

**Nutritional status and dietary intake of acute care patients
results from the Nutrition Care Day Survey 2010**

Agarwal, Ekta; Ferguson, Maree; Banks, Merrilyn; Bauer, Judith; Capra, Sandra; Isenring, Elisabeth

Published in:
Clinical Nutrition

DOI:
[10.1016/j.clnu.2011.08.002](https://doi.org/10.1016/j.clnu.2011.08.002)

Licence:
CC BY-NC-ND

[Link to output in Bond University research repository.](#)

Recommended citation(APA):

Agarwal, E., Ferguson, M., Banks, M., Bauer, J., Capra, S., & Isenring, E. (2012). Nutritional status and dietary intake of acute care patients: results from the Nutrition Care Day Survey 2010. *Clinical Nutrition, 31*(1), 41-7. <https://doi.org/10.1016/j.clnu.2011.08.002>

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

For more information, or if you believe that this document breaches copyright, please contact the Bond University research repository coordinator.

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

3

4 **Authors:**

5 Ekta Agarwal¹, Maree Ferguson², Merrilyn Banks³, Judith Bauer¹, Sandra Capra¹, Elisabeth
6 Isenring^{1,2}

7 ¹The University of Queensland, Brisbane, QLD 4072, Australia

8 ²Princess Alexandra Hospital, Brisbane, QLD 4102, Australia

9 ³Royal Brisbane and Women's Hospital, Brisbane, QLD 4029, Australia

10

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

13

14 **List of Abbreviations:**

15 ANCDS- Australasian Nutrition Care Day Survey

16 ANOVA- One-way analysis of variance

17 AuSPEN- Australasian Society of Parenteral and Enteral Nutrition

18 BMI- Body Mass Index

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

20 LOS- Length of Stay

21 MST- Malnutrition Screening Tool

22 NBM- Nil By Mouth

23 ONS- Oral Nutritional Supplements

24 SGA- Subjective Global Assessment

25 TPN- Total Parenteral Nutrition

26

27

28

29 **Address for Correspondence:**

30 Mrs Ekta Agarwal

31 PhD Candidate,

32 School of Human Movement Studies

33 The University of Queensland

34 St Lucia

35 Queensland 4072

36 Australia

37 Contact Number: + 61 422 851650

38 Email address: e.agarwal@uq.edu.au

39

40

41

42

43

44

45

46

47

48

49

50

51

52

53

54

55

56

57 **Abstract:**

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

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

68 **Results:** 3122 patients (mean age: 64.6 ± 18 years) participated in the study. Forty-one
69 percent of the participants were "at risk" of malnutrition. Overall malnutrition prevalence was
70 32%. Fifty-five percent of malnourished participants and 35% of well-nourished participants
71 consumed $\leq 50\%$ of the food during the 24-hour audit. "Not hungry" was the most common
72 reason for not consuming everything offered during the audit.

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

75

76 (199 words)

77

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

79

80

81

82

83

84

85 **Introduction**

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

97 One of the many factors implicated in the aetiology of malnutrition is sub-optimal food intake
98 during hospitalisation [7-10]. Although optimal nutritional intake forms an essential part of
99 therapeutic treatment of malnutrition, only two Australian studies were identified describing
100 the food intake trends of acute care patients. One study audited the nutritional intake at main
101 meals of acute care patients and reported that on average, the energy consumption of over
102 one-third of their participants was less than 50% of that provided in a standard hospital diet
103 [11]. However, this study did not capture information on the nutritional status of the
104 participants. In a recent study, Bauer et al (2011) found on average nearly 50% of patients
105 reported eating half or less of their meal and these patients were found to be up to four times
106 more likely to be malnourished compared to those who ate more than half of their meal [12].

107 The European NutritionDay Study captured information on the body mass index of acute
108 care patients and audited their one-day food intake [8]. The study found that fewer than half
109 the participants finished the meals offered during the one-day audit [8]. The strength of the
110 European NutritionDay Study was its large sample size of 16000 participants (from 256
111 hospitals across Europe) and the involvement of a variety of people (such as doctors,
112 nurses, catering and food service staff, administrative staff, patients themselves and/or their

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

120 The aim of this paper is to:

- 121 • provide point prevalence data for malnutrition;
 - 122 • determine food consumption of acute care patients; and
 - 123 • evaluate the differences in food intake of well-nourished and malnourished patients
- 124 in hospitals across Australia and New Zealand.

125

126

127

128

129

130

131

132

133

134

135

136

137

138

139

140

141 **Materials and Methods:**

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

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

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

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

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

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

174 Participating sites collected data over a 24-hour period (starting at 2pm on day 1 and ending
175 at 2pm on day 2) in June and July 2010. A majority of sites collected data over one 24 hour
176 period. Due to limited staff capacity four sites (Australia- 3, New Zealand-1) collected data
177 over two 24-hour periods. Two sites (Australia- 1, New Zealand-1) collected data over three
178 24-hour periods. Those sites collecting data over more than one 24-hour period recruited
179 different wards and patients each time to prevent over-representation.

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

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

185

186

187

188

189

190

191

192

193

194

195

196 **Data Collection**

197 The following information was collected:

198 1. **Demographic-** date of birth, date of admission, gender, ethnic background, height, and
199 weight. Height and weight data were used to calculate participants' Body Mass Index
200 (BMI). Participants were grouped into the following categories: Underweight (BMI < 18.5
201 kg/m²), Normal Weight (BMI 18.5 – 24.9 kg/m²) and Overweight (BMI 25 – 29.9 kg/m²)
202 and Obese (BMI > 30 kg/m²) [13]. The number of days between date of admission and
203 day one of the survey determined number of days spent in the hospital prior to the survey
204 (Pre-survey length of stay (LOS));

205 2. **Type of diet prescribed on day of survey:** Diets were described as follows:

206 a. *Standard diets-* diets that do not demand a dietary modification to manage a
207 patient's medical condition;

208 b. *Special (normal texture) diets-* diets prescribed for medical conditions e.g.
209 carbohydrate-modified, fat-modified, fibre-modified, lactose-free, gluten-free, low-
210 residue, and elimination diets;

211 c. *High energy- high protein diets-* diets prescribed to meet the increased nutritional
212 demands of malnourished or catabolic patients;

213 d. *Texture modified diets-* prescribed for dysphagia or difficulty with chewing and
214 swallowing and included pureed/vitamised, minced, mashed, soft, cut-up diets.
215 Thickened fluids were integrated into this category;

216 e. *Oral Nutritional Supplements (ONS) -* non-commercial and commercially prepared
217 drinks and food items, high in energy and/or protein, to provide increased
218 nutritional intake.

219 **3. Nutritional Status:**

220 a. Nutritional Screening- was performed with the Malnutrition Screening Tool (MST)
221 [14]. The MST has been recommended for use in the acute care setting with high
222 inter-rater reliability (> 90%), specificity (93%) and sensitivity (93%) [15]. The MST
223 is a two-question screening tool (appetite and recent unintentional weight loss)

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

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

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

251

252 4. Dietary Intake:

253 a. Percentage of meals and snacks consumed by the participants along with their
254 reason/s for not consuming all the food provided by the hospital during the 24-
255 hour survey were recorded. At the end of each meal and two snacks (morning tea
256 and afternoon tea), dietitians conducted a visual evaluation of the proportion
257 consumed by each participant on a five-point scale (0%, 25%, 50%, 75%, and
258 100%). Percentage intake for supper was collected either via visual evaluation,
259 patient recall on the following day, or nursing records. Dietitians were advised to
260 evaluate only hospital-provided foods and to exclude other foods (such as those
261 brought in by family members/friends, purchased in cafeterias or vending
262 machines). Dietitians were also advised to exclude low energy beverages (such
263 as water-based tea, coffee) due to their insignificant nutritional content. If patients
264 were storing food items of significant nutritional content for later consumption (e.g.
265 oral nutritional supplements and sandwiches), dietitians were requested to
266 evaluate the intake of these items at a later time and record the percentage
267 consumption for the meal or snack retrospectively.

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

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

275

276 **Statistical Analysis**

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

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

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

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

293

294

295 **Results**

296 **a. Demographics:**

297 A total of 3122 participants from 370 acute care wards from 56 hospitals across Australia (n=
298 42) and New Zealand (n= 14) participated in the study. Eight main specialities (Medical,
299 Surgical, Oncology, Neurology, Orthopaedics, Renal/Urology, Gastroenterology, and
300 Cardiology/Respiratory) were represented. Ward size ranged from 7 to 54 beds. A total of
301 300 dietitians were involved in data collection.

302 Participant characteristics are provided in Table 1. There was no significant difference
303 between the mean age of males and females. Most participants were aged ≥ 65 years (n=
304 1725, 55%). Measured heights and weights were reported for 286 participants (9%). For
305 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%).

308

309

310 ***b. Nutritional Status:***

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/m² 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/m²) 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/m² 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.

330

331

332

333

334 **c. Food Intake:**

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

338
339 Highest food consumption was observed at breakfast with almost half the participants (47%)
340 consuming everything offered and about one in four (28%) consuming half or less of
341 breakfast. One-third of the participants (n= 1082, 35%) consumed all the dinner offered and
342 40% (n= 1236) consumed half or less of the dinner. Approximately 40% of the participants
343 were not offered morning tea (41%) or afternoon tea (45%) and more than half the
344 participants (n= 1722, 55%) were not offered any food at supper. Morning tea appeared to be
345 the best consumed with 34% of the participants consuming all of the food offered in contrast
346 to one-quarter of the participants (27%) consuming afternoon tea or supper.

347
348 On average, one in two malnourished participants (n= 558, 55%) ate $\leq 50\%$ of the food
349 offered (Table 3). In contrast, one in three well-nourished participants (n= 725, 35%)
350 consumed $\leq 50\%$ of the food during the survey (Table 3). Participants from surgical (CI: 1.50-
351 2.23), oncology (1.33-2.48) and gastroenterology wards (CI: 1.24-2.67) were 1.8 times more
352 likely to eat $\leq 50\%$ of the food during the survey. Participants who ate $\leq 50\%$ of the food
353 offered were also 2.4 times (CI: 2.06-2.81; $p < 0.001$) more likely to be malnourished. One-
354 quarter of all malnourished patients (n= 208) and 25% of severely malnourished patients (n=
355 42) were not offered any of the three snacks during the survey.

356
357 Information on types of prescribed diets are summarised in Table 1. Sixty-one percent of the
358 malnourished patients (n= 596) were either NBM or received standard hospital diets, special
359 (normal texture) diets, texture modified diets, or oral fluids **without** additional nutritional
360 support (e.g. through ONS, tube feeds or TPN). Additional nutritional support in the form of
361 ONS \pm high energy-high protein diets were provided to 31% of the malnourished patients (n=

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

364

365 A relationship between percentage overall food intake and type of diet was apparent ($p <$
366 0.001). The proportion of participants consuming half or less of their food was the highest in
367 the patients receiving texture modified diets ± ONS (50%) in comparison to those on high
368 energy-high protein diets (43%), standard diets ± ONS (35%), or special (normal texture)
369 diets ± ONS (34%).

370

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

374

375

376 **Discussion**

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

382 The finding that heights and weights were measured for less than ten percent of the cohort
383 indicates that these measurements are not routinely done in hospitals. Since the ICD-10-am
384 also defines malnutrition in adults as $BMI < 18.5\text{kg/m}^2$ [17] it is important that these
385 measurements are performed at the time of hospital admission and patients with a BMI of $<$
386 18.5 kg/m^2 are monitored for further weight loss and sub-optimal dietary intake during the
387 course of hospitalisation. The study also identified that some participants who might be
388 considered “healthy” based on BMI, were in fact malnourished (SGA-B or SGA-C) when a
389 comprehensive nutritional assessment was performed. Therefore it is possible for patients

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

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

404
405 Neither the present study nor the European study evaluated the nutritional efficacy of the
406 diets to meet the nutritional requirements of the participants. However, the convergence in
407 the food intake findings from these two studies suggests that eating “less” is common in
408 acute care hospital patients and questions the extent to which nutritional requirements of
409 these patients are met, especially at a time when they are unwell and when nutritional
410 support maybe warranted. In the Australasian setting, more than half of the malnourished
411 patients requiring additional nutritional support did not receive appropriate diets that met their
412 increased nutritional requirements. Malnutrition may not have been diagnosed in these
413 participants. Alternatively a prolonged decreased dietary intake during hospital admission
414 may have led to deterioration in their nutritional status, which went untreated. The ANCDs
415 found that one in three well-nourished individuals consumed half or less of the food offered
416 during the survey. Suboptimal food intake over an extended period during hospitalisation
417 carries the potential risk of nutritional status deterioration. Participants in the ANCDs who

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

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

438 In contrast, according to a qualitative study conducted by Naithani et al in two London
439 hospitals, patients often felt hungry but had difficulty accessing food during hospitalisation,
440 especially between meals when little food was offered [28]. In a study conducted in two
441 Australian hospitals, Vivanti et al found that participants who had been admitted for seven
442 days or more and had increased nutritional requirements preferred to receive between-meal
443 snacks more frequently and at times different to those currently existing [29]. Vivanti et al
444 also found that although most of their unwell study participants felt like eating “nothing”,
445 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/m² 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

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

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

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

487

488

489 **Strengths and Significance:**

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

501 **Conclusion**

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

511

512

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

514

515

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

521

522

523 ***Acknowledgements:*** *The authors would like to thank (1) Participating sites for their time*
524 *and effort in collecting the data for this study; (2) AuSPEN for its support in organising the*
525 *webinars for training dietitians involved with data collection; and the small research grant*
526 *awarded to Ekta Agarwal in 2010; (3) Members of the AuSPEN Steering Committee for their*
527 *valuable feedback on the project plan in the initial stages of the project; (4) Queensland*

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

530

531

532 **Tables**

533 **Table 1: Demographic, Nutritional Status and Type of Diet of participants in the**
 534 **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/m²)	237 (8%)
Normal Weight (18.5 – 24.9 kg/m²)	1095 (36%)
Overweight (25 - 29.9 kg/m²)	898 (30%)
Obese (> 30 kg/m²)	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 + 275 (9%)
ONS)**

High Energy-High Protein Diet + ONS 153 (5%)

Special (normal texture) Diets + ONS 43 (1%)

Texture Modified Diet + ONS 57 (2%)

Tube Feed/TPN (\pm 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 (%)

539 b: Continuous variables represented as Mean \pm Standard Deviation (Range) for data that is
540 normally distributed

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

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

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

544 f: Malnourished participants: included patients with BMI < 18.5 kg/m² [13] [17], moderately
545 malnourished (SGA- B) [16] and severely malnourished (SGA-C) participants [16].

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

549

550

551

552

553

554

555

556

557

558

559

560

561

562

563

564

565

566

567 **Table 2: Characteristics of well-nourished (n= 2087) and malnourished patients (n=**
 568 **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%)	

569 a: Well-nourished participants: included those “not at risk” of malnutrition (as per the MST)
 570 [14] and SGA-A [16]

571 b: Malnourished participants: included patients with BMI < 18.5 kg/m²[13], moderately (SGA-
 572 B) [16] and severely malnourished (SGA-C) participants [16]

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

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

576 e: Categorical variables represented as n (%)

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

578 **Table 3: Percentage (%) overall food intake by participants as per each meal, overall**
 579 **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

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

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

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

583 d: Well-nourished participants: included those “not at risk” of malnutrition (as per the MST)

584 [14] and SGA-A [16]

585 e: Malnourished participants: included patients with BMI < 18.5 kg/m² [13], moderately

586 malnourished (SGA- B) [16] and severely malnourished (SGA-C) [16] participants

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

588 g: p-value < 0.001

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

592

593

594

595

596

597

598

599

600

601

602

603

604

605

606

607

608

609

610

611

612

613

614

615

616

617 **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%)

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

620

621

622

623

624

625

626

627

628

629

630

631

632

633 **References:**

- 634 1. Norman, K., et al., *Prognostic impact of disease-related malnutrition*. Clin Nutr
635 2008. **27**: p. 5-15.
- 636 2. Banks, M., et al., *Prevalence of malnutrition in adults in Queensland public hospitals and*
637 *residential aged care facilities*. Nutr Diet, 2007. **64**: p. 172-178. doi: 10.1111/j.1747-
638 0080.2007.00179.x.
- 639 3. Beck, E., et al., *Implementation of malnutrition screening and assessment by dietitians:*
640 *malnutrition exists in acute and rehabilitation settings*. Aust J Nutr Diet, 2001. **58**(2): p. 92-97.
- 641 4. Kahokehr, A., et al., *Prevalence of malnutrition on admission to hospital - Acute and elective*
642 *general surgical patients*. E Spen Eur E J Clin Nutr Metab, 2010. **5**(1): p. e21-e25.
- 643 5. Middleton, M.H., et al., *Prevalence of malnutrition and 12-month incidence of mortality in*
644 *two Sydney teaching hospitals*. Intern Med J, 2001. **31**(8): p. 455-461. doi: 10.1046/j.1445-
645 5994.2001.00109.x.
- 646 6. Lazarus, C. and J. Hamlyn, *Prevalence and documentation of malnutrition in hospitals: A case*
647 *study in a large private hospital setting*. Nutr Diet, 2005. **62**(1): p. 41-47.
- 648 7. Dupertuis, Y., et al., *Food intake in 1707 hospitalised patients: a prospective comprehensive*
649 *hospital survey*. Clin Nutr, 2003. **22**(2): p. 115-123. doi: 10.1054/clnu.2002.0623.
- 650 8. Hiesmayr, M., et al., *Decreased food intake is a risk factor for mortality in hospitalised*
651 *patients: The NutritionDay Survey 2006*. Clin Nutr
652 2009. **28**(5): p. 484-491.
- 653 9. Meier, R. and R. Stratton, *Basic concepts in nutrition: Epidemiology of malnutrition*. E Spen
654 Eur E J Clin Nutr Metab, 2008. **3**(4): p. e167-e170.
- 655 10. Volkert, D., *Malnutrition in the elderly -- prevalence, causes and corrective strategies*. Clin
656 Nutr
657 2002. **21**(Supplement 1): p. 110-112.
- 658 11. Kowanko, I., S. Simon, and J. Wood, *Energy and nutrient intake of patients in acute care*. J
659 Clin Nurs, 2001. **10**: p. 51-57.
- 660 12. Bauer, J., et al., *nutritionDay: An Australian hospital's participation in international*
661 *benchmarking on malnutrition*. Nutrition & Dietetics, 2011. **68**(2): p. 134-139.
- 662 13. WHO. Physical status: the use and interpretation of anthropometry. Report of a WHO Expert
663 Committee. WHO Technical Report Series 854. Geneva: World Health Organization. 1995.
664 September 20, 2010]; Available from: http://whqlibdoc.who.int/trs/WHO_TRS_854.pdf.
- 665 14. Ferguson, M., et al., *Development of a Valid and Reliable Malnutrition Screening Tool for*
666 *Adult Acute Hospital Patients*. Nutrition, 1999. **15**(6): p. 458-464. doi: 10.1016/S0899-
667 9007(99)00084-2.
- 668 15. Watterson, C., et al., *Evidence based guidelines for nutritional management of malnutrition in*
669 *adult patients across the continuum of care* Nutr Diet, 2009. **66**(s3): p. s1-s34.
- 670 16. Detsky, A., J. McLaughlin, and J. Baker, *What is Subjective Global Assessment of nutritional*
671 *status*. JPEN J Parenter Enteral Nutr, 1987. **11**(1): p. 8-13. doi: 10.1177/014860718701100108
- 672 17. ICD-10-AM: The International Statistical Classification of Diseases and Related Health
673 Problems. 2010, National Centre for Classification in Health, Faculty of Health Sciences, The
674 University of Sydney, New South Wales, Australia. p. 95-96.
- 675 18. Byron, A. and C. McCathie, *Casemix: the allied health response*. Med J Aust, 1998. **169**: p.
676 s46-s47.
- 677 19. Australian Council of Healthcare Standards. *The ACHS Evaluation and Quality Improvement*
678 *Program (EQUIP) 4*. 2009 [cited 2009 December 10]; Available from:
679 <http://www.achs.org.au/EQUIP4/>.
- 680 20. Mueller, C., et al., *A.S.P.E.N. Clinical Guidelines*. JPEN J Parenter Enteral Nutr, 2011. **35**(1): p.
681 16-24.
- 682 21. Volkert, D., et al., *ESPEN Guidelines on Enteral Nutrition: Geriatrics*. Clin Nutr
683 2006. **25**(2): p. 330-360.

- 684 22. Frew, E., J. Sequeira, and R. Cant, *Nutrition screening process for patients in acute public*
685 *hospital servicing an elderly, culturally diverse population* Nutr Diet, 2010. **67**: p. 71-76.
- 686 23. Pablo, A.M.R., M.A. Izaga, and L.A. Alday, *Assessment of nutritional status on hospital*
687 *admission: nutritional scores.* Eur J Clin Nutr, 2003. **57**(7): p. 824-831.
- 688 24. Mudge, A.M., et al., *Helping understand nutritional gaps in the elderly (HUNGER): A*
689 *prospective study of patient factors associated with inadequate nutritional intake in older*
690 *medical inpatients.* Clin Nutr
691 **In Press, Corrected Proof.**
- 692 25. Amaral, T., et al., *Undernutrition and associated factors among hospitalized patients.* Clin
693 Nutr, 2010. **29**(5): p. 580-585.
- 694 26. Nieuwenhuizen, W., et al., *Older adults and patients in need of nutritional support: Review of*
695 *current treatment options and factors influencing nutritional intake.* Clin Nutr
696 2010. **29**: p. 160-169.
- 697 27. Patel, M. and F. Martin, *Why don't elderly hospital inpatients eat adequately.* J Nutr Health
698 Aging, 2008. **12**(4): p. 227-231.
- 699 28. Naithani, S., et al., *Hospital inpatients' experiences of access to food: a qualitative interview*
700 *and observational study.* Health Expectations, 2008. **11**: p. 294-303.
- 701 29. Vivanti, A., et al., *Meal and food preferences of nutritionally at-risk inpatients admitted to*
702 *two Australian tertiary teaching hospitals.* Nutr Diet, 2008. **65**: p. 36-40.
- 703 30. Wright, L., et al., *Comparison of energy and protein intakes of older people consuming a*
704 *texture modified diet with a normal hospital diet.* J Hum Nutr Diet, 2005. **18**: p. 213-219.
- 705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721