Canadian Malnutrition Task Force (CMTF) Overview and Results

Co-Chairs:
- Johane Allard, MD, FRCPC
- Heather Keller, RD, PhD, FDC

Members:
- Paule Bernier, PDt, MSc
- Donald R. Duerksen, MD, FRCPC
- Leah Gramlich, MD, FRCPC
- Khursheed Jeejeebhoy, MBBS, PhD, MRCP, FRCP
- Manon Laporte, RD, MSc, CNSC
- Hélène Payette, PhD
• Defining malnutrition and nutrition risk
• Prevalence of nutrition risk in the community
  – Types of risk factors
• Prevalence of malnutrition in acute care
  – Challenges as compared to other adults
• Screening as a means of improving care
  – Ethical screening process
  – Potential process in acute care
  – Post discharge
• Suggested screening tools
• Discussion
  – Feasibility and Implementation barriers
Some definitions

Malnutrition: a global definition
1) Undernourishment resulting from insufficient food intake
2) Overnutrition caused by excess food intake
3) Specific nutrient deficiencies
4) Imbalance due to disproportionate food intake

Jelliffe, 1966
Malnutrition, Sarcopenia, Cachexia
Same Phenotypes different Etiology

- **Malnutrition:**
  Caused by chronic Protein-Energy Imbalance
  Responds to Protein-Energy Feeding

- **Cachexia (kakos=Bad Rexis=Condition):**
  Disease related loss of muscle, weakness and lethargy
  Does not respond to feeding (Evans et al Clin Nutr 2008, 27:793-99)

- **Sarcopenia and Frailty:**
  Specific loss of muscle related to ageing
  Frailty when there is loss of body fat
  Sarcopenic obesity if associated with increased fat
  Responds to exercise and partly to feeding
Prevalence of Hospital Malnutrition: Subjective Global Assessment (SGA)

28-70%

Factors promoting Malnutrition

• Organizational barriers to food access (Naithani et al., 2008)
  – 48 patient interviews
  – Food not available between meals; enough time; positioning; assistance; interruptions

• Patient completed exit survey (Naithani et al., 2009)
  – N=764
  – Hunger 30%; physical barriers 24%; organizational barriers 29%; food choice 24%; food quality 21%
Nutrition Care Issues

• ~70% do not eat enough to meet needs (Thibault et al., 2010)

• Nurses identify 15% as malnourished; MNA identified 57% as malnourished (Suominen et al., 2009)

• Individualized nutrition interventions lead to higher intakes, weight maintenance, better outcomes (Feldblum et al., 2010; Starke et al., 2010)
Nutrition Care Issues

- Organizational barriers to food access (Naithani et al., 2008)
  - 48 patient interviews
  - Food not available between meals; enough time; positioning; assistance; interruptions

- Patient completed exit survey (Naithani et al., 2009)
  - N=764
  - Hunger 30%; physical barriers 24%; organizational barriers 29%; food choice 24%; food quality 21%
Some nutritional parameters may reflect severity of disease:
- Serum albumin: Independent predictor of mortality in wide range of diseases
- Often normal in severe starvation due to anorexia nervosa

Factors contributing to Malnutrition

Before admission:
- Weight loss often present
- Disease Factors
- Aging process

At admission:
- Patients often not properly screened
- Health care professionals: shortage, perception
- Nutritional Care Plan not systematic
- Underlying disease

During hospitalization/institutionalization:
- Food issues
- Tests issues
- Monitoring issues
- Recognition issues
- Lack of nutritional interventions
Screening and Assessment Across the Continuum of Care for Older Canadians

**Primary Prevention**

**Phase 1**
- Risk Factors Present
  - appetite
  - swallowing
  - chewing
  - restrictive diet
  - FADL
  - food security

**Determinants**

**Interventions**
- Educational materials
- Food demonstrations
- Cooking groups
- Meal programs
- Transportation help
- Meal preparation help

**Secondary Prevention**

**Phase 2**
- Impaired Food Intake
  - food groups
  - nutrients
  - energy

**Tertiary Prevention**

**Phase 3**
- Sub-clinical Malnutrition
  - Changes in:
    - weight
    - anthropometry
    - biochemistry

**Phase 4**
- Overt Malnutrition
  - Significant changes in:
    - weight
    - anthropometry
    - biochemistry

Adapted from Keller, 2007
Older adults have poor food intake..

- Poor intake of all four food groups (Quebec, British Columbia, New Brunswick, Ontario and Canadian Community Health Survey)

- A variety of nutrients consumed at low levels; A, D, C, B6, B12, folate, B carotene, calcium, zinc, magnesium (Levy-Milne, 2004; New Brunswick Dept Health, 2005; Shatenstein et al., 2004)

- 65% do not consume 5 F & V (CCHS 2.2)
Outcomes of Poor Nutrition

• Bartali et al., 2008
  – 698 Italians followed for 3 years
    • Food intake, blood measures and physical functioning
    • Low serum vitamin E and D associated with impaired physical functioning

• Ramesh et al., 2010
  – Increased incidence of dementia
    • High saturated fat, calories and alcohol
    • Low intake of antioxidants, fish, methionine, vitamins

• Semba et al., 2006
  – 3 year study in women
    • Those with lowest protein (0.7 g/kg/d) at baseline lost 40% more muscle mass than those with highest (1.1 g/kg)
    • Low levels of serum vitamin D, carotenoids, selenium, zinc, B6, B12 predicted disability
Probability of Survival at 18 months
(adjusted for covariates; n=310)
Keller & Ostbye J Nutr Health Aging 2003

Follow-up time (months)

Proportion Surviving

Nutritional Risk
More risk (<37)
Less risk (>=37)
1. To assess nutrition status and prevalence of malnutrition, including obesity, in hospital patients

2. To determine whether malnourished and obese patients have extended length of stay or increased 30-day re-admission & mortality

3. To demonstrate the change in nutritional status that occurs during hospitalization

4. To evaluate the practice of nutritional care

5. To determine if patients are satisfied with their nutrition care, including meals

6. Identify Barriers to good nutrition care in hospitals

7. To determine the cost-benefit of quality care
CMTF Protocol

- Prospective cohort study
  patients followed during hospitalization
  + 30 days post discharge

- Patient population: adults
  - consecutive admissions
  - hospital stay > 2 days
  - surgical and medical wards

- Exclusion: pediatric, obstetric, psychiatry, palliative, admitted directly to ICU,

- academic / community / small and large centers
Measurements (1)

• **Admission:**
  - Subjective global assessment (SGA)
  - NRI, NRS-2002, CMTF screening tool
  - Weight, Height, BMI
  - Mid arm and calf circumference;
  - C-reactive protein and plasma albumin
  - Charlson comorbidity index
  - 3 day food record during first week of admission including nutritionDAY patient survey 1 meal

• **Hospital Stay:**
  - In-hospital mortality
  - Antibiotic use, surgeries,
  - Nutrition care- workload of RD and DT
  - Diet orders, ONS
  - Weight q 2 days;
  - repeat estimation of food intake and nutritionDAY patient survey
### Table 1 Initial Screening

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>1.</strong> Is BMI &lt; 20.5?</td>
<td></td>
</tr>
<tr>
<td><strong>2.</strong> Has the patient lost weight within the last 3 months?</td>
<td></td>
</tr>
<tr>
<td><strong>3.</strong> Has the patient had a reduced dietary intake in the last week?</td>
<td></td>
</tr>
<tr>
<td><strong>4.</strong> Is the patient severely ill? (e.g. in intensive therapy)</td>
<td></td>
</tr>
</tbody>
</table>

### Nutrition Screening Tools – Definitions (1)

**- Nutrition Risk Screening NRS-2002:**

#### Table 2 Final Screening

<table>
<thead>
<tr>
<th>Impaired nutritional status</th>
<th>Severity of disease (increase in requirements)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Absent score 0</strong></td>
<td>Normal nutritional status</td>
</tr>
<tr>
<td><strong>Mild score 1</strong></td>
<td>Wt loss &gt;5% in 3 months or food intake below 50-75% of normal requirements in preceding week</td>
</tr>
<tr>
<td><strong>Moderate score 2</strong></td>
<td>Wt loss &gt;5% in 2 months or BMI 18.5–20.5 + impaired general condition or food intake 25 – 60% of normal requirement in preceding week</td>
</tr>
<tr>
<td><strong>Severe score 3</strong></td>
<td>Wt loss &gt;5% in 1 month (&gt;15% in 3 months) or BMI &lt;18.5 + impaired general condition or food intake 0-25% of normal requirement in preceding week</td>
</tr>
</tbody>
</table>

**Age** if ≥70 years: add 1 to total score = age-adjusted total score

Patients with a score of ≥ 3 are classified as nutritionally at-risk

Subjective Global Assessment

History:
- Changes in weight over past 6 months
- Changes in dietary intake
- Gastrointestinal symptoms
- Functional capacity
- Stress of disease

Physical:
- Loss of subcutaneous fat: triceps, chest
- Muscle wasting: deltoids, quadriceps, biceps, …
- Edema: ankle, sacral, ascites

Classification:
- A: Well nourished: no history or physical findings of malnutrition
- B: Moderately malnourished
- C: Severely Malnourished

Detsky et al. JPEN 11:8, 1987
Charlson Co-Morbidity Index

- Charlson comorbidity index: to classify the prognostic comorbidity

1: CVD disorders, dementia, cerebrovascular, COPD, conjunctive tissue disorders, diabetes without complications, chronic liver disease

2: Hemiplegia, moderate/severe kidney disease, diabetes with complications, tumours, leukemia, lymphoma

3: moderate to severe liver disease

6: malignant tumour, metastasis, AIDS
Measurements (2)

• **Discharge:**
  - Repeat nutrition measurements
  - Length of stay
  - 30-days mortality
  - 30-day admission rate
  - Patient satisfaction survey

• **Nutrition Care Process:**
  - Clinical Nutrition Team focus groups
  - Physician survey
Statistical Analysis

• **Descriptive analysis**: mean, SD, % of patients

• **Comparison among SGA groups**
  – ANOVA (normally distributed)
  – Kruskal-Wallis test followed by Mann-Whitney test (skewed)
  – Pearson chi square test, Fisher’s exact test

• **Comparison discharge vs. baseline**
  – Paired t-test, Wilcoxon test (continuous)
  – McNemar test, Marginal Homogeneity test (categorical)

• **Univariate and multivariate analysis**

• **IBM SPSS Statistics 19.0 (IBM)**
### Patients’ Demography

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Median (range) or % of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>722</td>
</tr>
<tr>
<td>Age (years)</td>
<td>65 (18-98)</td>
</tr>
<tr>
<td>Gender %</td>
<td>Male 53.7</td>
</tr>
<tr>
<td>Ethnicity %</td>
<td>Canadian Caucasian 83.1</td>
</tr>
<tr>
<td></td>
<td>European 15.4</td>
</tr>
<tr>
<td></td>
<td>Asian (^a) 3.8</td>
</tr>
<tr>
<td></td>
<td>Aboriginal/Natives 4.0</td>
</tr>
<tr>
<td>Education</td>
<td>High school 36.2</td>
</tr>
<tr>
<td></td>
<td>Post Secondary 40.2</td>
</tr>
</tbody>
</table>

\(^a\)South Asian, West Asian, East/South East Asian.
Primary Admitting Diagnosis

Presence of Cancer on Admission 16.9%
## Admission Parameters

<table>
<thead>
<tr>
<th>Admission Parameter</th>
<th>N</th>
<th>Median (Range) / %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charlson Co-Morbidity Index</td>
<td>708</td>
<td>2 (0; 17)</td>
</tr>
<tr>
<td>Number of Medication</td>
<td>719</td>
<td>10.0 (0; 32)</td>
</tr>
<tr>
<td>Number of Supplements (Multivitamins, Minerals)</td>
<td>671</td>
<td>0 (0; 10)</td>
</tr>
<tr>
<td>Oral meal replacement/supplement</td>
<td>721</td>
<td>18.7%</td>
</tr>
<tr>
<td>Antibiotic on admission</td>
<td>703</td>
<td>42.8%</td>
</tr>
</tbody>
</table>
Prevalence of Malnutrition at Admission Based on SGA

- Well Nourished (n=417) 58.1%
- Moderate Mal'n (n=222) 30.9%
- Severe Mal'n (n=79) 11.0%
### Comparison between SGA Classes at Admission (1)

<table>
<thead>
<tr>
<th></th>
<th>SGA A</th>
<th>SGA B</th>
<th>SGA C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Admission</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Age (Years)</strong></td>
<td>62 (18; 89)a</td>
<td>67.5 (23; 96)</td>
<td>69 (42; 89)a</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male (% (n))</td>
<td>57.0 (86/151)</td>
<td>50.0 (42/84)</td>
<td>58.3 (14/24)</td>
</tr>
<tr>
<td>Female</td>
<td>43.0 (65/151)</td>
<td>50.0 (42/84)</td>
<td>41.7 (10/24)</td>
</tr>
<tr>
<td><strong>Charlson Co-Morbidity Index</strong></td>
<td>2 (0;14) a</td>
<td>2 (0;13) b</td>
<td>3 (0; 12) a,b</td>
</tr>
<tr>
<td><strong>Medications (n)</strong></td>
<td>10 (0; 24)</td>
<td>9 (0; 22)</td>
<td>8.5 (1; 20)</td>
</tr>
<tr>
<td><strong>Antibiotics (n)</strong></td>
<td>0.5 (0;5)</td>
<td>0 (0;3)</td>
<td>0 (0;2)</td>
</tr>
</tbody>
</table>

Values expressed as median (range), or % of patients.

Values with identical superscript letters are significantly different.

a,b: P<0.05/k, k=number of post hoc tests
## Comparison between SGA Classes at Admission (3)

<table>
<thead>
<tr>
<th>Admission</th>
<th>SGA A</th>
<th>SGA B</th>
<th>SGA C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=146</td>
<td>n=78</td>
<td>n=21</td>
</tr>
<tr>
<td>BMI (m/kg²)</td>
<td>29.4 (19.0; 59.1)</td>
<td>24.9 (17.1; 66.4)</td>
<td>22.0 (13.3; 36.5)</td>
</tr>
<tr>
<td>Mid Arm Circumference (cm)</td>
<td>31.6 (22.5; 48.0)</td>
<td>29.6 (19.9; 52.3)</td>
<td>23.9 (17.6; 36.3)</td>
</tr>
<tr>
<td>Calf Circumference (cm)</td>
<td>37.7 (25.0; 59.0)</td>
<td>34.5 (23.1; 49.4)</td>
<td>29.9 (23.1; 40.5)</td>
</tr>
<tr>
<td>Handgrip Strength (kg)</td>
<td>23.0 (1.5; 57.0)</td>
<td>18.0 (4.0; 59.9)</td>
<td>14.2 (0; 38.0)</td>
</tr>
</tbody>
</table>

Values expressed as median (range)

Values with identical superscript letters are significantly different.
a,b,c: P<0.017 (Bonferroni correction); A,B,C: P<0.0001
## Comparison between SGA Classes at Admission (2)

<table>
<thead>
<tr>
<th>Admission</th>
<th>n</th>
<th>SGA A</th>
<th>N</th>
<th>SGA B</th>
<th>N</th>
<th>SGA C</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-Reactive Protein (mg/L)</td>
<td>142</td>
<td>24.9 (0.4; 339.9)</td>
<td>79</td>
<td>33.8 (0.6; 330.9)</td>
<td>20</td>
<td>30.9 (0.2; 112.8)</td>
</tr>
<tr>
<td>Plasma Albumin (g/L)</td>
<td>146</td>
<td>33 (18; 45)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>82</td>
<td>32 (15; 44)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>22</td>
<td>28 (16; 42)&lt;sup&gt;a,b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Nutritional Risk Index</td>
<td>140</td>
<td>90.8 (10.0; 109.3)&lt;sup&gt;a,B&lt;/sup&gt;</td>
<td>77</td>
<td>88.0 (10.0; 106.1)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>22</td>
<td>79.2 (64.1; 98.0)&lt;sup&gt;B&lt;/sup&gt;</td>
</tr>
<tr>
<td>NRS-2002</td>
<td>150</td>
<td>0 (0; 4)&lt;sup&gt;A,B&lt;/sup&gt;</td>
<td>84</td>
<td>3 (0; 6)&lt;sup&gt;A&lt;/sup&gt;</td>
<td>24</td>
<td>3 (0; 5)&lt;sup&gt;B&lt;/sup&gt;</td>
</tr>
<tr>
<td>CMTF Screening Tool: Patients at High Risk (%) (n))</td>
<td>150</td>
<td>23.3 (35/150)&lt;sup&gt;A,B&lt;/sup&gt;</td>
<td>84</td>
<td>88.1 (74/84)&lt;sup&gt;A&lt;/sup&gt;</td>
<td>24</td>
<td>91.7 (22/24)&lt;sup&gt;B&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Values expressed as median (range), or % of patients.

Values with identical superscript letters are significantly different.

a,b: P<0.017 (Bonferroni correction); A,B: P<0.0001
# Types of malnutrition at admission
(n=251 SGA B/C with CRP)

<table>
<thead>
<tr>
<th>Type of Malnutrition</th>
<th>% (n) of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starvation-related malnutrition (SGA B or C, CRP &lt; 10mg/L)</td>
<td>23.9 (60/251)</td>
</tr>
<tr>
<td>Disease-related malnutrition (SGA B or C, CRP ≥10mg/L)</td>
<td>76.1 (191/251)</td>
</tr>
</tbody>
</table>
## History of Weight Loss and Food Intake

*n=556*

<table>
<thead>
<tr>
<th>Admission Reported Weight Loss</th>
<th>&lt; 50% of Intake</th>
<th>&gt;= 50% of Intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5%</td>
<td>29%</td>
<td>71%</td>
</tr>
<tr>
<td>&gt;=5%</td>
<td>40%</td>
<td>60%</td>
</tr>
</tbody>
</table>

Average of food Intake during entire admission; \(X^2 = 5.8 \text{ p}=0.012\)
## Food Intake & Malnutrition

$n=630$

<table>
<thead>
<tr>
<th>Nutritional Status</th>
<th>&lt; 50% of food intake in week 1</th>
<th>&gt;= 50% of food intake in week 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well nourished</td>
<td>29%(^a)</td>
<td>71%</td>
</tr>
<tr>
<td>Starvation Malnutrition (SGA B or C and normal CRP)</td>
<td>21%(^b)</td>
<td>79%</td>
</tr>
<tr>
<td>Chronic Disease Malnutrition (SGA B or C and elevated CRP)</td>
<td>46%(^a, b)</td>
<td>54%</td>
</tr>
</tbody>
</table>

Items with identical superscripts are significantly different; $X^2 = 21.0$ $p<0.0001$; 33% of patients have a low intake in their first week.
## Nutritional Parameters: Admission vs Discharge

<table>
<thead>
<tr>
<th>Parameters</th>
<th>n</th>
<th>Admission</th>
<th>Discharge</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-Reactive Protein (mg/L)</td>
<td>303</td>
<td>27.0 (0.16-352.9)</td>
<td>13.1 (0-321.8)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Plasma Albumin (g/L)</td>
<td>378</td>
<td>33.0 (12.0-51.0)</td>
<td>33.0 (12.0-49.0)</td>
<td>0.70</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>485</td>
<td>75.5 (34.6-194.7)</td>
<td>73.5 (35.9-190.7)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>BMI (kg/m^2)</td>
<td>419</td>
<td>27.0 (13.3-66.4)</td>
<td>26.3 (13.4-66.1)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Mid arm Circumference (cm)</td>
<td>436</td>
<td>30.2 (14.25-57.45)</td>
<td>29.9 (14.0-58.3)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Calf Circumference (cm)</td>
<td>433</td>
<td>36.0 (18.5-72.2)</td>
<td>35.4 (18.45-70.4)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Handgrip Strength (kg)</td>
<td>443</td>
<td>20.0 (0-70.0)</td>
<td>20.0 (0-68.0)</td>
<td>0.013</td>
</tr>
</tbody>
</table>

Values expressed median (range)
# Change in SGA

Admission vs. Discharge n=534

<table>
<thead>
<tr>
<th>Admission</th>
<th>Discharge Well nourished</th>
<th>Discharge Moderate Maln’n</th>
<th>Discharge Severe Mal’n’n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well nourished</td>
<td>245</td>
<td>58</td>
<td>2</td>
</tr>
<tr>
<td>Moderate Mal’n’n</td>
<td>46</td>
<td>98</td>
<td>25</td>
</tr>
<tr>
<td>Severe Mal’n’n</td>
<td>9</td>
<td>13</td>
<td>38</td>
</tr>
</tbody>
</table>

n.s. difference $X^2 = -0.692$
p = 0.489, McNemar-Bowkar Test

71.3% no change; 12.7% Improve; 15.9% worsen
Other Outcomes

- Length of stay
  - < 7 days = 50.6%
  - >= 7 days = 49.4%

- Hospital mortality 2.7% (n=19)
- 30-Day mortality 1.5% (n=10)

- 30 day readmission 19.1% (n=131)
Any Mortality & Nutritional Status

Malnourished have a 7.4 times higher odds of dying than well nourished

N=679

\[ X^2 = 21.7 \text{P}<0.0001 \]
Predictors of Mortality  
(n=29 deaths of n=669 included in analysis)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Wald Statistic</th>
<th>Odd’s Ratio [Exp (B)]</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &lt; 60 vs &gt;=60</td>
<td>5.5</td>
<td>5.8</td>
<td>1.3, 25.6</td>
<td>0.02</td>
</tr>
<tr>
<td>CCI &lt;3 vs &gt;=3</td>
<td>4.1</td>
<td>2.4</td>
<td>1.04, 5.5</td>
<td>0.04</td>
</tr>
<tr>
<td>SGA A vs B/C</td>
<td>13.9</td>
<td>6.5</td>
<td>2.4, 17.5</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

All covariates significant predictors in bivariate analysis  
Omnibus Tests of Model Coefficients $X^2= 39.2$, df=3, p<0.0001;  
Hosmer & Lemeshow $X^2= 2.1$ p=0.84
Readmission & Nutritional Status

Malnourished have a 1.6 times higher odds of being readmitted, N=662

\[ X^2 = 5.46 \quad p = 0.02 \]
# Outcome:
## Length of Stay & Potential Predictors

Mann-Whitney Test

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Category</th>
<th>Median (range)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutritional Status</td>
<td>Well nourished</td>
<td>6 (1-81) 8 (2-117)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td></td>
<td>Malnourished</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>Female</td>
<td>6 (1-105) 7 (1-117)</td>
<td>0.76</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cancer</td>
<td>Present</td>
<td>7 (2-85) 6 (1-117)</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Absent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCI</td>
<td>&lt; 3</td>
<td>6 (1-93) 8 (1-117)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td></td>
<td>&gt;3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Intake</td>
<td>&lt; 50%</td>
<td>8 (2-85) 6 (1-117)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td></td>
<td>&gt;= 50%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Protective Factors Associated with Earlier Discharge

### Cox Regression  Fully Adjusted n=651

<table>
<thead>
<tr>
<th>Parameter</th>
<th>B</th>
<th>Relative Risk 95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (&lt; 60 yoa)</td>
<td>0.26</td>
<td>1.3 (1.1, 1.5)</td>
<td>0.002</td>
</tr>
<tr>
<td>Gender (female)</td>
<td>0.14</td>
<td>1.1 (0.98, 1.3)</td>
<td>0.09</td>
</tr>
<tr>
<td>Cancer (not present)</td>
<td>-0.12</td>
<td>0.89 (0.69, 1.1)</td>
<td>0.3</td>
</tr>
<tr>
<td>CCI (&lt; 3)</td>
<td>0.37</td>
<td>1.4 (1.2, 1.7)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Food intake (&gt;= 50%)</td>
<td>0.32</td>
<td>1.37 (1.2, 1.6)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Well nourished</td>
<td>0.37</td>
<td>1.4 (1.2, 1.7)</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

-2 log likelihood = 6999.316 overall $X^2= 62.3$, $p<0.0001$

Omnibus test of model coefficients $\lambda^2(6) = 62.34$, $p<0.0001$
Conclusion

• Prevalence of malnutrition ~ 42% (SGA, NRS)
• Severely malnourished SGA C: older, more co-morbidities
• Chronic disease malnutrition more prevalent ~ 57%
• Nutritional status deteriorates in hospital
• Patients satisfied with food quality but up to 1/3 eat < 50% for various reasons
• Physicians don’t assess nutrition at admission and discharge in the majority of cases
• Malnourished patients have higher mortality (SGA B & C)
• Significant protective factors associated with early discharge:
  - age < 60 y
  - food intake > 50%
  - SGA A