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# Rehabilitation inpatients are not meeting their energy and protein needs

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## **Abstract**

**Background & aims:** This study aimed to determine the amounts of energy and protein required, ordered and consumed daily by long stay rehabilitation inpatients. **Methods:** A quantitative, weighed plate waste study. Thirty inpatients (16 females, 14 males; mean age 79.2 years; mean length of stay 52 days) from three rehabilitation hospitals in the Illawarra region of Australia. Data were collected over two days, including nutrition assessment details and weighed plate waste. Daily energy and protein requirements, amounts ordered and consumed were the outcome measures. Statistical analyses included paired t-tests, Wilcoxon Signed Rank tests and Spearman correlations. **Results:** Although adequate amounts of energy and protein were provided, significantly less was consumed than was required or ordered ( $p < 0.05$ ). Fifty-seven percent of the supplements were wasted, although they contributed 21.5% of energy and 20.6% of protein to the intakes of those who were prescribed them. **Conclusions:** Promising areas for interventions to improve intakes include the use of targeted supplement usage, food fortification, designated ward feeding assistants and ongoing nutrition surveillance.

## **Keywords**

Elderly, Nutritional status, Food service, Dietary intake, Hospital, Malnutrition

## **Disciplines**

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## **Rehabilitation inpatients are not meeting their energy and protein needs**

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**Conclusions:** Promising areas for interventions to improve intakes include the use of targeted supplement usage, food fortification, designated ward feeding assistants and ongoing nutrition surveillance.

## **Introduction**

The issue of malnutrition in hospital patients and the associated risks and complications were first identified over thirty years ago.<sup>1</sup> However the risk of patient malnutrition is still a very real issue in hospitals around the world today as patients are often admitted with multiple medical problems, may already be malnourished, or may be at an increased risk of malnutrition prior to admission.<sup>2</sup> Malnourished patients usually have longer lengths of stay (LOS), generate increased hospital costs, increased rates of complications and have an increased risk of adverse medical outcomes and mortality than well nourished patients.<sup>2-5</sup>

Information about the nutritional status of older, rehabilitation patients is limited but several studies estimate the rate of malnutrition to be between 29-63%.<sup>6-8</sup> The figures vary due to the assessment method used and the type of patients studied. Subjective Global Assessment (SGA) and Mini Nutrition Assessment (MNA) are two methods used in clinical practice to determine the nutritional status of patients. The SGA involves a review of weight history, dietary intake, gastrointestinal symptoms, functional capacity, nutritional requirements related to disease and physical examination to determine if a patient is 'A' well nourished, 'B' moderately malnourished or 'C' severely malnourished.<sup>9</sup> The MNA includes a review of anthropometry, a general assessment, dietary assessment and self assessment, and is used with older patients (>65 years). The maximum score is 30, with a score of less than 17 indicating malnutrition, between 17 and 23.5 suggesting 'at risk' of malnutrition and 24 or above indicating that the patient is well nourished.<sup>10</sup>

A recent Australian clinical study compared the nutritional status of patients in acute and rehabilitation settings using SGA and found much higher levels of malnutrition amongst the longer stay patients: 7-14% of acute care patients versus 49% of rehabilitation patients,  $P < 0.01$ .<sup>11</sup> Middleton et al<sup>12</sup> also used SGA to determine the nutritional status of 819 inpatients at two acute care Sydney hospitals and determined that 36% were malnourished. They also found the length of stay (LOS) of the older, malnourished patients to be significantly longer than for adequately nourished inpatients (17 days vs 11 days,  $P < 0.0005$ ) and mortality at 12 months follow up significantly greater ( $P < 0.0005$ ). Other studies have also found that malnutrition among older patients is associated with a longer LOS, delayed wound healing, higher readmission rates and discharge to higher level care.<sup>6,7,13</sup>

In 2004, people 65 years and over made up 13% of the general Australian population, but accounted for 32% of hospital separations and 51% of total bed days.<sup>14</sup> The average LOS for inpatients (excluding day-only) was 7.5 days, but 24% stayed longer than seven days, with 10% having a LOS greater than 14 days. The nutritional status of older people can deteriorate as their hospital stay extends<sup>3,8,15</sup> and in New South Wales (NSW), Australia, they have a much longer average LOS as inpatients: 11.5 days for those over 65 years versus 5.2 days for younger patients.<sup>16</sup>

Dietary intake in hospital is complex and can be influenced by numerous factors including: the appetite of the patient, their health status, interest in food, appearance of meals, degree of flexibility of the hospital food service, texture modified or restricted

therapeutic diet, amount of packaging, assistance required with eating, lack of acceptance of some of the foods provided <sup>2,17,18</sup>, differences between some patients' and staff concerns about mealtimes <sup>19</sup> and the lack of training in, and the low priority given to nutrition by some doctors and nurses <sup>19</sup>. Sullivan et al <sup>20</sup> reported that 20% of older hospitalized patients consume less than 50% of their estimated requirements and a recent pilot study with 346 patients in the USA found that patients with a longer LOS and/or altered textured diets had more plate waste. <sup>21</sup>

There appears to also be a lack of scientific research about the factors that influence food intakes positively and negatively in Australian and overseas hospitals. A current research project from our centre has quantitative and qualitative components that include weighed food records to determine dietary intakes, and observations and interviews with staff and inpatients in a number of rehabilitation settings. It is investigating factors that impact on food intakes by inpatients, as well as attempting to determine priority opportunities for ongoing improvement.<sup>22</sup> The qualitative findings will be reported in a future publication and this paper reports some of the quantitative findings. This study aimed:

1. To calculate the estimated daily energy and protein requirements, and compare these with the provision of foods ordered and consumed by patients.
2. To calculate the contribution of supplements to intakes.
3. To identify opportunities for interventions to improve the nutritional care of long stay inpatients.

## **Methods**

### **Study Population**

Thirty inpatients were recruited from three rehabilitation wards in the Illawarra region of NSW, Australia. The hospitals included one private and two public, with varying food service systems (both cook fresh and cook chill) and menu ordering procedures (using paper menus and *CBORD*<sup>™</sup> on palm pilots).

### **Study Design**

The study involved two day visits during each data collection period. The chief investigator, a dietitian and PhD candidate, was assisted by a team of four student dietitians who worked as research assistants. Convenience sampling was utilized with the Nurse Unit Manager (NUM) or delegate inviting patients within a shared room of four to five to take part in the study. The study was explained, and written consent was obtained by the chief investigator. Three separate visits were made to the first site, two visits to the second and one to the third, which totaled 12 days of data collection. An additional one day pilot study was also conducted prior to the first data collection period. This allowed a trial of all procedures and forms as well as providing onsite training for the research assistants.

### **Inclusion and Exclusion Criteria**

Inclusion criteria included any patient within a shared room in the rehabilitation ward who gave consent. Exclusion criteria included anyone less than 18 years old, or those who were nil by mouth, or receiving enteral or parenteral nutrition.

**Determining estimated daily requirements**

Quantitative data were collected about each patient from the medical records by the chief investigator. Data on weight, height, body mass index (BMI), diet type, age, reason for admission, nutrition assessment (from the medical notes if conducted) and meal orders from the tray ticket or menu slip were recorded. This was used to determine each individual's estimated daily requirements for protein and energy, in addition to describing the study population.

**Determining nutritional status**

Where available, the details about the assessment of nutritional status were obtained from the medical record. These assessments reflect the clinical assessments made by the usual ward dietitians who work in the study locations. Nutrition assessment (SGA for those under 65 years and MNA for those over 65 years) was conducted by the student researchers on eight patients for whom assessment hadn't been formally undertaken and documented in the medical notes.

**Weighing standard meals and plate waste**

One set of electronic scales (CAS Smart Weighing Scale SW-1; accurate to  $\pm 1$ g) were used to determine all food and beverage weights. Their accuracy was reviewed before each use by checking the mass of two known standard weights. A copy of the standard serve sizes of each food and fluid item was provided by each of the hospital food service departments. Duplicate samples of each meal and beverage option were requested so they could provide baseline information about weights and be compared to the standard serve size information. After the meal trays were collected by the food service assistants, the

foods and beverages left on them were weighed to determine the amounts eaten at each meal, and compared to the standard serve sizes. Many snack and beverage items were commercially packaged with known weights. Intakes of between-meal snacks provided by the hospital and visitors were estimated by observations and questions asked of the patients on the last afternoon of each data collection period.

## **Data Analysis**

### *Determining estimated daily requirements*

Estimated daily energy and protein requirements were calculated for each patient using the Schofield equation, as recommended in Australia<sup>23</sup> and the Recommended Dietary Intakes (RDI's) for protein.<sup>24</sup> Estimated energy and protein requirements were determined using a mean activity factor of 1.3 ( range of 1.2-1.4), a mean injury factor of 1.2 (range of 1-1.5) and a mean protein requirement of 1.1g/kg/day (range of 1-1.3), which is in line with the amounts recommended by the Committee of Experts on Nutrition, Food Safety and Consumer Protection<sup>25</sup>. The level of activity used was based on observations, while the injury factor and protein requirements considered the medical condition of each individual patient. The estimated amounts of energy and protein required were compared to the amounts ordered and consumed by the patients.

Estimates by the ward dietitian of daily energy and protein requirements were also available at two of the three settings, but given the possible variation in methods used, the single set of the values determined by the chief investigator were used for comparison.

### *Weighing standard meals and plate waste*

FoodWorks (Professional Edition) nutrient analysis software (Version 4, 1998-2003, Xyris Software Pty Ltd, Highgate Hill, Australia) <sup>26</sup> was utilized to calculate the estimated energy and protein content of the food ordered and consumed for each patient. Where available, actual nutrient analyses of recipes were entered into FoodWorks.

### *Statistical Analyses*

A power calculation (where  $P=0.05$  and the power is 90%) showed that 13 patients would be sufficient to detect a deficit of 1000kJ (SD of 1000kJ) energy and 10g (SD of 10g) protein, between actual and required intakes. Means and standard deviations were calculated for the data set of the estimated requirements, amounts ordered and amounts consumed. The Shapiro-Wilk test of normality was also used. Paired samples t-tests were used for parametric data and Wilcoxon Signed Rank tests were used for the non-parametric data. Bivariate correlation (using Spearman's rho) was used to determine the strength of relationship between LOS vs age, LOS vs energy intakes and age vs energy intakes. All statistical analyses were completed using the Statistical Package for the Social Sciences (SPSS Version 11.5 for Windows, 2001, SPSS Inc., Chicago, IL).<sup>27</sup>

### **Ethics**

Ethics approval for the study was obtained from the University of Wollongong and Illawarra Area Health Service Human Research Ethics Committee in 2004. Written consent was obtained from patients or their next of kin where the patient was cognitively unable to provide informed consent. Verbal consent was obtained from staff and visitors.

## Results

Table 1 summarizes the patient characteristics. The patients (16 female, 14 male) had an average age of  $79.2 \pm 11.9$  years (with three patients younger than 65 years) and a mean length of stay of  $52.8 \pm 32.6$  days (range 33-133 days). Thirteen patients had a BMI less than  $24\text{kg/m}^2$ , which is below the healthy range recommended for older patients<sup>28</sup>. Fractures were the most common reason for admission (33%) and high protein high energy (HPHE) diets (60%) were the most common diets ordered. As would be expected in this age group, texture modified diets (47%) also were common, as were multiple diet modifications. There was a medium strength, negative relationship between the length of stay and energy intakes of the patients ( $r=-0.380$ ,  $n=30$ ,  $p<0.05$ ).

Given the high mean age, the SGA was used for only 10% patients and the MNA was utilized for the remainder. Thirty-seven percent of the patients were found to be malnourished, while 40% were certainly 'at risk' and 23% appeared to be 'nourished' as indicated in Table 1.

The reliability of standard portion sizes was evaluated by weighing a range of standard food and beverage items.. The serving sizes of the items available were usually within 10% of the stated standard serve size, but there were some variations, with main protein dishes approximately 3% larger, soups 14% smaller and in house dairy desserts 9% smaller.

Although the amounts of energy and protein ordered were adequate, significantly less was consumed on average, than was required or ordered ( $p < 0.05$ ). Table 2 outlines the means and standard deviations of the estimated amounts of protein and energy required, ordered and consumed.

Only seven patients (2 well nourished, 3 at risk and 2 malnourished) met their individual estimated energy requirements and eight (2 well nourished, 2 at risk and 4 malnourished) met their estimated daily protein requirements, with a further three patients consuming above 97.5% of their estimated daily protein requirements.

Table 3 indicates the contribution of energy and protein at various meal times. A large proportion of energy (28%) was provided by the snacks (morning tea, afternoon tea and supper), but the largest amount consumed was at breakfast (29%). The largest protein provision was at lunch, followed by tea, with the mean consumption mirroring these provisions.

The mean contribution of macronutrients to energy was 17% protein, 31% fat and 52% carbohydrate for the foods and beverages ordered and consumed. On average the mass of foods and beverages provided each day was 3009g, and the wastage was approximately 27% (by weight). The snacks had the largest amount of wastage on average (mean of 40% of energy and 43% of protein from snacks was not consumed).

Thirteen patients were receiving high protein, high energy supplements in the form of commercial drinks and puddings. Table 4 indicates that while only 43% of these supplements were consumed, they did contribute over 20% of the energy and protein intakes of the supplemented patients.

## **Discussion**

### **Energy and protein required, ordered and consumed**

While adequate amounts of energy and protein were provided, most patients did not consume their estimated daily requirements. The average intake recorded in this study (73% of all foods and beverages provided) is similar to that reported previously in the literature. Schenker<sup>29</sup> reported that the average food intake by the hospitalized elderly was less than 75% of the amount required.

Energy and protein provision was spread across the day in three meals and three snacks, suggesting that all meals have a role to play in offering choices and opportunities for nourishing options. Many patients received a hot breakfast, and had the opportunity for an additional high protein choice from 'real' foods. The findings of this study support other studies that have found hot breakfasts are an important strategy for increasing patient food intake.<sup>30</sup> Snacks, which often consisted of milk-based drinks and puddings, had the largest amount of wastage (57%). The findings highlight the need for greater choices at snack times, targeting nourishing snacks more appropriately and monitoring their intakes. Several hospitals have reported success with mid meal 'snack trolleys' where patients can choose from a range of options (including options such as yoghurt, cheese, biscuits and chocolate) at the time of consumption if their diet type allows.

### **Supplement usage**

While only 43% of supplements ordered were consumed on average, they did contribute significantly to the intakes of the supplemented patients. This provides further evidence that high protein/high energy diets and supplements only partly addresses the problems of

inadequate intakes of elderly hospitalized patients. Clearly adequate amounts of foods and beverages were provided, however a plethora of reasons inhibited their intakes, including the amounts offered, palatability, flavour fatigue, patient appetite, packaging, access issues, not being 'real' food, too much food, served at room temperature, no serving equipment or inadequate assistance.<sup>29, 31,32</sup>

Larsson et al<sup>33</sup> reported a great benefit from supplements used prophylactically, to prevent deterioration in patients 'at risk' of malnutrition. They investigated the influence of nutrition supplements on the clinical outcome of 501 geriatric patients given either a standard diet (2200kcal) or a standard diet supplemented with an additional 400kcal. Nutritional status was determined at admission, eight weeks and 26 weeks and 41% of those initially malnourished (28% of the total) were no longer so after intervention.

### **Nutrition status, reasons for admission and diet type**

Nutritional status can be defined as a 'dynamic state', with no single or standard way of measuring.<sup>29</sup> The rate of malnutrition reported in this study (37%) and the rate of those 'at risk' (40%) is certainly in line with other studies in this area<sup>3,8,11,12</sup>, highlighting the seriousness of this issue and the need to identify it early so as to assist by putting appropriate intervention strategies in place. Three of the patients were younger than 65 years (two males aged 39 and 59 years and one female aged 61 years), but even when their data were removed from the statistical analyses significant differences remained in both the energy and the protein results.

Only three-quarters of the patients in the current study had a formal nutrition assessment conducted and documented during their admission. There is a need for ongoing nutritional surveillance of long stay inpatients.<sup>13</sup> Malnourished patients need effective dietetic treatments and close monitoring, as do those who are determined to be 'at risk' of malnutrition as this second group needs to be carefully monitored to try to prevent the transition to malnutrition.<sup>29</sup>

The reason for admission and type of diet required may also impact on the amounts of food and beverages consumed, and the nutritional status of the patient. One-third of the patients were admitted with fractures so it is no surprise that a large proportion of patients (60%) were receiving high protein/high energy diets to provide additional nutritional support to assist with wound healing and meet rehabilitation demands. Cerebrovascular accidents were the second highest reason for admission (23%), which accounts for the large number of texture modified diets (47%), and also contributed to the large amount of high protein/high energy supplemented diets. Wright et al<sup>34</sup> investigated the intakes of 25 older patients on normal textured diets and 30 older patients on texture modified diets. They reported that patients in the texture modified group had a significantly lower intake of energy and protein compared to those on a normal diet. Kandiah et al<sup>21</sup> reviewed the plate wastage of 346 patients at lunch over four days and demonstrated a relationship between LOS and increased plate waste, and also texture modified diets and increased waste.

Nutritional treatment for malnutrition in the elderly can positively influence body composition, muscular strength for some, in addition to well-being and immune function.<sup>35</sup> Oral nutritional supplements and food fortification can certainly positively influence dietary intakes, however it is important to tailor them to meet the needs of individual patients. Given the multitude of issues that can influence intakes, successful treatment relies not only on timely nutrition screening and assessment, but also on finding priority, practical intervention strategies that can be monitored so as to maximize intakes by patients. Numerous strategies are used in practice to varying extents and degrees of success, including: the use of commercial supplements<sup>33,36</sup>, prescription of commercial supplements on the medication charts<sup>37-38</sup>, high protein, high energy diets, fortifying real foods with protein and calories<sup>31-32,39</sup>, small, frequent meals and snacks<sup>17,29</sup> and offering a bulk food service, with meal size and food choices available at the time of consumption.<sup>40,41</sup>

Clearly there will never be a 'one size fits all' intervention to optimise dietary intakes, just as increasing nutrient provisions in no way guarantees improved intakes. An ongoing concerted effort is necessary on the part of all involved in patient care, from nutritional screening and assessment, menu and food provision, feeding assistance to inpatients and monitoring, particularly for aged and/or long stay patients.

## **Limitations**

One of the limitations of the study was the small sample size but the significant results indicate that this hasn't impacted on the conclusions drawn. Nematy et al<sup>42</sup> also used a relatively small sample of 25 subjects in a study of elderly patients requiring nutritional support. A second limitation was the fact that food intake data was only collected from breakfast to supper each day, so that snacks outside these hours may have been missed. However, questions were asked about any overnight consumption, as well as the food and beverage items brought in, so that estimates could be made of such items.

Subtracting the weighed plate waste from the standard serve size information for food and beverage items in order to calculate the amounts consumed for each meal component is another limitation. Although weighing each item before service would be the ideal method for practical reasons this method was not able to be adopted.<sup>40,41</sup> However measurement of a sample of standard serves indicated that this is not likely to have affected the findings significantly; even if all patients had received larger serves than the standard amounts and eaten 10% more than calculated, the average intake would still not have met the estimated requirements.

The fact that this was an overt study may have influenced some behaviours and resultant intakes, however more than one day was included at each site to attempt to minimize this bias. At least two patients required assistance with packaging at times and the researchers provided assistance when asked, which would have positively influenced some intakes in this study.

Nutritional assessments were conducted by a variety of practitioners as part of normal hospital care practice. Where this had not been undertaken (eight patients) the researchers conducted the assessments. This may have introduced inconsistency into the nutrition assessment categories, but the proportions of patients found to be at risk, or malnourished were similar to those reported in other rehabilitation populations<sup>11</sup>.

## **Conclusion**

This study supports the findings of other studies in that adequate nutrition support of long stay rehabilitation patients is difficult in the hospital setting. While adequate amounts of energy and protein were provided, very few patients met their estimated daily requirements. Supplements were often utilized to provide additional nutrients, and while they contributed approximately one-fifth of the energy and protein to those receiving them, more than half of the supplements were wasted, highlighting the need for other strategies to assist, and the importance of targeting supplements to enhance effectiveness and reduce costly waste. Further studies are urgently needed to investigate the effectiveness of targeted interventions to support dietary intakes, particularly for elderly rehabilitation patients.

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**Table 1: Reasons for admission, diet type and nutritional status of the participants**

<b>Variable</b>	<b>No.</b>	<b>Percentage (%)</b>
<b>Males</b>	14	47
<b>Females</b>	16	53
<b>Reason for admission</b>		
- CVA	7	23
- Fracture	10	33
- Skeletal surgery	4	13
- Brain haemorrhage	2	7
- Fall	2	7
- Miscellaneous	5	17
<b>Diet type</b>		
- Full/Diabetes	12	40
- Puree/Minced/ Thick HPHE	4	13
- Soft HPHE	10	34
- HPHE	4	13
<b>Nutrition Assessment</b>		
- Malnourished	11	37
- At Risk	12	40
- Nourished	7	23
<b>Weight (kg)</b>		
- Range	42-123	
- Mean	68.9	
- SD	16.2	
<b>BMI (kg/m<sup>2</sup>)</b>		
- <24	13	43
- 24-29	14	47
- 29+	3	10

**Legend:** CVA: cerebrovascular accident, HPHE: high protein high energy

**Table 2: Mean estimated daily amounts of protein and energy ordered, required and consumed (n=30)**

<b>Category</b>	<b>Protein (g/day)</b>	<b>Energy (kJ/day)</b>
Ordered (mean $\pm$ SD)	95 ( $\pm$ 32)	10103 ( $\pm$ 2686)
Required (mean $\pm$ SD)	76 ( $\pm$ 8)	8380 ( $\pm$ 907)
Consumed (mean $\pm$ SD)	67 ( $\pm$ 25)	7029 ( $\pm$ 2233)
Ordered vs Required (mean, p value)	19 (0.008*)	1723 (0.001*)
Ordered vs Consumed (mean, p value)	28 (0.000*)	3074 (0.000*)
Consumed vs Required (mean, p value)	9 (0.046 #)	1351 (0.003 #)

**Legend:** \* Wilcoxon Signed Rank test and # Paired samples t-test

**Table 3: Mean energy and protein at each meal time: amounts provided and consumed (n=30)**

<b>Meal time</b>	<b>Energy (kJ)</b>		<b>Protein (g)</b>	
	<b>Ordered</b>	<b>Consumed</b>	<b>Ordered</b>	<b>Consumed</b>
<b>Breakfast</b>	2670	2039	20.1	15.5
<b>Lunch</b>	2434	1736	29.2	21.1
<b>Tea</b>	2292	1687	27.5	20.4
<b>Snacks</b>	2889	1717	19.5	11.2

**Table 4: High protein, high energy supplement usage (n=13)**

<b>Supplements</b>	<b>Energy</b>	<b>Protein</b>
<b>Mean amounts provided</b>	3627kJ	33.4g
<b>Mean amounts consumed</b>	1532kJ	14.8g
<b>Proportion of amount provided</b>	42%	44%
<b>Contribution to total intakes</b>	21.5%	20.6%