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Conflict of interests

The authors declare that there are no conflicts of interest.

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Authorship

This project was undertaken as part of the PhD study of EA and was supervised by EI, MF and MB. The project was conceptualised, planned and designed by EA, EI, MF and MB. Data collection was coordinated, acquired, analysed and interpreted by EA. The original manuscript was written by EA, and all authors participated in editing and final revisions. All authors have read and approved the final manuscript.

Ethics Statement

Ethics approval for the study was provided by the Medical and Research Ethics Committee of The University of Queensland and local Human Research Ethics Committees of participating hospitals.

Title: Malnutrition coding shortfalls in Australian and New Zealand hospitals

ABSTRACT

Aim: The International Classification of Diseases, Version 10, Australian modification (ICD-10-AM) is used to classify diseases in hospital patients in Australia and New Zealand. ICD-10-AM defines malnutrition as "BMI < 18.5 kg/m^2 or unintentional weight loss of ≥ 5% with evidence of suboptimal intake resulting in subcutaneous fat loss and/or muscle wasting." The Australasian Nutrition Care Day Survey (ANCDS) is the most comprehensive survey to evaluate malnutrition prevalence in acute care patients from Australian and New Zealand hospitals. This study determined if malnourished participants were assigned malnutrition-related codes according to ICD-10-AM.

Methods: The ANCDS recruited acute care patients from 56 hospitals. Hospital-based dietitians evaluated participants' nutritional status using BMI and Subjective Global Assessment (SGA). In keeping with the ICD-10-AM definition, malnutrition was defined as BMI <18.5kg/m^2, SGA-B (moderately malnourished) or SGA-C (severely malnourished). After three months, in this prospective cohort study, staff members from each hospital's health information/medical records department provided coding results for malnourished participants.

Results: Malnutrition was prevalent in 30% (n=869) of the cohort (N=2976) and a significantly small number of malnourished patients were coded for malnutrition (n= 162, 19%, p<0.001). In 21 hospitals, none of the malnourished participants were coded.

Conclusion: This is the largest study to provide a snapshot of malnutrition coding in Australian and New Zealand hospitals. Findings highlight gaps in malnutrition

documentation and/or subsequent coding, which could potentially result in significant loss of casemix-related revenue for hospitals. Dietitians must lead the way in developing structured processes for malnutrition identification, documentation and coding.

(246 words)

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Keywords: malnutrition, casemix, coding, International Classification of Diseases, hospitals

INTRODUCTION

Malnutrition, a common problem in hospital patients, may occur as a result of inadequate dietary intake and/or increased nutritional requirements, impaired nutrient absorption, transport, and/or utilisation.[1] International studies report that malnutrition affects 20 – 50% of hospital patients.[2,3] The Australasian Nutrition Care Day Survey (ANCDS) evaluated the nutritional status of 3122 adult patients admitted in 370 acute care wards across 56 Australian and New Zealand hospitals, making this the largest study thus far to report malnutrition point prevalence in Australian and New Zealand hospitals.[4] The survey found that one-in-three patients were malnourished[4] and also established an independent association between malnutrition and increased length of stay (LOS) in hospital and higher incidence of in-hospital mortality.[4,5]

A small number of cost-of-illness studies indicate higher hospital costs for malnourished patients (attributable to longer hospital stay, higher incidence of complications, increased costs of care and services) compared with well-nourished patients.[6-9] Despite the high prevalence and adverse consequences of malnutrition, Australian literature continues to report that malnourished patients are often not identified during hospitalisation.[10-14] In 2009, Watterson et al published "Evidence based practice guidelines for the nutritional management of malnutrition in adult patients across the continuum of care".[15] These guidelines, endorsed by the Dietitians Association of Australia (DAA) and Dietitians NZ, recommend the use of a number of validated and reliable nutrition screening tools and assessment methods to identify malnutrition.[15] However, an evaluation of nutrition screening practices in 370 wards that participated in the ANCDS revealed that nutrition risk screening was not routinely performed in one-in-three wards.[10]

Identification of malnourished patients serves two purposes: it allows for the *(a)* implementation of appropriate nutrition intervention/s to manage malnutrition[16]; and *(b)* malnutrition coding using the diagnosis-related group (DRG) system.

Australian and New Zealand hospitals use the Australian Refined DRG (AR-DRG) to classify the mix of cases (or 'casemix') according to their diagnoses.[17,18] Medical coders review documentation in medical charts and, based on the reason for hospitalisation and coexisting comorbidities and complications, classify patients into casemix categories.[18] The DRG-system is predicated on cases within a group being likely to utilise similar levels of hospital resources thereby incurring similar costs.[18,19]

The inclusion of malnutrition can potentially influence the DRG by resulting in a higher classification and attracting greater financial reimbursement for the hospital.[20] However, if a patient already has complex comorbidities, then the single effect of malnutrition will not make a difference in the case severity, and therefore in reimbursement.[21] Regardless, since medical coders depend on documentation to assign casemix classification and coding, the quality of the clinician's documentation of patients' diagnoses in medical charts is important.[22]

To the best of our knowledge, practices related to malnutrition coding in New Zealand hospitals have never been reported. Since 1997, only four Australian studies have reported malnutrition coding practices in hospitals and findings from all four studies indicate that malnutrition was often not coded, therefore resulting in considerable loss of casemix-related reimbursement for hospitals.[11,19,23,24] Three of these studies reported coding practices in individual hospitals and therefore their results cannot be generalised across Australian and New Zealand hospitals.[11,19,23] Rowell and Jackson (2011)

evaluated malnutrition coding for >250,000 inpatients admitted in 45 public hospitals in Victoria and found that less than 2% of the patients had been coded for malnutrition.[24] This is perhaps the most comprehensive report on malnutrition coding practices in Australian hospitals, however as the results are limited to hospitals in Victoria, they cannot be generalised across Australia and New Zealand.

The present study aims to provide an insight into malnutrition coding for malnourished patients from the ANCDS cohort.

METHODS

This was a prospective cohort study. Nutritional status of ANCDS participants was assessed by dietitians from participating hospitals[4] as follows: Dietitians screened participants for nutrition risk using the validated Malnutrition Screening Tool (MST).[25] The MST is a two-question screening tool (appetite and recent unintentional weight loss) and provides a score between 0–5.[25] Patients are considered at nutritional risk if they score ≥2.[25] Participants who were deemed "at risk" (MST score ≥2) underwent comprehensive nutrition assessment using Subjective Global Assessment (SGA).[26] The SGA includes two components: medical (changes in weight, dietary intake, gastrointestinal symptoms, nutrition-related functional capacity) and physical (evidence of oedema, ascites, loss of subcutaneous fat and muscle). Results from both components are combined to provide an overall rating: well-nourished (SGA-A), moderately malnourished (SGA-B) or severely malnourished (SGA-C). Dietitians also recorded participants' weight and height, based on which BMI was calculated.

The International Classification of Disease and Related Health Problems, 10th version, Australian modification (ICD-10-AM) defines malnutrition in adults as "BMI <18.5 kg/m^2 or unintentional weight loss of at least 5% with evidence of sub-optimal intake resulting in subcutaneous fat loss and/or muscle wasting".[27] Therefore, in keeping with this definition, patients with BMI <18.5 kg/m^2 or assessed as SGA-B or SGA-C were included in the "malnourished" category.[4] Patients with MST scores of <2 or an SGA rating of well-nourished (SGA-A) were categorised as "well-nourished".

Three months after evaluating ANCDS participants' nutritional status, malnutrition coding data were compiled by staff members of health information records departments of participating hospitals. Admission-related information, including admission status (emergency, elective or other), Australian Refined Diagnosis Related Group codes (AR-DRG, reflecting participants' clinical diagnosis), Patient Clinical Complexity Level Scores (PCCL, reflecting participants' disease severity) and type of admission (medical, surgical, and other) were recorded. These have been reported elsewhere.[5]

For purpose of data cleaning, participants were excluded from analyses if post-three months data were missing, and if LOS ≤1 day (additional diagnoses for the episode of admission was unlikely to be recorded if the LOS was ≤ 1day.[28] Ethics approval for the study was provided by [Removed for blind peer review].

Statistical analyses:

Data were analysed using IBM SPSS Statistics 21. Data are presented as frequency and percentage. Chi-square tests were used to determine malnutrition coding according to participants' nutritional status.

RESULTS

Of the 3122 participants recruited in the ANCDS[4], 146 were excluded during data cleaning (Missing data: n=111 (3%); LOS ≤ 1 day: n= 35 (1%)). Of the remaining 2976 participants (96% of the original cohort), 2067 participants were well-nourished (70%) and 869 participants (30%) were malnourished.

Table 1 summarises malnutrition coding results for the cohort (n= 2976). A significantly small number of malnourished participants were coded for malnutrition (n= 162, 19%; p< 0.001). Three percent of the participants (n= 69) who were assessed as well-nourished were coded for malnutrition.

When results were analysed for each of the 56 participating hospitals, malnutrition codes were allocated to:

- all the malnourished patients in 1 hospital;
- none of the malnourished patients in 21 hospitals (malnutrition prevalence: average 28% (range: 5 – 50%));
- 33% – 95% of the malnourished patients in the remaining 34 hospitals (malnutrition prevalence: average 29% (range: 11 – 53%).

DISCUSSION

The objective of this paper was to report if malnutrition codes had been assigned to patients who were identified as malnourished in the ANCDS cohort.[4] According to the findings, a significantly lower number of malnourished patients were coded. In fact, malnourished participants from 21 hospitals were not coded for malnutrition. This may have potentially translated to lower malnutrition-related reimbursements for the

hospitals. It is likely that the inclusion of malnutrition as a comorbidity may not have increased the DRG-classification (and associated reimbursement) for patients who had complex comorbidities already. However, correct assignment of malnutrition codes is still warranted to reflect the burden of malnutrition in Australian and New Zealand hospitals.

Our observation regarding poor malnutrition coding in hospitals is consistent with the findings from the three previous Australian studies.[11,19,23] Researchers in all three studies retrospectively reviewed documentation and subsequent coding for malnutrition (defined using SGA). When malnutrition coding was warranted but not included, the codes were allocated hypothetically to derive an estimate of the financial shortfall experienced by the hospitals. It appears that the inclusion of malnutrition changes the DRG for approximately 20% of patients, which is equivalent to approximately AU$3500 of hypothetical reimbursement for each patient (Appendix I). Therefore, in the ANCDS, the estimated collective average loss of reimbursement may have been AU$603780 (range: AU$480240 – AU$727320) (Appendix I).

When Ferguson et al (1997) and Lazarus and Hamlyn (2005) conducted their studies, malnutrition was acceptable for DRG coding only if a medical practitioner documented it in patients' medical charts. [11,19] In 2008, the National Centre for Classification in Health agreed that malnutrition may be coded when it is documented by a dietitian in the medical record.[29,30] This change presented dietitians with the opportunity to become leaders in establishing concrete pathways for the identification and documentation of malnutrition in hospital patients, and to collaborate with medical coders to ensure

malnutrition is correctly coded. Given the multicentre nature of this study, it was not possible to identify whether malnutrition coding did not occur as a result of poor documentation and/or due to the absence of a structured process for identification, documentation, and coding for malnutrition. It has also been suggested that dietitians may lack self-confidence in making a malnutrition diagnosis, which may result in inadequate malnutrition coding.[23] There is emerging evidence to indicate that when malnutrition is coded, the associated reimbursement also improves the profile of dietitians amongst other healthcare members but can also result in increased funding for employing more dietitians within the facility.[31,32]

An interesting finding was that patients who had been previously identified as well-nourished in the ANCDS were prospectively coded for malnutrition. A closer look at the LOS data revealed that these patients had significantly longer ($p < 0.001$) median LOS (23 days, range: 3 – 395 days) compared to patients who were identified as well-nourished (10 days, range: 2 – 158 days) and malnourished (15 days, range: 2 – 119 days) in the ANCDS.[5] Deterioration of nutritional status during hospitalisation has previously been reported.[2,33,34] Since these patients had a significantly extended LOS compared with the rest of the cohort, it is possible that their nutritional status deteriorated during hospitalisation, which reiterates the importance of regularly reviewing patients' nutritional status during hospitalisation.

One limitation of this study is that malnutrition coding results may not be conclusive due to the missing data. However, malnutrition coding data was missing for fewer than five percent of the cohort and this is still the largest study to provide a snapshot of

malnutrition coding in Australian and New Zealand hospitals. It is also likely that the screening process may have missed some malnourished patients. However, this reflects real world practice. It was beyond the scope of this study to allocate malnutrition codes hypothetically to estimate the potential financial shortfall experienced by participating hospitals. Based on the three previous Australian studies,[11,19,23] we have attempted to provide a conservative estimate of the potential loss in reimbursement (Appendix I).

It is noteworthy that participating hospitals represent 20% of Australian acute care hospitals[35] and 38% of acute care hospitals in New Zealand[36] (with >60 beds). Even though malnutrition coding practices are not reflected for a majority of Australian and New Zealand hospitals, this study provides insight into malnutrition coding practices in public and private hospitals in this region.

In conclusion, the ANCDS has identified that malnutrition continues to be a common problem in Australian and New Zealand acute care.[4] This paper demonstrates gaps in processes related to the documentation and subsequent coding for malnutrition, which may result in financial loss of reimbursement for hospitals. This study highlights the need for further research to identify barriers and enablers for malnutrition documentation and coding. In the current stringent financial climate and rising healthcare costs, a structured process for the identification, documentation and coding for malnutrition will ensure appropriate casemix-related allocations for hospitals.[37] We suggest that managers of dietetics departments, dietitians, and medical coders collaborate to identify and address problems related to malnutrition documentation and/or coding.

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Appendix I: An estimate of the financial loss of reimbursement related to malnutrition coding

Authors, Year	Number of malnourished patients	Number of patients for whom DRG was changed due to malnutrition coding	Percentage of patients for whom DRG changed due to malnutrition coding	Hypothetical reimbursement per patient
Lazarus et al, 2005[11]	**137**	**30**	**22**	**AU$4180**
Gout et al, 2009[23]	**53**	**10**	**19**	**AU$2760**
		Average:	**20%**	**AU$3470**

Notes: Since malnutrition coding for approximately 20% of the patients in the above studies led to an increase in financial reimbursement, in the ANCDS (2010):

Number of malnourished patients: 869

20% of malnourished patients= 174

Estimated total average loss in reimbursement: 174 * $3470= AU$603780

Estimated total minimum loss in reimbursement: 174 * $2760= AU$480240

Estimated total maximum loss in reimbursement: 174 *$4180= AU$727320

Table 1: Malnutrition coding results (n= 2976)

	Well-nourished[a] (n= 2067, 70%)		Malnourished[b] (n= 869, 30%)		p-value[c]
	Coding not required	Coded for malnutrition[c]	Not coded for malnutrition	Coded for malnutrition	
Participants (n (%))	**1998 (97%)**	**69 (3%)**	**707 (81%)**	**162 (19%)**	**<0.001**

[a] Well-nourished participants: included those "not at risk" of malnutrition (according to the MST[25]) and SGA-A[26].

[b] Malnourished participants: included those with BMI <18.5 kg/m^2 [27], moderately malnourished (SGA-B)[26], or severely malnourished (SGA-C)[26].

[c] Chi-square test