Title: ***Nutritional Status and Dietary Intake of Acute Care Patients: Results from the Nutrition Care Day Survey 2010***

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Short Title: ***Nutritional Status and Dietary Intake: The Australasian Nutrition Care Day Survey 2010***

List of Abbreviations:

ANCDS- Australasian Nutrition Care Day Survey

ANOVA- One-way analysis of variance

AuSPEN- Australasian Society of Parenteral and Enteral Nutrition

BMI- Body Mass Index

ICD-10-AM- International Statistical Classification of Disease and Related Health Problems

LOS- Length of Stay

MST- Malnutrition Screening Tool

NBM- Nil By Mouth

ONS- Oral Nutritional Supplements

SGA- Subjective Global Assessment

TPN- Total Parenteral Nutrition

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Abstract:

Background and Aims: One aim of the Australasian Nutrition Care Day Survey was to determine the nutritional status and dietary intake of acute care hospital patients.

Methods: Dietitians from 56 hospitals in Australia and New Zealand completed a 24-hour survey of nutritional status and dietary intake of adult hospitalised patients. Nutritional risk was evaluated using the Malnutrition Screening Tool. Participants 'at risk' underwent nutritional assessment using Subjective Global Assessment. Based on the International Classification of Diseases (Australian modification), participants were also deemed malnourished if their body mass index was < 18.5 kg/m^2. Dietitians recorded participants' dietary intake at each main meal and snacks as 0%, 25%, 50%, 75%, or 100% of that offered.

Results: 3122 patients (mean age: 64.6 ± 18 years) participated in the study. Forty-one percent of the participants were "at risk" of malnutrition. Overall malnutrition prevalence was 32%. Fifty-five percent of malnourished participants and 35% of well-nourished participants consumed ≤ 50% of the food during the 24-hour audit. "Not hungry" was the most common reason for not consuming everything offered during the audit.

Conclusion: Malnutrition and sub-optimal food intake is prevalent in acute care patients across hospitals in Australia and New Zealand and warrants appropriate interventions.

(199 words)

Keywords: Malnutrition; dietary intake; acute care patients; hospital.

Introduction

In recent published literature, several international studies report hospital malnutrition prevalence ranging from 20-50% [1]. A weighted mean of studies from Europe and USA indicated that 31% of hospital patients are either malnourished or at nutritional risk [2]. In the last decade results from malnutrition prevalence studies emerging from four Australian and one New Zealand hospital report malnutrition prevalence ranging from 11-47% [2-6]. Variation in sample size and the use of a variety of techniques to evaluate nutritional status (including anthropometric measurements, nutritional screening and assessment tools) are factors that prevent generalisation of the prevalence of malnutrition in the Australian and New Zealand acute care setting. The largest multicentre malnutrition study conducted by Banks et al (n= > 2200) reported 30% malnutrition prevalence in the acute care setting, however its results were limited to public hospitals in the state of Queensland only [2].

One of the many factors implicated in the aetiology of malnutrition is sub-optimal food intake during hospitalisation [7-10]. Although optimal nutritional intake forms an essential part of therapeutic treatment of malnutrition, only two Australian studies were identified describing the food intake trends of acute care patients. One study audited the nutritional intake at main meals of acute care patients and reported that on average, the energy consumption of over one-third of their participants was less than 50% of that provided in a standard hospital diet [11]. However, this study did not capture information on the nutritional status of the participants. In a recent study, Bauer et al (2011) found on average nearly 50% of patients reported eating half or less of their meal and these patients were found to be up to four times more likely to be malnourished compared to those who ate more than half of their meal [12]. The European NutritionDay Study captured information on the body mass index of acute care patients and audited their one-day food intake [8]. The study found that fewer than half the participants finished the meals offered during the one-day audit [8]. The strength of the European NutritionDay Study was its large sample size of 16000 participants (from 256 hospitals across Europe) and the involvement of a variety of people (such as doctors, nurses, catering and food service staff, administrative staff, patients themselves and/or their

family members and friends) to assist with data collection[8]. The striking results provided the Australasian Society of Parenteral and Enteral Nutrition (AuSPEN) an impetus to conduct a similar study in Australian and New Zealand hospitals. Senior staff within hospitals in this region felt that perhaps only dietitians could be enthused to assist with data collection and there was also a strong desire to conduct nutritional assessment of participants using a validated tool. With these factors in mind and to improve nutrition care practices in Australasian hospitals, the Australasian Nutrition Care Day Survey (ANCDS) was designed. The aim of this paper is to:

- provide point prevalence data for malnutrition;
- determine food consumption of acute care patients; and
- evaluate the differences in food intake of well-nourished and malnourished patients

in hospitals across Australia and New Zealand.

Materials and Methods:

The ANCDS was a multisite cross-sectional study. In an effort to solicit participation from as many acute care hospitals across Australia and New Zealand, members of the Australasian Society of Australia and New Zealand (AuSPEN), and Dietitians Association of Australia (DAA) Interest Groups were invited to a webinar in March 2010 where details of the study aims, methodology, and sample size requirements were provided.

Ethical approval was provided by the Medical Research Ethics Committee of The University of Queensland. Approval was also obtained from local Human Research Ethics Committees of participating Australian and New Zealand hospitals.

Sites were requested to recruit a minimum of 60 participants from acute care wards that were representative of their hospital's acute care population. Patients could voluntarily participate in the study if they were ≥ 18 years of age and had provided written informed consent to partake in the study. The exclusion criteria for types of wards and participants were as follows:

- Admissions or discharges within the 24-hour data collection period
- Patients undergoing day surgery within the 24-hour data collection period
- Patients with dementia who do not have an authorised carer or next of kin to provide consent and data for the survey
- Outpatients
- Patients with eating disorders
- Terminally-ill patients
- Patients undergoing end-of-life palliative care
- Wards to be excluded- Maternity and Obstetric, Paediatric, Mental Health, Intensive Care Units, Emergency Departments, High Dependency Units, Rehabilitation and Sub-Acute wards.

After nominating eligible acute care wards, the sites provided the Project Coordinator with a list of bed numbers for each ward. To help prevent recruitment bias associated with the

potential recruitment of patients more familiar to the ward dietitian, and to provide all eligible patients an equal opportunity to participate in the study, the Project Coordinator randomised the order of bed numbers (using software package PASW Statistics Gradpack 18 (SPSS Inc., USA)) for data collection. By recruiting patients on a random basis, dietitians also had the opportunity to screen and therefore identify malnutrition/malnutrition risk in patients who may have not been previously reviewed by the ward dietitian.

Participating sites collected data over a 24-hour period (starting at 2pm on day 1 and ending at 2pm on day 2) in June and July 2010. A majority of sites collected data over one 24 hour period. Due to limited staff capacity four sites (Australia- 3, New Zealand-1) collected data over two 24-hour periods. Two sites (Australia- 1, New Zealand-1) collected data over three 24-hour periods. Those sites collecting data over more than one 24-hour period recruited different wards and patients each time to prevent over-representation.

Data from eligible participants from non-English speaking backgrounds were recorded through authorised carers, family members, or hospital-appointed interpreters who could provide translated responses.

Standardized training for data collection was provided by the Project Coordinator through five webinars.

Data Collection

The following information was collected:

1. **Demographic-** date of birth, date of admission, gender, ethnic background, height, and weight. Height and weight data were used to calculate participants' Body Mass Index (BMI). Participants were grouped into the following categories: Underweight (BMI < 18.5 kg/m^2), Normal Weight (BMI 18.5 – 24.9 kg/m^2) and Overweight (BMI 25 – 29.9 kg/m^2) and Obese (BMI > 30 kg/m^2) [13]. The number of days between date of admission and day one of the survey determined number of days spent in the hospital prior to the survey (Pre-survey length of stay (LOS));
2. **Type of diet prescribed on day of survey:** Diets were described as follows:
    a. *Standard diets*- diets that do not demand a dietary modification to manage a patient's medical condition;
    b. *Special (normal texture) diets*- diets prescribed for medical conditions e.g. carbohydrate-modified, fat-modified, fibre-modified, lactose-free, gluten-free, low-residue, and elimination diets;
    c. *High energy- high protein diets*- diets prescribed to meet the increased nutritional demands of malnourished or catabolic patients;
    d. *Texture modified diets*- prescribed for dysphagia or difficulty with chewing and swallowing and included pureed/vitamised, minced, mashed, soft, cut-up diets. Thickened fluids were integrated into this category;
    e. *Oral Nutritional Supplements (ONS)* **-** non-commercial and commercially prepared drinks and food items, high in energy and/or protein, to provide increased nutritional intake.
3. **Nutritional Status:**
    a. Nutritional Screening- was performed with the Malnutrition Screening Tool (MST) [14]. The MST has been recommended for use in the acute care setting with high inter-rater reliability (> 90%), specificity (93%) and sensitivity (93%) [15]. The MST is a two-question screening tool (appetite and recent unintentional weight loss)

and provides a score between zero and five. Patients are considered at nutritional risk if they score ≥ 2 [14].

b. Nutritional Assessment- was performed with the Subjective Global Assessment (SGA) tool [16] for those patients who had an MST score of ≥ 2. The SGA is a valid and reliable nutrition assessment tool and includes two components: Medical (records changes in weight, dietary intake, gastrointestinal symptoms, nutrition related functional capacity) and Physical (evaluates evidence of oedema, ascites, loss of subcutaneous fat and muscle) [16]. Results from both these components are combined to provide an overall assessment or global rating: well-nourished (SGA-A), moderately malnourished or suspected of being malnourished (SGA-B), and severely malnourished (SGA-C) [16]. The International Statistical Classification of Disease and Related Health Problems (ICD-10-AM) defines malnutrition in adults as BMI < 18.5 kg/m^2 or unintentional weight loss with suboptimal dietary intake thereby resulting in muscle wasting and/or loss of subcutaneous fat [17]. The ICD-10-AM includes specific codes for malnutrition-related conditions [17]. By using validated nutritional assessment tools (like the SGA) dietitians are able to diagnose and code malnutrition as a comorbidity thereby not only providing appropriate and timely care but also potentially increasing casemix reimbursement for their health care facility [18]

c. Nutritional status of participants at the time of hospital admission- Although several guidelines [15, 19-21] advocate for nutrition screening at the time of hospital admission, there is no indication of a timeframe for the same. Published studies that aim to evaluate participants' nutritional status during hospitalisation have done so within 48-hours of hospital admission [22, 23]. Therefore, the nutritional status of a sub-group of participants who were admitted within two days prior to the audit was evaluated to ascertain the prevalence of malnutrition (or nutritional risk) at the time of hospital admission.

4. Dietary Intake:

a. Percentage of meals and snacks consumed by the participants along with their reason/s for not consuming all the food provided by the hospital during the 24-hour survey were recorded. At the end of each meal and two snacks (morning tea and afternoon tea), dietitians conducted a visual evaluation of the proportion consumed by each participant on a five-point scale (0%, 25%, 50%, 75%, and 100%). Percentage intake for supper was collected either via visual evaluation, patient recall on the following day, or nursing records. Dietitians were advised to evaluate only hospital-provided foods and to exclude other foods (such as those brought in by family members/friends, purchased in cafeterias or vending machines). Dietitians were also advised to exclude low energy beverages (such as water-based tea, coffee) due to their insignificant nutritional content. If patients were storing food items of significant nutritional content for later consumption (e.g. oral nutritional supplements and sandwiches), dietitians were requested to evaluate the intake of these items at a later time and record the percentage consumption for the meal or snack retrospectively.

b. For participants on tube feeds or total parenteral nutrition (TPN), data related to the method of administration (i.e. bolus or continuous) and route (nasogastric, gastrostomy, nasojejunal, jejunostomy, others) for tube feeds was captured. The reason/s for not administering the recommended regimen was also recorded.

If participants received nutritional support via tube feeds and/or parenteral feeds in addition to an oral diet, the ward dietitian recorded dietary intake and tube feed/parenteral feed information.

Statistical Analysis

All statistical analyses were performed with software package PASW Statistics Gradpack 18 (SPSS Inc., USA). Categorical variables (gender, ethnicity, nutritional status, percentage

dietary intake, type of diet) were described by frequency and percentage. Normality of data for continuous variables was determined using standard criteria.

Normally distributed continuous variables (age, height, weight) were presented as mean, standard deviation and range. Normality of data was checked based on the following:

Continuous variables not normally distributed (pre-survey LOS and BMI) were presented as median and range. Bivariate analysis was undertaken using Chi-square tests. Odds ratios (OR) were reported with 95% confidence interval (CI). Comparisons of means were performed using independent t-tests and one-way analysis of variance (ANOVA).To provide an indication of the magnitude of difference between groups, eta squared was used as the effect size statistic. Comparisons of medians were performed using non-parametric tests (Mann-Whitney U Test). Differences in nutritional status were analysed based on SGA rating and ICD10-AM Malnutrition diagnosis coding. Both methods were consistent in their findings and hence malnutrition diagnosis results based on ICD-10-am coding are presented. P-values less than 0.05 (two tailed) were considered statistically significant.

Results

a. Demographics:

A total of 3122 participants from 370 acute care wards from 56 hospitals across Australia (n= 42) and New Zealand (n= 14) participated in the study. Eight main specialities (Medical, Surgical, Oncology, Neurology, Orthopaedics, Renal/Urology, Gastroenterology, and Cardiology/Respiratory) were represented. Ward size ranged from 7 to 54 beds. A total of 300 dietitians were involved in data collection.

Participant characteristics are provided in Table 1. There was no significant difference between the mean age of males and females. Most participants were aged ≥ 65 years (n= 1725, 55%). Measured heights and weights were reported for 286 participants (9%). For 2739 participants (88%) height and/or weight measurements were either self-reported by the

306 participants or their family members, or were estimated by the dietitian. Height and/or weight
307 measurements were missing for 97 participants (3%).
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309
310 ***b. <u>Nutritional Status:</u>***
311 Thirty percent of the participants (n= 902) were malnourished (includes SGA-B and SGA-C)
312 (Table 1). Consistent with the ICD-10-AM definition of malnutrition, if participants with BMI <
313 18.5 kg/m^2 were added to the malnourished group, a total of 993 participants (32%) were
314 malnourished. Eighteen percent of the overweight/obese participants (n= 299) (BMI >
315 25kg/m^2) were assessed as malnourished (SGA-B: n= 276, SGA-C: n= 23).
316 There was no association between gender and participants' nutritional status. There was a
317 significant difference in the mean age of well-nourished and malnourished patients (Mean
318 difference= -2.73 years, 95% CI: -4.08 to -1.37, eta squared 0.005), (Table 2). A significant
319 difference between the median pre-survey LOS and BMI of well-nourished and malnourished
320 participants was also observed (Table 2). Table 2 provides malnutrition prevalence as per
321 ward type. Participants admitted to gastroenterology and oncology wards were 1.5 and 1.7
322 times respectively, more likely to be malnourished than other participants (Gastroenterology
323 wards- CI: 1.01-2.17, p-value < 0.05; Oncology wards- CI: 1.24-2.32, p-value < 0.01).
324 A total of 909 participants were admitted within two days prior to the audit. Of these, 28% (n=
325 256) were at nutritional risk. More than 60% of the participants who were at nutritional risk
326 were malnourished (SGA-B: n= 136, 53%; SGA-C: n= 28, 11%). When participants with a
327 BMI < 18.5 kg/m^2 were added to the malnourished group, 20% (n= 180) of the participants in
328 the sub-group were identified as malnourished. There was no association between gender
329 and/or age and participants' nutritional status.
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c. Food Intake:

Participants who did not consume main meals and/or snacks during the survey period may not have been offered food for reasons such as “nil by mouth” or were offered food but did not consume it.

Highest food consumption was observed at breakfast with almost half the participants (47%) consuming everything offered and about one in four (28%) consuming half or less of breakfast. One-third of the participants (n= 1082, 35%) consumed all the dinner offered and 40% (n= 1236) consumed half or less of the dinner. Approximately 40% of the participants were not offered morning tea (41%) or afternoon tea (45%) and more than half the participants (n= 1722, 55%) were not offered any food at supper. Morning tea appeared to be the best consumed with 34% of the participants consuming all of the food offered in contrast to one-quarter of the participants (27%) consuming afternoon tea or supper.

On average, one in two malnourished participants (n= 558, 55%) ate ≤ 50% of the food offered (Table 3). In contrast, one in three well-nourished participants (n= 725, 35%) consumed ≤ 50% of the food during the survey (Table 3). Participants from surgical (CI: 1.50-2.23), oncology (1.33-2.48) and gastroenterology wards (CI: 1.24-2.67) were 1.8 times more likely to eat ≤ 50% of the food during the survey. Participants who ate ≤ 50% of the food offered were also 2.4 times (CI: 2.06-2.81; $p < 0.001$) more likely to be malnourished. One-quarter of all malnourished patients (n= 208) and 25% of severely malnourished patients (n= 42) were not offered any of the three snacks during the survey.

Information on types of prescribed diets are summarised in Table 1. Sixty-one percent of the malnourished patients (n= 596) were either NBM or received standard hospital diets, special (normal texture) diets, texture modified diets, or oral fluids ***without*** additional nutritional support (e.g. through ONS, tube feeds or TPN). Additional nutritional support in the form of ONS ± high energy-high protein diets were provided to 31% of the malnourished patients (n=

300). The remaining malnourished patients (n= 80, 8%) received tube feeds/ TPN ± oral diets.

A relationship between percentage overall food intake and type of diet was apparent ($p < 0.001$). The proportion of participants consuming half or less of their food was the highest in the patients receiving texture modified diets ± ONS (50%) in comparison to those on high energy-high protein diets (43%), standard diets ± ONS (35%), or special (normal texture) diets ± ONS (34%).

Table 4 provides the frequency of the most commonly cited reasons for not eating everything offered at all main meals and snacks during the 24-hour survey period. These results remained consistent after controlling for ethnic background.

Discussion

The ANCDS is the first multicentre study to determine the prevalence of malnutrition and food intake in the acute care setting in hospitals across Australia and New Zealand. With almost one third of all participants malnourished these results are comparable to malnutrition prevalence reports from Europe and USA and the study by Banks et al, thereby confirming that malnutrition is an ongoing issue in the acute hospital setting in this region [1, 2].

The finding that heights and weights were measured for less than ten percent of the cohort indicates that these measurements are not routinely done in hospitals. Since the ICD-10-am also defines malnutrition in adults as BMI < 18.5kg/m^2 [17] it is important that these measurements are performed at the time of hospital admission and patients with a BMI of < 18.5 kg/m^2 are monitored for further weight loss and sub-optimal dietary intake during the course of hospitalisation. The study also identified that some participants who might be considered “healthy” based on BMI, were in fact malnourished (SGA-B or SGA-C) when a comprehensive nutritional assessment was performed. Therefore it is possible for patients

with a normal or high BMI to have a sub-optimal nutritional status. This underscores the importance of using validated nutritional screening and assessment tools to identify malnutrition as advocated by numerous national organisations [15, 19] and international bodies [20, 21].

The results that two-thirds of the participants did not consume all the food offered in hospital during the survey and “not hungry” was the most frequently cited explanation are consistent with the results of the European NutritionDay Survey [8]. Bauer et al also found that loss of appetite was the most common reason for eating less [12]. In the Australasian setting, a greater proportion of the meal was consumed at breakfast and morning tea in comparison to other meals and snacks respectively [12]. To the best of our knowledge, no published evidence could be found to explain this, but perhaps a period of overnight rest and fasting allows patients to consume relatively more of the smaller meals usually offered at these times. Further research is needed to evaluate the best times for consumption of meals, and the form of the meal in order to optimise the service delivery and consumption.

Neither the present study nor the European study evaluated the nutritional efficacy of the diets to meet the nutritional requirements of the participants. However, the convergence in the food intake findings from these two studies suggests that eating “less” is common in acute care hospital patients and questions the extent to which nutritional requirements of these patients are met, especially at a time when they are unwell and when nutritional support maybe warranted. In the Australasian setting, more than half of the malnourished patients requiring additional nutritional support did not receive appropriate diets that met their increased nutritional requirements. Malnutrition may not have been diagnosed in these participants. Alternatively a prolonged decreased dietary intake during hospital admission may have led to deterioration in their nutritional status, which went untreated. The ANCDS found that one in three well-nourished individuals consumed half or less of the food offered during the survey. Suboptimal food intake over an extended period during hospitalisation carries the potential risk of nutritional status deterioration. Participants in the ANCDS who

consumed less than half the food offered were also 2.4 times more likely to be malnourished. Participants from the gastroenterology and oncology wards were 1.5 and 1.7 times respectively more likely to be malnourished. Considering that these patients were also 1.8 times more likely to consume ≤ 50% of the food during the survey, it appears that they are the most at risk of malnutrition and sub-optimal food intake. These findings reiterate the importance of regular nutrition screening, and rescreening of participants along with monitoring their food intake during hospital admission to manage these risks.

"Not hungry" was the primary reason for poor food intake for all main meals and snacks in this study. Mudge et al conducted an Australian prospective cohort study in 134 medical inpatients aged > 65 years to evaluate patient-related factors associated with inadequate nutritional intake during hospitalisation [24]. They found that only 41% of participants met their estimated resting energy requirements and a poor appetite was associated with decreased energy intake [24]. Current literature suggests patients' appetite during hospital admission can be impacted by a number of reasons such as the illness itself, malabsorption, early satiety, lack of flavour perception, lack of variety, cognitive impairment, absence of feeding assistance, meal timing, social isolation, poor ambience in hospital wards, depressed mood, large meal portions, swallowing and chewing difficulties, frailty, decreased functional capacity, restrictive diets, financial issues, effect of polypharmacy, depression and/or dementia [25-27]. Future studies could perhaps evaluate the effectiveness of appetite stimulants on the food intake of hospitalised patients.

In contrast, according to a qualitative study conducted by Naithani et al in two London hospitals, patients often felt hungry but had difficulty accessing food during hospitalisation, especially between meals when little food was offered [28]. In a study conducted in two Australian hospitals, Vivanti et al found that participants who had been admitted for seven days or more and had increased nutritional requirements preferred to receive between-meal snacks more frequently and at times different to those currently existing [29]. Vivanti et al also found that although most of their unwell study participants felt like eating "nothing", some desired soup, dry biscuits or fruit [29]. Patients may have a preference for nibbling on

446 small, frequent, nutritionally fortified snacks rather than full meals. The ANCDS identified
447 being away for a diagnostic test/procedure was the second most common reason why
448 participants did not consume between meal snacks. These findings indicate that there is a
449 need for hospitals to review their menus and food service system to better meet the needs of
450 patients who have (or are at risk of) a compromised nutritional status.
451
452 Participants on texture modified diets ± ONS were least likely to consume all the food
453 offered. This finding is consistent with published evidence that suggests that patients,
454 especially older patients receiving texture modified diets in acute care, have an inadequate
455 energy and protein intake in comparison to those who consume a standard hospital diet [30].
456 The unpalatable nature of the food, unappealing presentation, and lower protein and energy
457 levels (due to the addition of fluid to maintain consistency) of texture-modified foods along
458 with the higher incidence of eating and utensil manipulation difficulties in this group are
459 primary reasons for poor intake [30]. Low acceptability and/or intake of texture modified diets
460 therefore warrants that these diets are prescribed only after consideration that the dietary
461 intake and nutritional status of these patients should be carefully monitored.
462
463 ***Limitations:***
464 For a majority of the participants, malnutrition has been reported as point prevalence data.
465 Although data regarding those who were malnourished at the time of hospital admission
466 versus those who became malnourished during their hospital stay was not recorded for all
467 patients, the study has reported malnutrition at the time of hospital admission for almost one-
468 third of the cohort.
469 The process of selecting a nutrition assessment tool is challenging since there is no gold
470 standard for assessing nutritional status. The ICD-10 AM definition of malnutrition uses
471 BMI<18.5 kg/m^2 or presence of at least 5% weight loss, decreased intake and presence of
472 subcutaneous fat loss and/or muscle wasting which are components of SGA. The SGA is a

valid and reliable tool, has good intra- and inter-rater reliability, is easy to administer, and was therefore selected as the tool of choice for the present study [15].

The type of food service and delivery of meals in hospitals may have had an impact on the participants' oral intake. However, it was beyond the scope of this study to capture this information.

Anecdotal evidence from dietitians across participating hospitals revealed that many potentially vulnerable patients were unwilling to participate in the study. The ethical requirement of "written" consent was a barrier to participate for some patients who were very ill or had dementia and did not have an authorised carer present to provide consent on their behalf. Data related to BMI values, MST scores and SGA ratings was missing for a small number of participants. Only those patients who were at risk according to the MST received a nutrition assessment. Although the MST has high sensitivity and specificity, some patients in the not at risk group may have been malnourished. Therefore, it is likely that this study has underestimated malnutrition prevalence.

Strengths and Significance:

The ANCDS is the first study to provide a snapshot of malnutrition prevalence and dietary intake across a large sample of adult patients from a variety of acute care wards in Australia and New Zealand. The study is significant for its large sample size and consistent methodology in defining malnutrition using validated nutrition screening and assessment tools. It is the first study to use the ICD-10-AM coding to diagnose malnutrition. Efforts to maintain consistency between the 300 dietitians collecting data were made by conducting webinars for standardised training and providing written instructions for data collection. Benchmarking reports will provide participating sites with individual results, compared with mean results from other hospitals from this region, and will serve as a valuable stepping-stone for sites to introduce appropriate interventions and appraise the effectiveness of these interventions over time.

Conclusion

The ANCDS found that one third of acute care patients in Australia and New Zealand hospitals are malnourished. A significant proportion (40%) of patients eat less than half the food offered and are at least twice more likely to be malnourished than those who consume more than half the food offered. Being the first large multicentre study in Australia and New Zealand, this study provides hospitals with a fresh insight into the ongoing existence of malnutrition and sub-optimal food intake and reasons related to decreased food intake amongst acute care patients. It is hoped that this new knowledge will help hospitals in this region to redesign, restructure and reprioritise policies and interventions to provide optimal nutrition care to their patients.

Conflict of Interest: *None of the authors have a conflict of interest to declare.*

Statement of Authorship: *The project was done as part of the PhD study by EA and was supervised by EI, MF, and MB. The project was planned and designed by EI, MB, MF, and EA. The project was coordinated; data was acquired, analysed and interpreted by EA. The original manuscript was written by EA, and then all authors participated in editing and final revisions. All authors have read and approved the final manuscript.*

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Health for funding Queensland hospitals to recruit additional dietitians for aiding with data collection; (5) Statisticians Kylie-Ann Mallett and Dr Marijka Batterham for statistical advice.

Tables

Table 1: Demographic, Nutritional Status and Type of Diet of participants in the Australasian Nutrition Care Day Survey (N= 3122)

Variables	Results
Gender (Males: Females)[a]	**1643 (53%): 1476 (47%)**
Age (y)[b]	**64.6 ± 18 (18-100)**
Height (cm)[b]	**168.5 ± 10.2 (130-204)**
Weight (kg)[b]	**76.7 ± 22.2 (30-231)**
Pre-survey LOS[c]	**6 (0-449)**
Ethnicity [a]	
Caucasian	**2761 (90%)**
Other	**91 (3%)**
Maori	**89 (3%)**
Asian	**74 (2%)**
Aboriginal and Torres Strait Islander	**61 (2%)**
BMI (kg/m2) [c]	**25.8 (10.5 – 84.8)**
BMI Categories (Overall) [a, d]	
Underweight (< 18.5 kg/m^2)	**237 (8%)**
Normal Weight (18.5 – 24.9 kg/m^2)	**1095 (36%)**
Overweight (25 - 29.9 kg/m^2)	**898 (30%)**
Obese (> 30 kg/m^2)	**795 (26%)**

Malnutrition Risk (MST) [b]	
Not at risk of malnutrition (0,1)	**1820 (59%)**
At risk of malnutrition (2-5)	**1276 (41%)**
SGA Rating [a,e]	
SGA-A (well-nourished)	**352 (11%)**
SGA-B (suspected or moderately malnourished)	**732 (24%)**
SGA-C (severely malnourished)	**170 (6%)**
Overall Nutritional Status [a, f]	
Well-nourished	**2087 (68%)**
Malnourished	**993 (32%)**
Types of Diets [a]	
• **Diets without additional nutritional support:**	
Standard Diet	**1361 (45%)**
Special (normal texture) Diet	**632 (21%)**
Texture Modified Diet	**201 (7%)**
Oral Fluids	**144 (4.5%)**
NBM	**33 (1%)**
• **Diets providing additional nutritional support:**	
High Energy-High Protein Diet (includes Standard Diet + ONS)	**275 (9%)**
High Energy-High Protein Diet + ONS	**153 (5%)**
Special (normal texture) Diets + ONS	**43 (1%)**
Texture Modified Diet + ONS	**57 (2%)**
Tube Feed/TPN (± Diet)	**148 (4.5%)**

535 [LOS: Length of Stay; BMI: Body Mass Index; MST: Malnutrition Screening Tool [14]; SGA:
536 Subjective Global Assessment [16]; ONS: Oral Nutritional Supplements; NBM: Nil by Mouth;
537 TPN: Total Parenteral Nutrition]
538 a: Categorical variables represented as n (%)

b: Continuous variables represented as Mean ± Standard Deviation (Range) for data that is normally distributed

c: Continuous Variable presented as Median (Range) for data that is not normally distributed

d: BMI Categories based on World Health Organisation [13]

e: SGA was performed for participants who had an MST score of 2-5 (At risk of malnutrition)

f: Malnourished participants: included patients with BMI < 18.5 kg/m^2 [13] [17], moderately malnourished (SGA- B) [16] and severely malnourished (SGA-C) participants [16].

Note: Ethnicity data was missing for 46 participants, BMI data was missing for 98 participants, MST data was missing for 26 participants, SGA data was missing for 22 participants, and data on types of diets was missing for 75 participants.

Table 2: Characteristics of well-nourished (n= 2087) and malnourished patients (n= 993)

Characteristics	Well-nourished [a]	Malnourished [b]	p-value
Age [c]	64 ± 18 years (18-100 years)	66 ± 18 years (18-100 years)	< 0.001
Pre-Survey LOS [d]	5 days (0-364 days)	9 days (0-449 days)	< 0.001
BMI [d]	27 kg/m^2 (18.5-84.8 kg/m^2)	22 kg/m^2 (10.8-65.8 kg/m^2)	< 0.001
Ward Type [e]:			< 0.001
Cardiology/Respiratory	321 (76%)	101 (24%)	
Gastroenterology	69 (56%)	55 (44%)	
Medical	537 (65%)	289 (35%)	
Neurology	119 (78%)	34 (22%)	
Oncology	104 (52%)	95 (48%)	
Orthopaedics	192 (72%)	76 (28%)	
Other	138 (69%)	62 (31%)	
Renal/Urology	48 (66%)	25 (34%)	
Surgical	559 (69%)	256 (31%)	

a: Well-nourished participants: included those “not at risk” of malnutrition (as per the MST) [14] and SGA-A [16]

b: Malnourished participants: included patients with BMI < 18.5 kg/m^2[13], moderately (SGA-B) [16] and severely malnourished (SGA-C) participants [16]

c: Continuous variables represented as Mean ± Standard Deviation (Range) for data that is normally distributed

d: Continuous Variable presented as Median (Range) for data that is not normally distributed

e: Categorical variables represented as n (%)

Note: Nutritional status information (BMI, MST, and/or SGA) was missing for 42 participants.

Table 3: Percentage (%) overall food intake by participants as per each meal, overall intake, and nutritional status

% Intake	Number (%) of participants				
	As per intake at main meals and snacks		As per overall food intake [a]	As per Nutritional Status	
	Main Meals[b] n (%)	Snacks [c] n (%)	Overall Intake n (%)	Well-nourished[d] n (%)	Malnourished[e] n (%)
Not Offered Anything[f]	191 (6%)	1464 (47%)	146 (5%)	81 (4%)[g]	63 (6%)[g]
0%	317 (10%)	466 (15%)	138 (5%)	84 (4%)[g]	51 (5%)[g]
25%	346 (11%)	58 (2%)	409 (13%)	206 (10%)[g]	191 (19%)[g]
50%	408 (13%)	141 (5%)	617 (20%)	354 (17%)[g]	253 (26%)[g]
75%	590 (19%)	69 (2%)	844 (27%)	575 (28%)[g]	264 (27%)[g]
100%	1258 (40%)	913 (29%)	937 (30%)	765 (37%)[g]	164 (17%)[g]

a: Reports % overall intake (for main meals and snacks combined during the 24-hour period)

b: Main Meals averages for intakes at Breakfast, Lunch and Evening meal

c: Snacks averages for intakes at Morning Tea, Afternoon Tea, and Supper

d: Well-nourished participants: included those “not at risk” of malnutrition (as per the MST) [14] and SGA-A [16]

e: Malnourished participants: included patients with BMI < 18.5 kg/m^2 [13], moderately malnourished (SGA- B) [16] and severely malnourished (SGA-C) [16] participants

f: Not offered anything for reasons such as Nil by Mouth (NBM)

g: p-value < 0.001

Note: Main meal intake data was missing for 12 participants; Snacks intake data was missing for 11 participants; overall intake data for participants as per their nutritional status was missing for 76 participants.

Table 4: Reasons for not consuming everything offered:

Main Meals		Snacks	
Reasons	**n (%)**	**Reasons**	**n (%)**
Not Hungry	1759 (56%)	Not Hungry	770 (24%)
Dislike Taste	841 (27%)	Away for Test/Procedure	215 (7%)
Normally Eat Less	481 (16%)	Dislike Taste	182 (6%)
Feeling too sick	400 (13%)	Tired	168 (6%)
Nausea/Vomiting	300 (10%)	Feeling too sick	133 (4%)
Feeling Full	254 (8%)	Nausea/Vomiting	108 (3%)
Tired	211 (7%)	Asleep	88 (3%)
Ate Food from Out	126 (5%)	Ate food from Out	83 (3%)
Away for Test/Procedure	121 (4%)	Normally Eat Less	59 (2%)
Dislike Smell	101 (3%)	Feeling Full	25 (1%)

Note: Participants could cite more than one reason for not eating everything offered at main- and snacks.

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