THE DOUBLE BURDEN OF MALNUTRITION

R. Blaauw (RSA)
THE DOUBLE BURDEN OF MALNUTRITION

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CONFLICT OF INTEREST

- I regularly give lectures that are organized by Fresenius Kabi and NNIA
- I serve on the Advisory Board for Fresenius Kabi, South Africa
- I provide consultancy work for Aspen, Future Life, Fresenius Kabi and NNIA
- I received an unconditional grant for research from Fresenius Kabi
- I declare no conflict of interest which might have interfered with the scientific validity of this presentation
LEARNING OBJECTIVES

At the end of this lecture, you should be able to:
1. Know the epidemiology of malnutrition with the concomitant presence of undernutrition and obesity in developing countries;
2. Understand the consequences in terms of public health;
3. Understand the consequences in a clinical setting;
4. Define and categorize malnutrition;
5. Discuss possible management options
INTRODUCTION

- Prevalence of Malnutrition (undernutrition / overnutrition) is huge and increasing
- Etiology is multifactorial and complex
  - Undernutrition:
    - Decreased food intake
    - Food insecurity
    - Chronic infections
  - Overnutrition
    - Intake > expenditure
    - Obesogenic environment
    - Genetics
    - Physical activity
    - Distorted hunger and satiety signals
## GLOBAL BURDEN OF DISEASE

<table>
<thead>
<tr>
<th></th>
<th>Boys &lt; 20 yr</th>
<th>Men &gt; 20 yr</th>
<th>Girls &lt; 20 yr</th>
<th>Women &gt; 20 yr</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overweight + Obesity</td>
<td>Obesity</td>
<td>Overweight + Obesity</td>
<td>Obesity</td>
</tr>
<tr>
<td>South Africa</td>
<td>18.8</td>
<td>7.0</td>
<td>38.8</td>
<td>13.5</td>
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<tr>
<td>Botswana</td>
<td>6.6</td>
<td>1.8</td>
<td>21.5</td>
<td>5.8</td>
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<tr>
<td>Germany</td>
<td>20.5</td>
<td>5.5</td>
<td>64.3</td>
<td>21.9</td>
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<tr>
<td>Denmark</td>
<td>19.7</td>
<td>8.7</td>
<td>59.2</td>
<td>19.6</td>
</tr>
<tr>
<td>USA</td>
<td>28.8</td>
<td>12.4</td>
<td>70.9</td>
<td>31.7</td>
</tr>
</tbody>
</table>

Ng et al, Lancet 2013;
http://dx.doi.org/10.1016/S0140-6736(14)60460-8
GLOBAL BURDEN OF DISEASE

Figure 3: Disability-Adjusted Life-Years (DALYs)
by Broad Group for Developing Countries, 2004

- Tunisia
- Thailand
- Indonesia
- Ghana
- Colombia
- Brazil
- South Africa

**Categories:**
- HIV/AIDS
- Other communicable/maternal/perinatal/nutrition
- Non-communicable
- Injuries

Econex, 2009
www.econex.co.za
GLOBAL BURDEN OF DISEASE

Figure 4: Disability-Adjusted Life-Years (DALYs)
by Broad Group for Developed Countries, 2004
South African National Health And Nutrition Examination Survey (SANHANES-1)

FUNDERS

SANHANES TEAM

Shisana et al. 2013
http://www.hsrc.ac.za/
SANHANES-1

- 6300 households and 25 532 individuals

Data generated:
- Interviewer-administered questionnaires
- Physical examinations (anthropometry, blood pressure)
- Laboratory testing (FBC, HbA1c, Chol, TG, CRP, Vit A, ferritin)

Shisana et al. 2013
http://www.hsrc.ac.za/
### SANHANES-1: ADULT ANTHROPOMETRY

#### Category | Females (%) | Males (%)
--- | --- | ---
Underweight | 4.0 | 13.1
Normal weight | 30.9 | 55.7
Overweight | 25 | 19.6
Obesity | 40.1 | 11.6

Shisana et al. 2013
http://www.hsrc.ac.za/
SANHANES-1: ANTHROPOMETRY CHILDREN

Shisana et al. 2013
http://www.hsrc.ac.za/
11,835 households
Females (15 – 49 yr)
N = 9,396
Mean BMI (females) = 24.8 kg/m²
- Underweight = 6% (BMI < 18.5 kg/m²)
- Overweight = 25% (BMI 25-30 kg/m²)
- Obese = 15% (BMI > 30 kg/m²)

Figure 11.1 Nutritional status of children by age

Note: Stunting reflects chronic malnutrition; wasting reflects acute malnutrition; underweight reflects either acute malnutrition or a combination of both. Plot values are smoothed by a five-month moving average.

N=2,895

GDHS 2014;
Figure 11.2 Trends in nutritional status of children under age 5, Ghana 2003-2014
KENYA DEMOGRAPHIC AND HEALTH SURVEY 2014

- 36,430 participating households

Females 15-49 years:
- N=13,143 participated in nutritional assessment
- Mean BMI (females) = 23.7 kg/m²
- Underweight = 9% (BMI < 18.5 kg/m²)
- Overweight = 23% (BMI 25-30 kg/m²)
- Obese = 10% (BMI > 30 kg/m²)

KDHS 2014; www.DHSprogram.com
Figure 11.1 Nutritional status of children by age

- Stunted
- Wasted
- Underweight

Note: Stunting reflects chronic malnutrition; wasting reflects acute malnutrition; underweight reflects chronic or acute malnutrition or a combination of both. Plotted values are smoothed by a five-month moving average.
HEALTH CONSEQUENCES OF MALNUTRITION

Undernutrition

- Micronutrient deficiencies
- Poor wound healing
- Stunting / growth retardation
- Impaired IQ
- Intra-uterine environment and longevity

Fig. 1. The thrifty phenotype hypothesis in relation to longevity.

Barnes & Ozanne, Proc Biophys Mol Biol 2011; 106:323
HEALTH CONSEQUENCES OF MALNUTRITION

Overnutrition

- Diabetes Mellitus / IGT
- CVD / Hyperlipidemias / Hypertension
- Cancer
- Stroke
- Pro-inflammatory state

Harford et al, Proc Nutr Soc 2011; 70:408
HOSPITAL MALNUTRITION

- Prevalence of hospital malnutrition on admission varies between 15 - 60%
- Increases during hospitalization

Figure 2.1 Prevalence of malnutrition risk in adult hospital patients using different screening methods by country and world region

MNI 2012 www.medicalnutritionindustry.com
HOSPITAL MALNUTRITION

Prevalence of hospital malnutrition in Africa

??
MALNUTRITION PREVALENCE IN TYGERBERG ACADEMIC HOSPITAL

- All adult patients (> 18 years) admitted to the surgical ICU over a 10 month period (n=400)
- Nutrition status assessed on admission

Results

- Average body mass index (BMI) was 25.3 ± 6.6 [12.6 – 52.9 kg/m²]
- LOS: 5.3 ± 6.5 days [0.5 – 48 days]

Malnutrition = 58% in this ICU population

Blaauw et al, Clin Nutr 2012
MALNUTRITION PREVALENCE IN CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL

- N=71 mixed ICU patients admitted to Charlotte Maxeke Tertiary Hospital
- Average age: 49.2 ± 17.1 years

Results
- Average body mass index (BMI) was 28.5 ± 8.1 [16.7 – 55.1 kg/m²]

Malnutrition = 64.8% in this ICU population

Veldsman et al, Nutr 2016; http://dx.doi.org/10.1016/j.nut.2016.02.010
REFEEDING RISK

CONSEQUENCES OF OVERNUTRITION

- Wound healing / anastomosis breakdown
- Respiratory challenges
- IV access difficulties
- Mobility problems
- Pharmacological challenges
- Nutrition support inadequacies

Patel et al, Curr Gastroenterol Rep 2016;18:45
CONSEQUENCES OF MALNUTRITION ON COMPLICATIONS

1. Aims of screening

IMPACT OF MALNUTRITION ON LOS

A)

In-hospital stay (days)

p < 0.05
(except M-D vs M-A/M-AD, M-A vs M-AD)

<table>
<thead>
<tr>
<th>Group</th>
<th>In-hospital Stay (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NM-AD</td>
<td>8.0</td>
</tr>
<tr>
<td>M-A</td>
<td>11.1</td>
</tr>
<tr>
<td>M-AD</td>
<td>11.8</td>
</tr>
<tr>
<td>M-D</td>
<td>15.2</td>
</tr>
</tbody>
</table>

NM-AD: Non-malnourished-at admission and at discharge
M-A: Malnourished-Only at admission
M-AD: Malnourished-at admission and at discharge
M-D: Malnourished-Only at discharge

IMPACT OF MALNUTRITION ON HEALTHCARE COSTS

## MALNUTRITION AND RE-ADMISSIONS

Comparison of hospitalization outcomes, costs and mortality between well-nourished and malnourished patients (n = 818).

<table>
<thead>
<tr>
<th>Outcome variables</th>
<th>Well-nourished (n = 583)</th>
<th>Malnourished (n = 235)</th>
<th>Results, unadjusted</th>
<th>Results, adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of hospital stay (days), mean ± sd</td>
<td>4.6 ± 5.6</td>
<td>6.9 ± 7.3</td>
<td>P &lt; 0.001</td>
<td>P = 0.001</td>
</tr>
<tr>
<td>Length of hospital stay (days), median (range)</td>
<td>3 (1–63)</td>
<td>4 (1–59)</td>
<td></td>
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<tr>
<td>Readmission within 15 days of index admission, n (%)</td>
<td>61 (10.5)</td>
<td>40 (17.0)</td>
<td>RR: 1.6</td>
<td>RR: 1.6</td>
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<td></td>
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<td></td>
<td>(CI: 1.1, 2.3)</td>
<td>(CI: 1.0, 2.4)</td>
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<td></td>
<td></td>
<td></td>
<td>P = 0.013</td>
<td>P = 0.040</td>
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<td>Readmission within 90 days of index admission, n (%)</td>
<td>133 (22.8)</td>
<td>87 (37.0)</td>
<td>RR: 1.6</td>
<td>RR: 1.5</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>(CI: 1.3, 2.0)</td>
<td>(CI: 1.1, 1.9)</td>
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<td></td>
<td></td>
<td></td>
<td>P &lt; 0.001</td>
<td>P = 0.010</td>
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<td>Readmission within 6 months of index admission, n (%)</td>
<td>187 (32.1)</td>
<td>118 (48.1)</td>
<td>RR: 1.5</td>
<td>RR: 1.3</td>
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<td></td>
<td></td>
<td></td>
<td>(CI: 1.2, 1.9)</td>
<td>(CI: 1.0–1.7)</td>
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<tr>
<td>Inpatient mortality, n (%)</td>
<td>2 (0.3)</td>
<td>10 (4.3)</td>
<td>RR: 12.3</td>
<td>RR: 12.0</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>(CI: 2.7, 55.5)</td>
<td>(CI: 2.5–59.0)</td>
</tr>
<tr>
<td>1-year mortality, cumulative, n (%)</td>
<td>24 (4.1)</td>
<td>80 (34.0)</td>
<td>RR: 8.3</td>
<td>RR: 7.4</td>
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<td></td>
<td></td>
<td></td>
<td>(CI: 5.4, 12.6)</td>
<td>(CI: 4.6–11.9)</td>
</tr>
<tr>
<td>2-year mortality, cumulative, n (%)</td>
<td>39 (6.7)</td>
<td>100 (42.6)</td>
<td>RR: 6.3</td>
<td>RR: 5.2</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>(CI: 4.5, 8.9)</td>
<td>(CI: 3.6–7.7)</td>
</tr>
<tr>
<td>3-year mortality, cumulative, n (%)</td>
<td>58 (9.9)</td>
<td>114 (48.5)</td>
<td>RR: 4.8</td>
<td>RR: 3.9</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>(CI: 3.7, 6.5)</td>
<td>(CI: 2.8–5.4)</td>
</tr>
</tbody>
</table>

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Lim et al, Clin Nutr 2012;31:345
Malnutrition was a significant predictor of overall mortality.
ESPEN endorsed recommendation

Diagnostic criteria for malnutrition — An ESPEN Consensus Statement

T. Cederholm a, *, I. Bosaeus b, R. Barazzoni c, J. Bauer d, A. Van Gossum e, S. Klek f, M. Muscaritoli g, I. Nyulasi h, J. Ockenga i, S.M. Schneider j, M.A.E. de van der Schueren k, l, P. Singer m
ESPEN MALNUTRITION CRITERIA

Diagnosis of malnutrition:

1. BMI < 18.5 kg/m\(^2\)

OR

1. Weight loss (unintentional)
   > 10% indefinite of time or > 5% over last 3 mo

Combined with either:

2. BMI < 20 kg/m\(^2\) if < 70 yr, or < 22 kg/m\(^2\) if ≥ 70 yr

or

3. FFMI < 15 (women) and < 17 (men) kg/m\(^2\)

Cederholm et al. Clin Nutr 2015; 34:335
ESPEN MALNUTRITION DIAGNOSTIC CRITERIA

- **Etiology-based** malnutrition classification

Cederholm et al. Clin Nutr 2015; 34:335
CACHEXIA

- Cachexia is a complex metabolic syndrome associated with underlying illness.
- It is characterized by loss of muscle mass, with or without loss of fat mass and ultimately loss of body weight.

Evans et al, Clin Nutr 2008;27:796
SARCOPENIA

- Disease that occurs with advancing age and which is associated with a decrease in skeletal muscle mass & muscle strength with/out an accompanying increase in fat mass

Table 1. Criteria for the diagnosis of sarcopenia

Diagnosis is based on documentation of criterion 1 plus (criterion 2 or criterion 3)

1. Low muscle mass
2. Low muscle strength
3. Low physical performance
Invited Review

The Academy of Nutrition and Dietetics/The American Society for Parenteral and Enteral Nutrition Consensus Malnutrition Characteristics: Application in Practice

Ainsley Malone, MS, RD, LD, CNSC¹; and Cynthia Hamilton, MS, RD, LD²
Table 1. General Characteristics for the Diagnosis of Malnutrition.\textsuperscript{4}

- Weight loss
- Inadequate energy intake
- Loss of muscle mass
- Loss of subcutaneous fat
- Fluid accumulation
- Hand grip strength

Any 2 out of 6 Characteristics = Malnutrition diagnosis

**ASPEN MALNUTRITION DIAGNOSTIC CRITERIA**

- **Etiology-based malnutrition classification**

![Diagram](image)

- Nutritional Risk Identified
  - Compromised intake or loss of body mass

- Inflammation Present? No / Yes

- **No**
  - Starvation-Related Malnutrition
    - (pure chronic starvation, anorexia nervosa)

- **Yes**
  - Mild to Moderate Degree
    - Chronic Disease-Related Malnutrition
      - (organ failure, pancreatic cancer, rheumatoid arthritis, sarcopenic obesity)
  - Marked Inflammatory Response
    - Acute Disease or Injury-Related Malnutrition
      - (major infection, burns, trauma, closed head injury)

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MANAGEMENT DILEMMAS

1. **Double-burden of malnutrition** poses a challenge in deciding on appropriate nutrition support
   - Refeeding guidelines (10–15 kcal/kg)
   - Hypocaloric obesity guidelines (15-20 kcal/kg + 2-2.5g protein/kg)
   - Conservative guidelines (20 – 25 kcal/kg + 1.2 g protein/kg)
   - Fistula guidelines (35 kcal/kg + additional protein for losses)

2. Finding suitable nutritional formula to meet needs becomes a challenge
TAKE HOME MESSAGES

1. Malnutrition is prevalent and increasing
   - Double-burden of under- and overnutrition

2. Health consequences has significant impact on outcomes

3. Optimal management of patients poses a challenge

4. *One size does not fit all* – Individualize approaches needed

Thank you.