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# Are energy and protein requirements met in hospital?

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7 **Abstract**

8

9 **Background:** Malnutrition is a problem within hospitals, which impacts on clinical outcomes. This  
10 audit assesses whether a hospital menu meets the energy and protein standards recommended by the  
11 British Dietetic Association's (BDA) Nutrition and Hydration Digest and determines the  
12 contribution of oral nutrition supplements (ONS), and additional snacks.

13 **Methods:** Patients in a UK South West hospital were categorised as 'nutritionally well' or  
14 'nutritionally vulnerable' according to their Malnutrition Universal Screening Tool score. Energy  
15 and protein content of food selected from the menu ('menu choice'), menu food consumed  
16 ('hospital intake') and total food consumed including snacks ('overall intake') were calculated and  
17 compared to the standards.

18 **Results:** In total 93 patients were included. For 'nutritionally well' patients (n=81) energy and  
19 protein standards were met by 11.1% and 33.3% ('menu choice'), 7.4% and 22.2% ('hospital  
20 intake') and 14.8% and 28.4% ('overall intake'). For 'nutritionally vulnerable' patients (n=12)  
21 energy and protein standards were met by 0% and 8.3% ('menu choice'), 0% and 8.3% ('hospital  
22 intake') and 8.3% and 16.7% ('overall intake'). Ten percent of patients consumed ONS. Patients  
23 who consumed hospital snacks (34%) were more likely to meet the nutrient standards ( $p \leq 0.001$ ).

24 **Conclusions:** This audit demonstrated that the majority of patients are not meeting the nutrient  
25 standards recommended by the BDA Nutrition and Hydration Digest. Recommendations include  
26 provision of energy/protein-dense snacks and menu, offering ONS where clinically indicated, and  
27 training for staff. A food services dietitian is ideally placed to lead this, forming a vital link  
28 between patients, caterers and clinical teams.

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### 33 **Introduction**

34 Nutritional problems in hospital patients are complex, resulting from both the consequences of  
35 disease and an altered food intake <sup>(1)</sup>. *‘Malnutrition is a state of nutrition in which a deficiency or*  
36 *excess (or imbalance) of energy, protein and other nutrients causes measurable adverse effects on*  
37 *tissue / body form (body shape, size and composition) and function and clinical outcome’* <sup>(2)</sup>.  
38 Consequences include increased infections and hospital admissions, prolonged recovery and  
39 increased mortality <sup>(3)</sup>. Previous research revealed that 29% of patients admitted to hospitals in the  
40 United Kingdom (UK) were at risk of malnutrition <sup>(4)</sup>, with hospitalisation potentially leading to  
41 further deterioration of nutritional status <sup>(5)</sup>. Due to its widespread health consequences,  
42 malnutrition is estimated to cost up to £19.6 billion annually in England <sup>(6)</sup>. Unfortunately, it is  
43 often an unrecognised and untreated problem within hospitals <sup>(6)</sup>. Consequently, the National  
44 Institute for Health and Clinical Excellence (NICE) identified that improved nutritional care could  
45 be one of the largest potential sources of cost saving to the NHS <sup>(7)</sup>.

46 The provision of food is integral to the prevention of malnutrition <sup>(8)</sup> and hospital menus should  
47 provide suitable food choices for all patients <sup>(9)</sup>. Energy and protein intakes are frequently  
48 insufficient to meet patients’ nutritional requirements <sup>(10)</sup> and as a result, the British Dietetic  
49 Association (BDA) published The Nutrition and Hydration Digest (The Digest) <sup>(9)</sup>, an evidence-  
50 based document applicable to all NHS hospitals <sup>(11)</sup>. The Digest provides information for best  
51 practice and auditable standards <sup>(12)</sup>. The nutrient standards which categorise inpatients into  
52 ‘nutritionally well’ and ‘nutritionally vulnerable’ (Table 1) are based on the Dietary Reference  
53 Values (DRVs) and British Association for Enteral and Parenteral Nutrition (BAPEN)  
54 recommendations <sup>(13)</sup>.

55 Although reasons for malnutrition are multifactorial, inadequate dietary intake is a principal factor  
56 in its development <sup>(14)</sup>. Barriers to an adequate dietary intake include interrupted meals, unwanted  
57 food, poor appetite, nausea and fatigue <sup>(15)</sup>. Patients often have higher nutritional requirements due  
58 to increased gluconeogenesis, muscle catabolism, and decreased absorption <sup>(16)</sup>. The development of  
59 validated screening tools, such as the Malnutrition Universal Screening Tool (MUST) <sup>(17)</sup>, has  
60 allowed for early detection and effective treatment <sup>(18)</sup>.

61 Clinical audit is an effective way of assessing and improving nutritional care within hospitals <sup>(19)</sup>. A  
62 systematic review highlighted the need for more effective evaluations and auditing of dietary intake  
63 within hospitals <sup>(20)</sup>. Although audits have been conducted, generalisability is often limited due to  
64 the assessment of specific patient populations and a lack of detail within dietary recall <sup>(21)</sup>.  
65 Furthermore, as well as concern about the adequacy of food intake, questions remain as to whether

66 patients make appropriate food choices. Assessing the nutritional content of patients' menu choices  
67 is important so that menus can be reviewed and updated as required <sup>(22)</sup>. BAPEN <sup>(17)</sup> recommends  
68 that audit measures include the nutritional content of the menu in addition to food intake.

69 Food fortification, hospital snacks and oral nutritional supplements (ONS) have been shown to  
70 positively impact on a patient's nutritional status <sup>(23)</sup>. However, it has been argued that both energy  
71 and protein requirements should be met through hospital meals alone due to the low protein content  
72 of many snacks <sup>(24)</sup> and to prevent reliance on ONS as a substitute for adequate food provision <sup>(25)</sup>. It  
73 is therefore important to understand to what extent hospital meals meet the nutrient standards, in  
74 order to assess the need and contribution of additional food items <sup>(25)</sup>. Research suggests that up to  
75 63% of patients consume non-hospital foods during their admission, which could have a significant  
76 impact on their nutritional status <sup>(26)</sup>. The potential for their contribution to reducing malnutrition  
77 highlights the importance of assessing the nutritional content of these non-hospital foods.

78 Although previous audits have investigated the provision of nutrition within hospitals <sup>(27)</sup> the extent  
79 to which hospitals are meeting the nutrient standards set by The Digest and the contribution of  
80 supplementary food items to nutritional intake have yet to be explored. This audit aimed to  
81 determine whether patients' choice and consumption of food from a South West Hospital menu,  
82 met nutrient standards for adults recommended by The Digest <sup>(9)</sup>. The secondary aim was to  
83 evaluate the contribution made by supplementary food items (hospital snacks, non-hospital food &  
84 drinks and prescribed ONS) to patients' overall intake of energy and protein.

85

## 86 **Methods**

### 87 **Participants:**

88 This audit recruited patients from a South West hospital in the UK in April-May 2015. Patients  
89 were selected from 24 inpatient wards across the hospital, excluding critical care, admission and  
90 maternity wards where a complete 24-hour dietary recall would be difficult to obtain. To eliminate  
91 human bias in selection, a systematic method including selecting from the 5<sup>th</sup>, 10<sup>th</sup>, 15<sup>th</sup> and 20<sup>th</sup>  
92 patients from a list, in line with previous Trust audits, was used on all the eligible wards.

93 Participants were excluded if they selected from a special diet menu (e.g gluten free, renal, modified  
94 consistency), did not receive all daily meals, were terminally ill, cognitively impaired, barrier  
95 nursed or had an incomplete MUST screening. Due to limited access to medical notes to assess  
96 appetite, oral intake prior to data collection and specific nutritional requirements, categorisation of

97 participants by MUST score allowed appropriate target nutrient levels, as outlined by the BDA  
98 (Table 1), to be identified. MUST scores, which had been calculated by the ward staff, were used to  
99 categorise patients as nutritionally well (MUST 0) or vulnerable (MUST  $\geq 1$ ) (Table 1).

100 The audit was registered with and approved by the Plymouth Hospitals NHS Trust and compliant  
101 with the Data Protection Act <sup>(28)</sup>.

### 102 **Dietary Assessment:**

103 A 24-hour dietary recall was conducted with each patient, using an audit tool developed for this  
104 audit (Appendix 1) and visual prompts for more accurate recall. The audit tool was adapted from a  
105 validated dietary assessment tool <sup>(29)</sup> and piloted with six patients who were asked to give feedback  
106 following the use of the audit tool on the format/questions, and whether it was clear and  
107 understandable. The pilot study did not highlight any areas that needed to be adapted, therefore their  
108 data was included in the final results. In addition to the adapted validated dietary assessment tool,  
109 patients were asked to provide as much detail as possible about the food and drink they had  
110 consumed over the past 24 hours and were provided with the hospital menu and visual aids (pictures  
111 showing a 1/4, 1/2, 3/4 and full plate of food) for the amount they consumed. Patients were asked if  
112 they were taking any nutritional supplement drinks (Options: Yes or No. If yes, how many per  
113 day?) and pictures of ONS were shown as a prompt for recall. Consumption was checked against  
114 the fluid charts. This recall included the breakfast selection on the morning of data collection, lunch  
115 and dinner from the previous day, as well as snacks provided by the hospital (e.g. biscuits, cheese  
116 and biscuits) and non-hospital food & drinks (e.g. any food brought in by the patient, friends and/or  
117 family). Additional questions included: 'Was the portion size correct?' (Options: Too Big, Plenty,  
118 Acceptable or Too Small) and 'Did you eat any food apart from hospital food?' Energy and protein  
119 intakes were estimated using a pre-analysed hospital menu provided by the catering company  
120 *Apetito*, McCance and Widdowson's 'The Composition of Foods' <sup>(30)</sup> and photographs of food  
121 portion sizes <sup>(31)</sup>. Where brands were specified, manufacturers' websites were used to determine the  
122 nutritional content. Three different dietary measurements: 'menu choice', 'hospital intake' and  
123 'overall intake' (Table 2) were compared against the nutrient standards (Table 1).

### 124 **Statistical Analysis**

125 Anonymised data were analysed using the Statistical Package for the Social Sciences (SPSS),  
126 version 21 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to describe the  
127 demographic characteristics of the participants. All tests were two-tailed and independent. As data  
128 from nutritionally well patients were normally distributed, a one-sample t-test was used to  
129 determine any significant differences between the energy and protein content of the nutritional

130 standards and ‘menu choice’, ‘hospital intake’ or ‘overall intake’ (Table 3). ONS were not included  
131 in overall intake so as to assess the adequacy of a food first approach, but their contribution to  
132 nutritional intake was assessed separately (Table 4). Due to low numbers in the nutritionally  
133 vulnerable category, the non-parametric one-sample Wilcoxon signed rank test was used to analyse  
134 this data. A Pearson’s chi squared test was used to compare the number of patients meeting the  
135 nutrient standards for energy and protein in those who did and did not receive hospital snacks and  
136 non hospital food & drink respectively. Additionally, an independent–samples t-test was used to  
137 demonstrate any differences between energy and protein intakes in those who did and did not  
138 receive non-hospital food & drinks.

139

## 140 **Results**

141 One hundred and twelve patients were reviewed, 19 of whom were excluded for having an  
142 incomplete MUST or an incomplete dietary recall. The median age was 70 years, with a range of  
143 23-97 years. Of the 93 patients included, 81 were classified as nutritionally well (87%) and 12 were  
144 classified as nutritionally vulnerable (13%). Average nutritional values for ‘menu choice’, ‘hospital  
145 intake’ and ‘overall intake’ are shown in Table 3.

146 Significantly lower values for energy provision ( $p \leq 0.001$ ) were observed in ‘menu choice’,  
147 ‘hospital intake’ and ‘overall intake’ when compared to the lower end of the energy standards for  
148 nutritionally well patients ( $n=81$ ). For protein, nutritionally well male patients’ ‘menu choice’,  
149 ‘hospital intake’ and ‘overall intake’ were significantly lower ( $p \leq 0.001$ ) than the nutrient standards.  
150 In females, in whom the standard for protein intake is lower than that for males, a significant  
151 difference was found between the standards and ‘hospital intake’ ( $p=0.002$ ). For nutritionally  
152 vulnerable patients energy and protein intakes were significantly lower than the standards in all  
153 three dietary categories ( $n=12$ ) (Table 3).

154 The proportion of patients meeting the nutrient standards is demonstrated in Figure 1. The  
155 percentages of patients receiving ONS, hospital snacks and non-hospital foods/drinks were  
156 compared, as well as their average nutritional contents (Table 4).

## 157 **Hospital Snacks**

158 Although 39 patients were offered hospital snacks, only 32 of these patients consumed them. An  
159 additional 2 patients had to ask for hospital snacks in order to receive them. Of those who consumed  
160 hospital snacks ( $n=34$ ), 15% ( $n = 5$ ) met the energy standards compared to 2% ( $n=1$ ) of those who

161 did not consume snacks (n=60) (p=0.011). Of patients who consumed hospital snacks, 41% (n = 14)  
162 met the protein nutrient standards compared to 9% (n=5) of those who did not (p≤0.001).

163

#### 164 **Non-hospital food & drink**

165 A significant difference was found in energy intake between those who did and did not receive non-  
166 hospital food & drinks. Those who received non-hospital food & drink consumed a mean (SD)  
167 daily energy intake of 1375 kcal/5753 kJ (509 kcal/2131 kJ), as compared to those who did not  
168 who consumed a mean (SD) daily energy intake of 1102 kcal/4611 kJ (520 kcal/2176 kJ);  
169  $t(85.18)=-2.53$ ;  $p=0.013$ ). No significant difference was found in protein intake between those who  
170 consumed non-hospital food & drink and those who did not ( $p=0.322$ ). Consumption of non  
171 hospital food & drink did not result in any significant difference in the numbers of participants  
172 meeting the nutrient standards for energy ( $X^2(1)=1.09$ ;  $p=0.297$ ) or protein ( $X^2(1)=0.212$ ;  
173  $p=0.645$ ).

#### 174 **Portion size and content**

175 Patients rated portion sizes as ‘acceptable/plenty’ (nutritionally well 81%, nutritionally vulnerable  
176 75%), ‘too big’ (nutritionally well 15%, nutritionally vulnerable 8%) or ‘too small’ (nutritionally  
177 well 4%, nutritionally vulnerable 17%). Based on the menu dietary coding 15% of patients chose  
178 energy dense main dishes ( $\geq 350$  kcal/ $\geq 1464$  kJ) and 25% chose energy-dense desserts ( $\geq 250$   
179 kcal/ $\geq 1046$  kJ).

180

#### 181 **Discussion**

182 In a move towards addressing malnutrition in hospitals, the Hospital Foods Standards Panel  
183 identified The Digest as being highly relevant to improving hospital food provision <sup>(11)</sup>. Providing  
184 guidelines to facilitate the adequate delivery of food services within hospitals, The Digest offers the  
185 opportunity for a positive change. In identifying aspects of the standards not being met, and factors  
186 contributing to this, it is possible to implement change to address the ongoing problem of  
187 malnutrition in hospitals. This audit investigated whether the energy and protein provided by the  
188 hospital menu met guidelines and builds on previous audits to develop a more detailed account of  
189 patients’ intake, including the contribution of ONS, hospital snacks and non-hospital food & drinks.

190 The results demonstrate that the mean energy and protein content of the ‘hospital foods consumed’  
191 was significantly lower than that recommended by The Digest (Table 3). This audit supports the  
192 findings from a comparative study in Switzerland <sup>(32)</sup>, which indicates consistent rates of inadequate  
193 intake of more than 70% over the past 15 years. A previous hospital survey found that patients  
194 consumed an average of 1536kcal/6427kJ and 58g protein <sup>(10)</sup> and only 41% of older patients met  
195 their energy requirements <sup>(33)</sup>. Nutritional intakes observed in this audit were considerably lower.  
196 The use of generic requirements as opposed to individual calculated requirements based on body  
197 weight may have contributed to the differences observed in the percentage of patients that met the  
198 recommendations. The lower end of The Digests’ standards used within this audit are based on the  
199 Estimated Average Requirements (EARs), which are meant for groups of healthy free-living people,  
200 who are likely to have significantly higher activity levels than that of hospitalised patients. In  
201 contrast, the lower end of the standards used are also based on the nutritional needs of a 75+ year  
202 old woman. Although some patients’ requirements may be higher than this, perhaps resulting in an  
203 overestimation of patients that met the nutrient standards, it must also be considered that patients’  
204 requirements may also be reduced due to a reduction in energy expenditure during hospitalisation.  
205 Considering gender, age and weight when determining nutrient standards may help provide a more  
206 accurate number of patients meeting their nutritional requirements.

207 Furthermore, the use of self-reported dietary intakes, as opposed to observations, could have  
208 affected the result <sup>(10) (33)</sup>. Although the use of self-reported estimations have been validated against  
209 direct weighing methods and observation <sup>(34)</sup>, Følri et al. reported that patients significantly under-  
210 reported their intake when compared to recalls of trained observers <sup>(29)</sup>. It is important to note that  
211 the dietary assessment tool used in this audit was adapted from a previous study and did not go  
212 through a formal validation process itself. An alternative validated method that could have  
213 increased the accuracy of dietary estimation would be incorporating technology. For example  
214 weighing foods and photographic documentation to allow more detailed analysis <sup>(35)</sup>.

215 A higher percentage of patients met the nutrient standards for protein than for energy (Figure 1).  
216 When energy intake is inadequate, the body will find an alternative metabolic fuel, in this case  
217 protein, preventing its use for tissue protein synthesis <sup>(36)</sup>. In those deficient in both energy and  
218 protein the body will break down healthy muscle and tissue, leading to decreased muscle mass,  
219 disruption of vital organ systems, poor wound healing, and prolonged rehabilitation <sup>(37)</sup>.

220 The majority of patients in this audit would not have meet the nutrient standards for energy and  
221 protein even if they had consumed all of the chosen food provided by the hospital (Figure 1). This  
222 suggests that in addition to the menu that provides coded information for high energy options,



223 patients would benefit from further support in making the most appropriate dietary choices. It is  
224 possible that patients are not always offered the full choice available, including snacks and that  
225 there is a lack of nutritional guidance for food choice, particularly for those at nutritional risk <sup>(35)</sup>.  
226 Naithani et al. reported 3% of patients had difficulty completing the menu order form, and 30%  
227 found it difficult to choose the right foods because of a lack of information <sup>(38)</sup>. Health-care  
228 professionals have the responsibility to facilitate patients in making appropriate food choices <sup>(39)</sup>. In  
229 order for this to happen, staff should receive dietitian-led training to help patients make appropriate  
230 food choices.

231 The vast majority of patients rated portions sizes as ‘acceptable/plenty’, however some evaluated  
232 that they were either ‘too big’ or ‘too small’. Elderly orthopaedic patients have been found to  
233 consume more energy and protein when offered larger portions <sup>(40)</sup>, however providing too large  
234 portions can limit patients’ ability to consume the food <sup>(41)</sup>. Conflicting research into the  
235 effectiveness of increasing portion size on energy and protein intake limits its application in a  
236 hospital setting <sup>(42)</sup>. Food fortification has been suggested as an alternative to larger portions,  
237 although some argue that the addition of calorie-dense foods compromises protein and  
238 micronutrient intake through suppression of appetite, and budgetary constraints are often considered  
239 to be a barrier <sup>(43)</sup>. It has been argued that budgeting for quality food and openness to new  
240 approaches, would demonstrate a patient-centred approach to address malnutrition <sup>(44)</sup>.

241 Food fortification has been found to successfully increase dietary intake <sup>(45)</sup> <sup>(46)</sup> but longer term  
242 interventions are needed to determine the impact on clinical outcomes. ONS may be a suitable  
243 alternatives to food fortification since they are nutritionally complete in sufficient quantities, and  
244 have been shown not to suppress appetite <sup>(43)</sup>. It has been demonstrated that those receiving ONS  
245 exceeded their estimated requirements, leading to positive changes in nutritional status <sup>(46)</sup>. Due to  
246 the low numbers of patients receiving ONS, the significance of their impact on meeting nutrient  
247 standards was not explored within this audit. However in those who consumed them, ONS  
248 contributed to over 30% of patients’ energy and protein intake, and provided substantially more  
249 energy and protein than hospital snacks or non-hospital food & drinks (Table 4). Where clinically  
250 indicated, ONS can be very effective <sup>(17)</sup> however, the potential for future increases in costs and poor  
251 compliance, are both barriers to ONS use.

252 The BDA supports a ‘food first’ approach <sup>(25)</sup>, recommending the improvement of nutritional status  
253 via ordinary food as a first step in providing nutritional support <sup>(47)</sup>. The provision of hospital snacks  
254 could be beneficial for patients who prefer to eat little and often <sup>(24)</sup>. However, in this audit, a  
255 number of patients were not offered hospital snacks although the reasons for this were not explored.

256 A lack of hospital snack provision has been identified as an inhibitory factor of optimal nutrition <sup>(48)</sup>  
257 and although snacks are often available some studies have found this is not always communicated  
258 adequately to patients <sup>(49)</sup>, which appeared to be the case in this audit. The Digest emphasises that  
259 patients should be offered hospital snacks twice daily, rather than relying on patient's requests <sup>(9)</sup>.  
260 However, this audit highlighted that energy and protein provided by additional snacks did not  
261 compare to that of ONS. This is important to reflect upon when considering nutritional goals of  
262 snack provision and how their nutritional contribution could be improved.

263 Over 50% of nutritionally well patients and over 80% of nutritionally vulnerable patients within this  
264 audit received non-hospital food & drinks (Table 4). Whilst reasons for their consumption were not  
265 investigated in this audit, one study highlighted that it is often due to hunger <sup>(38)</sup>. Although the  
266 majority of patients audited were satisfied with the portion size allocated, inconsistent snack  
267 provision and long gaps between meals may have resulted in hunger. This audit demonstrated that  
268 non-hospital food & drink choices were often low in protein. Patients, as well as their visitors, could  
269 benefit from education and guidance in making appropriate food choices <sup>(5)</sup>. Although patients who  
270 received non-hospital foods had a higher-energy intake, they were not significantly more likely to  
271 meet the nutrient standards and inequalities of care between those who do and do not have the  
272 money and/or resources to access food from outside the hospital requires ethical consideration. The  
273 Department of Health <sup>(11)</sup> state that patients' nutritional needs should be catered for by the hospital,  
274 implying that non-hospital food and drink should not be relied upon to meet the nutrient standards.

275 Limitations for this audit are the use of a single 24-hour recall although within a larger population  
276 one 24-hour recall can provide sufficient data to assess nutritional intake <sup>(50)</sup>. Furthermore,  
277 nutritional analysis was based on estimations of portion size using visual aids, menu prompts and  
278 household measures. Estimations were likely to cause inaccuracies, especially for non-hospital  
279 food. Finally, the calculation of each patients' individual nutritional requirements would have  
280 provided a more accurate representation of how many patients received adequate energy and  
281 protein.

282 As the literature indicates that 29% of patients are classified as at risk of malnutrition on admission  
283 to hospital <sup>(4)</sup>, 13% identified in this audit is comparatively lower. This may have been influenced  
284 by the study exclusion criteria including a number of patients at high risk of malnutrition, making  
285 the sample less representative of the hospital population. Furthermore people at low risk of  
286 malnutrition as defined by MUST may not necessarily fit the 'nutritionally well' definition provided  
287 by The Digest <sup>(9)</sup> (Table 1). In considering the definition of nutritional vulnerability provided by The

288 Digest, the use of disease type and appetite status could result in more accurate assessment of  
289 vulnerability and is an area to consider in future audits.

290 Qualitative reasons as to why patients were not consuming all of their food were not explored in  
291 this audit. Future audits would benefit from assessing factors effecting oral intake in order to tailor  
292 any dietary interventions accordingly. For example, providing more energy-dense options may not  
293 be beneficial if people are not receiving adequate support whilst eating, and providing snacks more  
294 consistently would be counterproductive if patients do not like the snacks that are available.  
295 Additionally the duration of admission may have an impact on oral intake and could be an  
296 important factor to consider in future audits.

## 297 **Conclusion**

298 The results of this audit demonstrate that most patients' energy and protein intakes failed to meet  
299 the nutrient standards recommended by The Digest. It is likely that this problem is not unique to  
300 this hospital. Organisations must provide assurance of high quality nutritional care if they are to  
301 meet the national standards set by the Care Quality Commission (CQC); provision of food which  
302 meets patients' requirements forms a central part of this. A publication by NHS England<sup>(51)</sup> has  
303 recently urged commissioners to view nutrition and hydration as a priority; providing guidance on  
304 ways of tackling malnutrition at a national and local level. This audit has highlighted a number of  
305 areas hospital trusts should focus on when trying to improve the nutritional intake of hospitalised  
306 patients. These include the provision of more energy-dense menu options, improving systems for  
307 provision of hospital snacks, supporting patients in making appropriate choices and providing ONS  
308 where clinically indicated. However, in order to tailor these changes in a patient-centred approach it  
309 would be important to explore reasons as to why patients are not consuming adequate nutrients. In  
310 addition to energy and protein intake, future research may also benefit from assessing micronutrient  
311 intake to gain a broader understanding of the true extent of malnutrition in hospitalised patients. A  
312 dedicated food services dietitian is ideally placed to lead this work, forming a vital link between  
313 patients, ward staff, caterers and clinical teams. Clear leadership and management support is  
314 required to engage staff at all levels and ongoing audits should demonstrate consistent compliance  
315 with the hospital food standards.

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#### 436 **Transparency Declaration**

437 *The lead author affirms that this manuscript is an honest, accurate, and transparent account of the*  
438 *study being reported, that no important aspects of the study have been omitted and that any*  
439 *discrepancies from the study as planned (and registered with) have been explained. The reporting*  
440 *of this work is compliant with CONSORT/STROBE guidelines.*

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**Table 1: Nutrition and hydration digest standards and definitions <sup>(12)</sup>**

	Energy	Protein
<p><b>Nutritionally Well</b>                      Normal nutritional requirements and normal appetite OR those with a condition requiring a diet that follows healthier eating principles.</p> <p>The lowest energy target is based on the Estimated Average Requirement (EAR) for women aged 75+ years and the highest target based on the EAR for men aged 19-59 years.</p>	1810-2550 kcal 7573-10669 kJ	56g*
<p><b>Nutritionally Vulnerable</b>                      Normal nutritional requirements but with poor appetite and/or unable to eat normal quantities at mealtimes OR those with increased nutritional needs.</p> <p>The energy target range is based on requirements of 1.3 to 1.5 times resting energy expenditure for a 75kg individual.</p>	2250-2625 kcal 9414-10983 kJ	60-75g

451 \* For females of the same age bracket the RNI is 45g.

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**Table 2: Definitions of dietary terms**

Dietary Term	Definition
Menu Choice	Amount of energy or protein provided by meals chosen by patients from the hospital main menu, assuming 100% consumption.
Hospital Intake	Amount of energy or protein provided by hospital meals and snacks, based on actual consumption. Not including ONS.
Overall Intake	Total amount of energy or protein provided by hospital meals and snacks plus non-hospital food and drinks consumed, based on actual consumption. Not including ONS.

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**Table 3: Energy and protein provision and consumption compared to the BDA (2012) nutrient standards**

	<b>Nutrient Standard</b>	<b>Menu choice</b>	<b>Hospital intake</b>	<b>Overall intake</b>
<b>Energy (kJ)</b>				
<b>Nutritionally well</b> (Male and Female) (n = 81)				
<b>Mean (SD)</b>	7573	5356 (1900)	4573 (1900)	5205 (2092)
<b>p value</b>		<0.001	<0.001	<0.001
<b>Nutritionally Vulnerable</b> (Male and female) (n = 12)				
<b>Median (Range)</b>	9414	4987 (5899)	4707 (7468)	5485 (9971)
<b>p value</b>		0.002	0.002	0.005
<b>Protein (g)</b>				
<b>Nutritionally well</b> (Male) (n = 42)				
<b>Mean (SD)</b>	56	49.0 (15.7)	41.8 (18.4)	44.4 (17.9)
<b>p value</b>		<0.001	<0.001	<0.001
<b>Nutritionally well</b> (Female) (n = 39)				
<b>Mean (SD)</b>	45	45.7 (12.9)	36.5 (15.8)	39.8 (18.6)
<b>p value</b>		0.727	0.002	0.819
<b>Nutritionally Vulnerable</b> (Male and Female) (n = 12)				
<b>Median (Range)</b>	60	44.2 (54.2)	40.9 (61.3)	45.8 (65.3)
<b>p value</b>		0.034	0.005	0.015

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**Table 4: Patients receiving ONS, hospital snacks and non-hospital food & drink**

<b>Nutritionally Well n = 81</b>	<b>No. of patients: n (%)</b>	<b>Energy and Protein Contribution</b>	<b>Contribution to overall intake (%)</b>
ONS	8 (10)	1891 kJ	36
		17.8g protein	42
Hospital Snacks	29 (36)	937 kJ	18
		6.1g protein	14
Non-hospital Food & Drinks	42 (52)	1034 kJ	20
		3.6g protein	9
<b>Nutritionally Vulnerable n = 12</b>	<b>No. of patients: n (%)</b>	<b>Energy and Protein Contribution</b>	<b>Contribution to overall intake (%)</b>
ONS	3 (25)	2092 kJ	38
		15.7g protein	37
Hospital Snacks	5 (42)	875 kJ	16
		7.8g protein	18
Non-hospital Food & Drinks	10 (83)	1335 kJ	24
		4.2g protein	10

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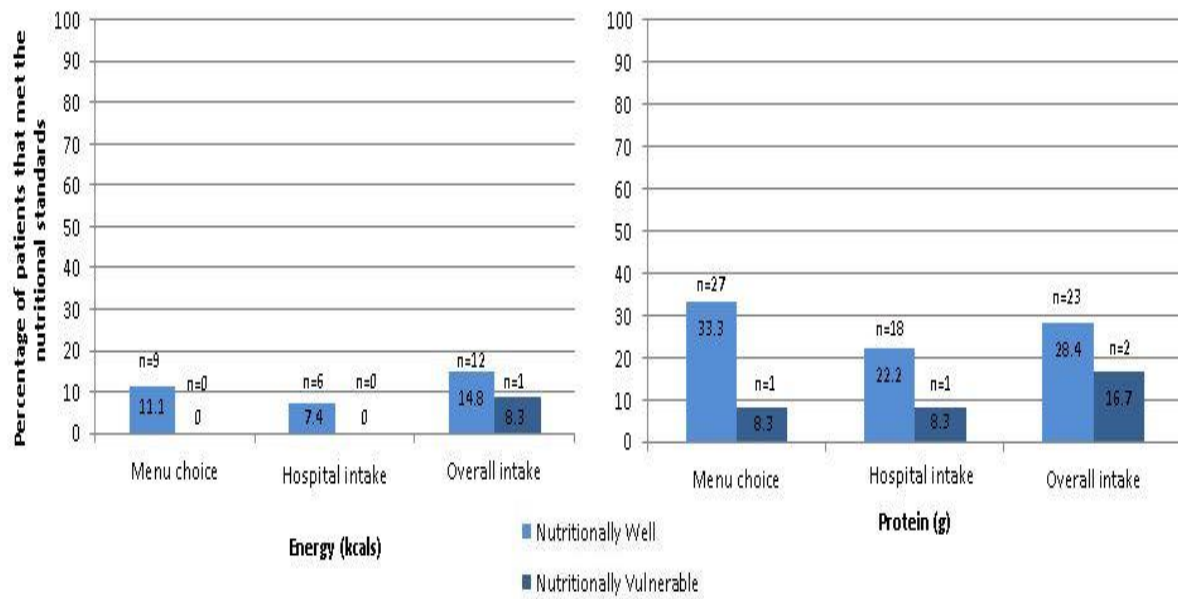
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492 **Figure 1: Percentage of patients meeting the BDA (2012) nutrient standards for energy and**  
 493 **protein.**

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507 Appendix 1: Example of the 24 hour recall section of the audit tool

Patient Number:

MUST:

Age:

Ward:

Gender:

Tuesday	Patient Selection	Amount consumed				
		0%	25%	50%	75%	100%
<b>Breakfast</b>						
Cereal						
Fruit Juice						
Prunes in Juice						
Toast						
Preserve						
<b>Lunch</b>						
Steak and Mushroom Pie						
Gammon and Pineapple						
Pasta Provencale						
Plain Omelette						
Roast Pork Salad						
Egg and Cress Salad						
Sandwich of the Day						
Cut Green Beans						
Sweetcorn						
Croquette Potatoes						
Ceamed Potatoes						
Raspberry Pudding						
Rice Pudding with Nutmeg						
Jelly						
Ice Cream Dessert						
Cheese and Biscuits						
Peaches in Natural Juice						
Fresh Fruit						
Diet Yogurt						
<b>Supper</b>						
Fruit Juice						
Home-made Pea and Ham Soup						
Wholemeal Bread Roll						
Chicken Cheese and Bacon Bake						
Cheese and Tomato Omelette						
Plain Omelette						
Sandwich of the Day						
Mixed Bean Salad						
Peas						
Potato Wedges						
Creamed Potatoes						
Chocolate Mousse						
Jelly						
Fruit Juice						
Cheese and Biscuits						
Ice Cream Dessert						
Diet Yogurt						

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