Inpatients with disease-related malnutrition (2007, USING HIPE DATA)

- Total number of bed days – all patients: 292,278,4
- No. of bed days used by malnourished patients: 113,988,5
- Additional bed days used by malnourished patients due to longer LOS: 263,050
Ideally, nutritional support should:

• Improve general status
  – Immune function
  – Wound healing
  – Ventilation
  – Strength
  – Mobility
  – Psychology

• Improve outcome

Does it?
EVIDENCE BASE
The Problems in Nutritional research

- Trials use different
  - Indications for intervention AND EXCLUSION
  - Levels of feeding
  - Controls
  - Starting times
  - Routes of support
  - Duration of support
  - Outcome measures
The Evidence

Wanted – volunteers for randomized, placebo controlled trial

Patients with an undoubted need for nutrition support cannot be randomized
Evidence for oral nutrition supplements and tube Feeds – early studies


- Supplemented group ate more hospital food
- Supplemented group mortality 8.6 % vs 18.6% in controls

RCT overnight NG feeding in underweight females with fractured NOF. Bastow et al. BMJ 1983

- ONS group mobilised at 16 days with 8% mortality vs controls at 23 days with 22% mortality
- (Normally nourished mobile at 10 days with 5% mortality.)
Impact of nutritional supplementation on length of stay

- Reduced length of hospital stay (LOS) found in patients who received ONS compared with control patients
  - average reductions shown in a meta-analysis ranged from 2 days (in surgical patients) to 33 days (in orthopaedic patients)¹

- Malnourished patients in a stroke rehabilitation centre receiving ONS showed improved recovery
  - higher level of functional independence was achieved and more of them were able to go home rather than to institutional care²

Impact of nutritional intervention on readmission rates

- Significantly lower proportion of acutely ill older people readmitted to hospital at six months when supplemented with high protein oral nutrition supplement (complete) compared with placebo\(^1\)

NICE data: Length of stay – impact of supplementation

<table>
<thead>
<tr>
<th>Study</th>
<th>% Weight</th>
<th>Standardised Mean diff. (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>{HARTSELL1997}</td>
<td>12.3</td>
<td>-0.32 (-0.83, 0.20)</td>
</tr>
<tr>
<td>{PEARL1998}</td>
<td>12.7</td>
<td>-0.49 (-0.78, -0.21)</td>
</tr>
<tr>
<td>{REISSMAN1995}</td>
<td>12.4</td>
<td>-3.00 (-3.45, -2.55)</td>
</tr>
<tr>
<td>Gist 2002</td>
<td>12.6</td>
<td>-0.03 (-0.39, 0.33)</td>
</tr>
<tr>
<td>Gocmen 2002</td>
<td>12.5</td>
<td>-2.54 (-2.93, -2.15)</td>
</tr>
<tr>
<td>Burrows1995</td>
<td>12.5</td>
<td>-0.38 (-0.78, 0.01)</td>
</tr>
<tr>
<td>Patolia2001</td>
<td>12.4</td>
<td>-2.08 (-2.53, -1.63)</td>
</tr>
<tr>
<td>Weinstein1993</td>
<td>12.6</td>
<td>0.11 (-0.25, 0.47)</td>
</tr>
<tr>
<td>Overall (95% CI)</td>
<td></td>
<td>-1.09 (-1.91, -0.27)</td>
</tr>
</tbody>
</table>
How much would it be worth spending per patient to prevent / treat malnutrition?

*€5,357*

- Any spend BELOW this figure which successfully treats DRM might be anticipated to deliver savings.

- Spend above this average may add value by improving quality of healthcare but would require justification

*Estimated additional cost of MN (€750m) / number of people at medium/high risk of DRM (140,000)*
HOW TO IDENTIFY ‘AT RISK’ PATIENTS
Malnutrition is not easy to spot until advanced...
And getting harder to identify as the population widens...

A patient of average BMI at the start of an illness would have to lose 25% of his/her body weight before reaching the cut off point for ‘low’ BMI.
Under-recognised, under-detected, under-treated.

About 1 in 4 patients in hospital 1-7

More than 1 in 3 patients in care homes 2;3;8-10

< 1 in 10 older persons living independently 11

1. Russell C, Elia M. Nutrition Screening Survey in the UK in 2008: Hospitals, Care Homes and Mental Health Units. 2009. Redditch, BAPEN.
BMI categories for chronic protein energy status

<table>
<thead>
<tr>
<th>BMI (kg/m²)</th>
<th>Weight category</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;18.5</td>
<td>Underweight (probable PEM*)</td>
</tr>
<tr>
<td>18.5-20</td>
<td>Underweight (possible PEM*)</td>
</tr>
<tr>
<td>20-25</td>
<td>Desirable weight</td>
</tr>
<tr>
<td>25-30</td>
<td>Overweight</td>
</tr>
<tr>
<td>&gt;30</td>
<td>Obese</td>
</tr>
</tbody>
</table>

* PEM = Protein-Energy Malnutrition
Unintentional weight loss over 3-6 months

- **<5% body weight**: normal intra-individual variation

- **5-10% body weight**: of concern
  - decrease in voluntary physical activity
  - increase in fatigue
  - less energetic

- **>10% body weight**: of significance
  - changes in muscle function
  - disturbances in thermoregulation
  - poor response or outcome to surgery and chemotherapy
**Step 1**
BMI score

<table>
<thead>
<tr>
<th>BMI kg/m²</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;20 (&gt;30 Obese)</td>
<td>0</td>
</tr>
<tr>
<td>18.5-20</td>
<td>1</td>
</tr>
<tr>
<td>&lt;18.5</td>
<td>2</td>
</tr>
</tbody>
</table>

**Step 2**
Weight loss score

<table>
<thead>
<tr>
<th>Unplanned weight loss in past 3-6 months %</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5</td>
<td>0</td>
</tr>
<tr>
<td>5-10</td>
<td>1</td>
</tr>
<tr>
<td>&gt;10</td>
<td>2</td>
</tr>
</tbody>
</table>

**Step 3**
Acute disease effect score

If patient is acutely ill and there has been or is likely to be no nutritional intake for >5 days
Score 2

**Step 4**
Overall risk of malnutrition
Add scores together to calculate overall risk of malnutrition
Score 0 Low Risk, Score 1 Medium Risk, Score 2 or more High Risk

**Step 5**
Management guidelines

- **0 Low Risk**
  Routine clinical care
  - Report screening
  - Hospital – weekly
  - Care Home – monthly
  - Community – annually
  - Special groups: e.g., those >75 yrs

- **1 Medium Risk**
  Observe
  - Document dietary intake for 3 days if subject in hospital or care home
  - If improved or adequate intake – little clinical concern: follow local policy
  - If no improvement – clinical concern: follow local policy
  - Repeat screening
  - Hospital – weekly
  - Care Home – at least monthly
  - Community – at least every 2-3 months

- **2 or more High Risk**
  Treat
  - Refer to dietitian: Nutritional Support Team or implement local policy
  - Improve and increase overall nutritional intake
  - Monitor and review care plan
  - Hospital – weekly
  - Care Home – monthly
  - Community – monthly
  - Unless detrimental or no benefit is expected from nutritional support e.g., imminent death

**Obesity:**
- Record presence of obesity. For those with underlying conditions, these are generally controlled before the treatment of obesity.

Re-assess subjects identified at risk as they move through care settings
See the MUST Exploratory Booklet for further details and the MUST Report for supporting evidence.
Consider oral nutrition support

- if patient malnourished and/at risk of malnutrition
- and
- can swallow safely and gastrointestinal tract is working
- ensure oral nutrition support contains a balanced mixture of protein, energy, fibre, electrolytes, vitamins and minerals
- stop when the patient is established on adequate oral intake from normal food
Does (mal) nutrition matter?

- Patients who are ill are likely to become malnourished
- The best time to act is early
- Nutritional support gives time for surgical and medical therapies to work