Queensland University of Technology
Brisbane Australia

This may be the author's version of a work that was submitted/accepted for publication in the following source:

Lim, Su Lin, Ong, Kian Chung, Chan, Yiong Huak, Loke, Wai Chiong, Ferguson, Maree, & Daniels, Lynne
(2011)
Malnutrition and its impact on cost of hospitalization, length of stay, readmission and 3-year mortality. In
Singapore Health & Biomedical Congress 2011, 2011-11-11 - 2011-11-12. (Unpublished)

This file was downloaded from: https://eprints.qut.edu.au/64441/

© Copyright 2011 The Author(s)

This work is covered by copyright. Unless the document is being made available under a Creative Commons Licence, you must assume that re-use is limited to personal use and that permission from the copyright owner must be obtained for all other uses. If the document is available under a Creative Commons License (or other specified license) then refer to the Licence for details of permitted re-use. It is a condition of access that users recognise and abide by the legal requirements associated with these rights. If you believe that this work infringes copyright please provide details by email to qut.copyright@qut.edu.au

Notice: *Please note that this document may not be the Version of Record (i.e. published version) of the work. Author manuscript versions (as Submitted for peer review or as Accepted for publication after peer review) can be identified by an absence of publisher branding and/or typeset appearance. If there is any doubt, please refer to the published source.*

MalNutrition and its impact on cost of hospitalization, length of stay, readmission and 3-year mortality

Su Lin Lim[1,6,7], Kian Chung Benjamin Ong[2], Yiong Huak Chan[3], Wai Chiong Loke[4], Maree Ferguson[5,7], Lynne Daniels[6,7]

[1]Dietetics Department, National University Hospital, Singapore, [2]Department of Medicine, National University Hospital, Singapore, [3]Biostatistics Unit, Yong Loo Lin School of Medicine, National University Health System, Singapore, [4]Health & Wellness Programme Office, Ministry of Health, Singapore, [5]Nutrition & Dietetics, Princess Alexandra Hospital, Australia, [6]Insitute Health Biomedical Innovation and [7]School of Public Health, Queensland University of Technology, Australia

Background

It is widely agreed that disease and malnutrition are closely linked and that disease may cause secondary malnutrition and vice-versa. However, the confounding effect of disease on the outcomes of malnutrition using diagnosis-related groups (DRG) has never been studied in a multidisciplinary setting.

Objective

This study aims to determine the impact of malnutrition on hospitalization outcomes and costs, controlling for DRG.

Methodology

This prospective cohort study included a matched case control study on 818 patients newly admitted to a tertiary acute hospital. To ensure that study subjects were as representative of the institution's patient profile as possible, consecutive patients newly admitted to a pre-determined sequence of 16 wards were screened for eligibility.

Recruitment

Inclusion criteria:
- **18-74 years old**
- **Not enrolled during previous admission**
- **Not Pediatric, Psychiatry, ICU & Maternity cases**

Nutritional Assessment

Subjective Global Assessment (SGA) to determine patients' nutritional status within 48 hours of admission

Well-nourished | **Malnourished**

Outcomes Tracking

- **Length of hospital stay (LOS)**
- **Unplanned readmissions**
- **Cost of hospitalization before government subsidy**
- **Mortality at 1, 2 & 3 years from index admission**

(Source: Hospital System & Singapore Death Registry)

Statistical Analyses

- **Mixed Model Analysis to analyze difference between well-nourished and malnourished groups with DRG as random effect**
- **Conditional Logistic Regression matching by DRG to evaluate the association between nutritional status and outcomes**

(All results were adjusted for gender, age and race)

(Participants who had been classified with a malnutrition sub-component in the DRG were reclassified with the corresponding DRG without malnutrition so that matching between similar codes of DRG can be performed)

Results

Using SGA, 29% patients were classified as malnourished. Out of the 235 patients that were identified as malnourished in this study, only three had been documented under the DRG co-morbidity as malnourished.

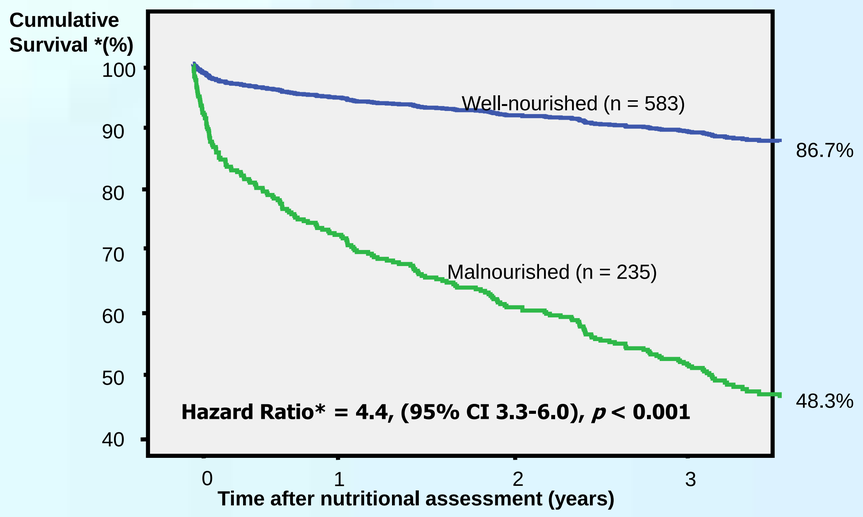
After controlling for the potential confounders of age, gender, ethnicity and DRG, we found that malnourished patients stayed in hospital on average two days longer and were almost twice as likely as well-nourished patients to be readmitted within 15 days of discharge (Table 1). Malnutrition posed almost a four-fold and three-fold increase in risk of death at 1-year and 3-year follow-up, respectively. It was a significant predictor of overall mortality (Figure 1).

TABLE 1. Comparison of hospitalization outcomes, cost and mortality between well-nourished and malnourished patients (n=818)

Outcome variables	Well-nourished (n=583)	Malnourished (n=235)	Results, unadjusted	Results, adjusted[a]	Results, DRG matched, adjusted[b]
Length of hospital stay (days), mean ± sd	4.6 ± 5.6	6.9 ± 7.3	*P* = 0.001*	*P* = 0.001*	*P* = 0.001*
Readmission within 15 days of index admission, n (%)	61 (10.5)	40 (17.0)	RR: 1.6 (CI: 1.1-2.3) *P* = 0.013*	RR: 1.6 (CI: 1.0-2.4) *P* = 0.040*	RR: 1.9 (CI: 1.1-3.2) *P* = 0.025*
1-year mortality, cumulative, n (%)	24 (4.1)	80 (34.0)	RR=8.3 (CI: 5.4-12.6) *P* < 0.001*	RR: 7.4 (CI: 4.6–11.9) *P* < 0.001*	RR: 4.4 (CI: 2.3-8.3) *P* < 0.001*
2-year mortality, cumulative, n (%)	39 (6.7)	100 (42.6)	RR: 6.3 (CI: 4.5-8.9) *P* < 0.001*	RR: 5.2 (CI: 3.6–7.7) *P* < 0.001*	RR: 3.2 (CI: 1.9-5.3) *P* < 0.001*
3-year mortality, cumulative, n (%)	58 (9.9)	114 (48.5)	RR: 4.8 (CI: 3.7-6.5) *P* < 0.001*	RR: 3.9 (CI: 2.8-5.4) *P* < 0.001*	RR: 2.8 (CI: 1.8-4.4) *P* < 0.001*
Cost of hospitalization for individual patient (S$), mean ± sd	3707 ± 5541	4606 ± 6665	*P* = 0.049*	*P* = 0.085	*P* = 0.070

DRG = diagnosis-related group; RR = relative risk; CI = 95% Confidence Intervals; S$ = Singapore dollars.
*Statistical significance
[a]Adjusted for ethnicity, age, gender.
[b]Adjusted for ethnicity, age, gender and matching for diagnosis-related group (DRG). Only 530 subjects could be matched for 95 DRGs.

FIGURE 1. Cumulative survival in well-nourished and malnourished patients (n=818)



*Adjusted for age, gender and race. Survival data from Singapore Death Registry

Conclusions

Malnutrition is evident in up to one third of the patients and leads to substantial increases in length of hospital stay, readmission rate, mortality and hospitalization cost when compared with well-nourished patients of similar diagnosis. This study provides evidence that the adverse outcomes of malnutrition are not just a consequence of the underlying disease process. Given the prevalence of malnutrition its poor outcomes, strategies are required to systematically identify and effectively prevent and treat malnutrition in the community, hospital and post-discharge.