

available at [www.sciencedirect.com](http://www.sciencedirect.com)journal homepage: [www.ejconline.com](http://www.ejconline.com)

## Failure of dietetic referral in patients with gastrointestinal cancer and weight loss

C. Baldwin<sup>a,b</sup>, C. McGough<sup>b</sup>, A.R. Norman<sup>c</sup>, G.S. Frost<sup>d</sup>,  
D.C. Cunningham<sup>b</sup>, H.J.N. Andreyev<sup>b,\*</sup>

<sup>a</sup>Division of Medicine, Chelsea and Westminster Campus, Imperial College London, 369 Fulham Road, London SW10 9NH, United Kingdom

<sup>b</sup>Department of Medicine, Royal Marsden Hospital, Fulham Road, London SW3 6JJ, United Kingdom

<sup>c</sup>Department of Computing, Royal Marsden Hospital, Fulham Road, London SW3 6JJ, United Kingdom

<sup>d</sup>School of Biomedical and Molecular Science, University of Surrey, Guildford, Surrey GU2 7XH, United Kingdom

### ARTICLE INFO

#### Article history:

Received 11 April 2006

Received in revised form 2 May 2006

Accepted 5 May 2006

Available online 23 August 2006

#### Keywords:

Weight loss

Gastrointestinal cancer

Outpatients

Nutritional screening

Referral to dietitian

### ABSTRACT

This study examined whether staff working within a cancer centre treating patients with gastrointestinal malignancy routinely identified individuals from outpatients for referral to a dietitian. A nutrition screening tool is employed only for in-patient admissions. Height, current and usual weight were recorded prospectively in all patients referred for consideration of treatment. First appointment with the dietitian, first hospital admission, demographic and clinical details were obtained from hospital records. Time from first appointment to referral to a dietitian was examined. Between September 2002 and March 2004, 920 patients were included. Five hundred and seventeen patients had lost weight, of whom 223 patients had lost between 5% and 10% and 294 patients had lost more than 10% of their pre-morbid weight. Three hundred and twenty-seven patients (36%) were referred to dietitians. Twenty eight (9%) of referrals were made by staff in outpatients. Two hundred and ninety-nine were referred during or after an inpatient admission but only 39% of these occurred within the first seven days following admission. One third of patients with more than 10% weight loss were not referred for dietary assessment, even following admission. The likelihood of referral was significantly associated with the degree of weight loss (univariate analysis hazard ratio (HR) 1.75, 95% Confidence Interval (CI) 1.4–2.19, multivariate HR 1.65, 95% CI 1.22–2.23) and was independent of factors such as performance status and clinical setting. Few patients were identified early in their treatment for referral to a dietitian. Since most chemotherapy is now given on an outpatient basis, patients are unlikely to be referred if they do not require admission. This study suggests that an out-patient dietetic screening tool is urgently required. Such screening is likely to result in considerable improvements to the clinical care of cancer patients with weight loss.

© 2006 Elsevier Ltd. All rights reserved.

## 1. Introduction

Weight loss has long been recognised as increasing the risk of death in cancer patients.<sup>1</sup> More recently, it has been demon-

strated in a range of cancers that weight loss in patients receiving chemotherapy is associated with reduced survival.<sup>2,3</sup> In addition, patients with metastatic gastrointestinal and lung cancers who present with weight loss receive

\* Corresponding author. Tel.: +44 20 7808 2105; fax: +44 20 7351 2477.

E-mail address: [j@andreyev.demon.co.uk](mailto:j@andreyev.demon.co.uk) (H.J.N. Andreyev).

0959-8049/\$ - see front matter © 2006 Elsevier Ltd. All rights reserved.

doi:10.1016/j.ejca.2006.05.028

less chemotherapy than patients without weight loss<sup>2,4</sup> yet have a significantly increased risk of developing chemotherapy-induced toxicity. Stabilisation of weight is associated with a significantly increased survival compared to those who continue to lose weight.<sup>2</sup>

The reported prevalence of malnutrition in cancer varies from 33% to 85%,<sup>5</sup> with some of the highest figures being found in patients with gastrointestinal cancers. It is self-evident that malnutrition must be identified before it can be treated and it is unacceptable not to do so when the opportunity arises, especially in healthcare settings where it is common.<sup>6</sup>

Nutritional screening is the process of identifying patients at risk of malnutrition or those suspected of becoming at risk. It has widespread support from a variety of professional organisations, governments and international agencies.<sup>6</sup> The National Institute for Clinical Excellence (NICE) has recently recommended that 'all hospital inpatients on admission and, outpatients at their first clinic appointment should be screened for the presence or risk of malnutrition'.<sup>7</sup> Despite this, numerous surveys of medical practice have highlighted the failure of healthcare staff to identify malnutrition in patients on admission to the hospital.<sup>8–11</sup> The most common reasons given for not doing so are lack of time, instructions and knowledge.<sup>12</sup> To our knowledge, there are no data on the identification of malnutrition in outpatients with cancer.

The most important feature of any screening programme is that it is linked to an effective treatment pathway which leads to a beneficial outcome for the patient. The evidence for the treatment of malnutrition is clear. Meta analysis of randomised controlled trials (RCTs) has shown that the nutritional treatment of weight loss is associated with significant improvements in survival and complication rates.<sup>5,7</sup> The NICE guideline on 'Nutrition support in adults' recommends that 'healthcare professionals consider interventions to improve oral intake in patients who are malnourished or at risk of developing malnutrition'.<sup>7</sup>

The Royal Marsden Hospital currently has a nutritional screening tool and care plan that is used for all hospital admissions. No nutritional screening takes place in the outpatient department. Referral for dietary assessment occurs on an 'ad hoc' basis.

The aim of this study was to examine the ability of the multidisciplinary team who care for patients referred for management of gastrointestinal malignancies, in the absence of formal screening, to identify patients who meet the hospital criteria for malnutrition and to assess how they acted upon this information.

## 2. Patients and methods

### 2.1. Patients

All new patients referred for consideration of treatment with chemotherapy for gastrointestinal malignancies to the Royal Marsden Hospital were included in the study. One of two research dietitians saw every patient. These dietitians worked independently of the clinical dietetics department. The study was approved by the Royal Marsden Hospital ethics committee.

### 2.2. Data

Height and weight were measured on a Marsden Professional Medical scale (MPPS200) and recorded to two decimal places. All measurements were made whilst in light indoor clothing without shoes. The patients were asked to recall their pre-morbid weight and date on which they began to lose weight.

Data were recorded in the medical notes on a clinical history sheet. The information was available to the clinician and other staff assessing the patient at the time of their clinical visit.

The patients were categorised according to the presence and degree of weight loss as follows: no weight loss (including patients with weight loss of up to 5% of usual weight, which is within the accepted intra-individual variation); 5–10% weight loss and more than 10% weight loss. Patients reporting substantial but unquantified weight loss were assumed to have lost more than 10%. Patients reporting a small but unquantified weight loss were included in the 5–10% weight loss category. Only 12 patients required assumptions to be made about the degree of weight loss. Body mass index (BMI) was calculated for all patients and used to determine the degree of nutritional risk according to the malnutrition universal screening tool (MUST). MUST recommends that patients are considered to be malnourished or at high risk of malnutrition if they meet one or more of the following criteria: BMI < 18.5, BMI = 18.5–20 with a weight loss of >5% in the past 3–6 months or >10% unintentional weight loss in the past 3–6 months<sup>13</sup> and at medium risk if a patient had a BMI of >20% and >5% unplanned weight loss in the past 3–6 months or BMI 18.5–20 and a weight loss of <5%. At the Royal Marsden Hospital, the policy is that patients are referred to a dietitian if they have a weight loss of more than 10% or a BMI less than 20 kg/m<sup>2</sup>.

Demographic and clinical details, as well as information on the date of the first appointment with the hospital dietitian and location of the patient (inpatient or outpatient) at the time of referral to a dietitian, were recorded. The date of the patient's first admission to the hospital and numbers of patients referred to the dietetic services were also recorded. Details of a patient's performance status assessed by the clinician at the first appointment were recorded when available.<sup>14</sup>

### 2.3. Statistics

Descriptive data are presented as absolute numbers and percentages and means or medians with standard deviation and ranges. The probability of referral to a dietitian according to the amount of weight lost was derived using a Kaplan–Meier survival analysis, using the date of first assessment as the baseline and the date of dietetic consultation as the event date. The date of last follow-up was used to remove patients from the analysis once they no longer had further appointments at the Royal Marsden Hospital. Differences between the numbers of patients referred at each time point were examined using the  $\chi^2$  test. Other factors were controlled for in a multivariate analysis using a Cox proportional hazards model. Performance status,

treatment setting (adjuvant, neoadjuvant and advanced) and weight loss were entered as variables into the model. The nutritional status of patients was also classified according to MUST. The data were examined for differences in the numbers of patients identified as malnourished using each criterion.

### 3. Results

Between September 2002 and March 2004, data were collected on 948 consecutive patients. Twelve patients were unable to recall their usual weight but were able to indicate whether they had experienced a small or substantial weight loss. Twenty-eight patients were unable to recall their usual weight and were unclear whether they had lost weight. These patients have been excluded from the analysis.

#### 3.1. Patient characteristics

The baseline characteristics of the remaining 920 patients are shown in Table 1. There were more males than females in the group (537 versus 383) although the median age and body mass index were similar for both groups. Forty-four percent of patients had no weight loss, 24% had a weight loss between 5% and 10% and 32% had greater than 10% weight loss. There was no difference in the percentages of men and women losing weight in each of the categories. Three hundred and nine (34%) patients met the MUST criteria for high risk of nutritional problems and a further 215 patients were classified as

a medium nutritional risk according to MUST (Table 2). It was not possible to obtain a height measurement on six patients and so there are data on BMI of 914 of 920 patients. There were differences in the amounts of weight loss according to the site and stage of the disease and performance status (Tables 1 and 2).

#### 3.2. Referral to dietetic services

Three hundred and twenty-seven patients (36%) were referred to the dietetic services. Of these, 41 (13%) referrals occurred before the patient was assessed in the gastrointestinal unit. One hundred and thirty-four (15%) patients had no further appointments after the first assessment or within the first two weeks of the study.

The probability of referral over time is shown in Fig. 1. Referrals increased over 12 months for all categories of patients. For patients with no or minimal weight loss at first assessment, 21% (95% CI 17.5–26.2) were referred to the dietetic services by three months and 40% (95% CI 34.4–46.0) by 12 months. The probability of referral for patients with 5–10% weight loss at first assessment was similar to patients with no weight loss, with 26% (95% CI 20.2–32.5) being referred by three months and 39% (95% CI 31.4–46.8) by 12 months. A significantly greater proportion of patients with 10% or more weight loss at first assessment were referred to the dietetic services at all time points with 41% (95% CI 34.5–46.8) being referred at three months, increasing to 56% (95% CI 48.5–62.9) by 12 months. Patients with 10% or more weight loss at first

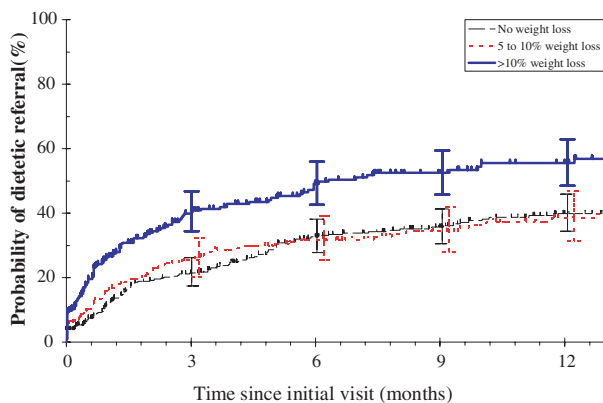
**Table 1 – Baseline characteristics of patients referred for assessment of gastrointestinal malignancy**

	Total	Male	Female
Number	920	537	383
Age (median, IQR)	66 (57–74)	66 (57–73)	67 (57–75)
Body mass index (mean (SD)) range	25 15–46	25.3 (4.2)	24.6 (4.7)
Weight status			
No weight loss (%)	403 (44%)	241 (45%)	162 (42%)
Weight loss 5–10% (%)	223 (24%)	132 (25%)	91 (24%)
Weight loss >10% (%)	294 (32%)	163 (30%)	131 (34%)
Number with each primary site			
Oesophagus/stomach	238	168	70
Locally advanced/metastatic disease	137		
Pancreas	122	75	47
Locally advanced/metastatic disease	104		
Liver and biliary	23	13	10
Locally advanced/metastatic disease	15		
Lower GI	501	261	240
Locally advanced/metastatic disease	222		
Unknown primary	18	11	7
Locally advanced/metastatic disease	15		
Other	18	9	9
Disease status			
Surgically resected (adjuvant)	131		
Disease present (radical treatment)	7		
Disease present (neo-adjuvant treatment)	16		
Disease present (palliative treatment)	471		
No treatment	295		

**Table 2 – Clinical and nutritional characteristics of patients according to the amounts of weight loss**

	Number of patients		
	No weight loss	5–10% weight loss	>10% weight loss
Total	403	223	294
Primary tumour sites			
Oesophagus/stomach	92 (39%)	58 (24%)	88 (37%)
Pancreas	38 (31%)	30 (25%)	54 (44%)
Liver and biliary	6 (26%)	11 (48%)	6 (26%)
Lower GI	244 (49%)	120 (24%)	137 (27%)
Unknown primary	12 (67%)	1 (5%)	5 (28%)
Other	11 (61%)	3 (17%)	4 (22%)
Performance status (WHO)			
PS0 n = 141	83 (59%)	31 (22%)	27 (19%)
PS1 n = 450	212 (47%)	114 (25%)	124 (28%)
PS2 n = 133	29 (22%)	40 (30%)	64 (48%)
PS3 n = 77	18 (23%)	12 (16%)	47 (61%)
Not recorded n = 119	61 (51%)	27 (23%)	31 (26%)
BMI (kg/m <sup>2</sup> )			
<18.5 n = 43	2 (5%) <sup>a</sup>	6 (14%) <sup>a</sup>	35 (81%) <sup>a</sup>
18.5–20.0 n = 50	7 (14%) <sup>b</sup>	10 (20%) <sup>a</sup>	33 (66%) <sup>a</sup>
>20 n = 821	390 (48%) <sup>c</sup>	208 (25%) <sup>b</sup>	223 (27%) <sup>b</sup>
Not recorded n = 6			

a MUST 2, high risk, needs nutritional treatment.  
b MUST 1, medium risk, observe.  
c MUST 0, routine clinical care.

**Fig. 1 – Probability of referral to dietetic services according to the amount of weight loss at first assessment.**

assessment were significantly more likely to be referred to the dietetic services at all time points ( $p < 0.00001$ ). Forty percent of patients with significant weight loss (>10%) were not identified or referred for dietetic assessment.

Referral may have been affected by factors such as performance status, diagnosis and clinical setting within which treatment was given (adjuvant, neoadjuvant and palliative). Therefore, the data were analysed without taking into consideration the influence of these factors (univariate analysis) and correcting for the influence of these factors (multivariate analysis). The likelihood of referral was significantly associated with the amounts of weight loss and was independent of factors such as performance status and clinical setting. The relative risks of referral are similar with univariate and

multivariate analysis (hazard ratio 1.75 (95% CI 1.4–2.19) and 1.65 (95% CI 1.22–2.23)), respectively.

### 3.3. Identification for referral

Of the patients referred to the dietetic services during the course of follow-up, 28 (9%) referrals were made from the out-patient department and the remaining 299 referrals (91%) were made whilst the patients were in the hospital. The median time from assessment to first hospital admission was 21 days (inter quartile range: 12–46).

Patients are routinely screened for nutritional problems on admission to the Royal Marsden Hospitals. This should result in patients with a weight loss of 10% since diagnosis or within the preceeding three months being referred to a dietitian. Table 3 shows the number of patients referred in each of the specified weight loss categories and the number of patients who had an episode of hospital admission but were not referred. Of the 176 patients with more than 10% weight loss who had a hospital admission, 35 patients had already been seen by a dietitian before first assessment in the gastrointestinal unit. Eighty-four patients were referred during a hospital admission, of whom 40 were referred during the first 7 days following first admission and a further 7 during the next 7 days. Fifty-seven (32%) patients with 10% weight loss at first assessment failed to be referred for dietary assessment on admission to the hospital. Only 11 of 118 (9%) patients with 10% weight loss, who did not require hospital admission, were referred for dietetic assessment. Only 17% of patients with a smaller degree of weight loss were identified for referral during the first two weeks of hospital admission.

**Table 3 – Identification of patients for referral to the dietetic services**

Total number in each category	Total number of patients in each category admitted into hospital	Number of patients seen by a dietitian before first assessment in our unit	Total number of referrals occurring during admission	Length of time from admission to referral			Number of patients admitted but not referred
				Number of referrals within 7 days of admission	Number of additional referrals within 14 days of admission	Number of additional referrals occurring 14 days or more after admission	
>10% weight loss, n = 294	176	35	84 (48%)	40	7	37	57
5–10% weight loss, n = 223	133	14	51 (38%)	18	2	31	68
No weight loss, n = 403	217	16	98 (53%)	33	8	57	103

### 3.4. Thresholds for nutritional screening

Two hundred and ninety-three patients presented with a weight loss of greater than 10%. This group of patients would meet the criteria for high risk of malnutrition and immediate referral to a dietitian at the Royal Marsden Hospital and when using the criteria established by MUST. The MUST includes additional components of assessment, compared with the Royal Marsden that combines BMI and weight loss. Use of the MUST criteria rather than the Royal Marsden cutoffs would identify an additional 18 patients as at high risk of malnutrition and 215 patients at medium risk (Table 2).

## 4. Discussion

This prospective study of consecutive patients referred for consideration of treatment of their newly diagnosed gastrointestinal cancer has four main findings. Firstly, the patients are not identified early in their treatment for referral to dietetic services. Secondly, it is unusual for the patients to be referred to a dietitian as an outpatient. Thirdly, the weight cutoffs for the identification of patients at high risk of malnutrition currently in use at the Marsden Hospital underestimate the number of patients compared with the criteria proposed by MUST and NICE. Finally, despite clear hospital guidelines for referral for nutritional assessment, 32% of the patients with malnutrition as defined in those guidelines are not referred within one week of a hospital admission.

Thirty-two percent of our patients met the hospital criteria for referral to a dietitian and 34% of our patients met the MUST guidelines<sup>8</sup> for consideration of immediate nutritional assessment. Despite this, in this study, the patients were not referred appropriately for nutritional help. The patients were more likely to be identified on hospital admission where there is a nutritional screening tool in use. Staff in outpatient departments do not recognise patients who may benefit from nutritional help, thus delaying access to appropriate nutritional intervention. This is problematic as cancer chemotherapy is increasingly given by outpatient schedules and patients may only have hospital admissions if toxicities develop that require inpatient management.

These data suggest that the introduction of a nutritional screening policy for outpatients could improve the identification and referral of patients who would benefit from nutritional

intervention. This suggestion raises a number of issues. Firstly, the clinical benefits of nutritional screening have not been demonstrated in the two randomised trials in this area,<sup>6</sup> but the absence of evidence from these trials may reflect flaws in their design. Nine other studies of variable design, suggest that nutritional screening linked to a care plan does have specific benefits<sup>6</sup>, and NICE have used these data combined with expert opinion to reach their recommendations.

Secondly, the introduction of nutritional screening for outpatients will have associated costs. The main costs associated with screening may be due to the costs of the treatment resulting from an increased use of nutritional support. It is hoped that these costs will be more than counteracted by the positive financial gains associated with clinical benefits such as reduced complications and lengths of hospital stay.

We have demonstrated that the criteria currently implemented at the Royal Marsden Hospital for referral of patients to a dietitian underestimate the number of patients at immediate nutritional risk compared with MUST. One study<sup>15</sup> demonstrated that MUST has a low sensitivity and specificity in identifying hospitalised cancer patients when compared with Subjective Global Assessment (SGA). SGA is based on a medical history, including details of weight history and a physical examination and has been validated in cancer patients to assess nutritional status and predict outcomes. In this study, 31% of patients were misclassified as being well nourished by MUST. If this is true for our study population, it is likely that the number of patients at nutritional risk is higher than we suggest and that even greater numbers of patients failed to receive the nutritional help needed.

Our study has a number of limitations. Firstly, the amounts of weight loss that we have found may not be representative of other centres. There are few reports in the literature on prevalence of weight loss in outpatients. A study of 50 consecutive patients referred to a gastrointestinal outpatient department reported that 18% met the MUST criteria for medium risk of malnutrition and 12% had high risk of malnutrition.<sup>16</sup> A second study in 1017 medical outpatients found that 11% of older adults (>65 years) and 7% of younger adults (<65 years) were undernourished.<sup>17</sup> We found a quarter of our patient population to be at medium risk and one third at high risk of developing malnutrition. Thus, the number of patients with gastrointestinal cancers at risk of malnutrition may be higher than outpatients in other clinical settings.



Secondly, the rate of recognition of patients at nutritional risk may not reflect the situation in other centres. However, our rate of 41% of patients with more than 10% weight loss at presentation referred to a dietitian within three months is similar to that of the only other published study investigating hospital outpatients. This study in general medical patients found that under nutrition was recognised in only 43% of the older adults and 12% of the younger adults and was managed in 14% of older and 5% of younger subjects.<sup>17</sup>

Thirdly, there may be inconsistency in patient recollection of their usual weight and patients may be wrongly classified as being at nutritional risk. A large study reported that 22% of men and 18% of women may be incorrectly classified on BMI category, based on self-reported weight, although this was much more common in overweight than underweight patients.<sup>18</sup> Distortions in self-reported weight appear to be much less in lean individuals than individuals with overweight.<sup>19</sup>

Finally, we have used date of referral to a dietitian to represent the first nutritional help given to a patient. Additionally, we have assumed that nutritional problems at presentation will still be evident on hospital admission. It is possible that any nutritional problems have resolved by the time hospital admission occurs.

In conclusion, this study suggests that urgent attention is required to identify outpatients with gastrointestinal malignancies who may be at nutritional risk, to facilitate referral to dietetic services. Such a strategy could have numerous beneficial clinical implications.

### Conflict of interest statement

None of the authors have any conflict of interest with any aspect of submitting this manuscript for publication.

### Acknowledgements

This study was funded by grants from The Henry Smith Foundation and the Chelsea & Westminster Hospital Trustees. The authors gratefully acknowledge the help of Dr. John Mee in the preparation and management of databases in this study and for assistance with data analysis.

### REFERENCES

- Warren S. The immediate causes of death in cancer. *Am J Med Sci* 1932;**184**:610–3.
- Andreyev HJN, Norman AR, Oates J, Cunningham D. Why do patients with weight loss have a worse outcome when undergoing chemotherapy for gastrointestinal malignancies? *Eur J Cancer* 1998;**34**(4):503–9.
- DeWys WD, Begg C, Lavin PT, et al. Prognostic effect of weight loss prior to chemotherapy in cancer patients. *Am J Med* 1980;**69**:491–7.
- Ross PJ, Ashely S, Norton A, et al. Do patients with weight loss have a worse outcome when undergoing chemotherapy for lung cancers? *Br J Cancer* 2004;**17**(90):1905–11.
- Stratton RJ, Green C, Elia M. *Disease-related malnutrition: an evidence based approach*. first ed. Oxford: CABI Publishing; 2003.
- Elia M, Zellopour L, Stratton RJ. To screen or not to screen for adult malnutrition? *Clin Nutr* 2005;**24**(6):867–84.
- NICE. Nutrition support in adults: oral supplements, enteral tube feeding and parenteral nutrition. National Institute for Clinical Excellence 2006. Available from: [www.nice.org.uk/](http://www.nice.org.uk/).
- Kelly IE, Tessier S, Cahill A, et al. Still hungry in hospital: identifying malnutrition in acute hospital admissions. *QJM* 2000;**93**:93–8.
- Campbell SE, Avenell A, Walker AE. Assessment of nutritional status in hospital in-patients. *QJM* 2002;**95**:83–7.
- Kondrup J, Johansen N, Plum LM. Incidence of nutritional risk and causes of inadequate nutritional care in hospitals. *Clin Nutr* 2002;**21**(6):461–8.
- McWhirter JP, Pennington CR. Incidence and recognition of malnutrition in hospital. *BMJ* 1994;**308**:945–8.
- Beck AM, Balknas UN, Camilo ME. Practices in relation to nutritional care and support – report from the Council of Europe. *Clin Nutr* 2002;**21**(4):351–4.
- Elia M. Screening for malnutrition: a multidisciplinary responsibility. Development and use of the 'Malnutrition Universal Screening Tool' (MUST) for adults. MAG, a standing committee of BAPEN. 2003. Available from: [www.BAPEN.org.uk](http://www.BAPEN.org.uk).
- Oken MM, Creech RH, Tormey DC, et al. Toxicity and response criteria of the Eastern Cooperative Oncology Group. *Am J Clin Oncol* 1982;**5**:649–55.
- Bauer J, Capra S. Comparison of a malnutrition screening tool with subjective global assessment in hospitalised patients with cancer – sensitivity and specificity. *Asian Pacific J Clin Nutr* 2003;**12**(3):257–60.
- Stratton RJ, Hackston A, Longmore D, et al. Malnutrition in hospital outpatients and inpatients: prevalence, concurrent validity and ease of use of the 'malnutrition universal screening tool' (MUST) for adults. *Br J Nutr* 2004;**92**:799–808.
- Wilson MM, Vaswani S, Liu D, Morley JE, Miller DK. Prevalence and causes of undernutrition in medical outpatients. *Am J Med* 1998;**10**(1):56–63.
- Spencer EA, Appleby PN, Davey GK, Key TJ. Validity of self-reported height and weight in 4808 EPIC-Oxford participants. *Public Health Nutr* 2002;**5**(4):561–5.
- Pirie P, Jacobs D, Jeffrey R, Hannan P. Distortations in self-reported height and weight data. *J Am Diet Assoc* 1981;**78**:601–6.